

Bremore Park,  
Balbriggan,  
Co. Dublin

## Flood Risk Assessment

Final Report

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## Contract

This report describes work commissioned by Margaret Egan on behalf of Fingal County Council. The representative for the contract was Margaret Egan of Ait Urbanism + Landscape. David Casey and Daniel Iordache of JBA Consulting carried out this work.

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## Purpose

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## Abbreviations

|              |  |
|--------------|--|
| AEP .....    | Annual Exceedance Probability                                |
| CFRAM .....  | Catchment Flood Risk Assessment and Management               |
| DoEHLG ..... | Department of the Environment, Heritage and Local Government |
| FFL .....    | Finish Floor Levels  |
| FRA .....    | Flood Risk Assessment  |
| GSI .....    | Geological Survey of Ireland                                 |
| OPW .....    | Office of Public Works                                       |
| PFRA .....   | Preliminary Flood Risk Assessment                            |
| SDCC .....   | South Dublin County Council                                  |
| SFRA .....   | Strategic Flood Risk Assessment                              |
| 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 to ensure sustainability and effective management of flood risk.

## 1.1 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 are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Recommend 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 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.

## 1.2 Development Proposal

The site is currently a park managed by Fingal County Council. The main areas of the proposed development are the Sports and Recreational Hub in the northwest of the park, the Coastal Park at the southern end, improvements to the existing Balbriggan FC Car Park. Refer to Figure 1-1 for the proposed development layout. It should be noted that areas not incorporated in this application have been greyed out in Figure 1-1.

