Waterman Moylan
Engineering Consultants

Flood Risk Assessment

Strategic Housing Development for Lands at Glenamuck Road North, Carrickmines, Dublin 18

April 2022

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This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
No. 1	June 2021	J. Rivero	I. Worrell	I. Worrell
No. 2	April 2022	J. Rivero	R. Miles	I. Worrell

Comments

Disclaimer

This report has been prepared by Waterman Moylan, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the Client.

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Content

1. Introduction

This Flood Risk Assessment (FRA) has been prepared by Waterman Moylan as part of the documentation in support of a SHD planning application for a proposed residential development to be submitted to An Bord Pleanála via the Strategic Housing Development (SHD) route, for the proposed development of 118 No. residential units within 3 No. blocks, at Lands at Glenamuck Road North, Carrickmines, Dublin 18.

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 System and Flood Risk Management"* 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 located in the administrative area of Dun Laoghaire Rathdown County Council.

The total site of c. 0.92 ha (c. 0.74ha relates to the main development site and c. 0.18ha relates to additional lands for drainage and access proposals) at Glenamuck Road North, Carrickmines, Dublin 18 (bounded by 'Tullybeg' to the north, 'Chigwell' to the northeast, 'Stafford Lodge' to the south and 'Carricáil' to the southeast). Refer to Figure 1 and Figure 2 for the location of the proposed development.

Figure 1: Site Location (image taken from Google Earth)

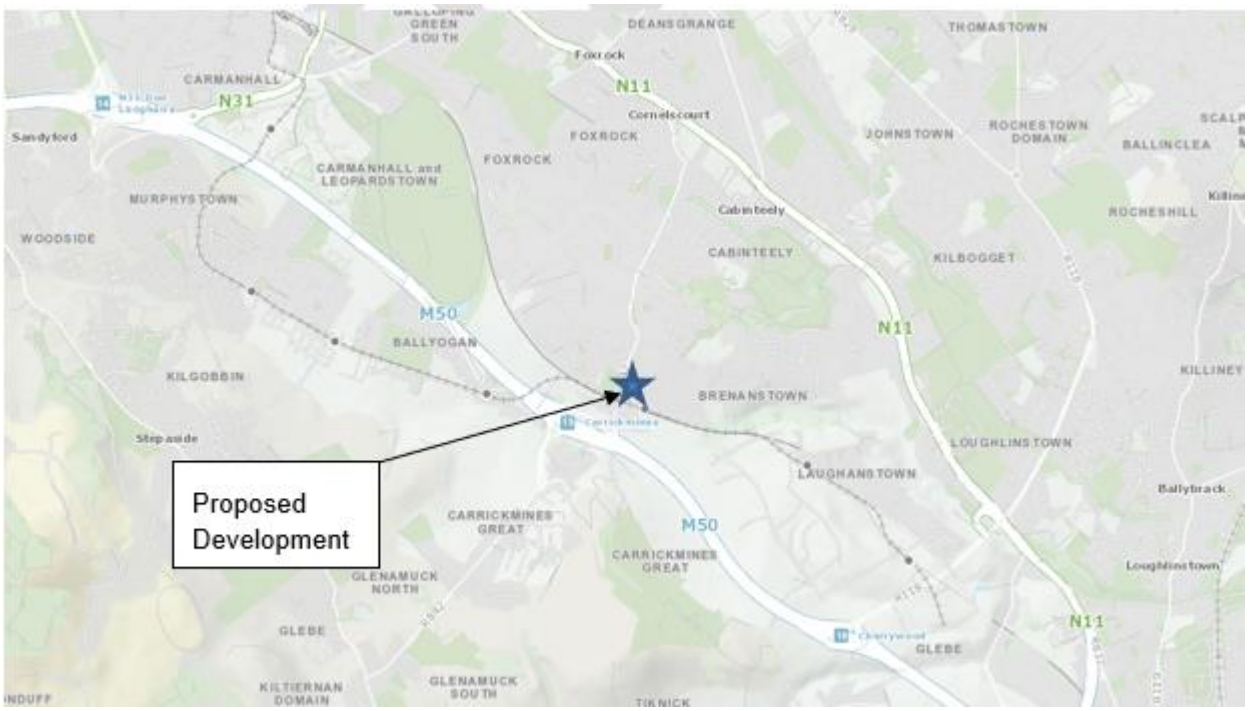


Figure 2: Site Location (image taken from Google Earth)

