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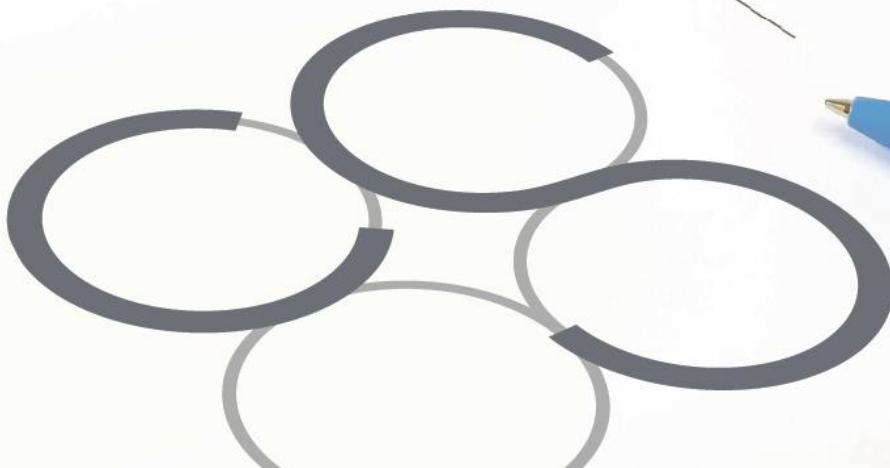
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**Site Specific Flood Risk Assessment
Stradbrook Road SHD
Mountashon, Blackrock, Co. Dublin**

Client: Tetrarch Residential Ltd

Job No. T059

July 2022



SITE SPECIFIC FLOOD RISK ASSESSMENT

STRADBROOK ROAD SHD, MOUNTASHTON, BLACKROCK, CO. DUBLIN

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Appendix A: Dún Laoghaire-Rathdown County Council Flood Risk Map

Appendix B: OPW Historic Flood History

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T059 Flood Risk Assessment

Job Ref.	Author	Reviewed By	Authorised By	Issue Date	Rev. No.
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1.0 INTRODUCTION

Cronin & Sutton Consulting Engineers (CS Consulting) have been commissioned by Tetrarch Residential Ltd to prepare a Site Specific Flood Risk Assessment to accompany a pre-planning application for a Proposed Development at Stradbrook Road, Mountashton, Blackrock, Co. Dublin.

This report was prepared by Gary Lindsay of CS Consulting, who holds a Bachelor's Degree in Civil Engineering from University College Dublin and is a Chartered Engineer with Engineers Ireland and practicing as a consulting engineer for over eighteen years.

In preparing this report, CS Consulting has referred to the following:

- Dún Laoghaire-Rathdown County Development Plan 2016–2022
- Draft Dún Laoghaire-Rathdown County Development Plan 2022–2028;
(Including Strategic Flood Risk Assessments to both)
- Greater Dublin Regional Code of Practice for Works;
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (2009)
- Office of Public Works Flood Maps;
- Department of the Environment Flooding Guidelines;
- Geological Survey of Ireland Maps;
- Local Authority Drainage Records;
- Visual Site Inspections

The Site Specific Flood Risk Assessment is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with the various additional information submitted by the other members of the design team, as part of the Planning Submission.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The proposed development site is located on the grounds of the existing car park to Blackrock College RFC off the Stradbroke Road, Blackrock Co. Dublin, approximately 360m to the southeast of the junction to the Stradbroke Road and Rowan Park (R827). The site is located in the administrative jurisdiction of Dún Laoghaire-Rathdown County Council and has a total area of approximately 0.4813 ha.

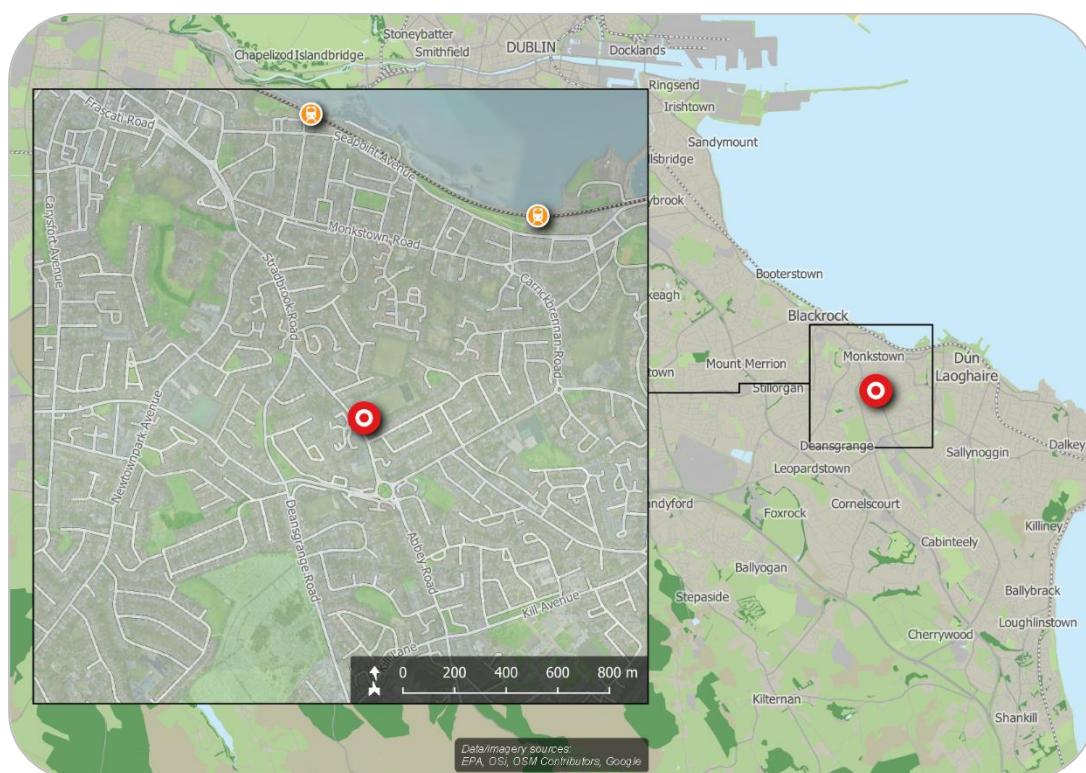


Figure 1 – Location of proposed development site
(Map data & imagery: EPA, OSM Contributors, Google)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

The site is bounded to the north and east by the existing Blackrock College RFC clubhouse and playing fields, to the south by existing residential properties, to the west by Stradbroke Road and Rockford Manor housing estate.

