Flood Risk Assessment (Site Specific)

Proposed Residential Development Site at Knockrabo Phase 2, Mount Anville Road, Goatstown

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This document has been prepared and checked in accordance with
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Contents

Figures

Tables

Appendices

1. Introduction[%initials1]

This Flood Risk Assessment has been prepared by Waterman Moylan as part of the planning documentation in support of the proposed development of 158 No. residential units, Phase 2 of the overall Knockrabo Lands development.

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 the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, 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

The site is in Goatstown, Dublin 14. In this regard, we refer you to the accompanying site location plan 20-086-P100 and Figure 1 below.

The site is bounded to the south-east by Mount Anville Road; to the south by 'Mount Anville Lodge' and by the rear boundaries of 'Thendara' (a Protected Structure – RPS Ref. 812), 'The Garth' (a Protected Structure – RPS Ref. 819), 'Chimes', 'Hollywood House' (a Protected Structure – RPS Ref. 829); to the south-west by existing allotments; to the north by the reservation corridor for the Dublin Eastern By-Pass (DEBP); and to the east by the site of residential development 'Knockrabo' (Phase 1, permitted under DLRCC Reg. Ref. D13A/0689 / An Bord Pleanála (ABP) Ref. PL.06D.243799 and DLRCC Reg. Ref. D16A/0821 (Phase 1); and DLRCC Reg. Ref. D16A/0960 (Phase 1A)). The site includes 'Cedar Mount' (a Protected Structure- RPS Ref. 783), 'Knockrabo Gate Lodge (West)' (a Protected Structure RPS Ref. 796), including Entrance Gates and Piers.

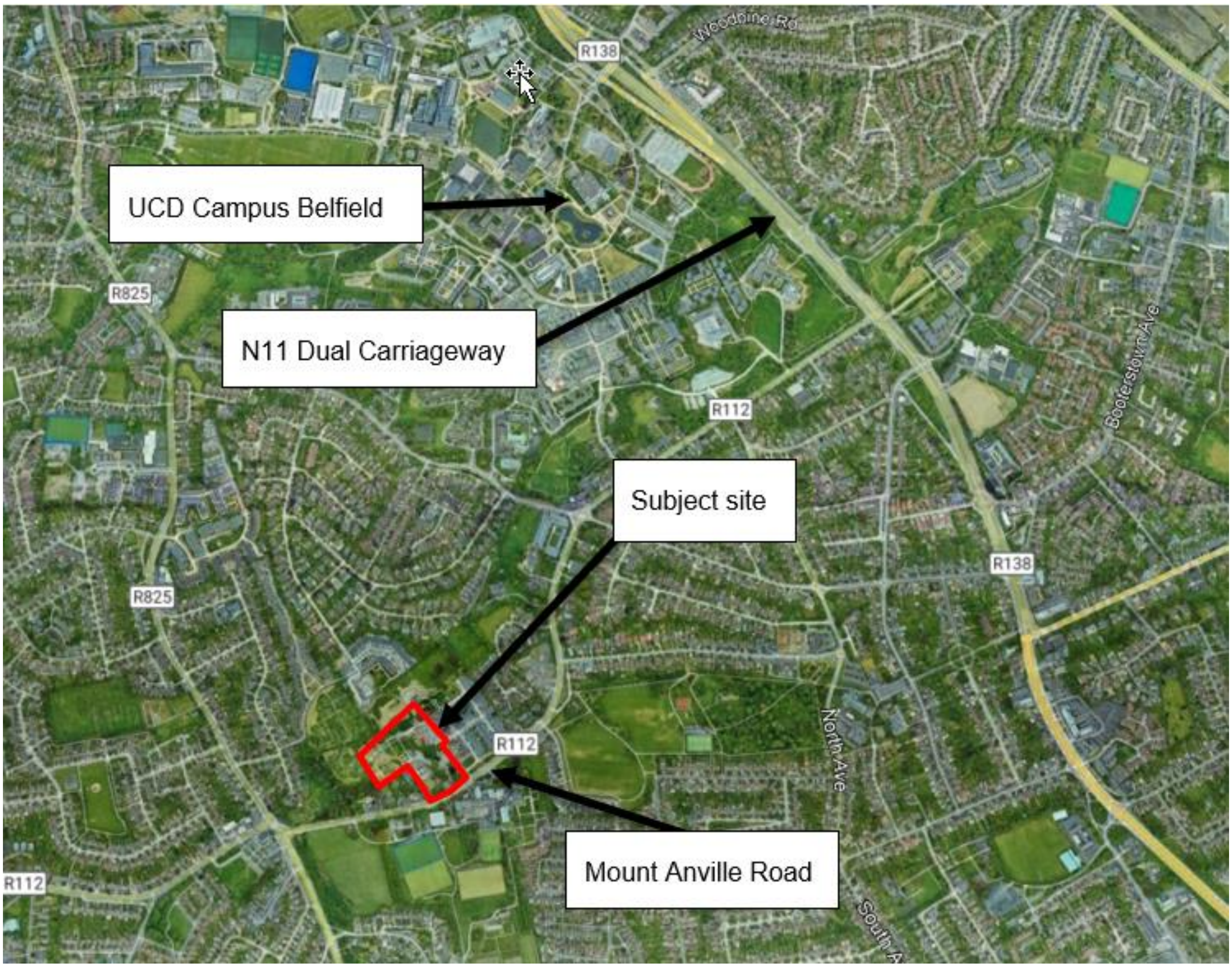


Figure 1 | *Site Location (Source: Google Earth)*

The site is a greenfield site that forms part of a broader site on which the construction of Phase 1 has already taken place. Phase 1 to the east of the subject lands comprises a mix of houses and apartments and was granted under Reg. Ref. D13A/0689. The subject lands occupy the western side of this broader Knockrabo site.

A topographic survey (OD Malin) of the area indicates that the site naturally falls sharply from south to north. The road level of Mount Anville Road at the entrance to the development is at a level of 76.93m. At the northern end of the proposed site, the low point is at a level of c. 59.60m.

The subject site area is approximately 2.54 hectares. There are several well-established trees and foliage on site.

1.2 Proposed Development

This Flood Risk Assessment[MOU2]has been prepared by Waterman Moylan as part of the planning application documentation for a proposed development on lands at Knockrabo, Mount Anville Road, Goatstown, Co. Dublin.

Knockrabo Investments DAC intend to apply for permission for a Large-scale Residential Development ranging from 2- part 8 storeys (for a period of 7 years) with a total application site area of c. 2.54 hectares, at Knockrabo, Mount Anville Road, Goatstown, Dublin 14.

The development will consist of the construction of 158 No. residential units (12 No. houses and 146 No. apartments (35 No. 1 beds, 81 No. 2 beds, 3 No. 3 beds and 27 No. 3 bed duplex units), a childcare facility and Community / Leisure Uses.

The accommodation schedule is set out in the Schedule of Accommodation in *Table 1* below.

Description	1-bed	2-bed	3-bed	4-bed	Total	GWF (sqm)
House	-	1	3	8	12	-
Duplex	-	-	27	-	27	-
Apartment	35	81	3	-	119	-
Childcare Facility	-	-	-	-	-	400
Community/ Leisure Uses	-	-	-	-	-	223
Total	**35**	**82**	**33**	**8**	**158**	**623**

Table 1 **|** Schedule of Accommodation

The development will also provide 130 No. car parking spaces consisting of 117 No. residential spaces (comprising 54 No. at podium level, 63 No. on-street and on curtilage spaces, 6 No. visitor spaces and 2 No. on-street car sharing spaces); and 5 No. non-residential spaces; provision of 366 No. bicycle parking spaces (consisting of: 288 No. residential spaces, 70 No. (residential) visitor spaces, 6 No. (non-residential) spaces and 2 No. visitor (non-residential) spaces); and 9 No. motorcycle parking spaces.

All other ancillary site development works to facilitate construction, site services, piped infrastructure, 1 No. sub-station, plant, public lighting, bin stores, bike stores, boundary treatments, provision of public, communal and private open space areas comprising hard and soft landscaping, site services all other associated site excavation, infrastructural and site development works above and below ground.

In addition to the repositioned access to Cedar Mount (a Protected Structure) as referenced above, the development will be served by the permitted access road 'Knockrabo Way' (DLRCC Reg. Ref. D13A/0689; ABP Ref. PL.06D.243799, DLRCC Reg. Ref. D16A/0821 and DLRCC Reg. Ref. D16A/0960).

The application does not impact on the future access to the Reservation for the Dublin Eastern Bypass.