2.2 Proposed Development

The proposed development shall provide for the construction of 118 no. residential apartment units in the form of 3 no. residential blocks of apartments ranging in height from 4 storey's and transitioning to 6-7 storeys overall

The overall development proposal shall provide for the following:

- Block A (7 storeys) comprising 44 no. units (13 no. 1 bed units, 28 no. 2 bed. units and 3 no. 3 bed units);
- Block B (6-7 storeys overall) comprising 38 no. units (11 no. 1 bed units, 26 no. 2 bed units and 1 no. 3 bed units); and
- Block C (6 storeys overall) comprising 36 units (10 no. 1 bed units; 22 no. 2 bed units and 4 no. 3 bed units);

Each new residential unit has an associated area of private open space in the form of balcony / terrace area and set back upper floor levels.

Open space is provided by one major centrally located public open space between blocks A and B which include a play area; two further communal open space areas are provided adjoining Block B & Block C.

Communal Area located at the ground floor of Block B comprising of a shared working space, meeting rooms, a gym and changing/tea stations is also proposed.

2 no. basement level areas (approx. 2,340.9 sqm) are also proposed at lower ground / ground floor level of Blocks A, B (1,470.0 sqm) and C (834.9 sqm) and include car parking, bicycle parking, refuse storage areas, plant areas and an ESB Substation which is located between Blocks B and C.

A total of 103 no. car parking spaces (67 no. at basement level and 36 no. at surface level to include 17 no. electric power points and 5 no. accessible parking spaces) are proposed. In addition, 5 no. motorcycle parking spaces (3 no. at basement level A and B, and 2 no. at basement level C). A total of 280 no. bicycle parking spaces (254 no. at basement level and 26 no. at surface level) are also proposed.

Proposals for vehicular and pedestrian access comprise via Glenamuck Road North and all associated upgrade works; The access point to the south (via Carricáil) is for pedestrians and cyclists only.

Associated site and infrastructural works including the provision for water services, foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works to include new tree and hedge planting; green roofs; boundary treatments; internal roads and footpaths; and electrical services.

The land naturally slopes significantly from the north (the highest point is c.79.60m) towards the south (the low point is c.74.0m).

The quantity of storm water discharged from the proposed development to the existing system will be restricted to 3.81 l/s/Ha based on the recommendations of the Greater Dublin Strategic Drainage Study, as required by Dun Laoghaire Rathdown County Council. This flow restriction is achieved by means of a Hydro-brake, or similar approved.

It is proposed that the surface water runoff from the site shall be attenuated before discharging, at a restricted rate, via a new surface water sewer to be laid from the subject site to the existing 225 mm diameter surface water sewer located at the southern boundary of the Carricail Site, to the south of the subject site.

It is proposed to drain the foul flows from the development to the existing 225 mm diameter foul sewer that located at the southern boundary of the Carricail site, to the south of the subject site.

The drainage system from the subject site will not be offered for Taking in Charge to Dun Laoghaire Rathdown County Council nor Irish Water. The development shall be a private development maintained by an owner's management company.

It is proposed to supply potable water to the site via a connection to the existing watermain laid along Glenamuck Road North.

The site's main vehicular and pedestrian access is via Glenamuck Road North. The site shall be entered via a priority T junction.

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;
- Ground Water – 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 1.

Table 1: OPW Guidelines

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 ground water 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, as further expanded in Section 3.3 below. In addition, the Strategic Flood Risk Assessment (SFRA) prepared as part of the Dún Laoghaire-Rathdown County Development Plan 2016 – 2022 (currently active) and the pending (at the time of writing) 2022-2028 County development plan, due to come into force on the 21st April 2022, have both been considered.

3.2 Tidal – Irish Sea

Tidal Flooding is caused by elevated sea levels or overtopping by wave action. The Irish Sea is approximately 4 km east of the subject site. The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The subject site is, between 71.05m and 76.65m above the highest tide recorded in the Dublin Coastal area.