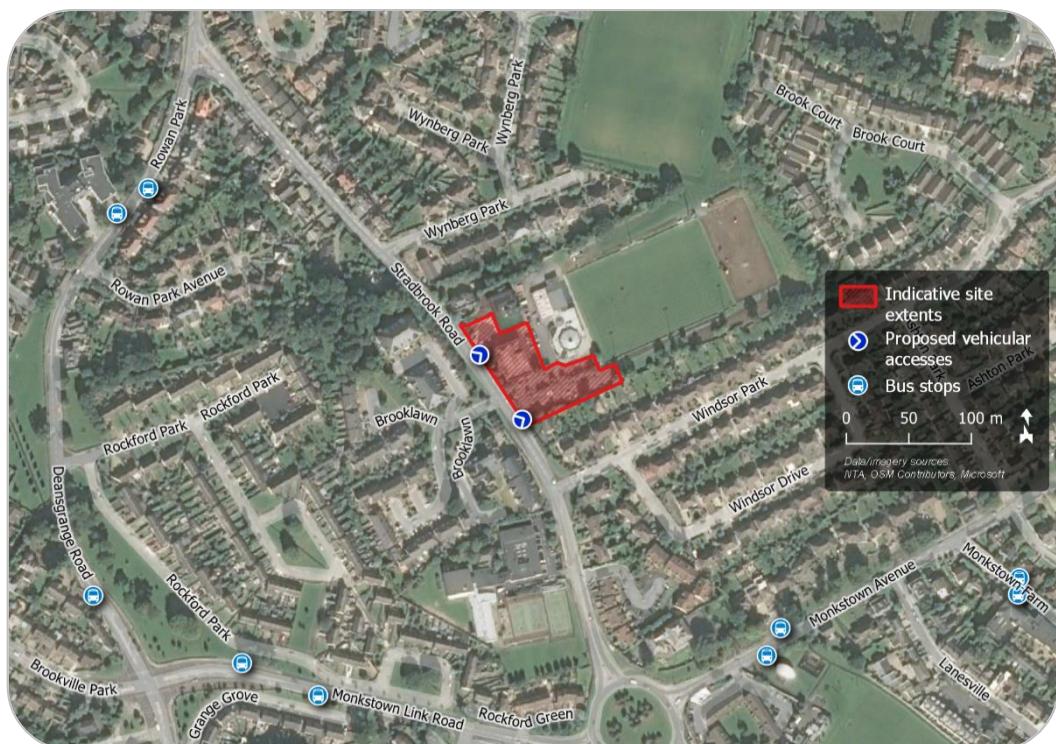


Figure 2 – Site extents and environs
(Map data & imagery: NTA, GoCar, OSM Contributors, Google)

2.2 Existing Land Use

The development site is at present occupied by an existing car park, a commercial building and car parking associated to an adjoining creche.

2.3 Proposed Development

The proposed mixed-use development at a site of some 0.4813ha on Stradbrook Road, Mountashton, Blackrock, Co. Dublin shall consist of:

The demolition of existing buildings and surface car park, and the construction of 108 No. Build-to-Rent residential senior living apartments (83 No. 1-bed apartments and 25 No. 2-bed apartments), with balconies / winter gardens at all elevations, across 2 No. blocks ranging between 3 to 7-storeys with set back at sixth-floor level and additional basement storey. The proposal also includes for 148 No. secure bicycle parking spaces, 55 No. underground car parking spaces, a two-way vehicular entrance ramp and bin storage, circulation areas and associated plant at basement level; a self-contained office unit, a residential staff management suite, resident's facilities, residents' communal amenity rooms, and residents' communal open space, as well as 13 No. surface car parking spaces (incl. 1 No. accessible commercial car parking space and 12 No. car parking spaces for use by the adjoining creche (incl. 1 No. accessible)), 24 No. secure cycle spaces within separate bike store, separate bin store for office use, 30 No. short-term bicycle parking spaces, and 3 No. ESB substations at ground floor level; additional communal amenity rooms at first, second, third, fourth and fifth-floor levels; roof gardens / terraces at third, fourth and sixth-floor levels; green roofs; and PV panels on third, fourth and sixth-floor roof-level; amendments to existing boundary wall to provide new vehicular and pedestrian entrances; provision of security gates; and associated site landscaping, lighting and servicing, and all associated works above and below ground.

3.0 LEVEL OF SERVICE

There is an existing inherent risk of any flood event occurring during any given year. Typically, this likelihood of occurrence was traditionally expressed as a 1-in-100 chance of a 100 year storm event happening in any given year.

A less ambiguous expression of probability is the Annual Exceedance Probability (AEP), which may be defined as the probability of a flood event being exceeded in any given year. Therefore a 1-in-100-year event has a return period of 1% AEP flood event, similarly a 100% AEP can be expressed as a 1-in-1-year event.

- 3.1** *The Planning System and Flood Risk Management, Guidelines for Planning Authorities* (the “Guidelines”) set out the best practice standards for flood risk assessment in Ireland. These are summarised in Table 1 below (Table 8.1 from Guideline’s document).

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible (docks, marinas)	-	>1% AEP	>0.5% AEP

Table 1 – Summary of Level of Service – Flooding Source

Under these guidelines a proposed development site has first to be assessed to determine the flood zone category it falls under.

It is a requirement of both Dún Laoghaire-Rathdown County Council, Greater Dublin Strategic Drainage Study, (DCC 2005) & the Department of the Environment, community & Local Government flooding guidelines, The

Planning System and Flood Risk Management, Guidelines for Planning Authorities, and the OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance (2009) where it considers the Mid-Range Future Scenario and High-End Future Scenario, that the predicted effects of climate change are incorporated into any proposed design. Table 2 below indicates the predicted climate change variations.