1.3 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
- Groundwater – flooding from springs / raised groundwater
- 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.

1.3.1 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 2 **|** *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

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

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.3.2 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.

1.3.3 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 3 **|** *3x3 Risk Matrix*

1.3.4 Flood Zones

Flood zones are used to identify the likelihood, and therefore vulnerability, of flooding in a particular area. The zones are geographical areas with associated ranges of the likelihood of flooding and are essential in the creation of flood risk management plans. According to the Guidelines (DEHLG/OPW) flood zones can be categorised into 3 types or levels of flood zones, namely:

Type	Description	Probability of flooding
Zone A	Where the probability of flooding from rivers and the sea is highest	Greater than 1% (1:100 year) for fluvial flooding, or greater than 0.5% (1:200 year) for coastal flooding
Zone B	Where the probability of flooding from rivers and the sea is moderate	Between 0.1% (1:1000 year) & 1% (1:100 year) for fluvial flooding, and 0.1% (1:1000 year) & 0.5% (1:200 year) for coastal flooding
Zone C	Where the probability of flooding from rivers and the sea is low	Less than 0.1% (1:1000 year) for both fluvial and coastal flooding

Table 4 | Flood Zone Types according to the Guidelines (DEHLF/OPW)

Flood zone maps are used to establish the level of flooding for a site, an example of this can be seen in the indicative map shown in Figure 2.

Figure 2 | *Indicative* flood zone map extract from the Guidelines (DEHLF/OPW)

1.3.5 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.

1.3.6 Residual Risk

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

1.3.7 Sequential Approach

A sequential approach to planning is a vital tool in ensuring that development, particularly new development, is first and foremost directed towards the land that is at low risk of flooding. The sequential approach principles are described in Figure 3, taken from the Guidelines (DEHLF/OPW). The sequential approach should be applied to all stages of the planning and development management process, particularly the planning stage. The mechanism for use of the sequential approach can be seen in Figure 4.

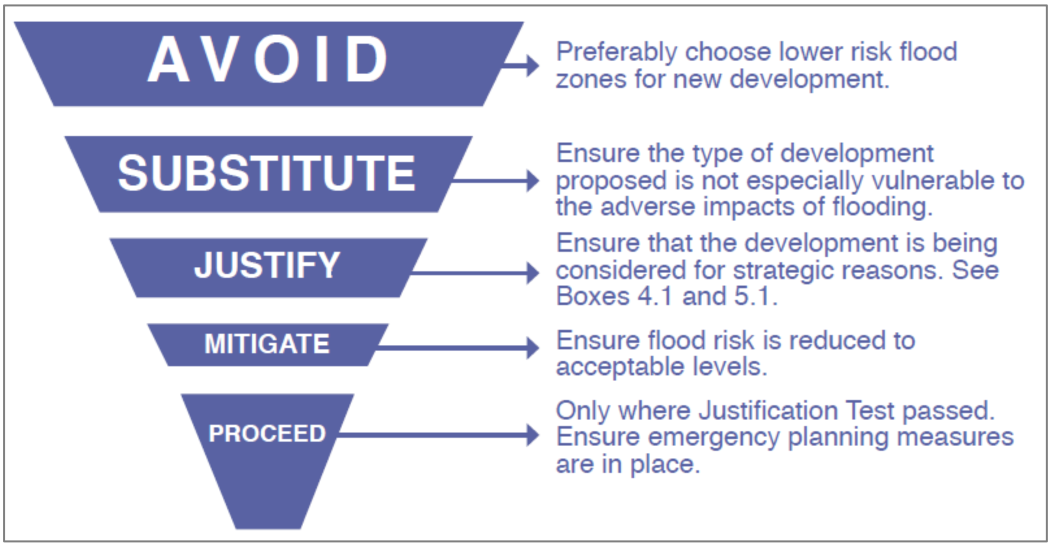


Figure 3 | Sequential Approach Principles in Flood Risk Management

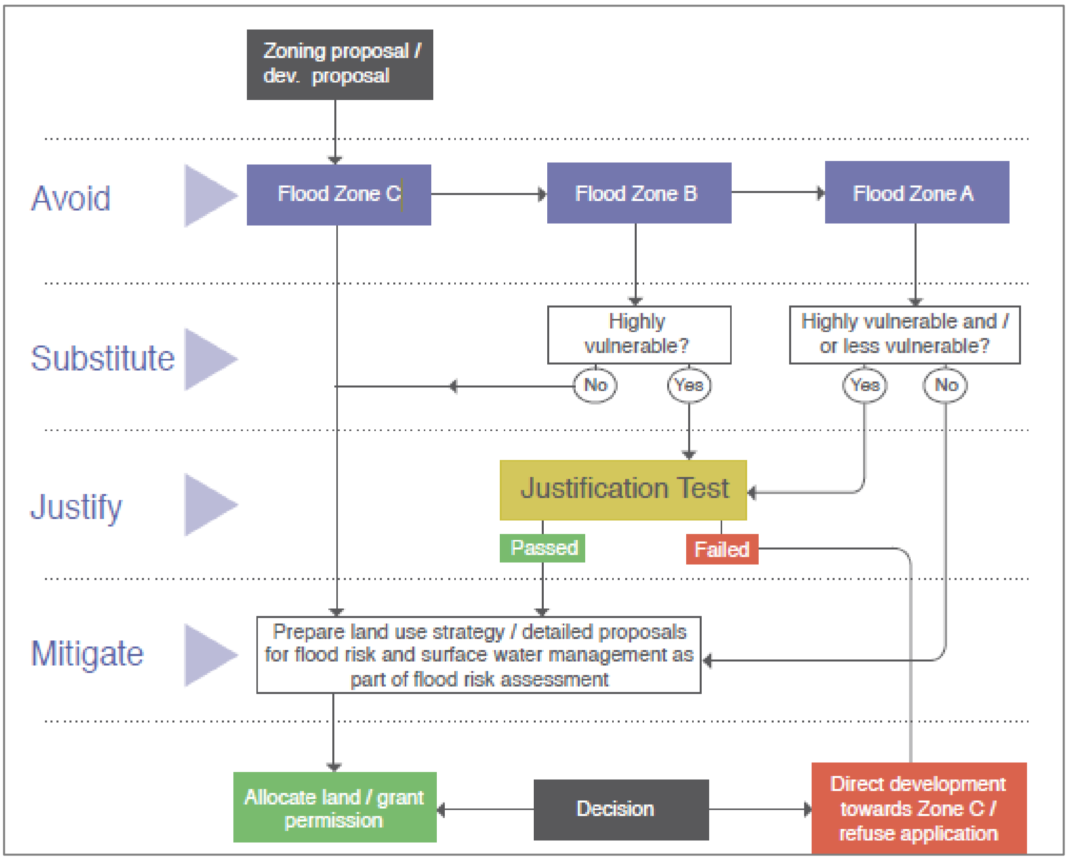


Figure 4 | Sequential Approach Mechanisms

If the subject site does not fall within the 'Avoid' or 'Substitute' tiers of the sequential approach principle, a Justification test is required.

As outlined in section 1.3.4 above, the proposed development is being considered in Flood Zone C.[MOU3] The proposed development is considered Appropriate and does not need a Justification Test. Refer to Table 5 for the matrix of vulnerability vs. flood zone relevant to the subject site.

Type	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

Table 5 **|** Matrix of vulnerability vs. flood zone - Justification Test

1.4 Stage 2 LRD Opinion

In August 2024, the Large-Scale Residential Development Opinion (LRD Opinion) of the submission made in June 2024 was received from Dún Laoghaire-Rathdown County Council (DLRCC).

The following section presents a response to Item 14 of the Opinion which stated the following:

Site Specific Flood Risk Assessment[%initials4]

a) A site specific Flood Risk Assessment should be included in the planning application. In addition, an analysis to determine the impact of a 50% blockage in the surface water drainage system will be required and shall be referenced in the Site Specific Flood Risk Assessment.

Response:

Please refer to Section 6 of this report for the impact assessment of a 50% blockage in the surface water drainage system.

2. Tidal

2.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

2.2 Pathway

The site is approximately 3km west of the nearest coastline at Dublin Bay. The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The lowest proposed finished floor level/basement level at the development is to be constructed at 62.50m OD Malin, well above the historic high tide event.