Given that the site is located 4km 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

Fluvial flooding is caused by rivers, watercourses or ditches overflowing. The Eastern Catchment Flood Risk Assessment & Management (CFRAM) Study. Maps prepared by RPS Group Ireland for the OPW, along with Strategic Flood Risk Assessment (SFRA) maps prepared as part of the Dún Laoghaire-Rathdown County Development Plan 2016 – 2022 (currently active) and the pending 2022-2028 County development plan, due to soon come into force 21 April 2022, have both been considered.

The Shanganagh-Carrickmines River Fluvial Flood Extents study map (Tile E10LOU_EXFC_F1_02 Sheet 2 of 9), dated 3 November 2017, as shown in Figure 3 indicates that the subject site is not at risk of flooding during a 1 in a 100 or a 1 in a 1000 year events.

The closest node to the site entrance is 1060M00513D, and is located c. 379m south of the site entrance. The Flood levels for a 1 in a 1000 is 66.34 m OD. The site entrance is located at c. 76.5m OD therefore there is no possible route of flooding from fluvial events. It can therefore also be concluded that the subject site is located in Flood Zone C.

The subject site falls within Flood Zone Map No. 9 of the draft DLRCC County Development Plan (2022-2028), similarly indicating that the subject site falls well outside of the fluvial flood extents of the Shanganagh-Carrickmines River, as shown in Figure 4.

Figure 3: OPW Shanganagh-Carrickmines River Fluvial Flood Extents Details

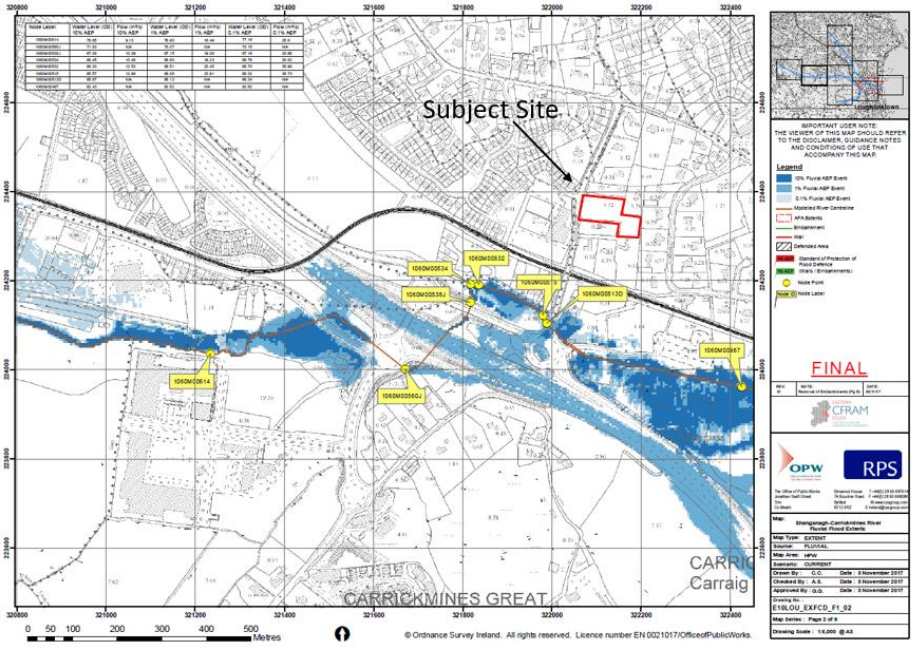
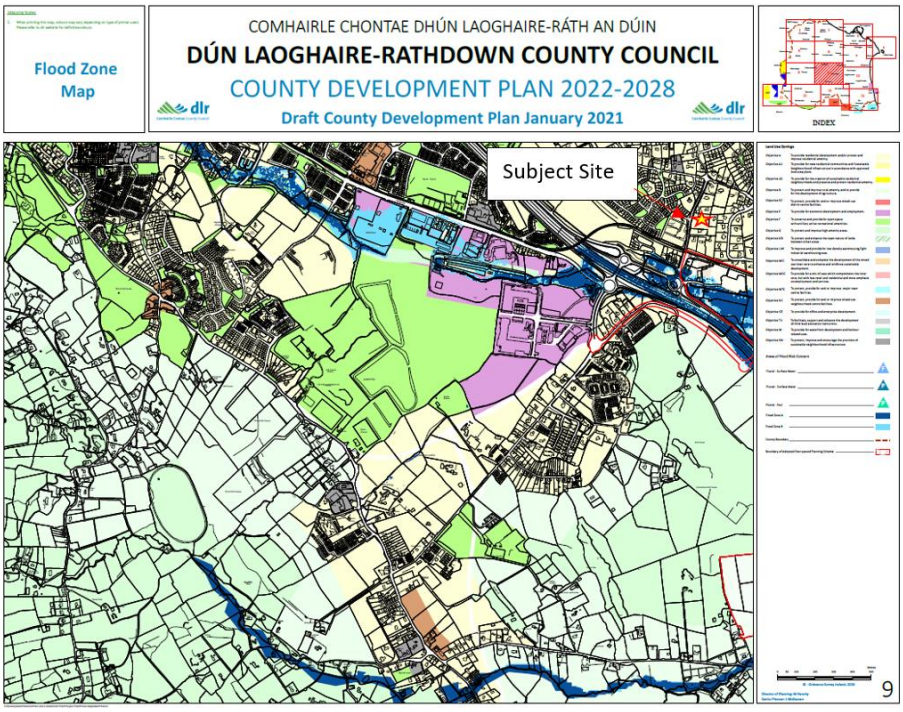


