Waterman Moylan
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Flood Risk Assessment

Barrington Tower SHD, Brennanstown Road, Dublin 18.

April 2022

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This document has been prepared and checked in accordance with
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Comments

Disclaimer

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This report is confidential to the Client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

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1. Introduction

This Flood Risk Assessment (FRA) has been prepared by Waterman Moylan on behalf of Cairn Homes Properties Ltd. Waterman Moylan have been appointed to provide Engineering services on the Strategic Housing Development at Brennanstown Road, Co. Dublin. This report has been prepared as part of a planning submission to An Bord Pleanála for the proposed SHD development of 534 No. residential apartments on the south side of Brennanstown Road (Barrington Tower). It is also proposed to build 1 No. creche and 1 No. 318 sqm (exclu. Bin Storage) retail facility along with resident support facilities/resident services and amenities.

This FRA has been carried out in accordance with the Department of Housing and Local Government (DEHLG) and the Office of Public Works (OPW) document *"The Planning Process and Flood Risk Management Guidelines for Planning Authorities"* published in November 2009. This Assessment identifies and sets out possible mitigation measures against potential risks of flooding from various sources. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical error.

This report provides an assessment of the subject site for flood risk purposes only.

2. Site Description

2.1 Site Location

The site is in Cabinteely, Dublin 18. It is bounded to the north by Brennanstown Road, to the south by Carrickmines Stream and the Brennanstown Luas stop (not yet open) and to the west by Brennanstown Vale. The proposed development is approximately 4.85 km from Dún Laoghaire Harbour, 1km (c.13-minute walk) east of the Carrickmines Luas station and 3.24 km west from the coastline. Refer to Figure 2-1 for the location of the proposed development.

Figure 2-1. Site Location Map (Google Images)

2.2 Existing Development

The total site area is approximately 3.81 hectares. The site is currently a greenfield. The site falls from northwest to southeast with the highest ground level of 80.00m OD Malin and the lowest ground level of 63.00m OD Malin.

Most of the site is categorised as greenfield, 2 no. existing dwellings are located on the northern portion of the site with an existing road traversing the site from north to south. Holmwood housing estate is further north of the site, across Brenannstown Road and Brennanstown Vale is located west of the site.

2.3 Proposed Development

The proposed 'Build-to-Rent' (BTR) development will consist of the construction of 8 no. blocks in heights up to 10 storeys comprising 534 residential units, a creche, a retail unit, residential support facilities and residential services and amenities. The proposal also includes car and cycle parking, public and communal open spaces, landscaping, bin stores, plant areas, substations, switch rooms, and all associated site development works and services provision. A full description of the development is provided in the statutory notes and in Chapter 3 of the EIAR submitted with this application.

3. Flood Risk

3.1 Introduction

The components to be considered in the identification and assessment of flood risk are set out in Table A1 of the DEHLG/OPW guidelines on the Planning Process and Flood Risk Management and are summarised below:

- Tidal – flooding from high sea levels;
- Fluvial – flooding from water courses;
- Pluvial – flooding from rainfall / surface water;
- Groundwater – flooding from springs / raised ground water and
- Human/mechanical error – flooding due to human or mechanical error.

Each component will be investigated from a source, pathway and receptor perspective and the likelihood of flood occurring and the possible consequences will be assessed.

The likelihood of flooding falls into three categories; low, moderate and high, as described in the OPW Guidelines and set out in Table 3-1.

Based on the determined 'likelihood' and 'consequence' values of a flood event, the 3x3 Risk Matrix seen in Table 5-1, in Section 5, will then be referenced to determine the overall risk of a flood event.

Table 3-1: OPW Guidlines on Likelihood of Flooding

Likelihood	Low	Moderate	High
Tidal	Where probability < 0.1 % chance of occurring in a year	0.5 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 0.5 % chance of occurring in a year
Fluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year
Pluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorised as low, moderate and high for these components. The likelihood and possible consequence of each event is considered, and the risk is evaluated. Risks will be mitigated where possible and the residual risks will then be considered as part of this assessment.