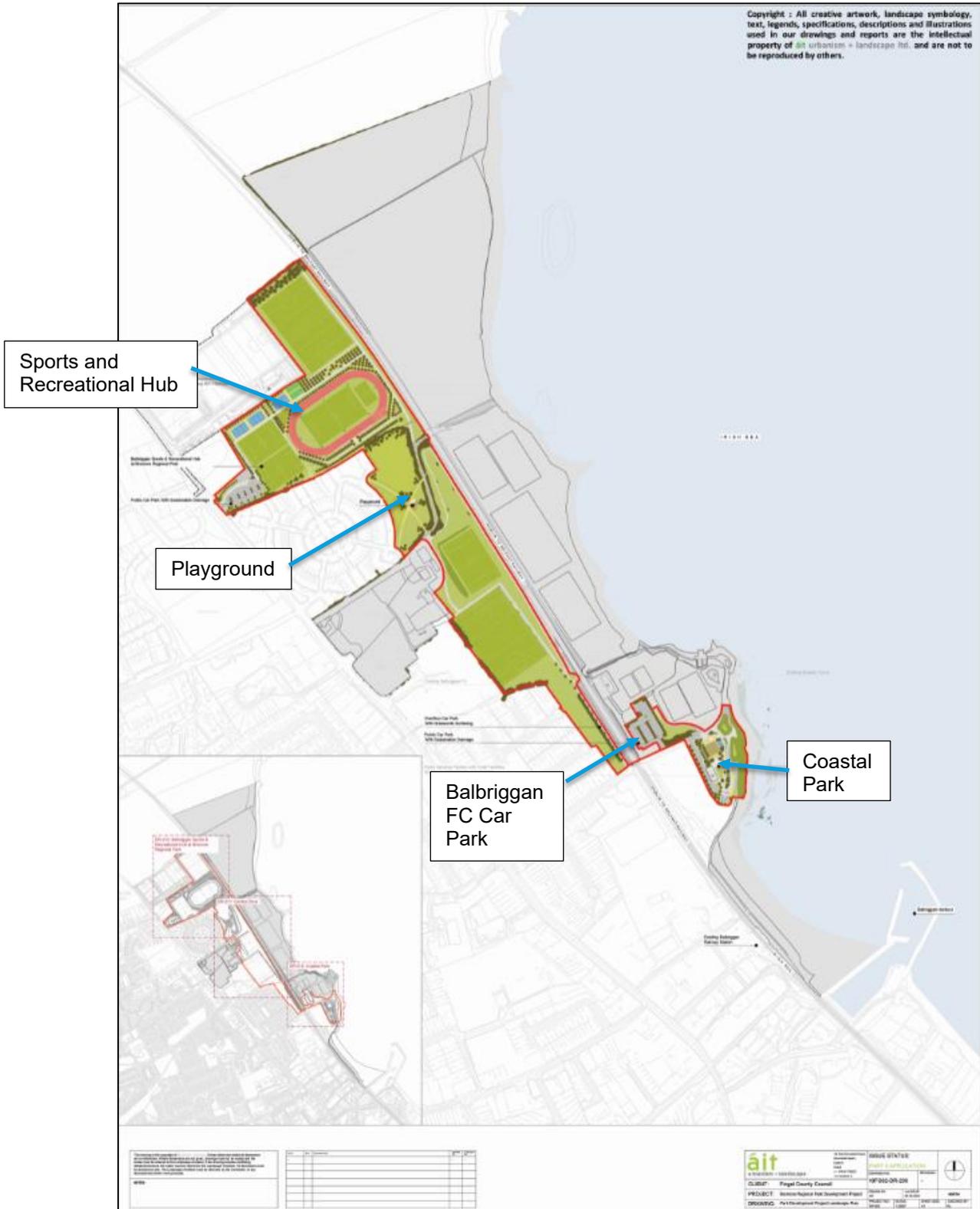


Figure 1-1: Site Layout

### 1.3 Report Structure

Section 2 - Provides an overview of the study location and associated watercourses to the site.  
Section 3 - Contains background information and the initial assessment of flood risk. Section 4 - Gives an overview of the technical to Flood Risk Assessment (FRA). The FRA conclusions are highlighted in Section 5.

## 2 Site Background

### 2.1 Location

The site is currently a greenfield area (park) located in Balbriggan, Co Dublin. The Irish Sea coast lies to the East, while Balbriggan Town is located to the West and South. The Dublin-Belfast railway line runs along the site from south-east to north-west and two local watercourses flow into the Irish Sea at the site proximity.