Figure 4: DLRCC Shanganagh-Carrickmines River Fluvial Flood Extents Details



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 2. and the risk associated with each pathway is outlined below.

Table 2: 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 On-site drainage system surcharging

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 mitigated however 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

The proposed development site is greenfield. There have been no recorded sewer flooding events in the immediate vicinity of the site. The surface water drainage from the proposed development will be attenuated on site and will have a restricted outflow to the public surface water sewer, reducing the rate of run-off to the sewer and further reducing the risk of the sewer surcharging. Therefore, the likelihood of flooding due to surcharging the existing drainage network is considered low.

3.4.3 Surface water discharge from the subject site causing downstream flooding

The proposed development site is greenfield. The development, as designed, will increase the impermeable area on site. As a result, the volume of run-off from the site will increase. However, in order to mitigate against this, surface water discharge from the development will be limited by an attenuation storage tank and downstream hydrobrake structure with a peak discharge similar to greenfield rates before discharging to the existing stormwater network adjacent the site. The development, will implement SUDs elements that will further help to mitigate the effects of the development on the local existing network, with the installation of permeable paving, green roofs and tree pits all of which will help reduce the volume of run-off from the site during low storm events. Surface water discharging from the development will be limited by hydrobrakes with a peak discharge of 2.1 l/s for the development. This will reduce the effects of the development on the local existing drainage network further reducing the risk of downstream flooding. The likelihood of the proposed development resulting in pluvial flooding downstream of the site is therefore considered extremely low.

3.4.4 Overland flooding from surrounding areas

A map showing all flood events within close proximity of the subject site is provided below in Figure 4. There is one instance of flooding c. 379m south of the subject site. Upon investigation, this event occurred in 27 November 2002 and there have been no recorded flood events since. In addition, the development is at a higher level than the point where this incident was recorded, directing overland flows from any drainage system failure away from the development. It is therefore considered that there is a low likelihood of flooding from surrounding areas.

Figure 5: Past Flood Events

3.4.5 Overland flooding from the subject site

Positive drainage in the form of gullies as well as SUDS systems such as permeable paving and tree pits will be provided to collect and discharge rain falling on hard standing areas to the attenuation tanks. External pavement will be laid so that water will be 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 risk to both the development and the surrounding areas from overland flooding from the development is considered low.

The finished floor levels throughout the development have been set at least 200mm above the level of the adjacent road drainage channel line.

Should fluvial flooding occur, surface water can flow overland via open areas and road surfaces, away from the apartment buildings, as shown in the overland flood routing drawing supplied as Appendix A of this report.

3.5 Groundwater

A site investigation (SI) has been carried out on site and no groundwater was encountered on site during the borehole logs or trial pits. In the event of ground water flooding the access road and surrounding green areas, this water can escape from the site via the overland flood routing and the building levels have been set higher than the surrounding access road levels.

The building's design will incorporate suitable damp proof membranes to protect against damp and water ingress from below ground level. To mitigate the risks of groundwater entering the basement it must be adequately waterproofed. Any penetrations through the basement wall or slab must also be appropriately sealed to prevent ingress of groundwater.