Design Category	Predicted Impact of Climate Change
Drainage	20% Increase in rainfall
Fluvial (River flows)	20% Increase in flood flow
Tidal / Coastal	Minimum Finished Floor Level 4.0 – 4.15m AOD

Table 2 - The predicted climate change variations.

- 3.2** The objective of a site-specific Flood Risk Assessment is to assess all types of flood risk to a development. The assessment should investigate potential sources of flood risk and include for the effects of climate change. The assessment is required to examine the impact of the development and the effectiveness of flood mitigation and management procedures proposed. It should also present the residual risks that remain after those measures are put in place.

This approach is based on the identification of flood zones for river and coastal flooding. "Flood Zones" are geographical areas used to identify areas at various levels of flood risk. It should be noted that these do not consider the presence of flood defences, as the risks remain of overtopping and breach of the defenses.

The flooding guidelines categorize the risks associated with flooding into three areas, Zone A, B & C. This categorisation is indicated below.

- **Zone A** – High Probability of Flooding. Where the average probability of flooding from rivers and sea is highest (greater than 1% annually or 1 in 100 for river flooding or 0.5% annually or 1 in 200 for coastal flooding).
- **Zone B** – Moderate Probability of Flooding. Where the average probability of flooding from rivers and sea is moderate (risk between 0.1% annually or 1 in 1000 years and 1% annually or 1 in 100 years for river flooding, and between 0.1% or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding).
- **Zone C** – Low Probability of Flooding. Where the probability of flooding from rivers and sea is moderate (risk is less than 0.1% annually or 1 in 1000 years for both rivers and coastal flooding).

In accordance with the *Planning Systems and Flood Risk Management Guidelines for Planning Authorities*, dwellings are classified as 'highly vulnerable developments'.

- 3.3** Following a review of the Map A.13 from Appendix 15 of the Strategic Flood Risk Assessment by DLRCC (2022-2028), the subject site is located outside the 0.1% AEP Flood Zone, i.e. **Flood Zone C**. See **Appendix A**.

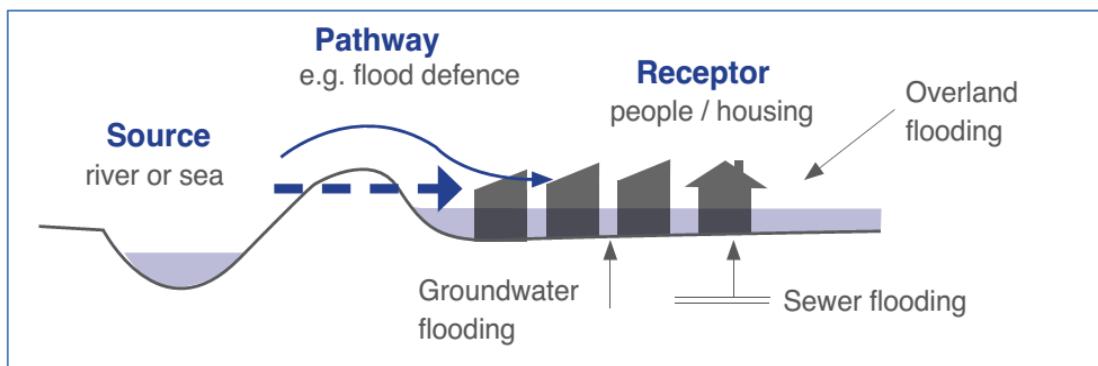


Figure 3 – Source-pathway-receptor model
 (imagery: *The Planning System and Flood Risk Management Guidelines*)

- 3.4** The flooding guidelines have developed an 'appropriateness' matrix for various developments and their potential risk factor. The table indicates if further analysis is required in the form of a justification test. Table 3 below outlines the conditions that require a justification test.

	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 3 - Flood Zone Vs Justification Test Matrix

As noted above the subject site is located within **Flood Zone C**, as such a justification test is not required.

4.0 FLOOD RISKS & MITIGATION MEASURES

4.1 Fluvial Flooding

A review of the Office of Public Works flood maps database, www.floodmaps.ie, the development area does not indicate historical or future predicting flooding at the site. A follow up review of the Dun Laoghaire Rathdown Co. Co. Flood Maps confirmed the same. please see **Appendix A** for DLR Flood Map.

Therefore, the risk of fluvial flooding is not an issue, and no mitigation measures are required.

4.2 Tidal Flooding

The sites elevated location indicates that the subject lands are not going to be affected by tidal flooding, the councils flood risk map does not indicate that the site is located in a tidal flood zone.

4.3 Pluvial Flooding

Pluvial flooding is flooding which has originated from overland flow resulting from high intensity rain fall. A high level pluvial flood map has been produced but it is for high level use than for a specific site. Previous flood events in the area can be reviewed on the Office of Public Works web site, www.floodmaps.ie. The website indicates areas where pluvial flooding has occurred in the past. The historical flood mapping indicates a past flood event to the north of the development site however due to the topography of the surrounding area has no potential effect on the proposed development lands, see **Appendix B** for OPW floodmaps report.

Therefore, the risk of pluvial flooding is not an issue however the entrances to the development site shall be superelevated above Stradbrook Road (to

match existing super elevation scenario) as a mitigation measure to prevent any external floodwater that occurs on Stradbrook Road from entering the site.

4.4 Potential for Site to Contribute to Off-Site Flooding

The site is currently developed but does not have any attenuation systems in place. As such the proposed redevelopment of the site shall require attenuation to be provided in line with the county development plan.

An attenuation tank with 240 cubic metres of a storage sized for a 1-in-100 year storm event (including 30% increase for climate change) and shall release the storm water in a controlled manner of 1.5 l/s via a hydrobrake manhole (see Engineering Services Report for further details) for the duration of the storm event and until the tank empties. By restricting the flow, the likelihood of the proposed development adversely affecting the public drainage system or contributing to downstream flooding is mitigated. The surface water network design and attenuation has been modelled through the WinDES Microdrainage software programme with the 30% climate change factors incorporated into the model and the results of model simulated for a 100 year storm event show no flooding occurs across the site.

