Waterman Moylan
Engineering Consultants

Flood Risk Assessment

Oldtown Planning: Phase 5 – Strategic Housing Development (SHD)

April 2022

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This document has been prepared and checked in accordance with
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Comments

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1. Introduction

This Flood Risk Assessment has been prepared by Waterman Moylan as part of the documentation in support of the Oldtown Phase 5 Planning application for a proposed housing development at Oldtown, Swords, Co. Dublin.

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process 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 (river), pluvial (direct heavy rain), groundwater, and human/mechanical errors.

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

1.1 Site Description and Proposed Development

The area of the Oldtown-Mooretown LAP lands is approximately 111 hectares. The lands are located at the western edge of Swords, within the catchment of the Broadmeadow River.

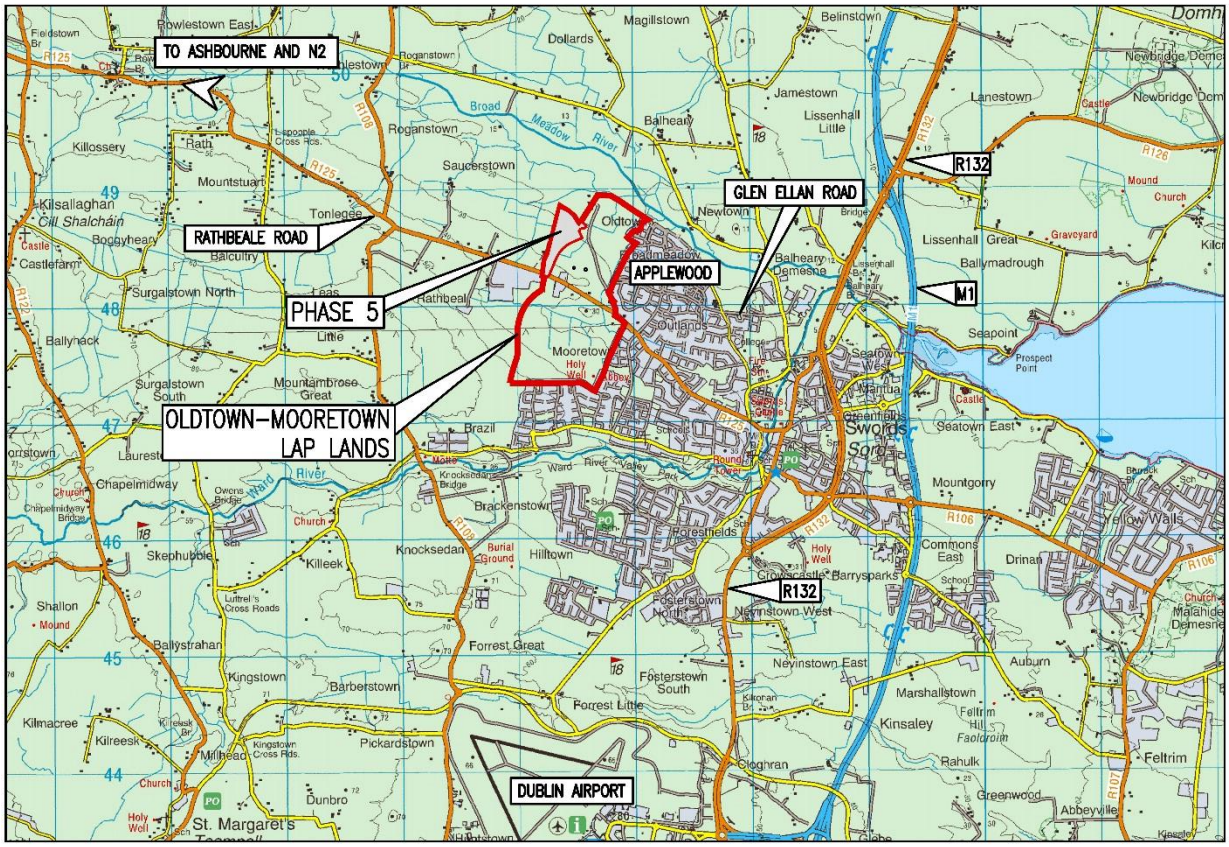


Figure 1 | *Site Location Plan*

The Oldtown–Mooretown lands are divided by the Rathbeale Road, with Oldtown lands to the north (circa 50 Ha) and Mooretown to the south (circa 61 Ha).