This report has considered the Eastern Catchment Flood Risk Assessment & Management (CFRAM) Study and maps prepared by RPS Group Ireland for the OPW.

3.2 Tidal – Irish Sea

Tidal Flooding is caused by elevated sea levels or overtopping by wave action. The Irish Sea is approximately 3.24km east of the subject site. The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The Proposed road levels range from 63.00m OD Malin and 80.00m OD Malin. The lowest FFL of the site is 66.42m, this is 63.47 above the recorded high tide event.

Given that the site is located 3.24km inland from the Irish Sea, the site levels exceed the highest ever recorded or projected tide in the area, and that there is no coastal flooding indicated on the OPW map, the risk from tidal flooding is considered **extremely low** and no flood mitigation measures need to be implemented.

3.3 Fluvial

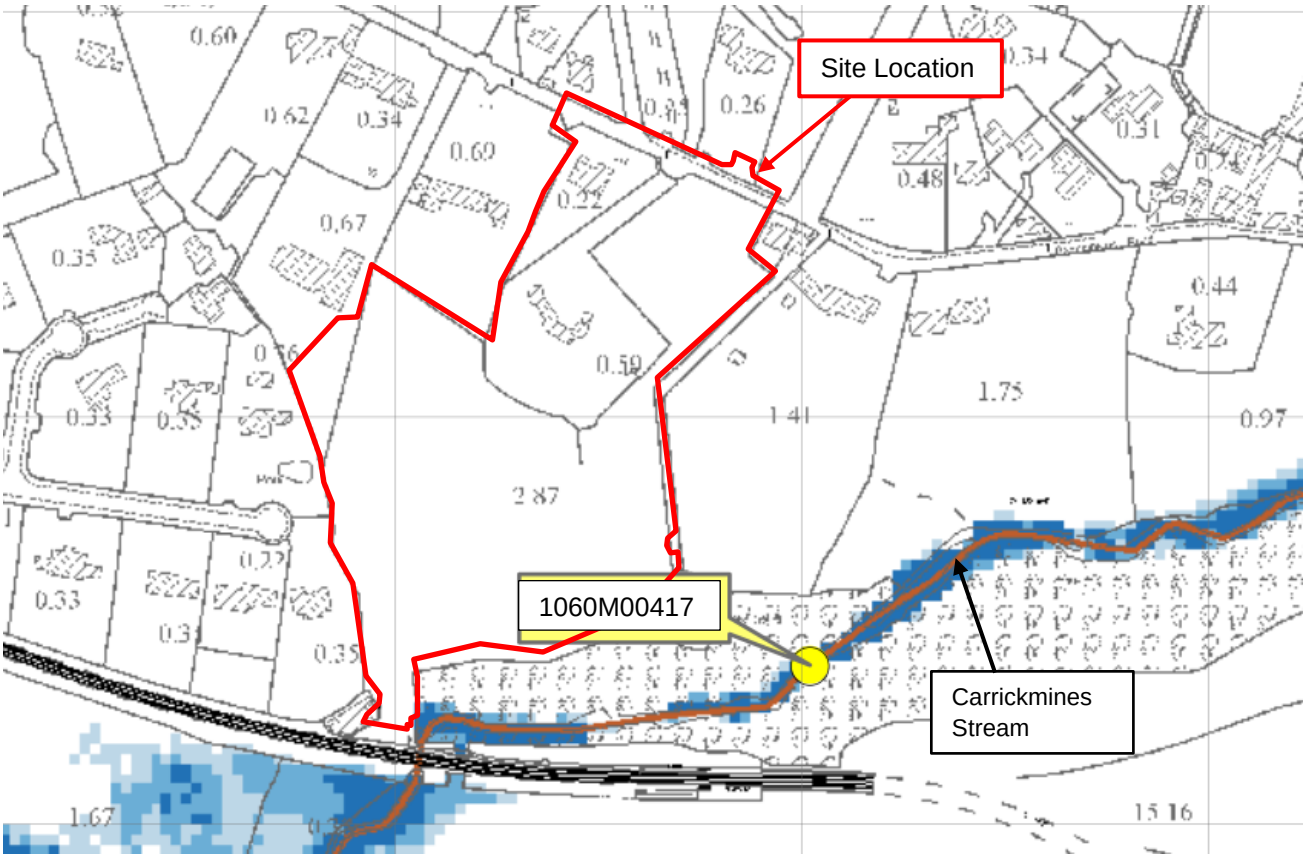
The Shanganagh-Carrickmines River Fluvial Flood Extents study map attained from the Office of Public Works (OPW) can be seen in Figure 3-1 OPW Fluvial Flood Node Details (drawing № E10LOU_EXFCD_F1_03), dated 3rd November 2017, indicates a node 1060M00417 In proximity of the southern border of the Barrington subject site which has a historically record flood event.