The maps available on the OPW's National Flood Information Portal have been consulted as part of this assessment. These maps include tidal flood mapping, which outlines existing and potential flood hazard and risk areas which are being incorporated into a Flood Risk Management Plan. An extract of Tidal Flood Extent Map is shown in the Figure below:

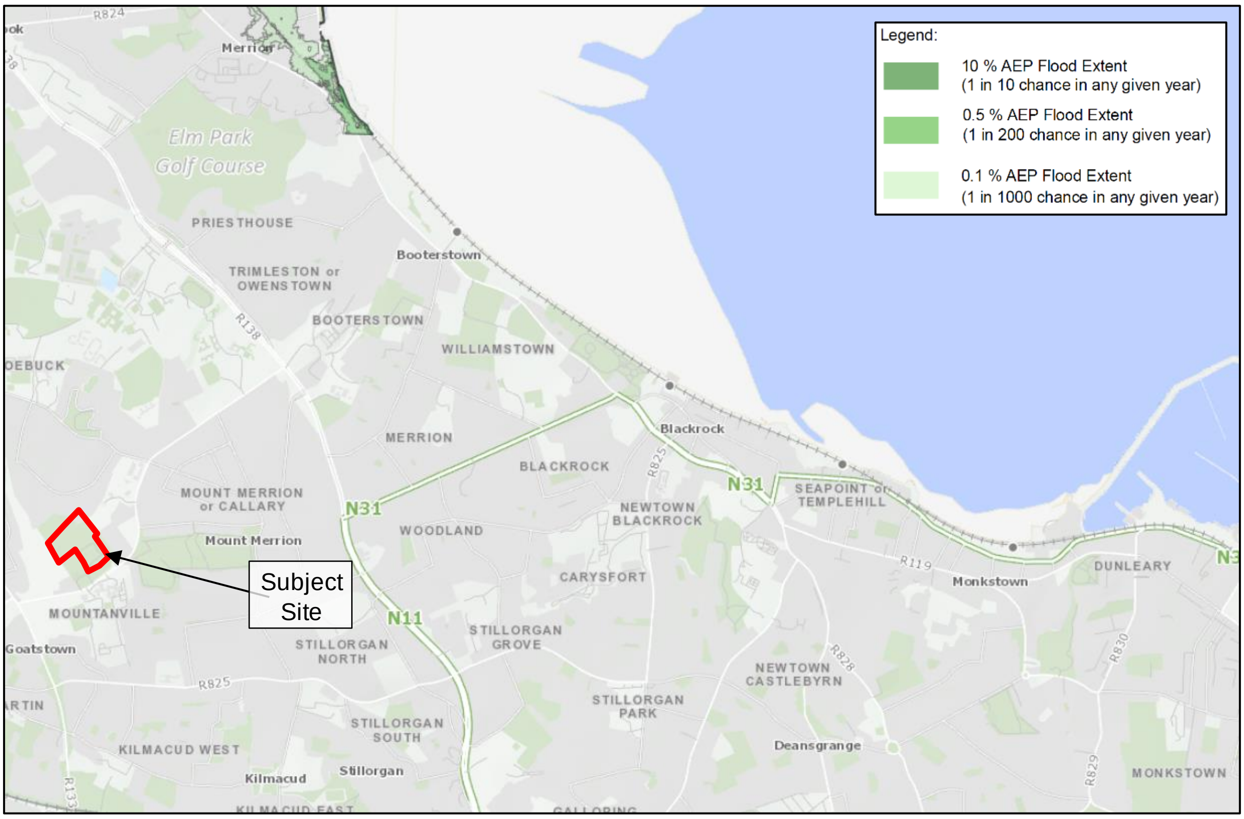


***Figure 5** | Extract from the Tidal Flood Extents Map*

High probability flood events, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm). The above map indicates that the subject development is not at risk of flooding for the 1-in-1,000 year event.

Given that the site is located 3 kilometres inland from the Irish Sea, that there is at large level difference between the proposed buildings and the high tide, and given that the site is outside of the 1-in-1,000 year flood plain, it is evident that a pathway does not exist between the source and the receptor. The risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

Fluvial flooding occurs when a water course/river's flow exceeds its capacity, typically following excessive rainfall.

3.2 Pathway

The subject site is located within a coastal catchment centred on Blackrock and Booterstown, that drains to Dublin Bay.

A review of the available historic records included as Figure 6 below, obtained via the OPW's National Flood information portal "Floodinfo.ie", does not indicate that there have been any known instances of flooding at the site or in the immediate area of the site. The nearest recorded event is located approximately 1km to the northeast of the site.

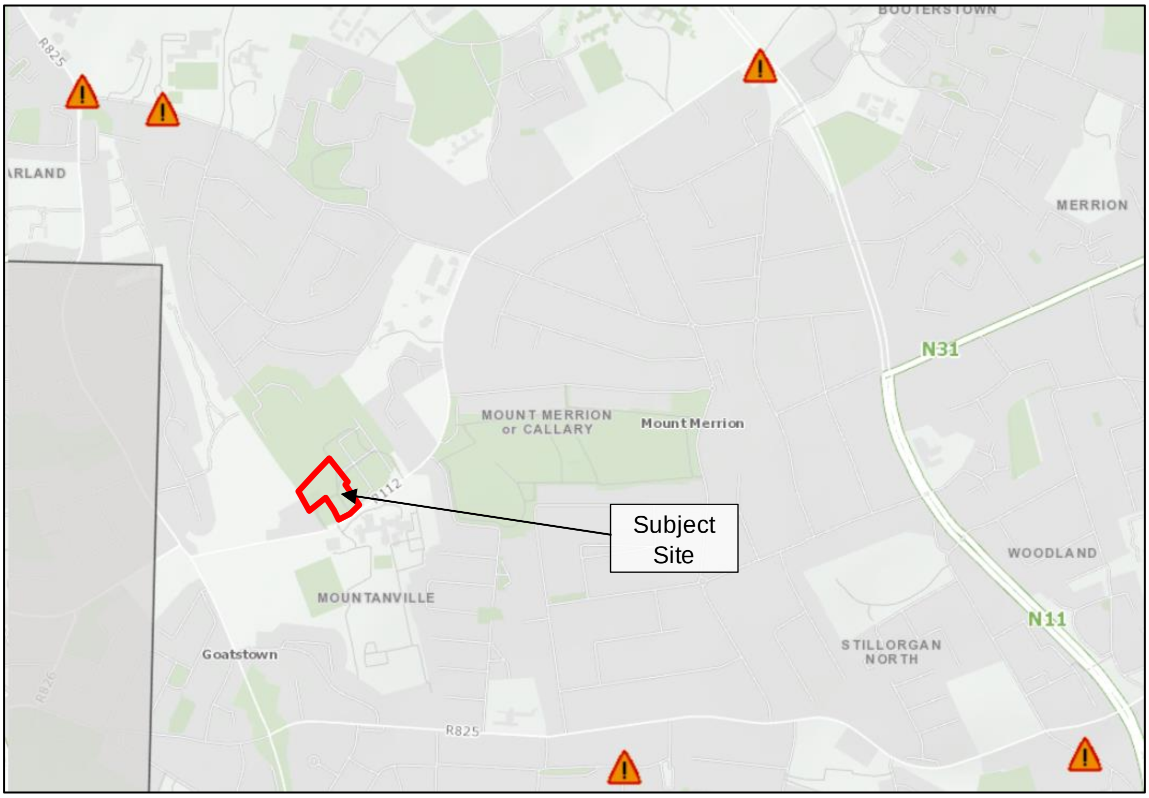
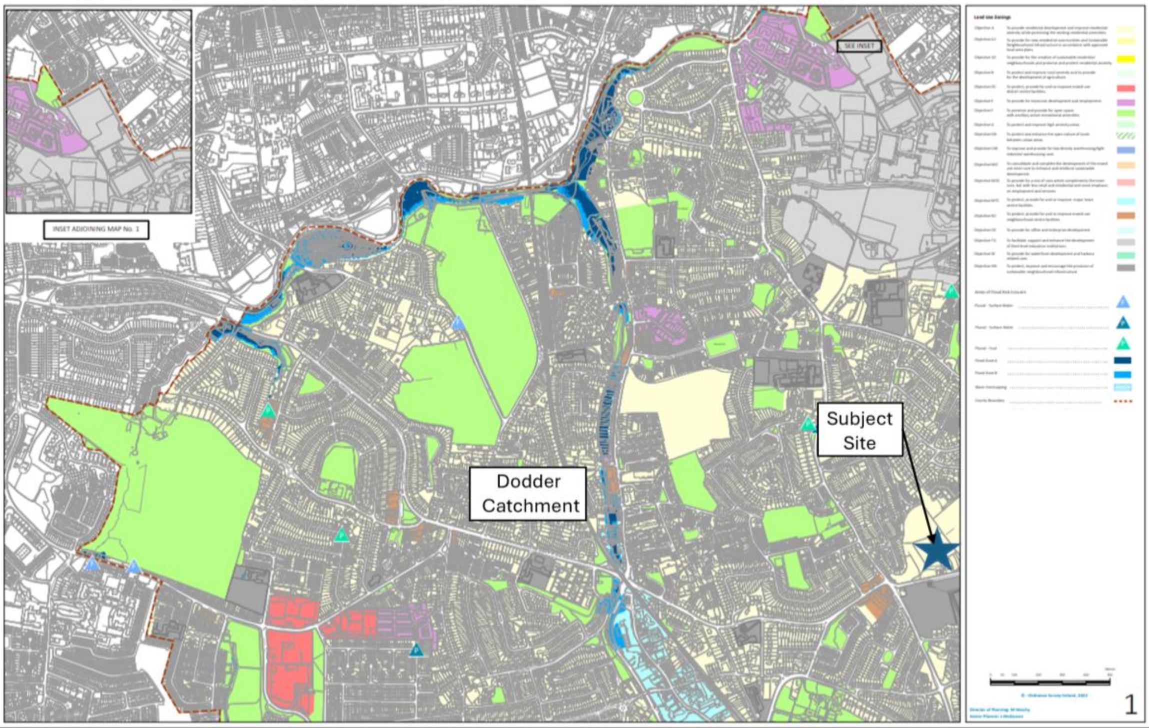