The subject site area (net area. 7.80 Ha) is located west of the Millers Avenue within the Oldtown lands and forms Phase 5 of the Oldtown–Mooretown Masterplan. See *Figure 1* for the Site Location.

The subject site generally slopes from south-west to north-east. The site has a high point of c. 33m OD Malin in the south-west corner, down to c. 16m OD Malin in the north of the site. The attenuation ponds have been designed to attenuate all the Oldtown development lands, including the subject Phase 5 development. The ponds discharge to the Broadmeadow River at a level of 7.76m OD Malin, at an outfall located immediately to the north of the ponds along the northern boundary of the Oldtown lands.

The Broadmeadow River traverses the northern boundary of the oldtown lands with a predicted FEM FRAM 1 in 1000-year flood level of 11.55m OD Malin at a node located immediately upstream of the development.

The accompanying Waterman Moylan drawing 17-144.P1000 shows the site location and the approved Oldtown–Mooretown Masterplan as background information.

The proposed development totals 377 No. units, comprising; 173 No. Houses, 134 No. Apartments, and 70 No. Apartment/Duplex units. A 519m² Creche is also proposed.

The proposed road levels around the site range from 33.39 to 15.99m OD Malin with finished floor levels ranging from 33.11m to 16.47m OD Malin.

The development includes all associated site works and infrastructure, including internal roads, paths, cycle-paths, public lighting, utilities, foul and surface drainage, and landscaped open space.

1.2 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- 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.
- Human/mechanical error – flooding due to human or mechanical error.

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring, and the possible consequences.

1.2.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate, and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	**Moderate**	**High**
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

Table 1 | *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

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 categorized as low, moderate, and high for these components.

Risks are then evaluated based on the level of likelihood and possible consequences of a flood occurring. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.2.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.2.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event:

		Consequences		
		Low	**Moderate**	**High**
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 2 | *3x3 Risk Matrix*

1.2.4 Flood Risk Management

After a risk has been assessed, flood risk management is the next stage. Flood risk management aims to minimize the risks to people, properties and the environment arising from flooding.

1.2.5 Residual Risk

The residual risk is the risk which remains after all risk avoidance, substitution, and mitigation measures have been implemented.

2. Tidal – Irish Sea

2.1 Source

The Irish Sea is approximately 3.6 kilometres east of the subject site.

The Dublin Coastal Protection Project indicated the highest recorded tide event occurred in 2002 with the high tide reaching 2.95m OD Malin.

2.2 Receptor

The proposed development is to be constructed at a level of between 33.39m and 15.99m OD Malin.

2.3 Likelihood

Given that the site is located 3.6 kilometres inland from the Irish Sea and the 13.04m level difference between the subject lands and the highest recorded tide, a pathway does not exist between the source and the sea, and therefore the likelihood from tidal flooding is extremely low and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

The subject site is located within the Broadmeadow River catchment. The Broadmeadow River traverses the lands to the north of the site. *Figure 2* below is an extract from the Flood Studies carried out by Fingal County Council as part of their strategic flood risk assessment for the draft Fingal Development Plan 2017-2023. The map shows that the subject site is outside of the 0.1% Annual Exceedance Probability (AEP) flood plain.

