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Galway County Council

## Proposed Housing Development, Ballymoe Village, Co. Galway

### Flood Risk Assessment



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## Flood Risk Assessment

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## Table of Contents

1.0	INTRODUCTION .....	3
2.0	FLOOD RISK MANAGEMENT GUIDANCE .....	5
2.1	The Planning System and Flood Risk Management Guidelines .....	5
2.1.1	<i>Flood Zones and Vulnerability Classes</i> .....	5
2.1.2	<i>The Justification Test</i> .....	6
2.2	The Flood Risk Management Climate Change Adaptation Plan .....	7
2.3	Galway County Development Plan 2015-2021 .....	8
3.0	INITIAL FLOOD RISK ASESSMENT .....	9
3.1	Past Flood Events .....	9
3.2	OPW Preliminary Flood Risk Assessment (PFRA) Study .....	10
3.2.1	<i>National Indicative Fluvial Mapping (NIFM)</i> .....	11
3.3	Catchment Flood Risk Assessment and Management Study .....	13
3.4	OPW Drainage Districts and Arterial Drainage Schemes .....	14
3.5	Geological Survey Ireland Mapping .....	15
4.0	DETAILED FLOOD RISK ASESSMENT .....	17
4.1	Fluvial Flooding.....	17
4.2	Pluvial Flooding .....	17
4.3	Groundwater Flooding .....	17
4.4	Coastal Flooding.....	18
4.5	The Justification Test .....	18
5.0	CONCLUSIONS.....	19

**Table of Figures**

Figure 1-1 Site Location..... 3

Figure 1-2 Proposed Residential Development ..... 4

Figure 2-1 Criteria of the Justification Test ..... 6

Figure 2-2 Galway County Council Flood Risk Management Objectives ... 8

Figure 3-1 OPW Flood Map of Past Flood Events..... 9

Figure 3-2 Indicative Flood Mapping [extract from PFRA Map 282]..... 10

Figure 3-3 National Indicative Fluvial Mapping 2020- Existing Scenario. 11

Figure 3-4 National Indicative Fluvial Mapping 2020- Mid-Range Future Scenario ..... 12

Figure 3-5 Shannon CFRAM MRFS Fluvial Flood Extents ..... 13

Figure 3-6 River Suck Drainage District..... 14

Figure 3-7 GSI Mapping of Karst Features and Predicted Groundwater Flooding ..... 15

Figure 3-8 GSI Mapping of Historic Groundwater & Groundwater/Surface Water Flooding and Winter 2015/2016 Surface Water Flooding..... 16

**Table of Tables**

Table 2-1 Decision Matrix for Determining the Appropriateness of a Development..... 5

Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios ..... 7

**Appendices**

**Appendix 1**

## 1.0 INTRODUCTION

TOBIN Consulting Engineers were appointed by Galway County Council to undertake a Flood Risk Assessment (FRA) for their lands (see Figure 1-1) and proposed residential development (see Figure 1-2) at Ballymoe Village, Co. Galway.

The 0.18ha brownfield site is located on the southern outskirts of Ballymoe, approximately 20km northwest of Roscommon. Island River flows southeast into Ballymoe, passing approximately 175m northwest of the subject site, before routing north to the confluence with the River Suck.

Existing ground levels at the subject site range from approximately 59.5mOD at the northern site boundary sloping gently upward to approximately 61.5mOD at the southern site boundary. A topographic survey of the subject site is provided in Appendix 1.

The purpose of this Stage 2 Flood Risk Assessment report is to identify, quantify, and communicate the risks of flooding, if any, to the proposed development.



*Figure 1-1 Site Location*

The proposed development consists of eight road frontage semi-detached units, including six 2B/4P 2 Storey 80msq units, two 3P/ Single Storey 68msq universal access units and surface water attenuation pits for each unit within rear gardens. Access will be via the adjacent R360. See Figure 1-2.



Figure 1-2 Proposed Residential Development

## 2.0 FLOOD RISK MANAGEMENT GUIDANCE

This Stage 2 Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Galway County Development Plan

### 2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

#### 2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of flood zones A, B, and C, which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The PSFRM Guidelines also categorise different types of development into three vulnerability classes based on their sensitivity to flooding. Residential developments are considered “highly vulnerable” in terms of sensitivity to flooding.

Table 2-1 shows a decision matrix that indicates which types of development are appropriate in each flood zone and when the Justification Test (see Section 2.1.2) must be satisfied. The annual exceedance probabilities used to define each flood zone are also provided.