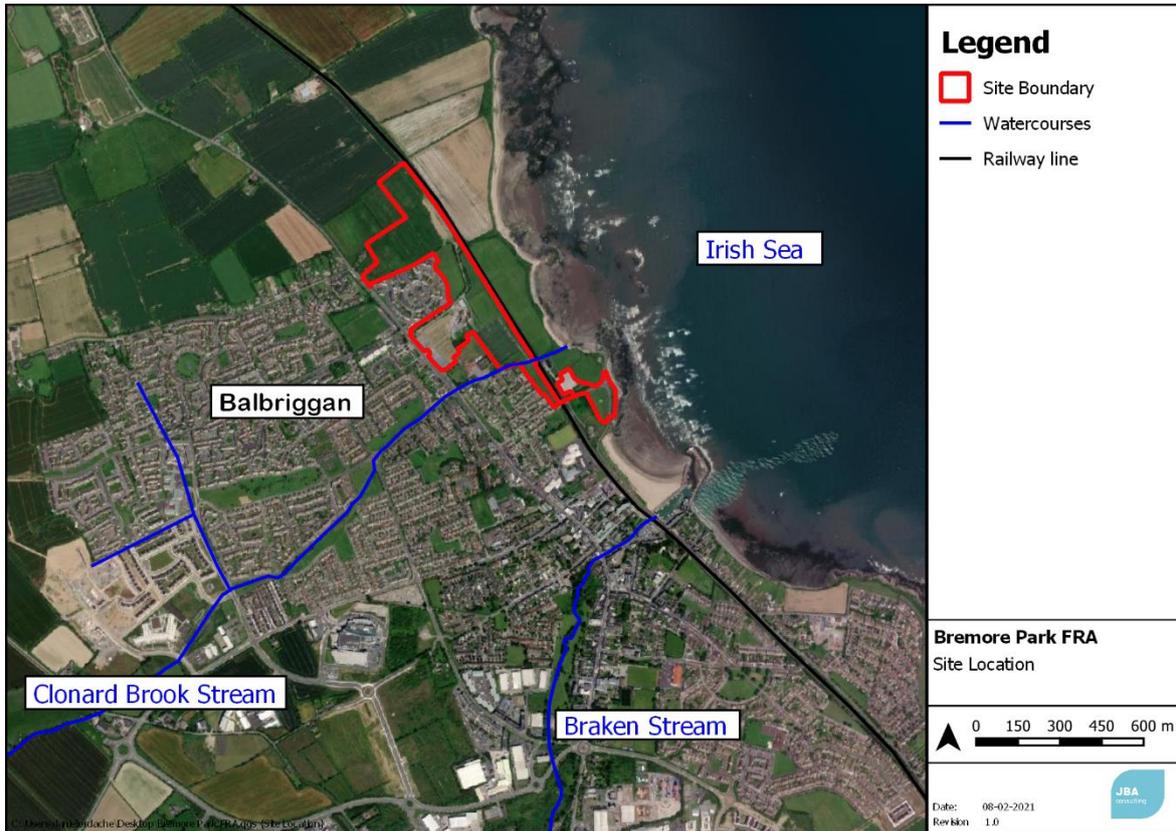


Figure 2-1: Site Location & Hydrological Environment

### 2.2 Watercourses

As shown in Figure 2-1, Clonard Brook and Braken are the two main local watercourses in the area.

The Clonard Brook Stream flows easterly, through farmland before continuing through Balbriggan Town, crossing the site and eventually flowing into the Irish Sea.

The Braken Stream flows into the Irish Sea through the Balbriggan Harbour approximately 0.34km downstream of the site.

### 2.3 Site Topography

The site topography slopes towards the coast (from west to east), with elevations ranging from 8mOD to 14mOD.

## 2.4 Site Geology

The Geological Survey of Ireland (GSI) groundwater and geological maps indicate that the subsoil within the site is largely made of Irish Sea Till, and, to a lower extent, Sandstone Till. The underlying bedrock is classified as Belcamp Formation which consists of andesite, pillow breccia and mudstone.

The groundwater vulnerability is classified from "high" (closer to the coast, where the bedrock is shallow) to "moderate". The groundwater vulnerability classifications reflect the potential risk of groundwater infiltrations through the bedrock and risk of groundwater contamination from the site. There is no evidence of karst features at the site or in the surrounding area, which would commonly be linked to groundwater flooding.