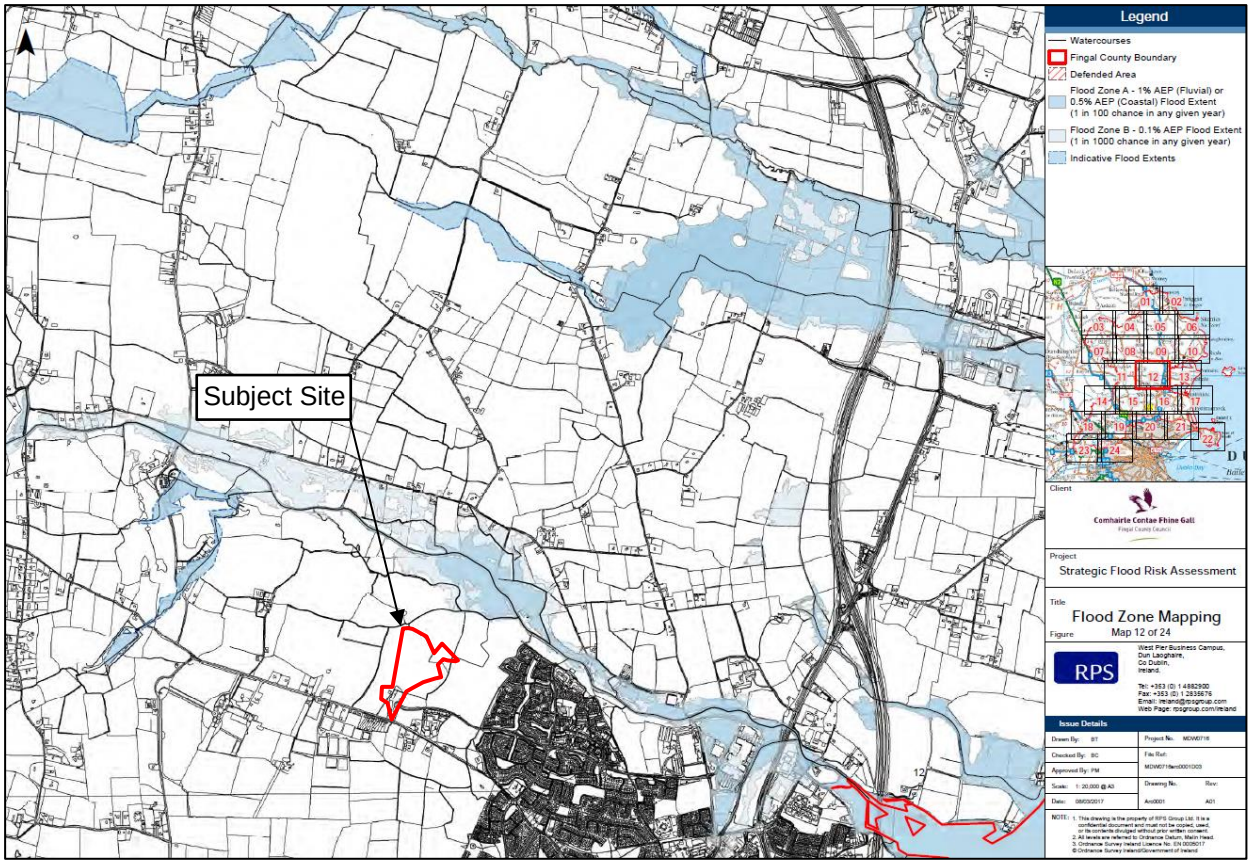