*Table 2-1 Decision Matrix for Determining the Appropriateness of a Development*

Flood Zone (Probability)	Annual Exceedance Probability (AEP)	Development Appropriateness		
		Highly Vulnerable	Less Vulnerable	Water Compatible
A (High)	<u>Fluvial &amp; Pluvial Flooding</u> More frequent than 1% AEP	Justification Test	Justification Test	Appropriate
	<u>Coastal Flooding</u> More frequent than 0.5% AEP			
B (Medium)	<u>Fluvial &amp; Pluvial Flooding</u> 0.1% to 1% AEP	Justification Test	Appropriate	Appropriate
	<u>Coastal Flooding</u> 0.1% to 0.5% AEP			
C (Low)	<u>Fluvial, Pluvial &amp; Coastal Flooding</u> Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate

## 2.1.2 The Justification Test

Any proposed development being considered in an inappropriate flood zone (as determined by Table 2-1) must satisfy the criteria of the Justification Test outlined in Figure 2-1 (taken from the PSFRM Guidelines).

### Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
  - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
  - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
  - (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
  - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

*Figure 2-1 Criteria of the Justification Test*



## 2.2 The Flood Risk Management Climate Change Adaptation Plan

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW's approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2-2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

*Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios*

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

## 2.3 Galway County Development Plan 2015-2021

The current Galway County Development Plan provides a strategic framework for planning and sustainable development in Co. Galway for 2015 to 2021. Chapter 8 outlines Galway County Council’s strategy for the management of Climate Change & Flooding, with Sections 8.6 and 8.7 outlining County Policies for effective flood risk management, setting out the following key objectives:

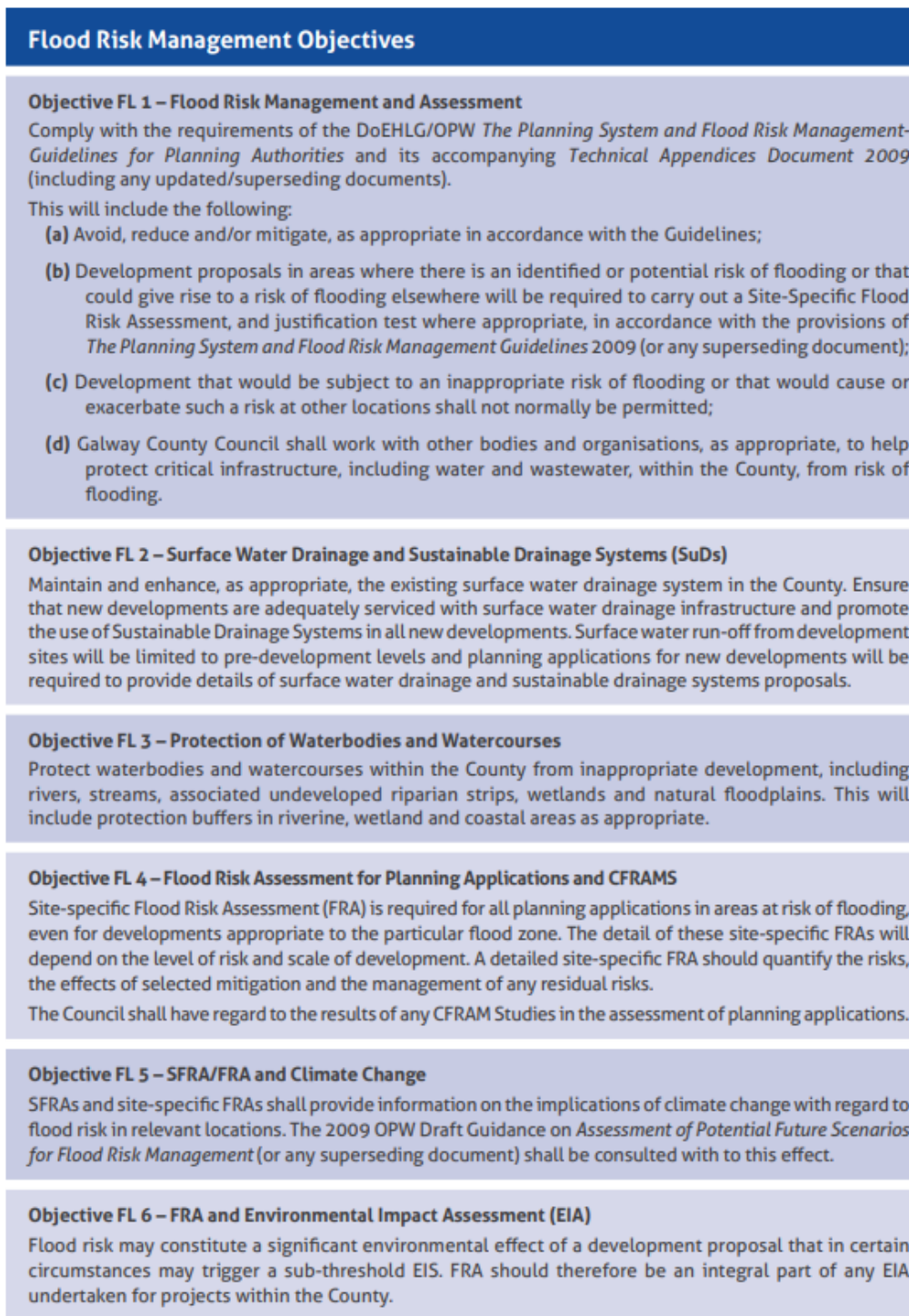


Figure 2-2 Galway County Council Flood Risk Management Objectives

### 3.0 INITIAL FLOOD RISK ASESMENT

#### 3.1 Past Flood Events

The OPW's National Flood Information Portal<sup>1</sup> provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data. Based on the flood map shown in Figure 3-1, a there no recorded locations of historical or recurring flooding noted within Ballymoe, or in the vicinity of the subject site.

The nearest reported instance of recurring flooding is located approximately 2km from the subject site, on a tributary of the River Suck.

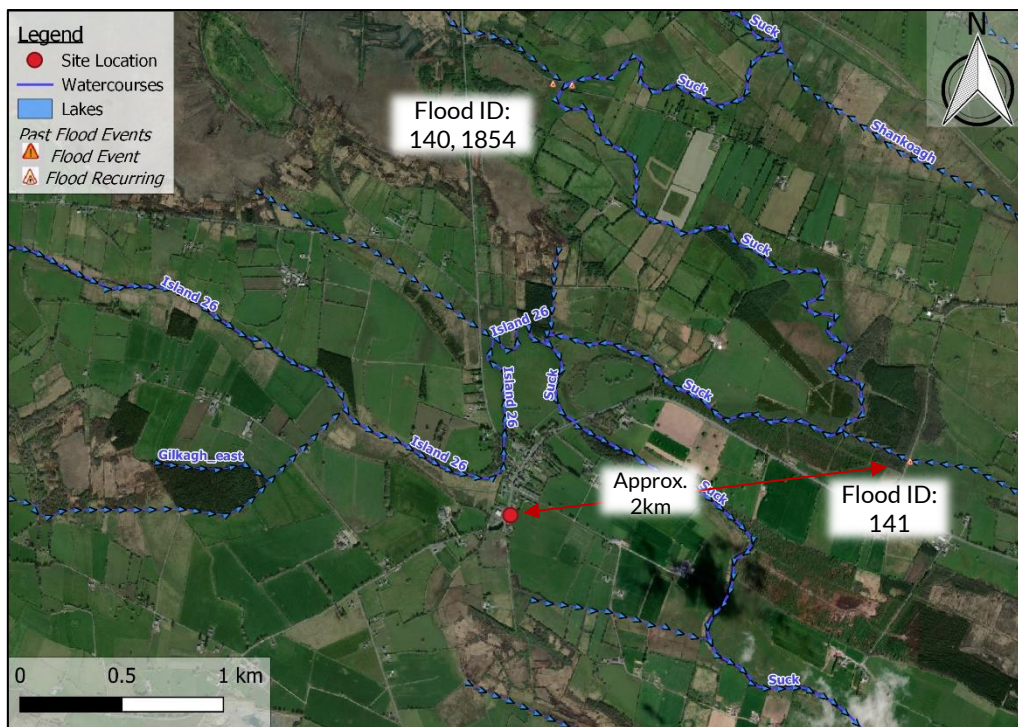


Figure 3-1 OPW Flood Map of Past Flood Events

<sup>1</sup> floodinfo.ie

### 3.2 OPW Preliminary Flood Risk Assessment (PFRA) Study

In 2009, the OPW produced a series of maps to assist in the development of a broad-scale FRA throughout Ireland. These maps were produced from several sources.

The OPW’s National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 noted that *“the flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location”*<sup>2</sup>.

Figure 3-2 provides an overview of the fluvial, coastal, pluvial, and groundwater indicative flood extents in the vicinity of the subject site.