It is proposed to install a granular blanket surrounding the basement structure, which will allow groundwater to seep around the basement, maintaining any long-term sub-surface perched water movement. This will minimise the effect that the proposed basement will have on the local water table, mitigating the risk to surrounding areas including other basements in the vicinity of the site.

Therefore, there is low residual risk of flooding from ground water.

3.6 Human / Mechanical Errors

The subject land will be drained by an internal private storm water drainage system which discharges to the existing separate foul and surface water sewer network. 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 within the private areas, private access road and basement levels.

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, 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.

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

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 and basement entrances. An overland flow path drawing has been included with the planning pack and indicates the route water will take should surcharging of the system occur at ground level. Any flood water in the basement will be instantly recognisable to the site management team which will allow for a fast response. 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.

Should fluvial flooding occur, surface water can flow overland via open areas and road surfaces, away from the apartment buildings, as shown in the overland flood map supplied as Appendix A of this report.

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", 2009"* and shown in Figure 6 below.

Figure 6: Sequential Approach

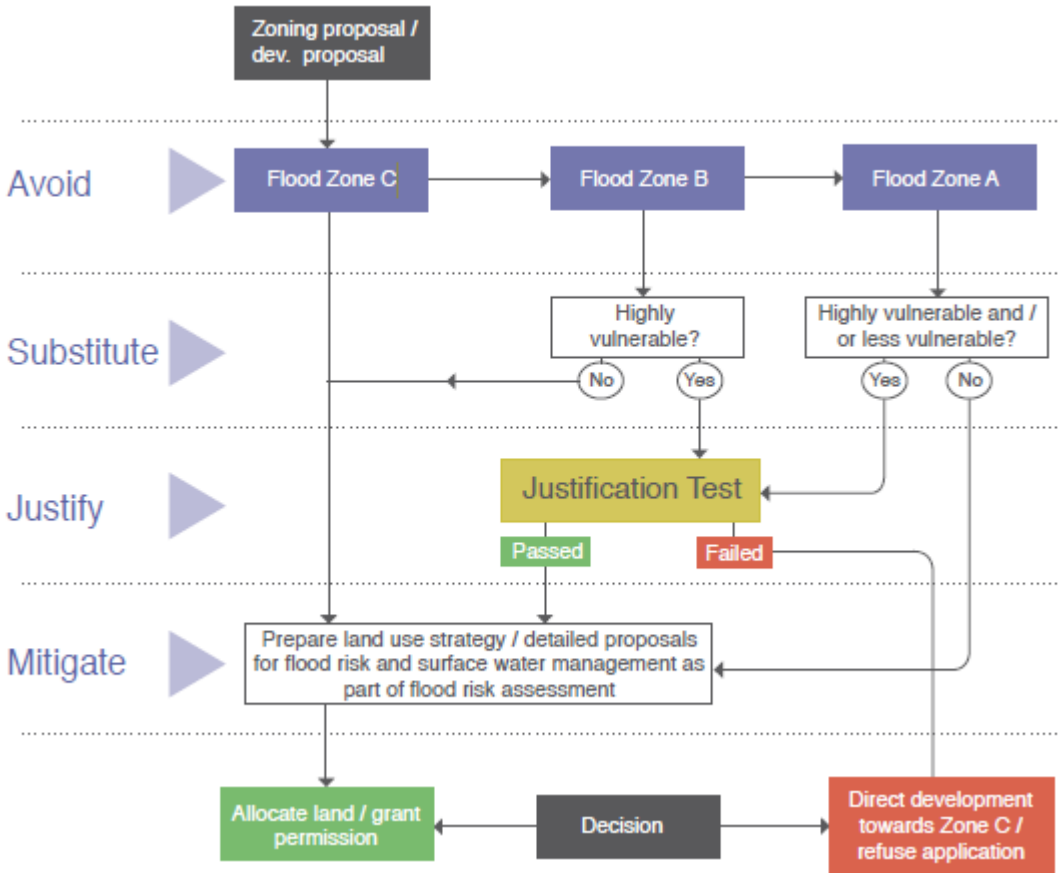


Table 3 below lists the vulnerability classes assigned to each land use and type of development and Table 4 outlines the matrix of vulnerability versus flood zone. Residential development is classified as "Highly vulnerable" development. As indicated in section 3.3, the site is located in Flood Zone C. This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

It is further noted that the subject site falls outside of the fluvial flood extents (Flood Zones A & B) of the draft DLRCC County Development Plan 2022-2028 Flood Zone Map No. 9, of the Shanganagh-Carrickmines River of the draft DLRCC County Development Plan, as indicated in Section 3.3. of this report.