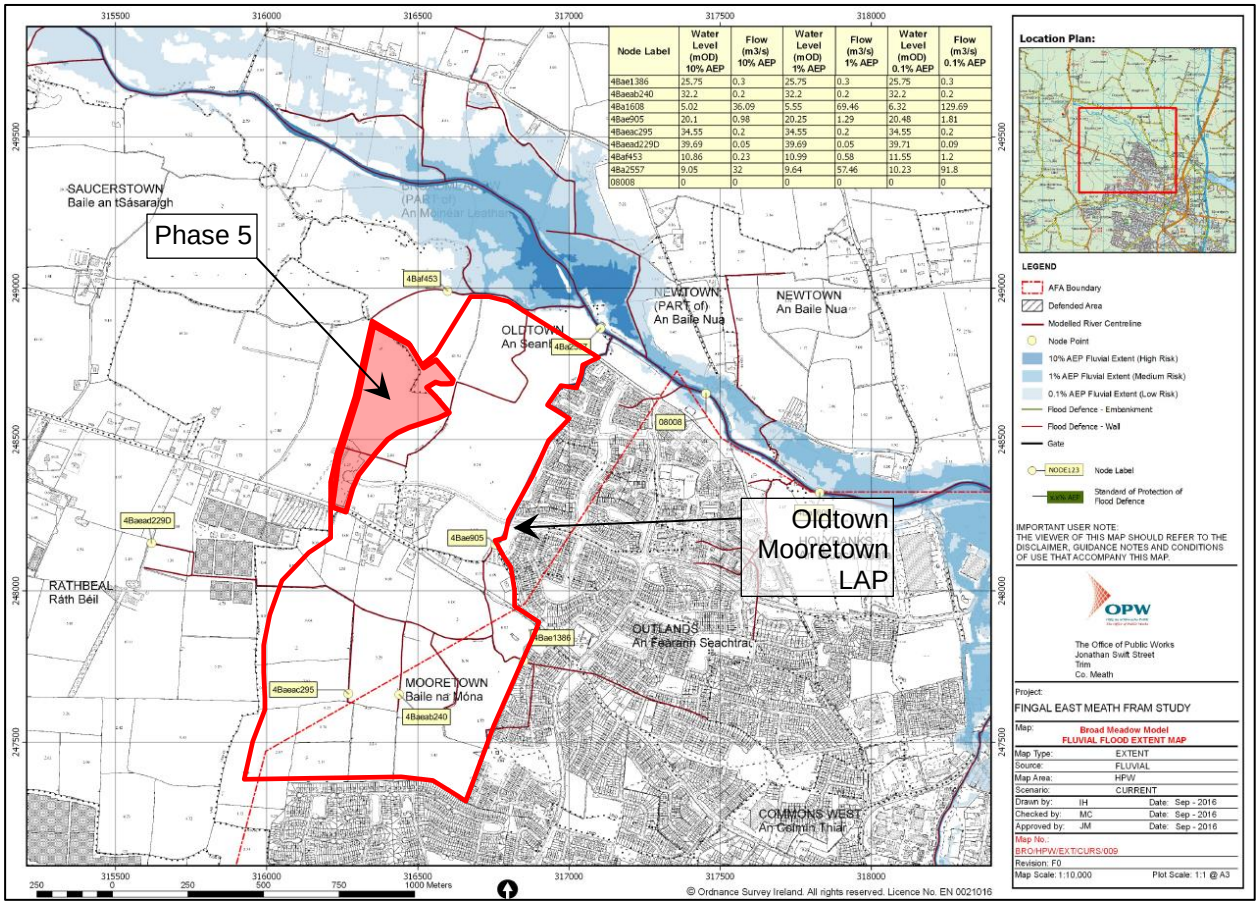