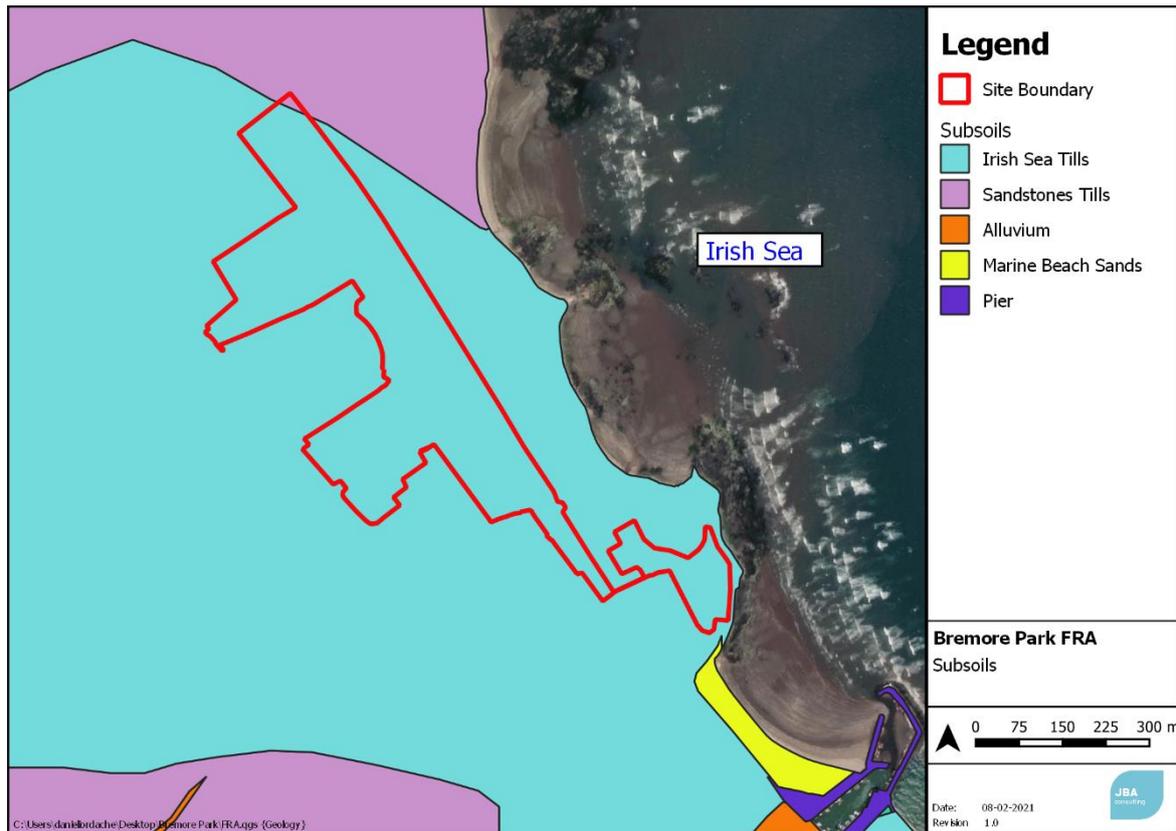


Figure 2-2: Quaternary Sediments

### 3 Flood Risk Identification

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

#### 3.1 Flood History

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](http://www.floodmaps.ie) and general internet searches.

##### 3.1.1 Floodmaps.ie

The OPW host a National Flood hazard mapping website, [www.floodmaps.ie](http://www.floodmaps.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 area, which are listed below.

Review of this mapping shows three instances of historical flooding within the area, two of which are located at the site boundary.

- Re-occurring flooding from coastal sources occurring at Bremore Court Balbriggan, located at the western site boundary
- 14th November 2002 - Flooding at Bath Road from coastal sources located at the south site boundary
- 14th November 2002 - Flooding at Covetown Balbriggan from coastal sources. Flooding was located approximately 300m west of the development site.



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

### 3.1.2 Internet Searches

An internet search was conducted to gather information about whether or not the site was affected by flooding previously. While there were no results for flooding affecting the site itself, there were reports confirming of flooding in the areas mentioned above.

## 3.2 Predictive Flooding

The study area has been subject to two predictive flood mapping and modelling studies.

- Irish Coastal Protection Strategy Study Phase 3 - North East Coast - 2010;
- Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAM) - 2014

The level of detail presented in each method varies according to the quality of the information used and the approaches involved, with FEM FRAM study being the most detailed assessment.

### 3.2.1 Fingal Est Meath Flood Risk Assessment and Management Study (FEM FRAM)

The FEM FRAM study is the most detailed mapping undertaken in the Balbriggan region. The study involves detailed hydraulic modelling of rivers, while also considering the tidal impacts. The Clonard Brook and the Braken watercourses were modelled within the FEM FRAM study which resulted in flood mapping for the 10%, 1% and 0.1% AEP fluvial and tidal events.

The fluvial flood extents presented in Figure 3-1 show the site is not at flood risk from the Braken Stream for events up to and including 0.1% AEP.

Whilst the 1% AEP flows are contained within the channel, the Clonard Brook Stream overtops on the right bank upstream of the site during the 0.1% AEP event, resulting in a minor spill within the site boundary upstream of the railway line.