Additionally, a number of SuDS proposals are being implemented across the development site, see below and Drawing BLK-CSC-ZZ-XX-DR-C-0013 for SuDS proposals. These measures shall also reduce the volume of surface water runoff generated across the development site.

- i) The use of green roof systems shall be introduced to roof areas of the building as well as the podium slab of the development. The total roof area of the proposed building is 1875sqm. Of that 1330sqm shall be constructed as a green roof which equates to 70.9% of the roof area.

- ii) External car park spaces at ground floor level shall be constructed of permeable paving systems.
- iii) Porous asphalt shall be constructed to the access road carriageways of the development site.
- iv) Permeable paving to other landscaped hardstanding areas shall be constructed across the development site.
- v) Rainwater ‘butts’- rain which falls first on to roof areas shall be collected in a water storage unit, to allow for re-use for landscaping purposes to reduce the reliance on the potable water network;
- vi) Oil Separator, at the end of the storm water network in the basement car park a suitable oil separator is to be fitted to allow any hydrocarbons which may have built up from on-site traffic to be removed from storm water prior to disposal.

Therefore, the risk of off-site flooding is mitigated, and no further measures are required.

4.5 Groundwater Flooding

According to the Geological Survey of Ireland interactive maps, the subject site is underlain with *Granite with microcline phenocrysts*. The area is listed as overlaying a poor aquifer which has bedrock which is *unproductive* except for *local zones*. The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is *low*. The proposed development and the general geology of the subject lands means that the potential risk from groundwater is deemed negligible. Please refer to **Appendix C** for GSI mapping information.

Therefore, the risk of groundwater flooding is not an issue, and no mitigation measures are required.

4.6 Flooding Risks during Construction

The risk of flooding during the construction period is considered low but must be mitigated against in accordance with best practices. During construction this shall be the responsibility of the contractor and shall agree all measures with the local authority prior to construction.

During construction, measures shall be put in place by the appointed contractor to reduce the risk of flooding downstream as well as mitigate against the risk of downstream pollution from construction activities during the storm event.

These measures shall include the following:

- i) Run-off from the working site or any areas of exposed soil should be channelled and intercepted at regular intervals for discharge to silt traps or lagoons with over-flows directed to land on site for ponding rather than discharging offsite. The contractor shall construct these temporary construction surface drainage and sediment control measures shall be in place before earthworks commence.
- ii) A maintenance schedule and operational schedule should be established by the contractor for silt and pollution control measures during the construction period. This should be undertaken in consultation with the relevant statutory authorities.
- iii) Routine visual inspections by the contractor across the development site, shall reduce any risk of excess construction materials causing blockages in the surface water network and remove any potential flooding occurring downstream.
- iv) During the basement construction, excess stormwater may pond and need to be removed via a pumping system. The discharge flow



from the basement area should be agreed with the local authority and additional dewatering measures put in place prior to discharging to the downstream if deemed acceptable to the local authority to do so.

Additional information in relation to construction pollution control can be found in the Construction Management Plan by CS Consulting under separate cover included with this planning submission.