Figure 6 | *OPW's FloodInfo.ie National Flood Hazard Mapping Past Events*

The OPW's National Flood Information Portal indicates that the subject site is a significant distance away from the flood zone of the local river systems, including that of the Carysfort/Maretimo fluvial flood extents to the southeast and the Dodder catchment fluvial flood extents to the west. Similarly, Dun Laoghaire Rathdown County Development Plan Flood Zone Maps have been referenced, and these too indicate that that the development site lies outside of the local fluvial flood extents. Figures 7A & 4B overleaf shows the subject site relative to the Dodder and Carysfort/Maretimo catchments respectively.



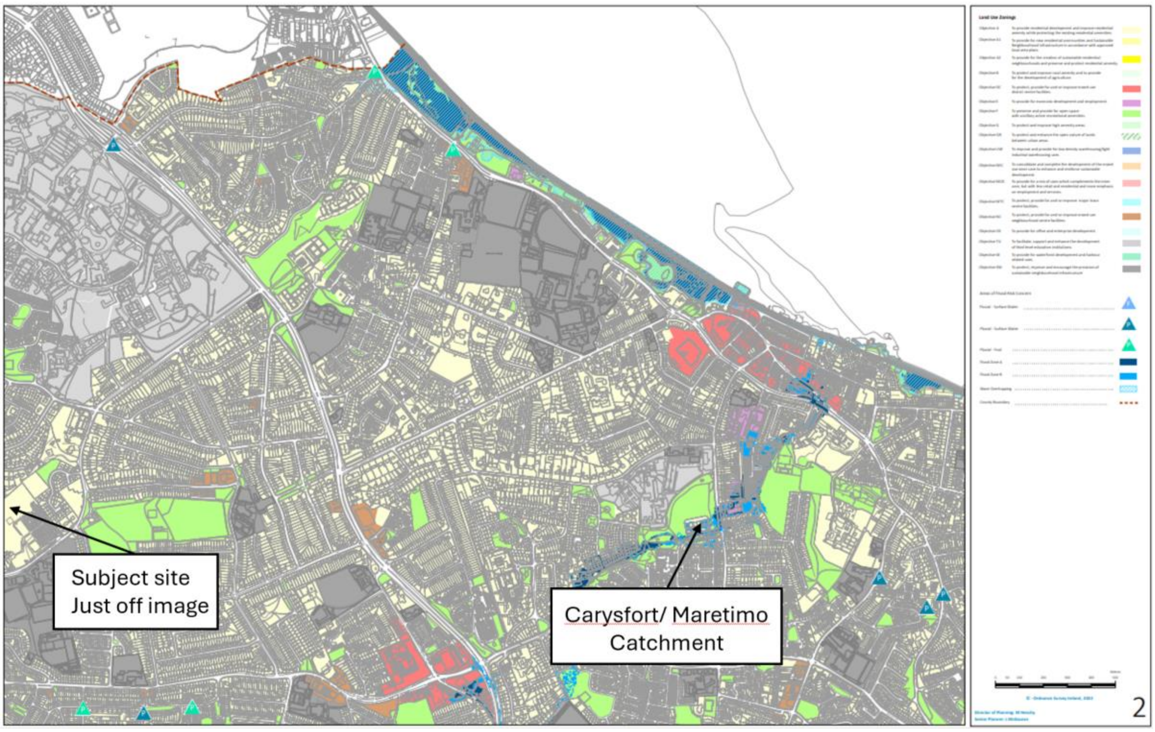


Figure 7A&B | *Extracts from the DLRCC CDP Fluvial Flood Zone Maps (Maps 01 & 02)*

3.3 Likelihood

Given that the site is outside of the 1-in-1,000 year flood plain, the likelihood of fluvial flooding is low.

3.4 Consequence

The consequence of fluvial flooding would be some minor damage to open spaces. Therefore, the consequences of fluvial flooding occurring at the proposed development is considered low.

3.5 Risk

There is an extremely low risk of fluvial flooding as the likelihood is low and the consequence is low.[%initials5]

3.6 Flood Risk Management

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 flood routing figure below and Waterman Moylan drawing 20-086-P150A.

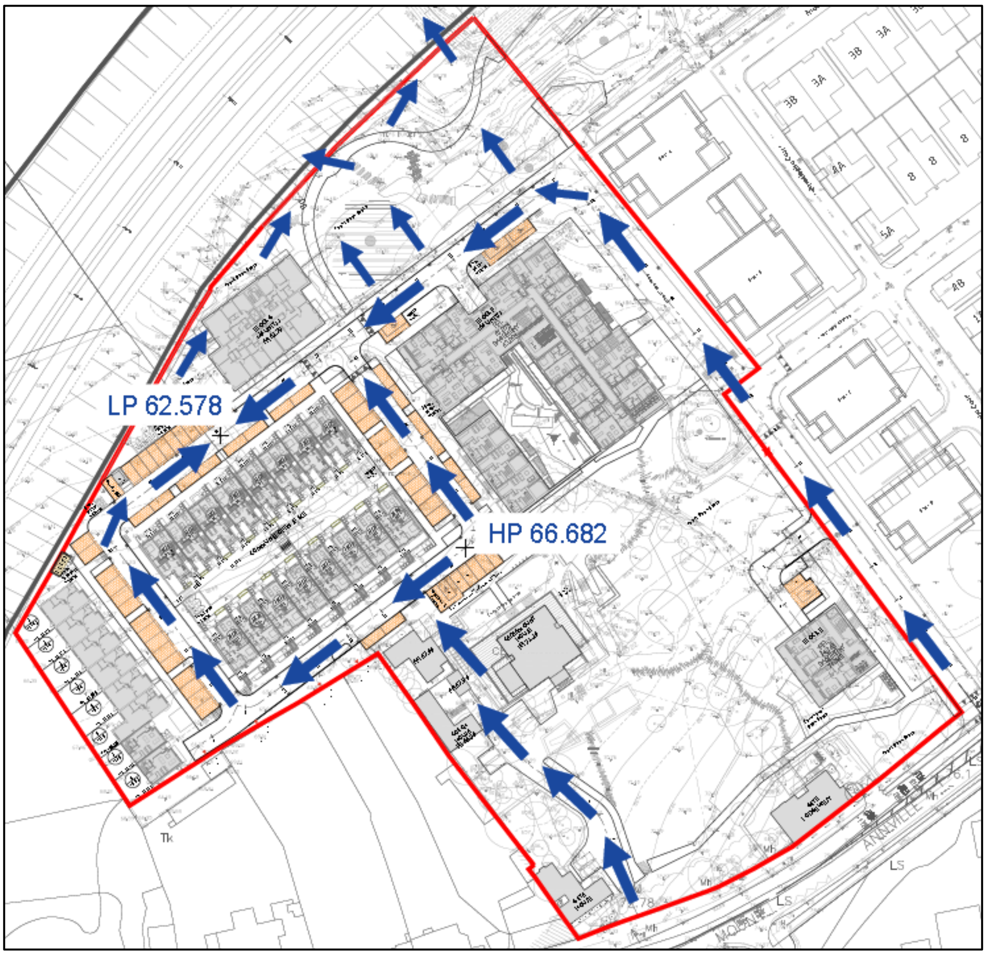


Figure 8 | *Overland Flood Route*

3.7 Residual Risk

The residual risk of fluvial flooding is considered extremely low.