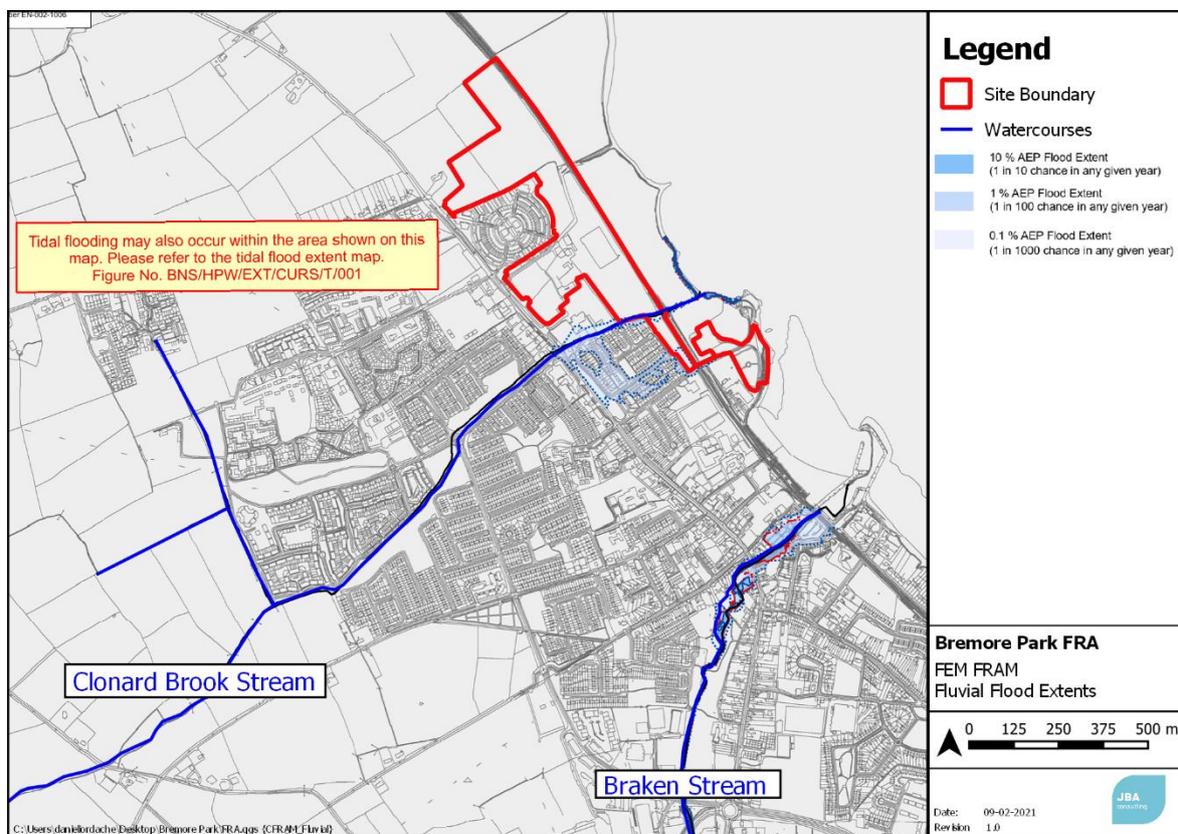


Figure 3-2: FEM FRAM-Fluvial Flood Extents

The tidal flood extents are presented Figure 3-2. Review of Figure 3-2 confirms that no areas of the proposed development are at flood risk from tidal flows for events up to and including the 0.1% AEP event.