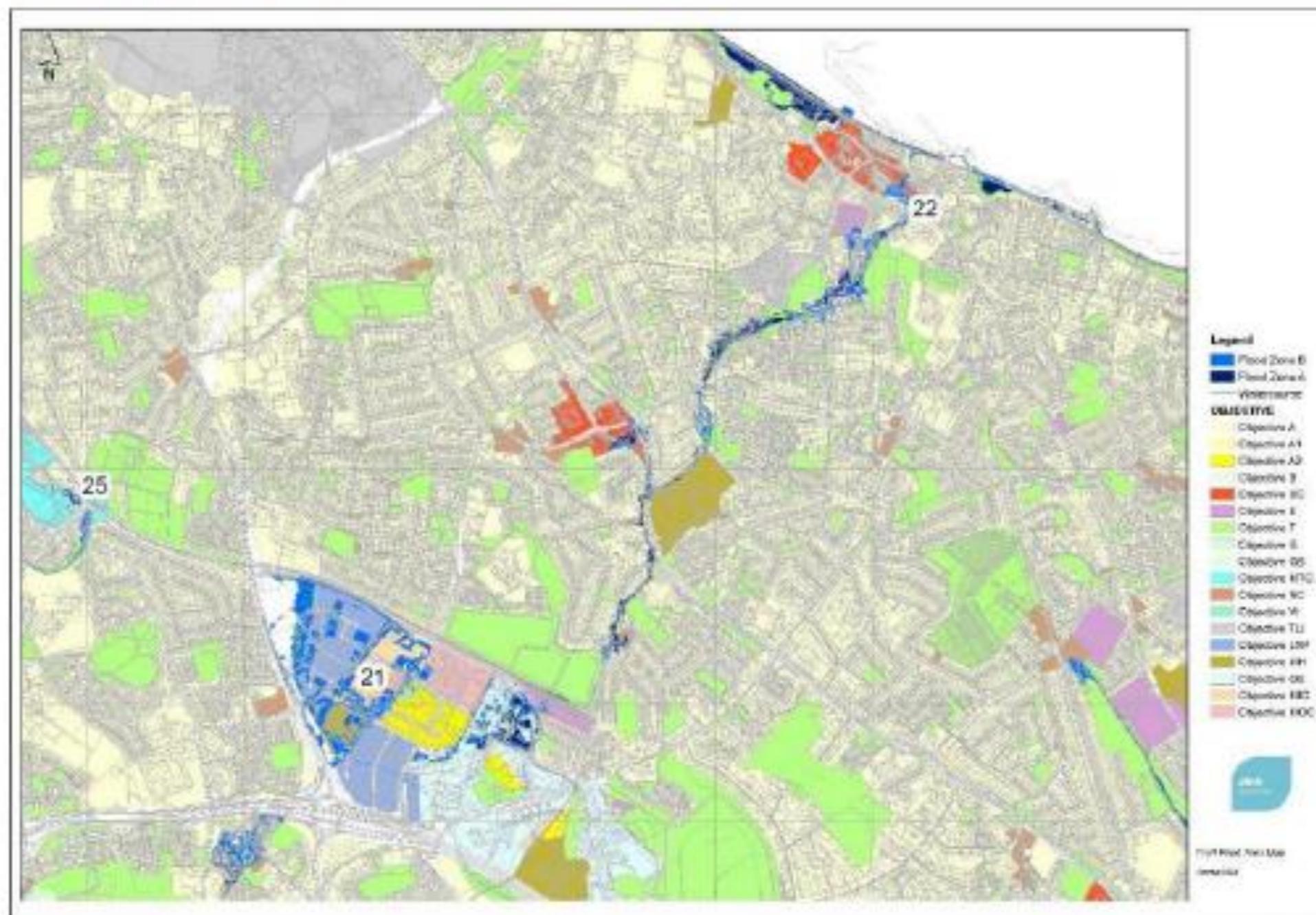
5.0 CONCLUSION

- The site historically has no recorded flood events as noted in the OPW's flood maps. The Dun Laoghaire Rathdown County Council Flood Risk Map A.13 from Appendix 15 of the Strategic Flood Risk Assessment by DLRCC (2022-2028), has indicated that the subject lands are located outside the 0.1% AEP Zone i.e. Flood Zone C.
- Predicted flood mapping for pluvial/tidal & fluvial flood events shall not affect the subject lands.
- The proposed development shall have a 240m³ storm water attenuation tank to address a 1 in 100 year extreme storm events increased by 30% for predicated climate change values to prevent flooding occurring onsite.
- Stormwater flow from the development site shall be limited to 1.5 l/s. This shall significantly reduce the volume of storm water leaving the site during extreme storms which in turn shall have the effect of reducing the pressure on the existing public drainage system and reduce the occurrence of downstream flooding.
- The likelihood of onsite flooding from the hydrogeological ground conditions are deemed to be negligible.
- During construction the contractor shall be responsible for the mitigating the risk of flooding on and offsite and shall agreed these measures with the local authority prior to construction



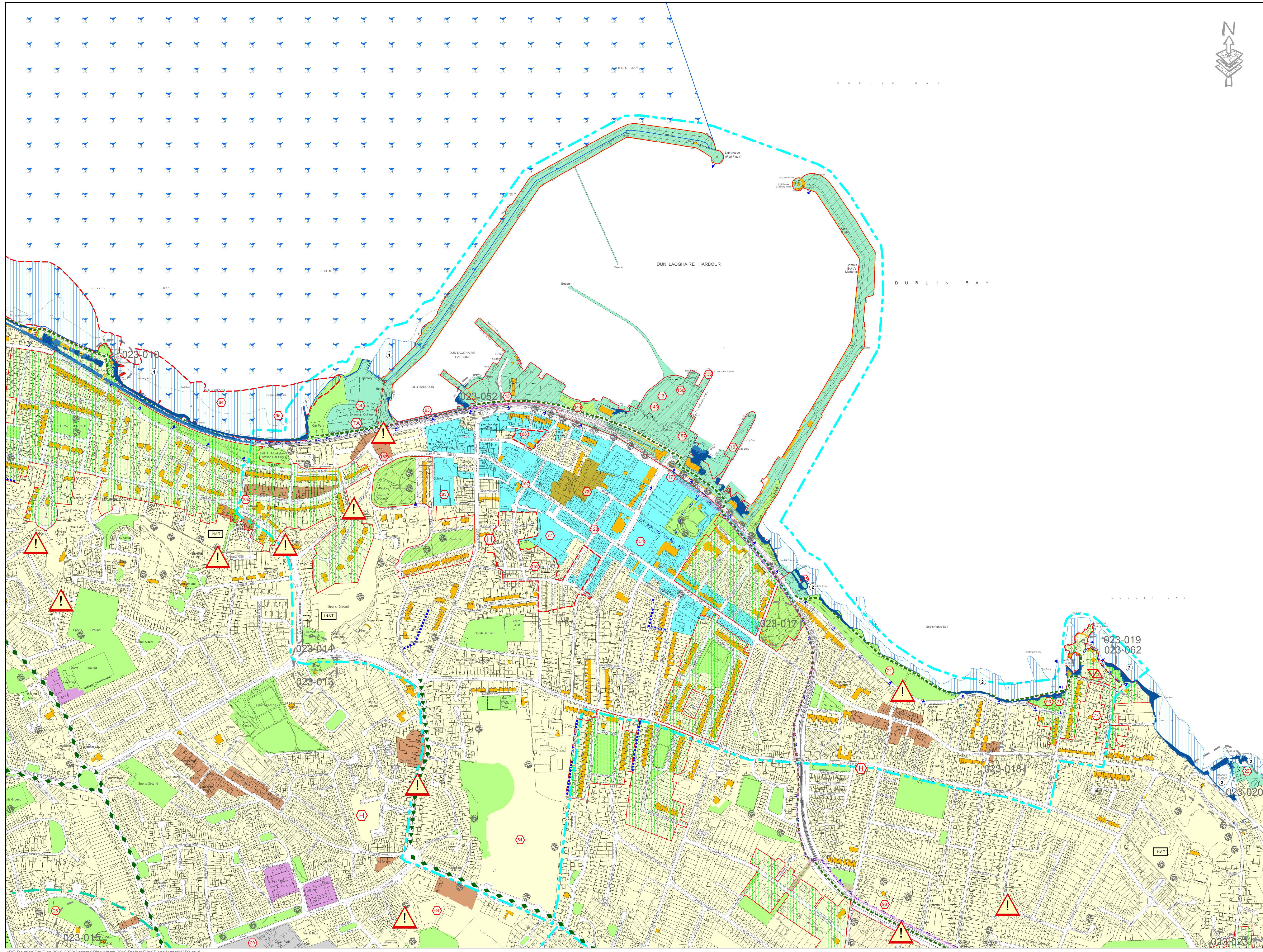
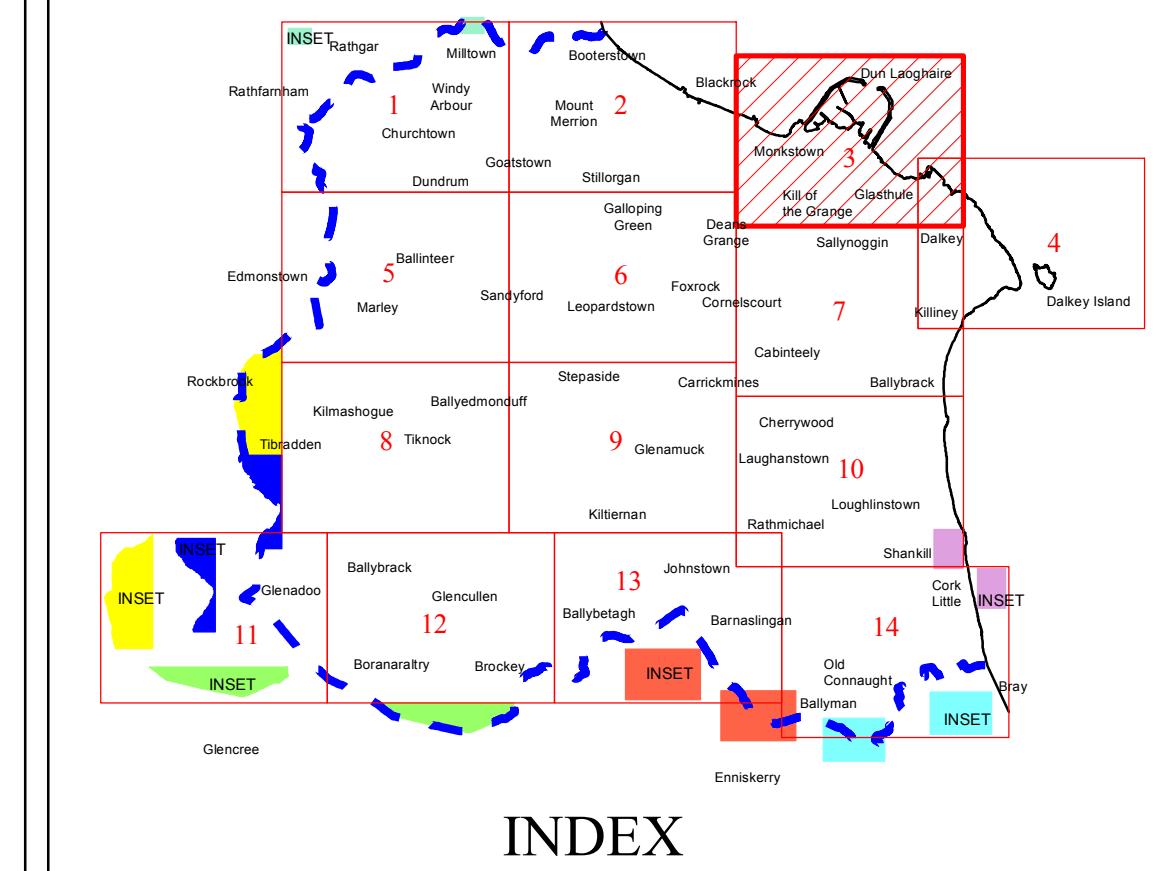
Appendix A: Dún Laoghaire-Rathdown County Council Flood Risk Map