***Figure 2** | Broadmeadow River Flood Extent Map - Up to 1 in 1,000 Year Return Period*

The lowest design road level of the proposed development is 15.99m OD Malin, with the lowest finished floor level at 16.47m OD Malin. The closest Broadmeadow River/Saucerstown stream node point (4Baf453) on the FEM FRAM 0.1% AEP (1 in 1000 year) flood level (refer *Figure 3* overleaf) is located just upstream of the northern boundary of the Oldtown Phase 5 lands. The estimated water level at this node for the current scenario for a 1 in 1000-year flood is 11.55m OD Malin. This provides 4.44m freeboard for the lowest proposed road level and 4.92m freeboard for the lowest proposed FFL from the 1 in 1000-year fluvial flood level.

A risk from fluvial flooding is therefore very low and no flood mitigation measures need to be considered.



Node Label	Water Level (mOD) 10% AEP	Flow (m3/s) 10% AEP	Water Level (mOD) 1% AEP	Flow (m3/s) 1% AEP	Water Level (mOD) 0.1% AEP	Flow (m3/s) 0.1% AEP
4Bae1386	25.75	0.3	25.75	0.3	25.75	0.3
4Baeab240	32.2	0.2	32.2	0.2	32.2	0.2
4Ba1608	5.02	36.09	5.55	69.46	6.32	129.69
4Bae905	20.1	0.98	20.25	1.29	20.48	1.81
4Baeac295	34.55	0.2	34.55	0.2	34.55	0.2
4Baead229D	39.69	0.05	39.69	0.05	39.71	0.09
4Baf453	10.86	0.23	10.99	0.58	11.55	1.2
4Ba2557	9.05	32	9.64	57.46	10.23	91.8
08008	0	0	0	0	0	0

Figure 3 | *FEM FRAM Fluvial Flooding Map*

4. Pluvial

4.1 Source

The source of pluvial flooding is from heavy rainfall.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	Receptor
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
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 – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 3 | *Pathways and Receptors*

It is proposed to discharge surface water from the proposed site to the existing surface water drainage network that has been designed to accommodate the proposed development. The surface water network discharges to the Broadmeadow River via attenuation ponds located to the north-east of the site and immediately south of the Broadmeadow River.

Refer to drawings 17-144-P1200 to 17-144-P1203 for the existing and proposed drainage layout.

4.3 Likelihood

The surface water system was designed using MicroDrainage which size the pipes to accommodate a 5-year return rainfall event with a maximum 50mm/hr rainfall intensity.

Blockages within the surface water system would increase the likelihood of pipes surcharging.

4.3.1 Surcharging of the Proposed On-Site Drainage Systems

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

4.3.2 Surcharging from the existing surrounding drainage system:

There is a moderate likelihood of surcharging from the surrounding surface water mains networks which have been designed accommodate a 5-year return storm.

4.3.3 Surface Water Discharge from the Subject Site

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of surface water discharge from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.3.4 Overland Flooding from Surrounding Areas

The Office of Public Works (OPW) records for predictive and historic flood maps and benefiting land maps have been consulted with regard to recorded flood events in the vicinity of the subject site. A map showing all flood events within the locality of the subject site was obtained from the OPW website, an extract of which is provided below in *Figure 4*.

Figure 4 | *OPW Land Benefiting Maps and Historic Flood Maps*

The 2 closest recorded flood events shown are historical in nature at a distance of 1.65km and 1.85km from the subject site, they are from 1982 & 1986 respectively.

With no recorded flood event in the immediate area that could have an impact on the subject site, it is considered that there is a low likelihood of flooding from surrounding areas.

4.3.5 Overland Flooding from the Subject Site

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas and possibly properties. The consequences of pluvial flooding are considered moderate.

4.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

4.5.1 Surcharging of the Proposed On-Site Drainage Systems

Given a high likelihood and the moderate consequences of flooding the site by surcharging the on-site drainage system, the resultant risk remains high and flood risk management will be required to be implemented.

4.5.2 Surcharging from the Existing Surrounding Drainage System

Given a moderate likelihood and moderate consequences of flooding the site from the existing surface water network, the resultant risk is moderate.

4.5.3 Surface Water Discharging from the Subject Site

Given a moderate likelihood and the moderate consequences of flooding downstream of the site due to excess discharge surface water from the site, the resultant risk is moderate, and implementation of flood risk management will be required.

4.5.4 Overland Flooding from Surrounding Areas

Given a low likelihood and the moderate consequences of overland flooding from surrounding areas, the resultant risk is low.

4.5.5 Overland Flooding from the Subject Site

Given a moderate likelihood and the moderate to high consequences of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

The development has been designed to provide overland flood routing to the east to the attenuation ponds and Broadmeadow River. The proposed development has designed finished floor levels generally over 200mm above the local road network to minimise the risk of flooding from overland flows.

Where localised low points occur in the road network, the finished floor levels have been designed above the local high point (crest in the road network). The result of this is a significant reduction in the risk of flooding for the subject site.

To minimise the risk of downstream flooding, surface water outflow from the site is limited to its equivalent green-field run-off rate via a flow control manhole. The ponds have been designed to attenuate flood volumes beyond the 1 in 100-year event which minimises the risk of downstream flooding.