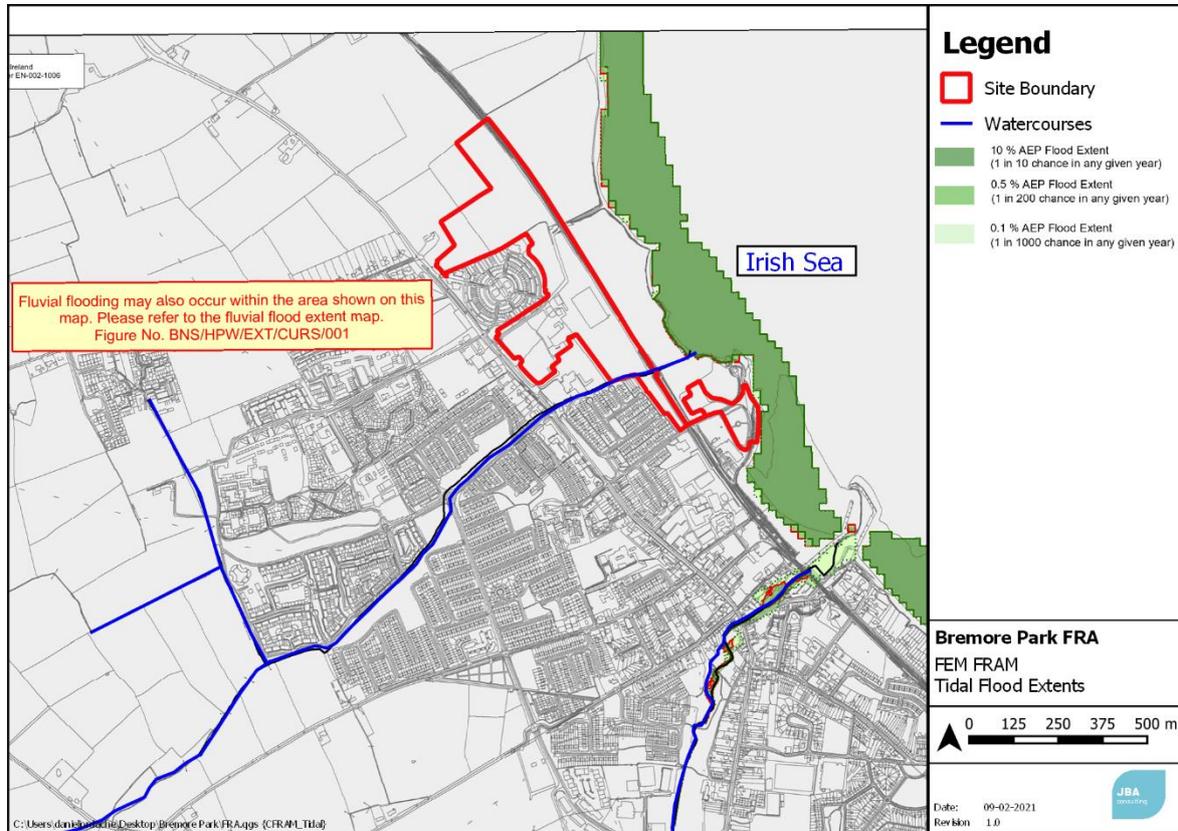


Figure 3-3: FEM FRAM - Coastal Flood Extents

### 3.3 Flood Sources

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. These sources are described below.

#### 3.3.1 Fluvial

Review of the FEM FRAM mapping identifies localised bank overtopping during the 0.1% AEP event along the Clonard Brook Stream within the site boundary just upstream of the railway line. The remaining sections of the site are not at risk from the predicted 1% & 0.1% AEP flood extents.

The Braken Stream is shown not to be a source of flood risk to the site.

#### 3.3.2 Tidal

Although the site is located close to the coast, the minimum site elevation is approximately 8mOD. Review of the FEM FRAM flood extents confirms that the site is not at flood risk from tidal sources.

#### 3.3.3 Pluvial/Surface Water

Pluvial or surface water flooding is the result of rainfall-generated flows that arise before run-off can enter a watercourse or sewer. The site topography slopes from west to east, allowing the pluvial waters to flow gravitationally towards the sea.

Additionally, in any development, the poor design of a surface water system can influence the specific surface water flood risk to a site. To manage the potential generation of surface water runoff by a proposed development on the site, careful consideration should be given to the overall site design.

#### 3.3.4 Groundwater

There are no karst features in the area which would indicate areas at risk of groundwater flooding. The overall vulnerability at the proposed development to groundwater is deemed low. As such, groundwater is not a likely source of flood risk to the site and has been screened out of this assessment.

## 4 Flood Risk Assessment and Mitigation

Review of the available historic and predictive flood risk information indicates that most of the site is contained within Flood Zone C. The most likely sources of flood risk to the site are identified as fluvial from Clonard Brook Stream. Mitigation measures to address the assessed risk and consideration of climate change are also considered.

### 4.1 Flood Risk Assessment

As reviewed in Section 3.2.1, the FEM FRAM flood studies provided mapping of fluvial flood extents that indicates only a minor spill from overland flows within the site boundary during the 0.1% AEP flood event, affecting a green area of the proposed development, as presented in the figure below. The depths expected within the site boundary are shallow.