Assessing the flooding events of this node for the 1 in 10 years, 1 in 100 years and 1 in 1000 years, the highest flood level of **45.23m** OD Malin for the 1 in 1000-year flood event of the Carrickmines Stream is the critical flood event. As the lowest level on the subject site is **63.00m** OD Malin, the risk of fluvial flooding on this site is seen as extremely low.

In addition, safe access for emergency services can be maintained to the development during an extreme flood event via the Brennanstown Road from the north of the development.

Considering the risk of fluvial flooding is **extremely low** no flood mitigation measures are needed.

Figure 3-1: OPW Fluvial Flood Node Details



3.4 Pluvial

Pluvial flooding is from heavy rainfall and is often referred to as flooding from surface water. Surface water flooding can occur as a result of overland flow or ponding during periods of extreme prolonged rainfall. Flooding may occur through any of the pathways outlined in Table 3-2 and the risk associated with each pathway is outlined within.

Table 3-2: Pluvial Flooding Pathways/Receptors

	Pathway	Receptor
1	Surcharging of the proposed internal drainage systems during heavy rainfall events leading to internal flooding	Proposed development – Basement and buildings
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – Basement and buildings
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads

4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – Basement and buildings
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

3.4.1 Surcharging of on-site drainage system

The proposed on-site surface water drains have been designed to accommodate flows from a 5-year return event which indicates that the internal system may surcharge during rainfall events with a return period in excess of five years.

Therefore, the likelihood surcharging of the on-site drainage system is considered **high** over the lifetime of the building.

The risk of flooding is however mitigated by providing attenuation for the development which can store water for the 1 in 100-year storm event plus a 30% allowance for climate change and therefore the residual risk is low.

3.4.2 Flooding from the existing surrounding drainage system surcharging

Utilities record do not show surface water sewers along Brennanstown Road. A combined sewer is located south of the site and north of the Luas line. The proposed surface water drainage will be attenuated on site and will have a restricted outflow, reducing the rate of run-off before discharging directly into the Carrickmines Stream. Considering the proposed development will not be connecting into an existing surface water/sewer network, the likelihood of flooding due to surcharging from the existing surrounding drainage network is considered **extremely low**.

No further mitigation measures are required.