4. Pluvial

4.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

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 6** | Pathways and Receptors*

4.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

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. Therefore, the likelihood surcharging of the on-site drainage system is considered high.

4.3.2 Surcharging from the existing surrounding drainage system:

The OPW's National Flood information portal "Floodinfo.ie", refer to section 3.2, has been consulted to identify recorded instances of flooding in the vicinity of the site. The nearest recorded flood event occurred approximately 1km northwest of the site, with no recorded flooding in the immediate vicinity of the site.

With no history of flooding in the area due to surcharging, the likelihood of such flooding occurring is considered low.

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:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records, and the site location being outside the local fluvial flood plain, both discussed earlier, 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 could impact the ground floor levels of buildings. 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:

With a high likelihood and moderate consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is high.

4.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is low.

4.5.3 Surface water discharge from the subject site:

With a moderate likelihood and moderate consequence of surface water discharge from the subject site, the resultant risk is moderate.

4.5.4 Overland flooding from surrounding areas:

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

4.5.5 Overland flooding from the subject site:

With a moderate likelihood and moderate consequence of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

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

4.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site surface water network and SuDS devices. Open grassed areas with low level planting and will ensure that these areas act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site. Green roofs to the apartment blocks, permeable paving to surface parking and filter drains will provide treatment volume, with underlying perforated pipes connecting to the storm water sewer network.

These proposed source and site control devices will intercept and slow down the rate of runoff from the site to the on-site drainage system, reducing the risk of surcharging.

Furthermore, a hydro-brake will limit runoff to the equivalent greenfield rate. Excess storm water from the site is to be attenuated in below ground storage tanks (Stormtech or similar approved) with sufficient volume for the 1-in-100 year storm (accounting for a 20% increase due to climate change), to limit the runoff from the site and minimise the discharge rate into receiving waters.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

4.6.2 Surcharging from the existing surrounding drainage system:

The risk of flooding due to surcharging of the existing surface water network is minimised with overland flood routing (refer to the Overland Flood Routing figure in Section 3.6). The risk to the surrounding buildings is mitigated by setting finished floor levels, at least 200mm above the adjacent road channel lines.

4.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1, minimising the risk of pluvial flooding from the subject site. Sufficient attenuation storage is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change.

4.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low. Overland flood routing and raised finished floor levels will provide protection for the proposed buildings, as described in Section 4.6.2 above.

4.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing SuDS features to intercept and slow down the rate of runoff from the site to the existing surface water sewer system, as described in Section 4.6.1 above. Sufficient attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change. Thus, even under extreme storm conditions, the surface water can be attenuated without causing flooding downstream.

4.7 Residual Risk

As a 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.

5. Groundwater

5.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

5.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, underground services and building foundations could also be affected by high water tables that do not reach the ground surface.

5.3 Receptor

The receptors for ground water flooding would be underground services, roads, and the ground floor of buildings.

5.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies within an area with high groundwater vulnerability.

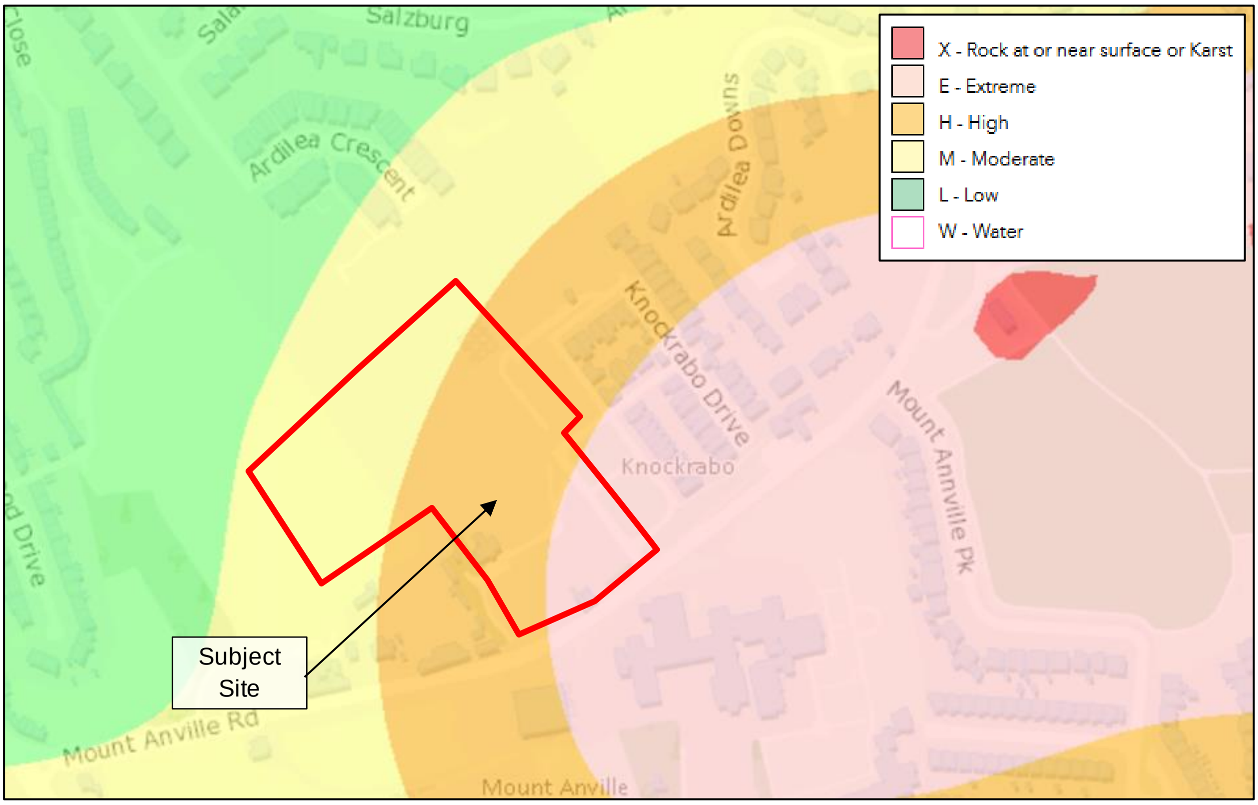


***Figure 9** | Extract of Groundwater Vulnerability Map*

With the site falling within an area with predominantly high groundwater vulnerability, the likelihood of groundwater rising through the ground and causing potential flooding on site during prolonged wet periods is high.

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. Underground services could be inundated from high water tables. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

With a high likelihood and moderate consequences of flooding due to groundwater, the risk is considered high.

5.7 Flood Risk Management

Finished floor levels have been set above the road levels, as described in Section 3.6, to ensure that any seepage of ground water onto the development does not flood into the buildings. In the event of ground water flooding on site, this water can escape from the site via the overland flood routing, also described in Section 3.6.

The buildings' design will incorporate suitable damp-proof membranes to protect against damp and water ingress from below ground level.

5.8 Residual Risk

As a result of the mitigation measures proposed, there is a low residual risk of flooding from ground water.

6. Human/Mechanical Errors

6.1 Source

The subject site will be drained by an internal private storm water drainage system, which discharges to the existing natural surface water network.

The internal surface water network is a source of possible flooding were it to become blocked. The drainage network has been analysed to determine the impact of a 50% blockage in the surface water drainage system.

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 ground floor levels of buildings, the roads and the open landscaped areas around the site.

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 3.6, finished floor levels have been designed to be generally above the adjacent road network, which will reduce the risk of flooding if the surface water network were to block. In the event of the surface water system surcharging, the surface water can still escape from the site by overland flood routing, as described in Section 3.6, without causing damage to the proposed buildings.

A suitable maintenance regime of inspection and cleaning will be incorporated into the safety file/maintenance manual for the development.

In order to mitigate against the risk of flooding from blockages, the surface water network must be regularly maintained and where required cleaned out. DLRCC, once the system has been taken in charge, 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.

Surface water drainage network has been modelled with outfall flow rate restricted to 50%. The Flow model shows that some manholes will surcharge during a 100 year + 20%cc storm event but no flooding occurs, see appendix A for details. However, should the flooding occur the surrounding ground levels have been set so that the resulting flood water is directed away from the building entrances to surrounding roads and the landscaped areas.