A.13 Carysfort Maretimo Rivers



COMHAIRLE CHONTAE DHÚN LAOGHAIRE-RÁTH AN DÚIN DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL

Flood Zone Maps





Appendix B: OPW Historic Flood History

Flooding at Stradbrook Gardens, Blackrock, Co. Dublin

24th October 2011

The information contained in this report has been extracted from a Flood Data Collection Form submitted to The Office Of Public Works (OPW) by Consultants working on the Eastern River Basin District (RBD) Catchment Flood Risk Assessment and Management (CFRAM) Project.

1 Location and date of flood event:

Location: Stradbrook Gardens, Blackrock, Co. Dublin.
Irish Grid Co-ordinates: 322,328 228,395

This flooding event started on 24th October 2011 and ended on 25th October 2011, the peak flood occurred on 24th October 2011.

2 Source and cause:

The source of the flooding was a surface depression. The Stradbrook Stream flows behind the gardens of Stradbrook Gardens in a culvert. Heavy overland flows from Stradbrook Road accumulated in Stradbrook Gardens and flooded properties in this area.

3 Flood data:

The following flood information was provided:

Flood Parameter	Max Value	Typical Value	Comments
Flood Level (metres OD Malin)			
Flood Depth (metres)		0.5	
Flood Flow (m ³ /s)			
Flood Velocity (m/s)			

Dáil records from 2nd Dec 1959 indicate that flooding occurred at Stradbrook, but it is not clear at what location.