Refer to Appendix A for Flood Route Drawing, 17-144-P1500.

The following are flood risk management strategies proposed to minimise the likelihood of pluvial flooding for each risk:

4.6.1 Surcharging of the Proposed On-Site Drainage Systems

The likelihood of flooding is minimised with adequate sizing of the on-site surface water network. The risk to properties from any surcharged surface water is reduced by designing the finished floor levels to generally be 200mm above the adjacent road levels. Furthermore, overland flood routing has been incorporated into the design of the development with all roads draining towards the Oldtown Attenuation Ponds. Finish floor levels have been set higher than internal road crest (high point) levels so that even if the road floods, the flood levels will not rise above adjacent floor levels. Refer to Overland Flood Route drawing in Appendix A.

4.6.2 Surcharging from the Existing Surrounding Drainage System

The risk of flooding to properties from the surcharging of the existing surface water network has been reduced by designing the finished floor levels to generally be 200mm above the adjacent road levels. Furthermore, overland flood routing has been incorporated into the road network design.

4.6.3 Surface Water Discharging from the Subject Site

Surface water discharging from the proposed development will be limited by a flow-controlled manhole to ensure the maximum discharge rate from the site is limited to mimic the green-field runoff rate. Excess discharge flows from the development will be attenuated within the attenuation ponds which have been sized to attenuate up to the 100-year rainfall event for each sub-catchment within the entire Oldtown lands development.

4.6.4 Overland Flooding from Surrounding Areas

Overland flood routing and raised finished floor levels will provide protection for the proposed properties. The resultant risk of overland flooding from surrounding areas to properties is low.

4.6.5 Overland Flooding from the Subject Site

The risk of overland flooding from the subject site is minimised by restricting surface water discharge runoff to green-field rates and provided on-site attenuation for rainfall events up to 1 in 100-year storm event.

4.7 Residual Risk

As the result of the design measures detailed above in Section 4.6, there is a low residual risk of flooding from each of the surface water risks. The flood risk management measures set out in Section 4.6 will minimise the risk, ensuring that any overland flooding from surface water will result in the temporary flooding of the internal roads only.

5. Ground Water

5.1 Source

During periods of prolonged rainfall, the groundwater can rise to above ground level.

5.2 Pathway

During periods of prolonged rainfall there is a possibility that the groundwater level could rise. This may result in ground water seeping above the ground surface.

5.3 Receptor

The receptors would be the underground services, houses, and road areas within the proposed development.

5.4 Likelihood

There is no known history of ground water / springs seeping through the ground in this area. However, it is possible for ground water to rise and cause potential flooding on site during prolonged wet periods. An extract of a groundwater vulnerability map below in *Figure 5*, shows that the site is located between a moderate and high vulnerability location. And thus, can be considered to have a moderate to high likelihood.