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 tidal flooding from the Irish Sea and the local fluvial systems, pluvial flooding, ground water and failures of mechanical systems. *Table 7*, below, presents the various residual flood risks involved.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Irish Sea (Dublin Bay)*	*Proposed development*	*Extremely low*	*None*	*Negligible*	*None*	Negligible
Fluvial	*Dodder/ Carysfort Maretimo*	*Proposed development*	*Low*	*Low*	*Extremely Low*	*Setting of floor levels, overland flood routing*	Extremely Low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties and roads*	*Ranges from high to low*	*Moderate*	*Ranges from high to low*	*Appropriate drainage, SuDS and attenuation design, setting of floor levels, overland flood routing*	Low
Ground Water	*Ground*	*Underground services, ground level of buildings, roads*	*High*	*Moderate*	*High*	*Appropriate setting of floor levels, flood routing, damp proof membranes*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*Moderate*	*High*	*Setting of floor levels, overland flood routing, regular inspection of SW network*	Low

Table 7 **|** *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

APPENDICES

A. 50% Blockage Surface Water Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	20	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.200	Minimum Backdrop Height (m)	0.200
Ratio-R	0.278	Preferred Cover Depth (m)	1.200
CV	0.800	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
46	0.015	4.00	65.856	1200	718298.952	728541.586	1.556
45	0.002	4.00	65.473	1200	718282.648	728529.348	1.471
44	0.057	4.00	65.392	1350	718276.732	728531.489	1.567
43	0.107	4.00	63.073	1200	718248.030	728570.016	1.955
42	0.028	4.00	62.972	1350	718247.319	728575.816	1.968
41	0.056	4.00	62.700	1350	718280.646	728601.153	2.000
4G	0.041	4.00	60.000	1350	718270.701	728624.739	0.900
8	0.016	4.00	66.815	1200	718327.564	728562.303	1.709
7	0.045	4.00	66.545	1200	718338.800	728572.411	1.616
5	0.122	4.00	64.140	1200	718318.142	728600.039	1.481
14EX			65.036	1200	718359.138	728658.012	2.236
3	0.003	4.00	63.935	1200	718334.320	728641.414	3.910
4	0.064	4.00	62.511	1350	718303.855	728619.131	2.082
3G			61.030	1350	718287.237	728638.693	2.038
2G			61.210	1350	718299.637	728659.246	2.338
1G IN			60.000	1350	718319.760	728661.471	2.090
10	0.023	4.00	67.535		718334.436	728543.089	1.535
11	0.090	4.00	69.224		718346.898	728526.883	2.094
12.1		4.00	69.708		718363.415	728538.552	1.499
12			71.188		718368.289	728507.070	1.484
13	0.045	4.00	71.504		718369.947	728499.374	1.460
14			71.763		718372.499	728492.516	1.442
9	0.071	4.00	67.012		718329.477	728550.452	1.712
47	0.035	4.00	66.671		718320.424	728557.164	1.531
1 OUT			60.700	1500	718343.330	728679.465	3.190
0			60.000		718342.465	728682.918	2.525
2 IN			61.510		718329.584	728648.246	3.360
2.1			63.800		718331.687	728645.675	3.800
2.2	0.037	4.00	64.000		718355.242	728664.312	1.000
6	0.183	4.00	66.305		718334.783	728577.800	1.485
48	0.144	4.00	64.523		718349.723	728651.552	2.104
49	0.058	4.00	68.970		718394.001	728615.854	1.200
50	0.023	4.00	70.570		718406.166	728600.789	1.200
51	0.031	4.00	72.553		718424.209	728576.191	2.190
1E	0.011	4.00	72.009		718407.132	728563.095	1.538
2E	0.051	4.00	71.734		718412.141	728555.118	1.200
5G	0.006	4.00	61.000		718268.180	728619.711	1.000
14A	0.038	4.00	72.900		718400.808	728506.746	1.180

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	14A	14	31.684	0.600	71.720	70.321	1.399	22.6	225	4.19	50.0
1.001	14	13	7.317	0.600	70.321	70.044	0.277	26.4	225	4.24	50.0
1.002	13	12	7.873	0.600	70.044	69.704	0.340	23.2	225	4.29	50.0
1.003	12	11	29.157	0.600	69.704	67.130	2.574	11.3	225	4.41	50.0
2.000	12.1	11	20.223	0.600	68.209	67.130	1.079	18.7	225	4.11	50.0
1.004	11	10	20.443	0.600	67.130	66.000	1.130	18.1	225	4.52	50.0
1.005	10	9	8.877	0.600	66.000	65.300	0.700	12.7	225	4.56	50.0
1.006	9	8	12.004	0.600	65.300	65.106	0.194	61.9	225	4.68	50.0
1.007	8	7	15.114	0.600	65.106	64.929	0.177	85.4	300	4.83	50.0
1.008	7	6	6.721	0.600	64.929	64.820	0.109	61.7	300	4.89	50.0
1.009	6	5	27.776	0.600	64.820	62.659	2.161	12.9	300	4.99	50.0
1.010	5	4	23.846	0.600	62.659	60.429	2.230	10.7	300	5.07	50.0
3.000	47	46	26.533	0.600	65.140	64.300	0.840	31.6	225	4.19	50.0
3.001	46	45	20.386	0.600	64.300	64.002	0.298	68.4	225	4.40	50.0
3.002	45	44	6.291	0.600	64.002	63.825	0.177	35.5	225	4.45	50.0
3.003	44	43	48.043	0.600	63.825	61.118	2.707	17.7	225	4.71	50.0
3.004	43	42	5.843	0.600	61.118	61.004	0.114	51.3	300	4.75	50.0
3.005	42	41	41.865	0.600	61.004	60.700	0.304	137.7	300	5.27	50.0
3.006	41	4	29.360	0.600	60.700	60.429	0.271	108.3	300	5.60	50.0
1.011	4	3	37.745	0.600	60.429	60.025	0.404	93.4	450	5.90	50.0
4.000	2E	1E	9.419	0.600	70.534	70.471	0.063	149.5	225	4.15	50.0
4.001	1E	51	21.520	0.600	70.471	70.363	0.108	199.3	225	4.54	50.0
4.002	51	50	30.506	0.600	70.363	69.370	0.993	30.7	225	4.75	50.0
4.003	50	49	19.363	0.600	69.370	67.770	1.600	12.1	225	4.84	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.761	109.8	6.7	0.955	1.217	0.038	0.0
1.001	2.555	101.6	6.7	1.217	1.235	0.038	0.0
1.002	2.730	108.6	14.4	1.235	1.259	0.083	0.0
1.003	3.909	155.4	14.4	1.259	1.869	0.083	0.0
2.000	3.036	120.7	0.0	1.274	1.869	0.000	0.0
1.004	3.091	122.9	30.0	1.869	1.310	0.173	0.0
1.005	3.694	146.9	34.0	1.310	1.487	0.196	0.0
1.006	1.665	66.2	46.4	1.487	1.484	0.267	0.0
1.007	1.702	120.3	49.1	1.409	1.316	0.283	0.0
1.008	2.005	141.7	56.8	1.316	1.185	0.328	0.0
1.009	4.408	311.6	88.5	1.185	1.181	0.510	0.0
1.010	4.834	341.7	109.7	1.181	1.782	0.632	0.0
3.000	2.336	92.9	6.1	1.306	1.331	0.035	0.0
3.001	1.583	62.9	8.8	1.331	1.246	0.051	0.0
3.002	2.201	87.5	9.2	1.246	1.342	0.053	0.0
3.003	3.120	124.1	19.2	1.342	1.730	0.110	0.0
3.004	2.201	155.6	37.8	1.655	1.668	0.218	0.0
3.005	1.338	94.6	42.6	1.668	1.700	0.246	0.0
3.006	1.510	106.7	52.4	1.700	1.782	0.302	0.0
1.011	2.103	334.5	173.0	1.632	3.460	0.998	0.0
4.000	1.067	42.4	8.8	0.975	1.313	0.051	0.0
4.001	0.922	36.7	10.7	1.313	1.965	0.062	0.0
4.002	2.369	94.2	16.1	1.965	0.975	0.093	0.0
4.003	3.782	150.4	20.1	0.975	0.975	0.116	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.004	49	14EX	54.706	0.600	67.770	62.800	4.970	11.0	225	5.07	50.0
4.005	14EX	48	11.418	0.600	62.800	62.419	0.381	30.0	225	5.15	50.0
4.006	48	3	18.440	0.600	62.419	61.804	0.615	30.0	225	5.27	50.0
1.012	3	2.1	5.009	0.600	60.025	60.000	0.025	200.4	450	5.96	50.0
5.000	2.2	2.1	30.036	0.600	63.000	62.500	0.500	60.1	225	4.30	50.0
1.013	2.1	2 IN	3.322	0.600	60.000	59.983	0.017	195.4	450	5.99	50.0
1.014	2 IN	1 OUT	34.111	0.600	58.150	57.923	0.227	150.3	450	6.34	50.0
6.000	5G	4G	5.627	0.600	60.000	59.100	0.900	6.3	225	4.02	50.0
6.001	4G	3G	21.637	0.600	59.100	58.992	0.108	200.3	225	4.41	50.0
6.002	3G	2G	24.004	0.600	58.992	58.872	0.120	200.0	225	4.84	50.0
6.003	2G	1G IN	20.246	0.600	58.872	58.771	0.101	200.5	225	5.21	50.0
6.004	1G IN	1 OUT	29.653	0.600	57.910	57.510	0.400	74.1	450	5.42	50.0
1.015	1 OUT	0	3.560	0.600	57.510	57.475	0.035	101.7	225	6.38	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.004	3.966	157.7	30.2	0.975	2.011	0.174	0.0
4.005	2.398	95.4	30.2	2.011	1.879	0.174	0.0
4.006	2.398	95.3	55.2	1.879	1.906	0.318	0.0
1.012	1.432	227.8	228.9	3.460	3.350	1.319	0.0
5.000	1.690	67.2	6.3	0.775	1.075	0.037	0.0
1.013	1.451	230.7	235.2	3.350	1.077	1.356	0.0
1.014	1.656	263.4	235.2	2.910	2.327	1.356	0.0
6.000	5.267	209.4	1.1	0.775	0.675	0.006	0.0
6.001	0.920	36.6	8.3	0.675	1.813	0.048	0.0
6.002	0.921	36.6	8.3	1.813	2.113	0.048	0.0
6.003	0.920	36.6	8.3	2.113	1.004	0.048	0.0
6.004	2.363	375.8	8.3	1.640	2.740	0.048	0.0
1.015	1.296	51.5	243.5	2.965	2.300	1.404	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	31.684	22.6	225	1 STANDARD	72.900	71.720	0.955	71.763	70.321	1.217
1.001	7.317	26.4	225	1 STANDARD	71.763	70.321	1.217	71.504	70.044	1.235
1.002	7.873	23.2	225	1 STANDARD	71.504	70.044	1.235	71.188	69.704	1.259
1.003	29.157	11.3	225	1 STANDARD	71.188	69.704	1.259	69.224	67.130	1.869
2.000	20.223	18.7	225	1 STANDARD	69.708	68.209	1.274	69.224	67.130	1.869
1.004	20.443	18.1	225	1 STANDARD	69.224	67.130	1.869	67.535	66.000	1.310
1.005	8.877	12.7	225	1 STANDARD	67.535	66.000	1.310	67.012	65.300	1.487