4 Impacts of flooding event:

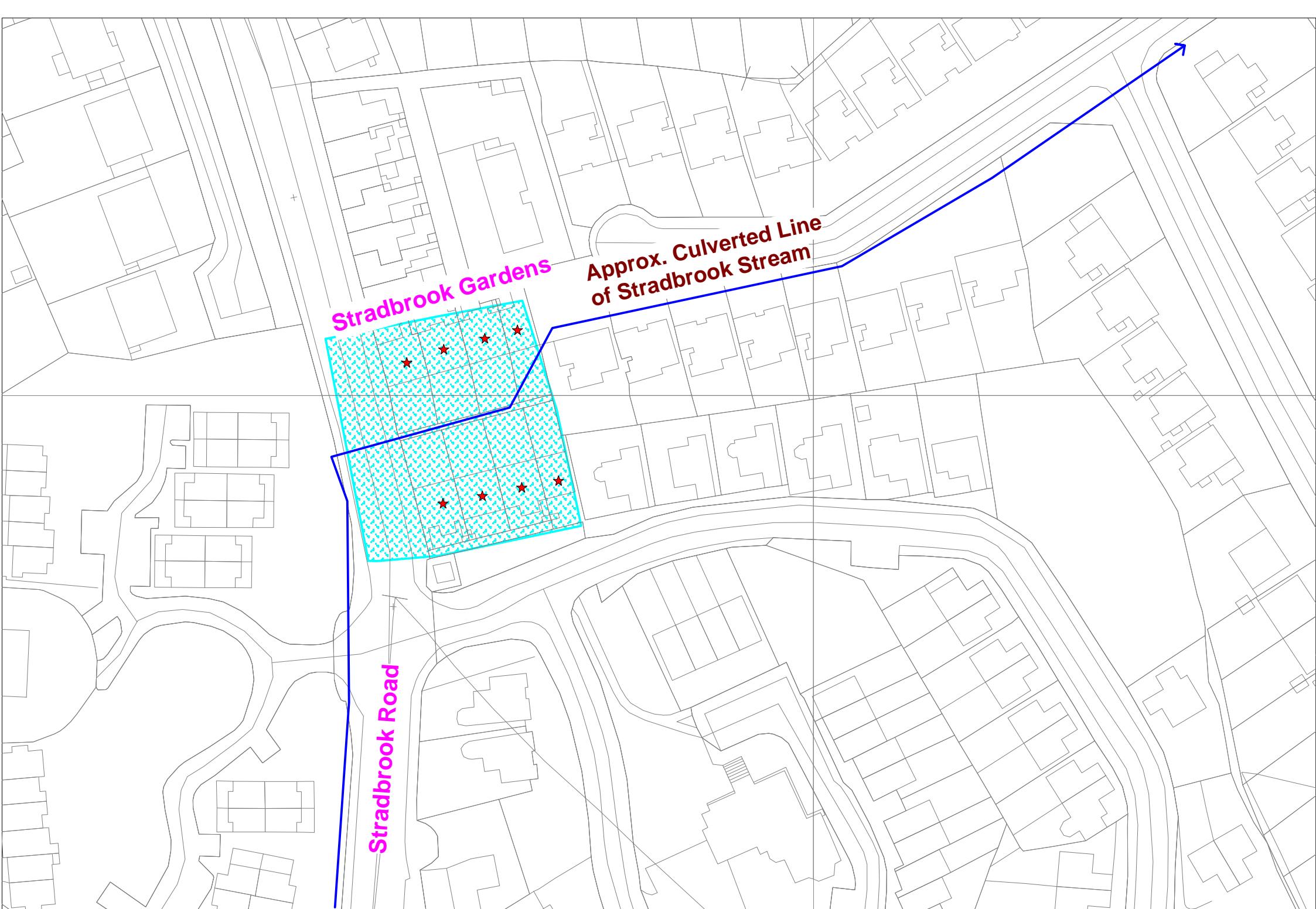
Impacts to people: There was no loss of life as a result of this flooding event.

Impacts to Property: Residential – There were 8 properties in Stradbrook Gardens affected by this event.

Impacts to transport infrastructure: Roads – 200m of Stradbrook Road (Urban) was affected by this event.

5 Documents attached:

A map of the affected area is attached.