3.4.3 Surface water discharge from the subject site causing downstream flooding

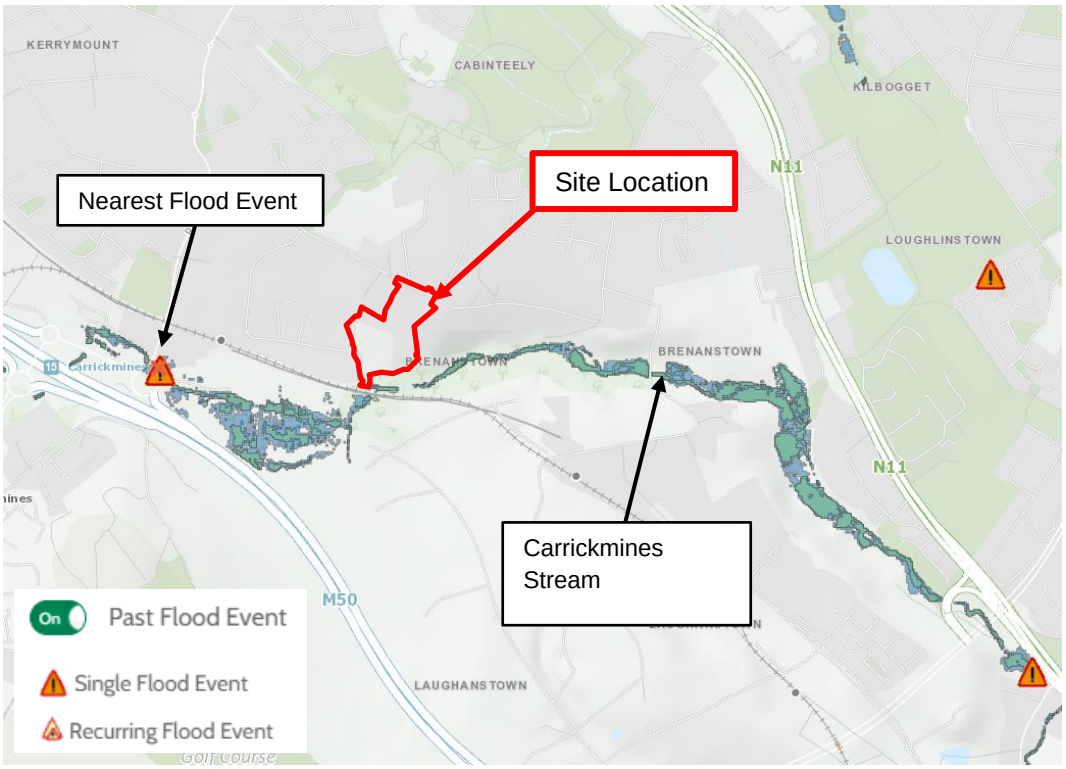
The proposed development is currently greenfield. The development, as designed, will increase the permeable area on site. As a result, the volume of run-off from the site will increase. However, in order to mitigate against this, permeable paving, planters, green roofs and podium areas and swales all of which will help reduce the volume of run-off from the site during low storm events. Surface water discharge from the development will be limited by a hydro-brake with a peak discharge equal to or less than greenfield rates before discharging to the Carrickmines Stream. This will reduce the effects of the development on developments downstream of the site. The likelihood of the proposed development resulting in pluvial flooding downstream of the site is therefore considered **low**.

3.4.4 Overland flooding from surrounding areas

A map from the OPW Flood Info site showing all flood events within the proximity of the subject site and the overlay of the floodplain extent of the *high-probability river flood* can be seen in Figure 3-2. There are no recurring flooding events close to the site, but only single flood events. The flood event located nearest to the site can be seen to the west of the proposed development within Figure 3-2.

The flood records list a single flood event at this location which occurred in 2002 and there have been no recorded flood events since.

Figure 3-2: OPW Past Flood Events



In addition, the development is at a lower level than Brennanstown Road and as such the levels have been set on site to direct overland flows from Brennanstown Road or any drainage system failure to the south of the site and into the Carrickmines Stream.

Given the above, it is considered that there is a **low** likelihood of flooding from surrounding areas.

3.4.5 Overland flooding from the subject site

Positive drainage in the form of gullies and ACO drains as well as SuDS systems such as permeable paving and swales will be provided to collect and discharge rain falling on hardstanding areas to the attenuation tanks. External pavements will be laid to ensure the water is directed away from building entrances towards the drainage gullies and channels.

Building maintenance will be responsible for ensuring the gullies and channels are kept free of debris and therefore, the likelihood to both the development and the surrounding areas from overland flooding from the development is considered **low**.