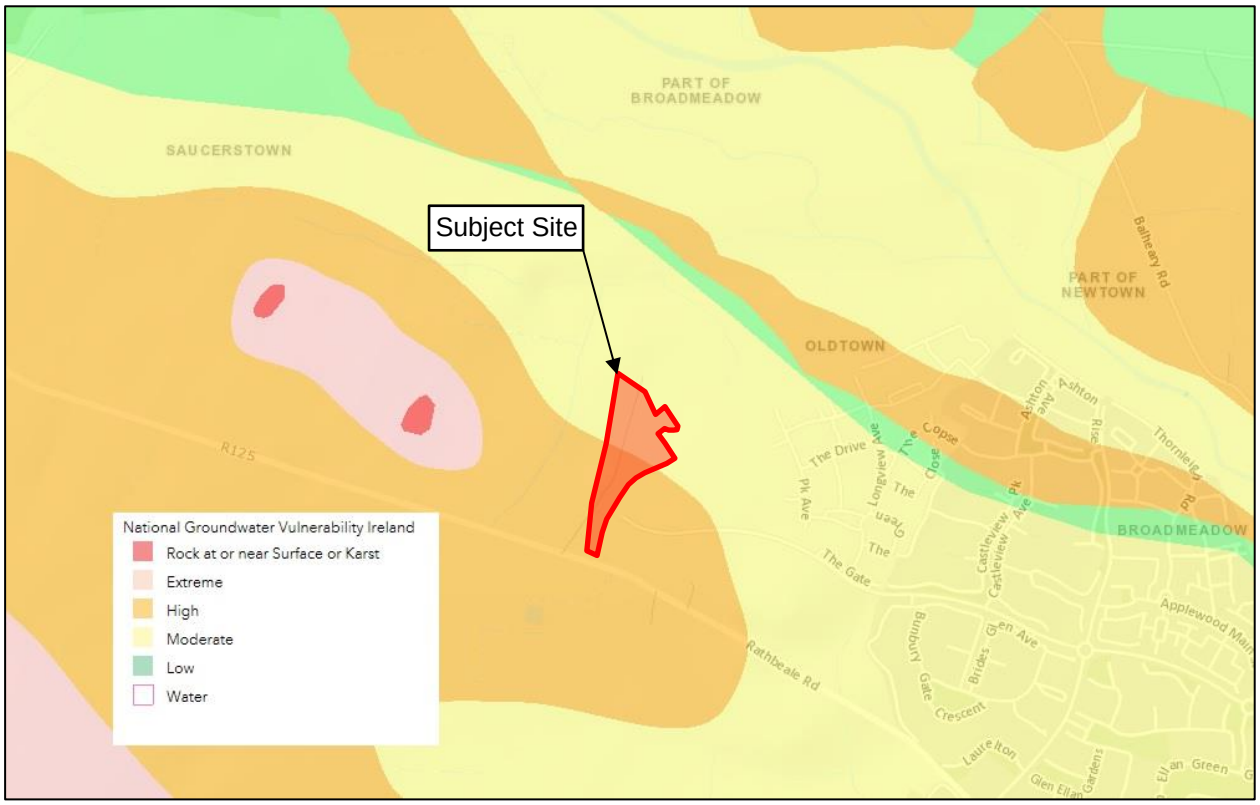


Figure 5 | *Groundwater Vulnerability Map*

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings and landscaped areas. Underground services may also be inundated from high water tables. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

There is a high risk of ground water flooding as the likelihood is moderate to high and the consequence is moderate, thus mitigation measures are required.

5.7 Flood Risk Management

Underground services have been designed to be as shallow as possible and will be watertight to eliminate the ingress of ground water, and unit foundations will incorporate a damp-proof membrane.

Finished floor levels have been set above the road levels and surrounding garden levels to ensure any seepage of ground water onto the development does not flood into the houses. Any groundwater that may potentially flood the site can escape from the site via the overland flood routing shown in Appendix A.

5.8 Residual Risk

There is a low residual risk of flooding from ground water.

6. Human / Mechanical Errors

6.1 Source

The subject lands will be drained by an internal private storm water drainage system which discharges to the existing surface water network before out-falling to the Broadmeadow River via the Oldtown Attenuation Ponds. There are flow control devices proposed at the attenuation pond outfall.

This internal surface water network is the source of possible flooding if the system was to block.

6.2 Pathway

If the proposed private drainage system blocks this could lead to possible flooding within the private and public areas.

6.3 Receptor

The receptors for flooding due to human/mechanical error would be the apartment/commercial blocks and the roads.

6.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

6.5 Consequence

The surface water network would surcharge and overflow through gullies and manhole lids. It is, therefore, considered that the consequences of such flooding are moderate.

6.6 Risk

With a high likelihood and moderate consequence, there is a high risk of surface water flooding should the surface water network block.

6.7 Flood Risk Management

As described in Section 4.6, levels on-site have been designed such that in the event of the surface water system surcharging, surface water can still escape from the site by overland flood routing without damaging properties. The risk to the surrounding buildings is mitigated by setting finished floor levels at least 200mm above the adjacent road channel line. Where there are localised low spots in the road, the FFLs have been set a minimum of 300mm above the adjacent road channel line.