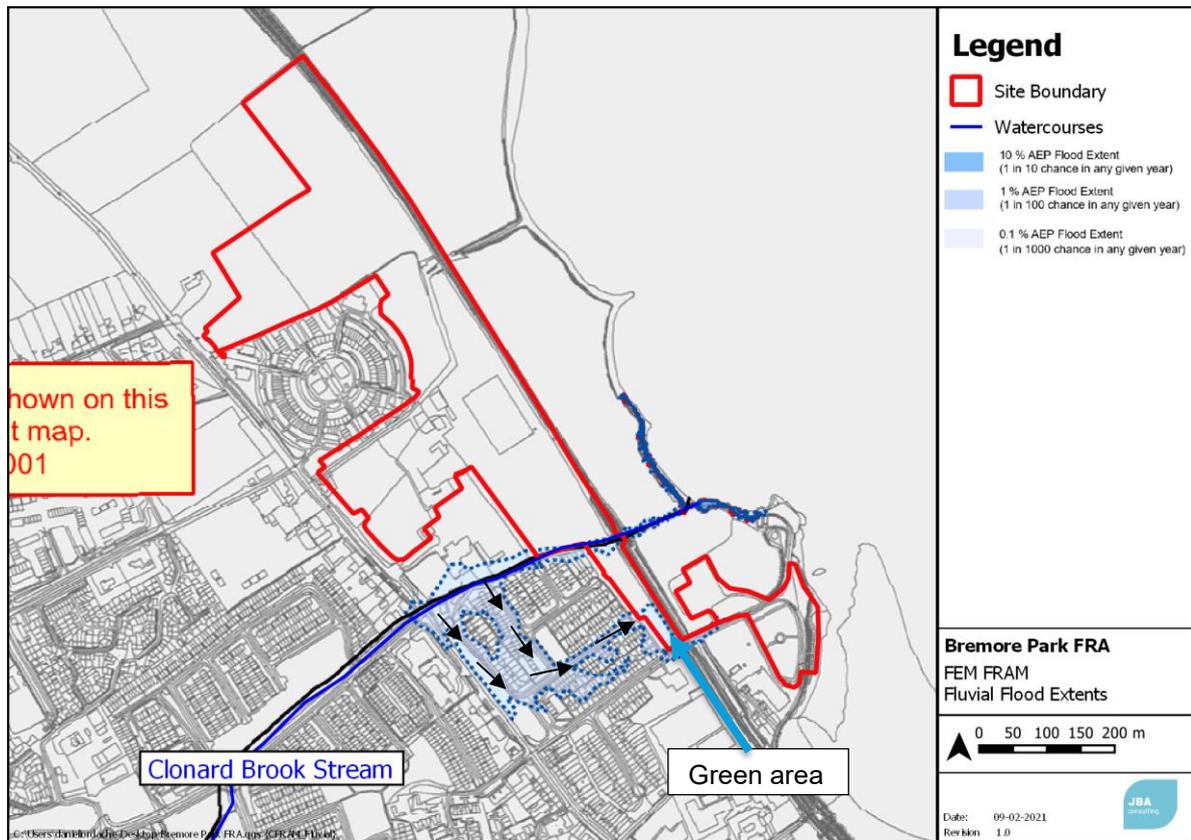


Figure 4-1: Fluvial Food Risk

## 4.2 Mitigation Measures

According to land use vulnerability of different types of development within the Planning Guidelines (DoEHLG, 2009), the proposed development is classified as “water compatible development” (park area, sport fields, car park). Therefore the park area/sports fields can be placed within Flood Zone A, while the car park can be placed in Flood Zone B.

It is noted that all the proposed works identified in Section 1.2 (Sports and Recreational Hub, car parks, Coastal Park, playground) are located within Flood Zone C and at low risk of flooding.

All areas located in Flood Zone B are classified as greenspace parklands and appropriate for development in Flood Zone B.

In order to manage sustainability and longevity of the flood risk at the site, the following mitigation measures were assessed.

### 4.2.1 Access and Egress

All the access routes onto the proposed development are located within Flood Zone C, with one exception, namely the access route from the Lambeecher Rd., which is located in Flood Zone B. Therefore access/egress to the site can be achieved during a 1% AEP flood event.

### 4.2.2 Drainage Design/Pluvial Flood Risk

A SuDS strategy has been employed as part of the proposed development to manage surface water runoff. The strategy aims to comply with the Fingal County Council development plan policies and incorporates measures to drain surface water to swales or stormwater tree pits. The car parking spaces will be constructed with permeable paving systems.

To minimise the risk of pluvial flooding, a threshold of at least 150mm is required from the FFL to the external ground levels for the proposed buildings on site.

### 4.2.3 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).

Similar to the 0.1% event, overland flows from the Clonard Brook watercourse would produce minor spill within a small area of the site during the 1% AEP MRFS fluvial event.

## 5 Conclusion

JBA consulting has undertaken a detailed Flood Risk Assessment (FRA) of the proposed site in Balbriggan, Co Dublin. The site is currently a park managed by Fingal County Council. The main areas of the proposed development are water compatible developments like the Sports and Recreational Hub in the northwest of the park, the Coastal Park at the southern end, improvements to the existing Balbriggan FC car park.