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	14A		Manhole	1 STANDARD	14		Manhole	1 STANDARD
1.001	14		Manhole	1 STANDARD	13		Manhole	1 STANDARD
1.002	13		Manhole	1 STANDARD	12		Manhole	1 STANDARD
1.003	12		Manhole	1 STANDARD	11		Manhole	1 STANDARD
2.000	12.1		Manhole	1 STANDARD	11		Manhole	1 STANDARD
1.004	11		Manhole	1 STANDARD	10		Manhole	1 STANDARD
1.005	10		Manhole	1 STANDARD	9		Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	12.004	61.9	225	1 STANDARD	67.012	65.300	1.487	66.815	65.106	1.484
1.007	15.114	85.4	300	1 STANDARD	66.815	65.106	1.409	66.545	64.929	1.316
1.008	6.721	61.7	300	1 STANDARD	66.545	64.929	1.316	66.305	64.820	1.185
1.009	27.776	12.9	300	1 STANDARD	66.305	64.820	1.185	64.140	62.659	1.181
1.010	23.846	10.7	300	1 STANDARD	64.140	62.659	1.181	62.511	60.429	1.782
3.000	26.533	31.6	225	1 STANDARD	66.671	65.140	1.306	65.856	64.300	1.331
3.001	20.386	68.4	225	1 STANDARD	65.856	64.300	1.331	65.473	64.002	1.246
3.002	6.291	35.5	225	1 STANDARD	65.473	64.002	1.246	65.392	63.825	1.342
3.003	48.043	17.7	225	1 STANDARD	65.392	63.825	1.342	63.073	61.118	1.730
3.004	5.843	51.3	300	1 STANDARD	63.073	61.118	1.655	62.972	61.004	1.668
3.005	41.865	137.7	300	1 STANDARD	62.972	61.004	1.668	62.700	60.700	1.700
3.006	29.360	108.3	300	1 STANDARD	62.700	60.700	1.700	62.511	60.429	1.782
1.011	37.745	93.4	450	1 STANDARD	62.511	60.429	1.632	63.935	60.025	3.460
4.000	9.419	149.5	225	1 STANDARD	71.734	70.534	0.975	72.009	70.471	1.313
4.001	21.520	199.3	225	1 STANDARD	72.009	70.471	1.313	72.553	70.363	1.965
4.002	30.506	30.7	225	1 STANDARD	72.553	70.363	1.965	70.570	69.370	0.975
4.003	19.363	12.1	225	1 STANDARD	70.570	69.370	0.975	68.970	67.770	0.975
4.004	54.706	11.0	225	1 STANDARD	68.970	67.770	0.975	65.036	62.800	2.011
4.005	11.418	30.0	225	1 STANDARD	65.036	62.800	2.011	64.523	62.419	1.879
4.006	18.440	30.0	225	1 STANDARD	64.523	62.419	1.879	63.935	61.804	1.906
1.012	5.009	200.4	450	1 STANDARD	63.935	60.025	3.460	63.800	60.000	3.350
5.000	30.036	60.1	225	1 STANDARD	64.000	63.000	0.775	63.800	62.500	1.075
1.013	3.322	195.4	450	1 STANDARD	63.800	60.000	3.350	61.510	59.983	1.077
1.014	34.111	150.3	450	1 STANDARD	61.510	58.150	2.910	60.700	57.923	2.327
6.000	5.627	6.3	225	1 STANDARD	61.000	60.000	0.775	60.000	59.100	0.675

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	9		Manhole	1 STANDARD	8	1200	Manhole	1 STANDARD
1.007	8	1200	Manhole	1 STANDARD	7	1200	Manhole	1 STANDARD
1.008	7	1200	Manhole	1 STANDARD	6		Manhole	1 STANDARD
1.009	6		Manhole	1 STANDARD	5	1200	Manhole	1 STANDARD
1.010	5	1200	Manhole	1 STANDARD	4	1350	Manhole	1 STANDARD
3.000	47		Manhole	1 STANDARD	46	1200	Manhole	1 STANDARD
3.001	46	1200	Manhole	1 STANDARD	45	1200	Manhole	1 STANDARD
3.002	45	1200	Manhole	1 STANDARD	44	1350	Manhole	1 STANDARD
3.003	44	1350	Manhole	1 STANDARD	43	1200	Manhole	1 STANDARD
3.004	43	1200	Manhole	1 STANDARD	42	1350	Manhole	1 STANDARD
3.005	42	1350	Manhole	1 STANDARD	41	1350	Manhole	1 STANDARD
3.006	41	1350	Manhole	1 STANDARD	4	1350	Manhole	1 STANDARD
1.011	4	1350	Manhole	1 STANDARD	3	1200	Manhole	1 STANDARD
4.000	2E		Manhole	1 STANDARD	1E		Manhole	1 STANDARD
4.001	1E		Manhole	1 STANDARD	51		Manhole	1 STANDARD
4.002	51		Manhole	1 STANDARD	50		Manhole	1 STANDARD
4.003	50		Manhole	1 STANDARD	49		Manhole	1 STANDARD
4.004	49		Manhole	1 STANDARD	14EX	1200	Manhole	1 STANDARD
4.005	14EX	1200	Manhole	1 STANDARD	48		Manhole	1 STANDARD
4.006	48		Manhole	1 STANDARD	3	1200	Manhole	1 STANDARD
1.012	3	1200	Manhole	1 STANDARD	2.1		Manhole	1 STANDARD
5.000	2.2		Manhole	1 STANDARD	2.1		Manhole	1 STANDARD
1.013	2.1		Manhole	1 STANDARD	2 IN		Manhole	1 STANDARD
1.014	2 IN		Manhole	1 STANDARD	1 OUT	1500	Manhole	1 STANDARD
6.000	5G		Manhole	1 STANDARD	4G	1350	Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	21.637	200.3	225	1 STANDARD	60.000	59.100	0.675	61.030	58.992	1.813
6.002	24.004	200.0	225	1 STANDARD	61.030	58.992	1.813	61.210	58.872	2.113
6.003	20.246	200.5	225	1 STANDARD	61.210	58.872	2.113	60.000	58.771	1.004
6.004	29.653	74.1	450	1 STANDARD	60.000	57.910	1.640	60.700	57.510	2.740
1.015	3.560	101.7	225	1 STANDARD	60.700	57.510	2.965	60.000	57.475	2.300