3.5 Groundwater

According to the SI report "*based on the information at the exploratory hole locations to date, it is considered likely that any shallow ingress into excavations of the CLAY will be slow*". 17 no. of the total 21 no. trial pits recorded no water, with excavations of these pits reaching 3.0m below ground level (GL).

Water ingress was found in TP21S next to an existing dwelling to the north of the site. As water ingress was not encountered anywhere else on site it can be assumed that surrounding hardstanding from the dwelling is not currently being positively drained and appears as a surface water seepage in the trial pit. Considering that TP21S was the only pit to record ingress, it is unlikely the site will encounter widespread ingress. Should groundwater be encountered, adequate measures to waterproof the basement structure must be put in place. With adequate waterproofing, there is low residual risk of flooding from groundwater.

3.6 Human / Mechanical Errors

The subject land will be drained by an internal private storm water drainage system which discharges to the Carrickmines Stream to the south of the subject site. This internal surface water network is a source of possible flooding from the system if it were to block. If the proposed private drainage system blocks this could lead to possible flooding on the podium levels, within the private areas and basement levels and within the private access road and landscaped areas.

In order to mitigate against the risk of flooding from blockages the surface water network must be regularly maintained and where required cleaned out. The building management team will be expected to prepare and follow a maintenance schedule which ensures all drainage is checked and cleared at least annually and after a heavy storm event.

Tree pits, green roofs and permeable paving and catch-pit gullies and manholes will be provided in order to minimise the volume of debris entering the drainage system and mitigate the risk of flooding.

Should a partial or total blockage occur within the drainage system the surrounding ground levels have been set so that the resulting flood water is directed away from the building entrances. Should the surface water system along the landscape areas and access road suffer a 50% blockage, the overland flood route will direct this runoff water to the landscaped areas and finally to the Carrickmines Stream to the south. Should a 50% blockage occur in the basement system the flood water will flow to the basement -2 level which has the lowest level at 66.25m OD where it will be stored within the carpark before being pumped out to the public sewer.. Any flood water in the basement will be instantly recognisable to the site management team which will allow for a fast response. The total volume required to be stored within Tank C for the 1 in 100 year storm plus 30% climate change is 1,129 m^3. Shall a 50% blockage occurred, a total volume of 565 m^3 would be flooded within basement -2 carpark. The total B2 car park areas is in excess of 8,500m^2 therefore, if the basement were to flood in a 1 in 100 year plus 30% climate change event, 67mm of water across the basement floor would accommodate 570m^3 of storage. The likelihood of this occurring is extremely low considering the steps outlined above to prevent a blockage occurring therefore the residual risk is considered low and therefore the risk to the residential dwellings is reduced.

Upon adoption of the proposed flood risk management strategies, outlined above, there is a **low** residual risk of overland flooding from human / mechanical error.

4. Sequential Test

A sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding. The sequential approach is set out in *"The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009"* and shown in Figure 4-1.

Figure 4-1: Sequential Approach (extract from Dublin City Council Development Plan 2016-2022 SFRA)