Table 3: Classification of Vulnerability of different types of development. (The Planning System and Flood Risk Management, 2009, OPW)

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Table 4: Matrix of vulnerability versus flood zone (The Planning System and Flood Risk Management, 2009, OPW)

	FLOOD ZONE A	FLOOD ZONE B	FLOOD ZONE C
Highly vulnerable development	JUSTIFICATION TEST	JUSTIFICATION TEST	APPROPRIATE
Less vulnerable development	JUSTIFICATION TEST	APPROPRIATE	APPROPRIATE
Water-compatible development	APPROPRIATE	APPROPRIATE	APPROPRIATE

5. Conclusions and Recommendations

The subject site has been analysed for risks from tidal flooding from the Irish Sea, fluvial flooding from the Shanganagh-Carrickmines River, pluvial flooding, groundwater and drainage system failures due to human error or mechanical system failure. Table 5 below presents the various residual flood risks involved. As the flood risk from all sources can be mitigated, reducing the flood risk to low or very low, the proposed development is considered acceptable in terms of flood risk.

Table 5: Summary of the Flood Risks from each flooding type.

Source	Pathway	Receptor	Likeli-hood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	Irish Sea Coastal zone	Proposed Development	Low	High. Flooding of building and the basements	Very Low	None required	**Very Low**
Fluvial	Shanganagh Carrickmines River	Proposed Development	Low	Moderate. Water ingress into the building and basements	Very Low	None required	**Very Low**
Pluvial	Private and Public Drainage Network	Proposed Development	High	High. Flooding of the building and basements	High risk of damage to the building and basements	Appropriate drainage design, over land flood routing and setting of appropriate floor levels	**Low**
Ground Water	Groundwater present in the ground seeping through basement walls and floor	Proposed Development	High	Moderate. Ground water ingress into basement	Low	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 risk of damage to the building	Maintenance strategy	**Low**

APPENDICES

A. Flood Route Map

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

LEGEND:

× 76.85	INDICATES PROPOSED ROAD LEVEL
1:20 →	INDICATES PROPOSED ROAD FALL DIRECTION
F.F.L. 78.20	INDICATES PROPOSED BUILDING FINISH FLOOR LEVEL
	INDICATES OVERLAND FLOOD ROUTE
+77.066	INDICATES EXISTING GROUND SPOT LEVEL
— 77.00 —	INDICATES EXISTING GROUND CONTOUR LEVEL
	INDICATES EXTENT OF PLANNING APPLICATION BOUNDARY

Block A
FFL 78.30m

Block B
FFL 78.20m

Block C
FFL 77.80m

N

1:250 0 5.0 10.0 15.0 20.0 25.0m
1:1 0 10 20 30 40 50 60 70 80 90 100

PLAN VIEW – OVERLAND FLOOD ROUTE LAYOUT
SCALE 1:250 @A1

REV.	DATE	AMENDMENT	DRN	APPD

STATUS **FOR PLANNING ONLY NOT FOR CONSTRUCTION**

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ARCHITECT MC GRANE AND PARTNERS LTD.

PROJECT
STRATEGIC HOUSING DEVELOPMENT AT GLENAMUCK ROAD NORTH, CARRICKMINES, DUBLIN 18

TITLE
OVERLAND FLOOD ROUTE LAYOUT

DRAWN	DESIGNED	APPROVED	DATE
G.Byrne	IW	JG	FEB. '22
SCALE	JOB NO.	DRG. NO.	REVISION
1:250 @A1	13-125	P235	

Apr 05, 2022 - 7:01pm Drawing Location: M:\Projects\13\13-125\Cad\Civil\Planning SHD 2021\13-125-P235-Overland Flood Route Layout.dwg

UK and Ireland Office Locations