According to *Table 3.1 Classification of vulnerability of different types of development* within the Planning System, the proposed development is classified as “less vulnerable development” (car parks), and “water compatible development” (park area, sport fields), and is therefore appropriate for development from a flood risk perspective in Flood Zone B-C.

FEM FRAM fluvial flood mapping identifies a small area of site being subject to inundation by overland flows from the Clonard Brook Stream during the 0.1% AEP event, placing most of the site in Flood Zone C, with a very small area within Flood Zone B. The remaining proposed works and all buildings are located within Flood Zone C, at low risk of flooding.

All the access routes onto the proposed development are located within Flood Zone C, with the exception of Lambeecher Rd., which is located in Flood Zone B. However, only shallow depths are predicted to occur during the 0.1% AEP event on the Lambeecher Rd access route and therefore the emergency access will be retained.

The proposed stormwater measures incorporate SUDS measures such as to swales or storm water tree pits. The car parking spaces will be constructed with permeable paving systems.

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:

$$\text{Flood Risk} = \text{Probability of Flooding} \times \text{Consequences of Flooding}$$

### A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period years, a 1% AEP flood 1 in 100 chance of occurring in any given year. In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can 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

| Returnperiod (years) | Annual exceedance probability (%) |
|----------------------|-----------------------------------|
| 2                    | 50                                |
| 10                   | 10                                |
| 50                   | 2                                 |
| 100                  | 1                                 |
| 200                  | 0.5                               |
| 1000                 | 0.1                               |

### A.2 Flood Zones

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

| Zone                | Description   |
|---------------------|---|
| <b>Flood Zone A</b> | 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 |
| <b>Flood Zone B</b> | Moderate probability of flooding, between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/ tidal.                            |
| <b>Flood Zone C</b> | Lowest probability of flooding, less than 0.1% from both rivers and coastal/ tidal.   |

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



### A.3 Consequences of Flooding

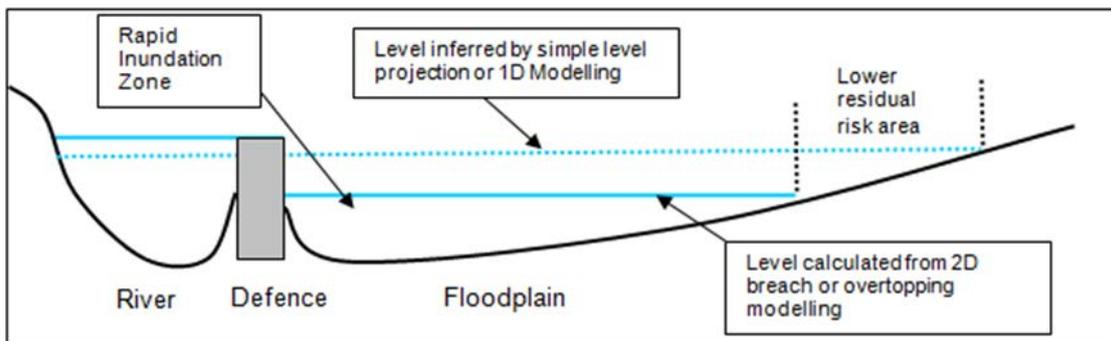
Consequences of flooding depend on the Hazards caused by flooding (depth of water, speed of flow. Rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure of the population, presence and reliability of mitigation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

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

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

### A.4 Residual Risk

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



## A.5 Sequential approach

A core principal of the Flood Risk Assessment and associated guidelines is the application of the Sequential Approach. The aim of the Sequential Approach is to ensure that that appropriate development is undertaken in areas at risk of flooding.

- **Avoid** - Avoid development in areas at risk of flooding; Preferably choose lower risk flood zones for new development, if this is not possible, consider substituting a land use that is less vulnerable to flooding.
- **Substitution** - Only when both avoidance and substitution cannot take place should consideration be given to mitigation and management of risks. Ensure the type of development proposed is not especially vulnerable to the adverse impacts of flooding
- **Justification Test** - Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted. Exceptions to the restriction of development due to potential flood risks are provided for through the use of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated.
- **Proceed** - only where the Justification Test has been passed can the development proceed. Need to ensure that emergency planning measures are in place. Site Topographic Survey

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