The surface water network would need to be unblocked and maintained should a blockage occur. Inspection monitoring should be carried out of the water levels in the Oldtown Attenuation Ponds at times of extreme rainfall events, with a periodic monitoring/maintenance regime to be implemented and incorporated in the project safety upon project completion.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding from human / mechanical error.

7. Conclusions and Recommendations

The subject lands have been analysed for risks from flooding from the Irish Sea, fluvial flooding, pluvial flooding, ground water and failures of mechanical systems. *Table 4* below presents the various residual flood risks involved.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*None*	*Proposed Development*	*Low*	*None*	*Negligible*	*None*	Extremely Low
Fluvial	*Broadmeadow River*	*Proposed Development*	*Low*	*None*	*Negligible*	*None*	Extremely Low
Pluvial	*Private and Public Drainage Network*	*Proposed Development*	*Low to High*	*Moderate*	*Low to High*	*Appropriate drainage design and flow control, over land flood routing, and setting of floor levels.*	Low
Ground Water	*Ground*	*Proposed Development*	*Moderate to high*	*Moderate*	*Moderate to high*	*Appropriate drainage design, Damp-proof membrane, over land flood routing and setting of floor levels.*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed Development*	*High*	*Moderate*	*High*	*Over land flood routing, setting of floor levels and inspection of SW network.*	Low

Table 4 | *Summary of the Flood Risks from the Various Components*

Appendix A: Overland Flood Route Layout

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.

3. ALL ROAD AND UTILITY WORKS, FIXTURES AND FITTINGS TO BE CONSTRUCTED IN ACCORDANCE WITH REQUIREMENTS AND SPECIFICATIONS OF DUBLIN CITY COUNCIL.

LEGEND

- OVERLAND FLOOD ROUTING
- + LP — LOW POINT
- + HP — HIGH POINT

SAUCERSTOWN STREAM

OLDTOWN FOOTBALL PITCH AND REGIONAL PARK UNDER CONSTRUCTION

EXTENT OF PROPOSED OLDTOWN PHASE 5

HP 19.268

HP 19.94

HP 18.93

HP 17.329

LP 17.156

HP 23.691

HP 26.95

HP 28.12

HP 29.649

HP 30.772

HP 33.191

HP 33.393

HP 32.683

OLDTOWN PHASE 4D CONSTRUCTED REG REF F18A/0750

MILLERS AVENUE

MILLERS AVENUE UNDER CONSTRUCTION

OLDTOWN PHASE 2A UNDER CONSTRUCTION REG REF F18A/0410

PARK AVENUE

OLDTOWN PHASE 2B UNDER CONSTRUCTION REG REF F18A/0412

COMMERCIAL BLOCK 1 UNDER CONSTRUCTION REG REF F11A/0473

GLENN ELLAN ROAD

REALIGMENT OF GLEN ELLAN ROAD CONSTRUCTED

OLDTOWN PHASE 2C PLANNING REG REF F19A/0101

RATHBEALE ROAD

EXISTING SCHOOL

1:1000 0 20.0 40.0 60.0 80.0 100.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

REV.	DATE	AMENDMENT	DRN	APPD

STATUS **PLANNING**

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CLIENT **GANNON PROPERTIES**

ARCHITECT **CONROY CROWE KELLY ARCHITECTS**

PROJECT
**PHASE 5,
MIXED USED DEVELOPMENT,
OLDTOWN, SWORDS**

TITLE
OVERLAND FLOOD ROUTING

DRAWN	DESIGNED	APPROVED	DATE
MS	RW	MD	MARCH 2022
SCALE	JOB NO.	DRG. NO.	REVISION
1:1000 @ A1	17-144	P1500	

Apr 01, 2022 - 5:17pm Drawing Location: M:\Projects\17\17-144\Cad\6 Civil\Planning\Planning Phase 5\Figs\17-144-P1500.dwg

UK and Ireland Office Locations