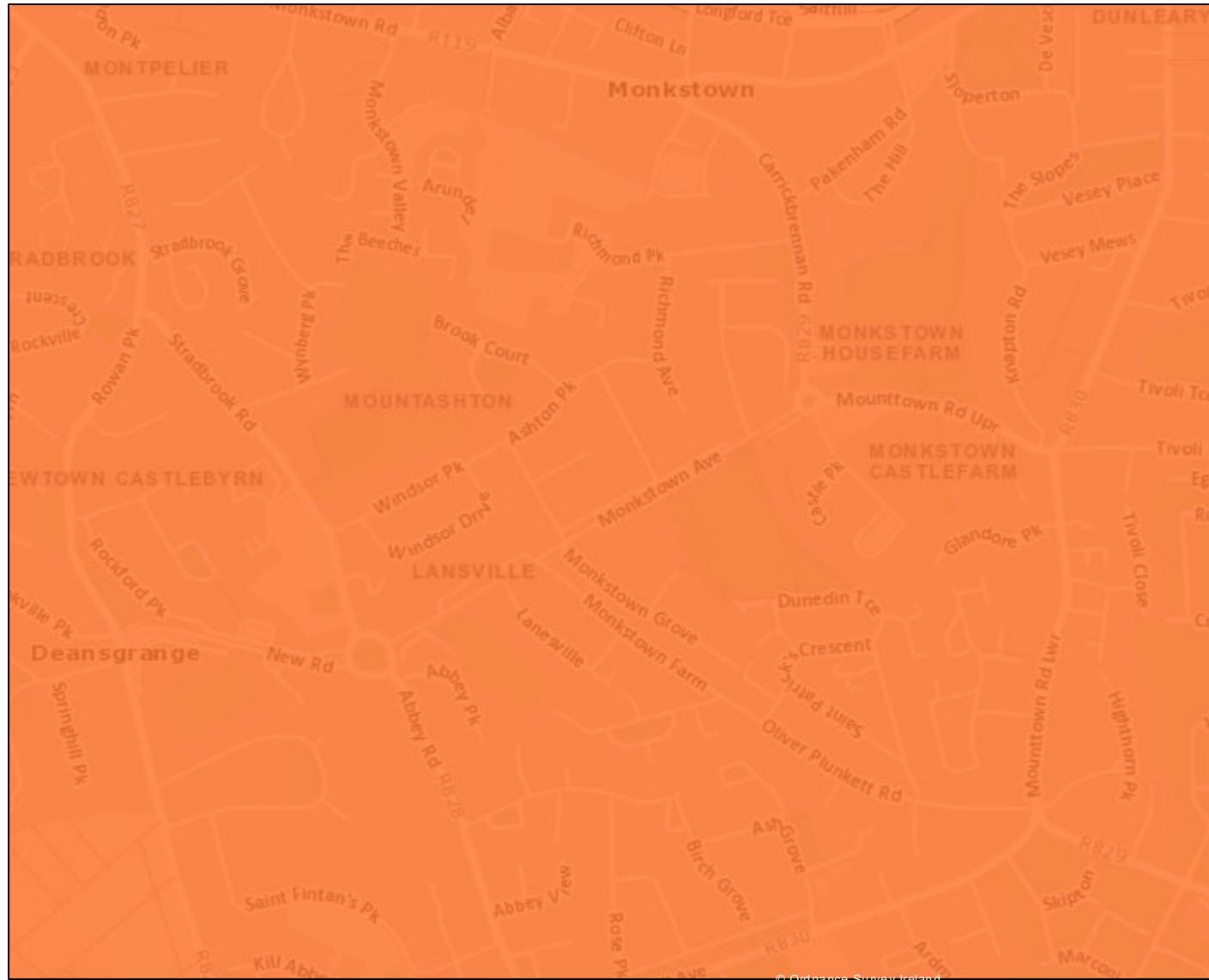




Appendix C: GSI Mapping



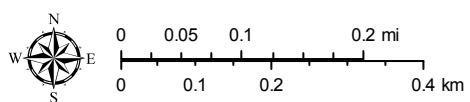
Geological Survey Ireland Public Data



Scale: 1:10,000

Geological Survey Ireland

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Legend

Structural Symbols

100K ITM 2018

- <all other values>
- ↑ Dip of bedding or main foliation, old GSI data
- ↑ First foliation parallel to bedding
- ↑ Foliation trend, Thorr and Rosses Granites
- ↔ Horizontal Bedding
- ↔ Strike and dip of bedding, right way up
- ↔ Strike and dip of bedding, way up
- ↔ unknown
- ↔ Strike and dip of first foliation
- ↔ Strike and dip of overturned bedding
- ↔ Strike and dip of second foliation
- ↔ Strike and dip of third foliation
- ↔ Strike and plunge of first generation fold axis
- ↔ Strike and plunge of second generation fold axis
- ↔ Strike and plunge of third generation fold axis
- ↔ Strike of vertical bedding/foliation
- ↔ Strike of vertical first foliation
- Bedrock Outcrops

100 ITM 2018

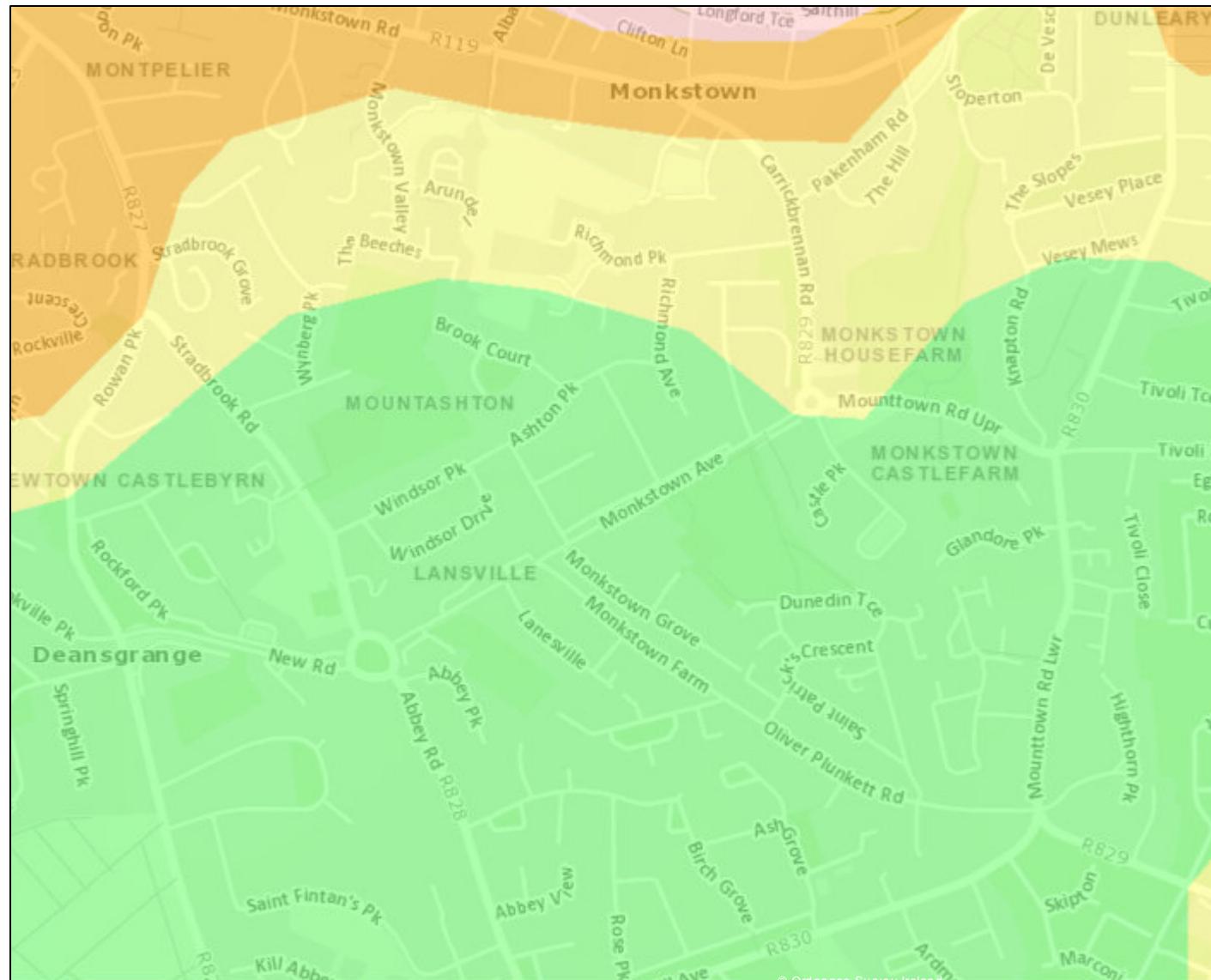
Bedrock Linework 100k

ITM 2018

- ◆ Anticlinal Axis
- ◆ Antiformal axis
- - Aquifer Boundary
- Area
- Coal seam
- Dyke
- Fault



Geological Survey Ireland Public Data



Legend

National Groundwater
Vulnerability Ireland

- Rock at or near Surface or Karst
 - Extreme
 - High
 - Moderate
 - Low
 - Water

Scale: 1:10,000

Geological Survey Ireland

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A number line representing distance in kilometers. The line starts at 0 and ends at 0.4 km. It has tick marks at intervals of 0.05 km. The labels 0, 0.05, 0.1, 0.2, and 0.2 mi are placed above the line. A bracket is drawn under the line between the 0.2 label and the 0.2 mi label, indicating that the distance from 0.2 km to 0.2 mi is the same as the distance from 0 to 0.2 km.

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