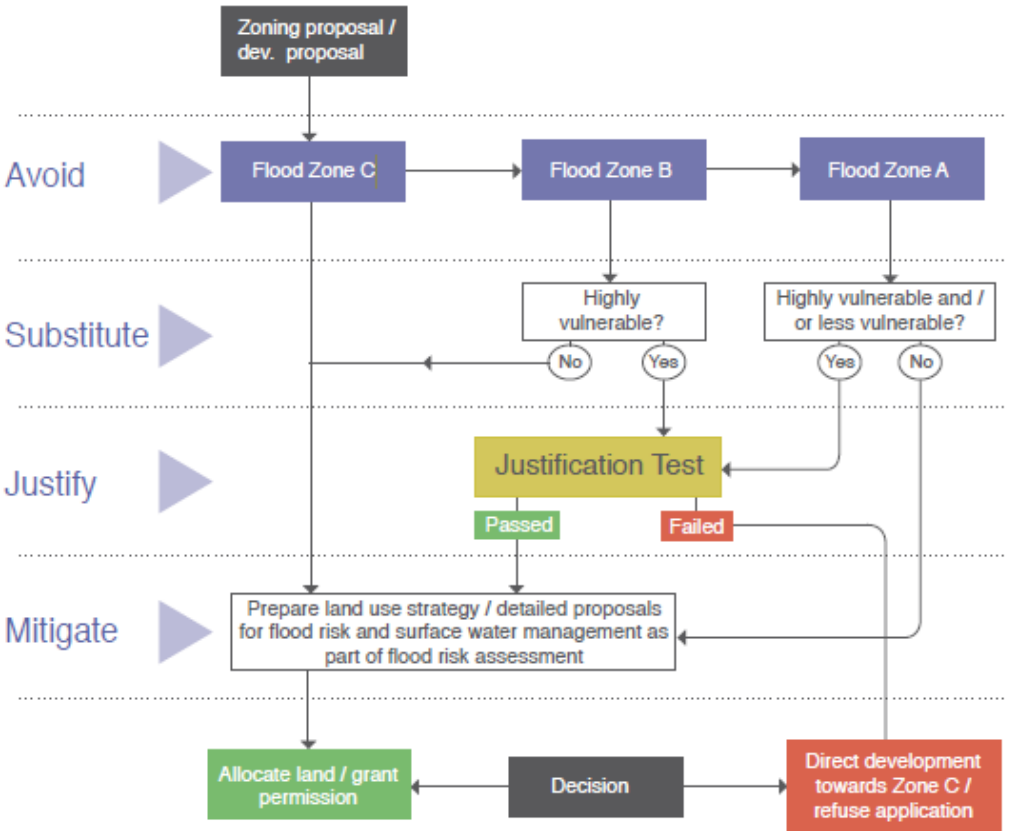


Figure 5.2 lists the vulnerability classes assigned to each land use and type of development, Figure 5.1 outlines the matrix of vulnerability versus flood zone. Both tables have been taken from the *Planning and Flood Risk Management Guidelines for Planning Authorities, 2009, OPW*.

All of the lands that are proposed to be developed on site are within Flood Zone C as they are at a low risk of flooding from all sources. Therefore, the proposed development is deemed an appropriate use of the site, following the sequential approach.

5. Conclusions and Recommendations

The subject site has been analysed for risks from tidal flooding from the Irish Sea, fluvial flooding from the Carrickmines Stream, pluvial flooding, groundwater and drainage system failures due to human error or mechanical system failure.

Considering the assessment of the likelihood, consequence, risk and residual risk of the development for various modes of flooding, the proposed development is considered acceptable in terms of flood risk.

Table 5-1: 3x3 Matrix Flooding Risk Matrix

	CONSEQUENCES			
Likelihood		LOW	MODERATE	HIGH
	LOW	Extremely Low Risk	Low Risk	Moderate Risk
	MODERATE	Low Risk	Moderate Risk	High Risk
	HIGH	Moderate Risk	High Risk	Extremely High Risk

Table 5-2: Summary of the Flood Risks from Flooding Types

Source	Pathway	Receptor	Likeli-hood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	Irish Sea Coastal zone	Proposed Development	Extremely low	High. Flooding of building and the basements	n/a	None required	Extremely Low
Fluvial	Carrickmines Stream	Proposed Development	Moderate	Moderate. Water ingress into the building and basements	Low	None required	Extremely Low
Pluvial	Private and Public Drainage Network	Proposed Development	High	High. Flooding of the building and basements	Extremely High	Appropriate drainage design, over land flood routing and setting of appropriate floor levels	Low
Ground Water	Groundwater present seeping through basement walls and floor	Proposed Development	High	Moderate. Ground water ingress into basement	Moderate	Adequately waterproofing of basement structure if found necessary	Low
Human / Mechanical Error	Drainage network	Proposed Development	High	Moderate. Water ingress into the building and basements	Moderate	Maintenance strategy	Low

UK and Ireland Office Locations