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	4G	1350	Manhole	1 STANDARD	3G	1350	Manhole	1 STANDARD
6.002	3G	1350	Manhole	1 STANDARD	2G	1350	Manhole	1 STANDARD
6.003	2G	1350	Manhole	1 STANDARD	1G IN	1350	Manhole	1 STANDARD
6.004	1G IN	1350	Manhole	1 STANDARD	1 OUT	1500	Manhole	1 STANDARD
1.015	1 OUT	1500	Manhole	1 STANDARD	0		Manhole	1 STANDARD

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.200	Check Discharge Rate(s)	✓
Ratio-R	0.278	1 year (l/s)	5.4
Summer CV	0.750	30 year (l/s)	10.7
Winter CV	0.840	100 year (l/s)	12.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year 360 minute (m³)	379

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	1.197	Betterment (%)	0
SAAR (mm)	774	QBar	6.5
Soil Index	4	Q 1 year (l/s)	5.4
SPR	0.47	Q 30 year (l/s)	10.7
Region	11	Q 100 year (l/s)	12.7
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.197	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.507
CWI	123.704	Runoff Volume (m³)	379

Node 1 OUT Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	57.510	Product Number	CTL-SHE-0124-7400-1200-7400
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.4	Min Node Diameter (mm)	1200

Node 1 OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	57.510
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	620.0	0.0	2.000	620.0	0.0	2.001	0.0	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	46	10	64.397	0.097	22.2	0.1292	0.0000	OK
15 minute summer	45	10	64.090	0.088	23.1	0.1025	0.0000	OK
15 minute winter	44	10	63.922	0.097	48.2	0.2096	0.0000	OK
15 minute winter	43	12	62.375	1.257	95.0	2.8035	0.0000	SURCHARGED
15 minute winter	42	12	62.321	1.317	84.1	2.2562	0.0000	SURCHARGED
15 minute winter	41	11	62.049	1.349	101.4	2.6909	0.0000	SURCHARGED
15 minute winter	4G	10	59.228	0.128	20.8	0.3007	0.0000	OK
15 minute winter	8	11	65.448	0.342	114.9	0.4500	0.0000	SURCHARGED
15 minute winter	7	11	65.215	0.286	133.0	0.4819	0.0000	OK
15 minute winter	5	11	63.268	0.609	263.6	1.6927	0.0000	SURCHARGED
15 minute winter	14EX	11	63.577	0.777	75.9	0.8783	0.0000	SURCHARGED
15 minute winter	3	11	61.125	1.100	489.0	1.2637	0.0000	SURCHARGED
15 minute winter	4	11	61.753	1.324	366.7	2.7027	0.0000	SURCHARGED
15 minute winter	3G	10	59.119	0.127	20.8	0.1811	0.0000	OK
15 minute winter	2G	11	58.998	0.126	20.6	0.1805	0.0000	OK
960 minute winter	1G IN	915	58.785	0.875	1.6	1.2525	0.0000	SURCHARGED
15 minute winter	10	11	66.525	0.525	83.9	0.1595	0.0000	SURCHARGED
15 minute winter	11	10	67.267	0.137	75.5	0.1175	0.0000	OK
15 minute summer	12.1	1	68.209	0.000	0.0	0.0000	0.0000	OK
15 minute summer	12	10	69.778	0.074	36.3	0.0000	0.0000	OK
15 minute summer	13	10	70.149	0.105	36.3	0.0638	0.0000	OK
15 minute summer	14	10	70.384	0.063	16.8	0.0000	0.0000	OK
15 minute winter	9	11	66.193	0.893	110.3	0.7426	0.0000	SURCHARGED
15 minute summer	47	10	65.202	0.062	15.4	0.0285	0.0000	OK
960 minute winter	1 OUT	915	58.785	1.275	48.5	792.9011	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	46	3.001	45	22.2	1.441	0.353	0.3145	
15 minute summer	45	3.002	44	23.1	1.503	0.264	0.0968	
15 minute winter	44	3.003	43	48.2	1.475	0.388	1.3475	
15 minute winter	43	3.004	42	73.9	1.369	0.475	0.4115	
15 minute winter	42	3.005	41	90.6	1.309	0.958	2.9481	
15 minute winter	41	3.006	4	114.3	1.624	1.071	2.0675	
15 minute winter	4G	6.001	3G	20.8	0.900	0.568	0.5007	
15 minute winter	8	1.007	7	115.6	1.645	0.961	1.0558	
15 minute winter	7	1.008	6	133.0	2.339	0.938	0.3831	
15 minute winter	5	1.010	4	245.1	3.569	0.717	1.6792	
15 minute winter	14EX	4.005	48	71.3	1.793	0.748	0.4541	
15 minute winter	3	1.012	2.1	488.5	3.084	2.145	0.7936	
15 minute winter	4	1.011	3	365.1	2.304	1.091	5.9804	
15 minute winter	3G	6.002	2G	20.6	0.909	0.561	0.5427	
15 minute winter	2G	6.003	1G IN	20.4	0.927	0.559	0.4464	
960 minute winter	1G IN	6.004	1 OUT	1.4	0.301	0.004	4.6983	
15 minute winter	10	1.005	9	81.2	2.042	0.553	0.3530	
15 minute winter	11	1.004	10	73.7	2.730	0.600	0.6651	
15 minute summer	12.1	2.000	11	0.0	0.000	0.000	0.2529	
15 minute summer	12	1.003	11	36.3	2.084	0.234	0.5292	
15 minute summer	13	1.002	12	36.3	2.483	0.334	0.1155	
15 minute summer	14	1.001	13	16.8	1.247	0.165	0.0994	
15 minute winter	9	1.006	8	109.1	2.744	1.648	0.4774	
15 minute summer	47	3.000	46	15.4	1.237	0.166	0.3346	
960 minute winter	1 OUT	1.015	0	7.4	0.860	0.144	0.0308	421.1

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	0	915	57.532	0.057	7.4	0.0000	0.0000	OK
15 minute winter	2 IN	11	59.418	1.268	502.7	0.0000	0.0000	SURCHARGED
15 minute winter	2.1	11	60.766	0.766	502.9	0.0000	0.0000	SURCHARGED
15 minute winter	2.2	10	63.077	0.077	16.0	0.0560	0.0000	OK
15 minute winter	6	11	65.002	0.182	211.6	0.4474	0.0000	OK
15 minute winter	48	11	63.291	0.872	122.9	1.1965	0.0000	SURCHARGED
15 minute winter	49	10	67.879	0.109	75.9	0.1057	0.0000	OK
15 minute summer	50	10	69.461	0.091	50.6	0.0356	0.0000	OK
15 minute summer	51	10	70.472	0.109	40.4	0.0307	0.0000	OK
15 minute summer	1E	10	70.618	0.147	27.0	0.0214	0.0000	OK
15 minute summer	2E	10	70.668	0.134	22.1	0.1129	0.0000	OK
15 minute summer	5G	10	60.018	0.018	2.8	0.0024	0.0000	OK
15 minute winter	14A	10	71.780	0.060	16.8	0.0390	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	2 IN	1.014	1 OUT	502.2	3.170	1.907	5.3500	
15 minute winter	2.1	1.013	2 IN	502.7	3.173	2.179	0.5210	
15 minute winter	2.2	5.000	2.1	16.0	1.372	0.238	0.3502	
15 minute winter	6	1.009	5	210.4	4.049	0.675	1.5988	
15 minute winter	48	4.006	3	122.6	3.084	1.286	0.7330	
15 minute winter	49	4.004	14EX	75.9	2.844	0.481	1.6111	
15 minute summer	50	4.003	49	50.7	2.964	0.337	0.3311	
15 minute summer	51	4.002	50	40.5	2.365	0.430	0.5222	
15 minute summer	1E	4.001	51	27.0	1.159	0.737	0.5007	
15 minute summer	2E	4.000	1E	22.1	0.851	0.521	0.2446	
15 minute summer	5G	6.000	4G	2.8	0.257	0.013	0.0698	
15 minute winter	14A	1.000	14	16.8	1.914	0.153	0.2781	

UK and Ireland Office Locations