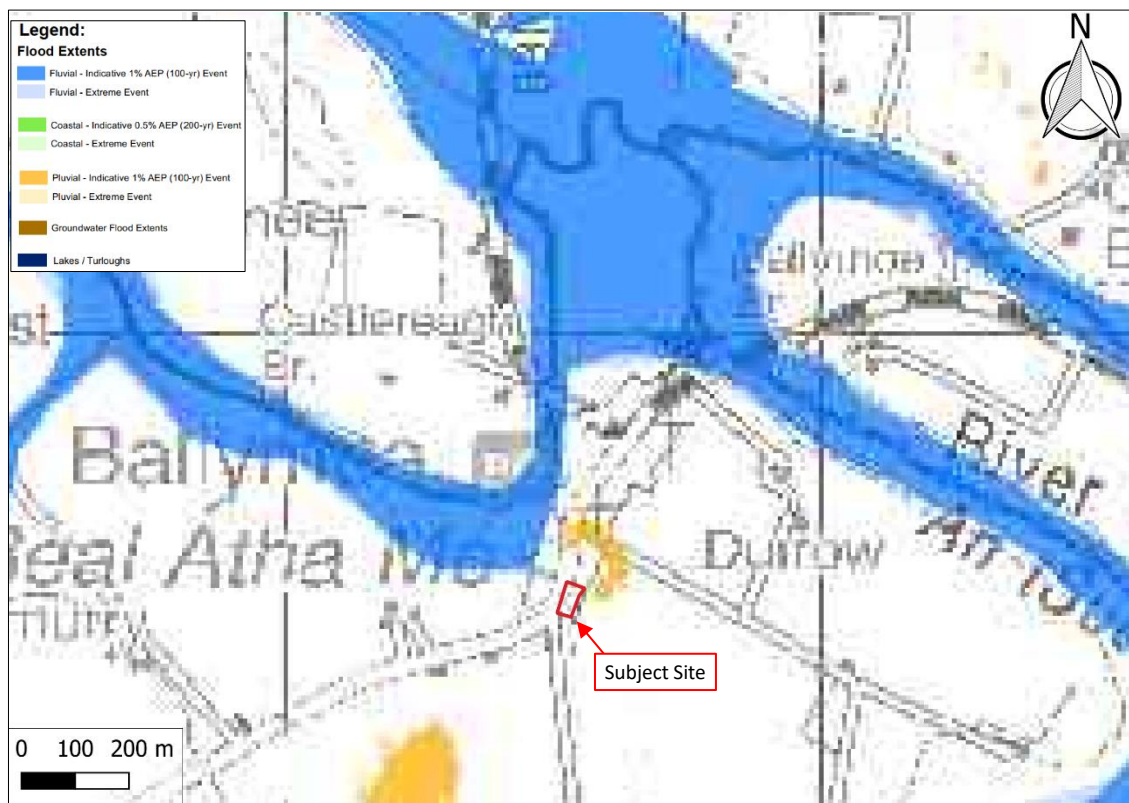


Figure 3-2 Indicative Flood Mapping [extract from PFRA Map 282]

The PFRA indicative mapping indicates an area adjacent to the northeastern site corner that may be liable to pluvial flooding, consistent with areas of low topography noted within the topographic survey (<59mOD).

Limitations on potential sources of error associated with the PFRA maps include:

- Assumed channel capacity (due to absence of channel survey information)
- Absence of flood defences and other drainage improvements and channel structures (bridges, weirs, culverts)
- Local errors in the national Digital Terrain Model (DTM)

Improved hydraulic modelling was carried out through the Catchment Flood Risk Assessment and Management Study (CFRAM) in 2015 (discussed in Section 3.3) and is considered more accurate than the PFRA study.

<sup>2</sup> The National Preliminary Flood Risk Assessment (PFRA) Overview Report, OPW (March 2012)

### 3.2.1 National Indicative Fluvial Mapping (NIFM)

In 2020, the OPW produced the second generation indicative fluvial flood mapping, improving upon the first generation PFRA and producing higher quality flood maps<sup>3</sup>.

The NIFM Flood Mapping Technical Data notes that “Cross sectional surveys have not been used to define the dimensions of river channels and structures within the 2D model. Channels have been represented in the 2D model by assuming their channel capacity is equivalent to the estimation of [the index flood flow]”<sup>4</sup>. The 2D model uses a Digital Terrain Model with a grid scale of 5m.

Figure 3-2 provides an overview of the 1% and 0.1% AEP indicative fluvial flood mapping of Island River. The NIFM flood extents are edited to remove overlaps with the fluvial flood extents of the CFRAM Study, which models the River Suck and confluence with Island River.

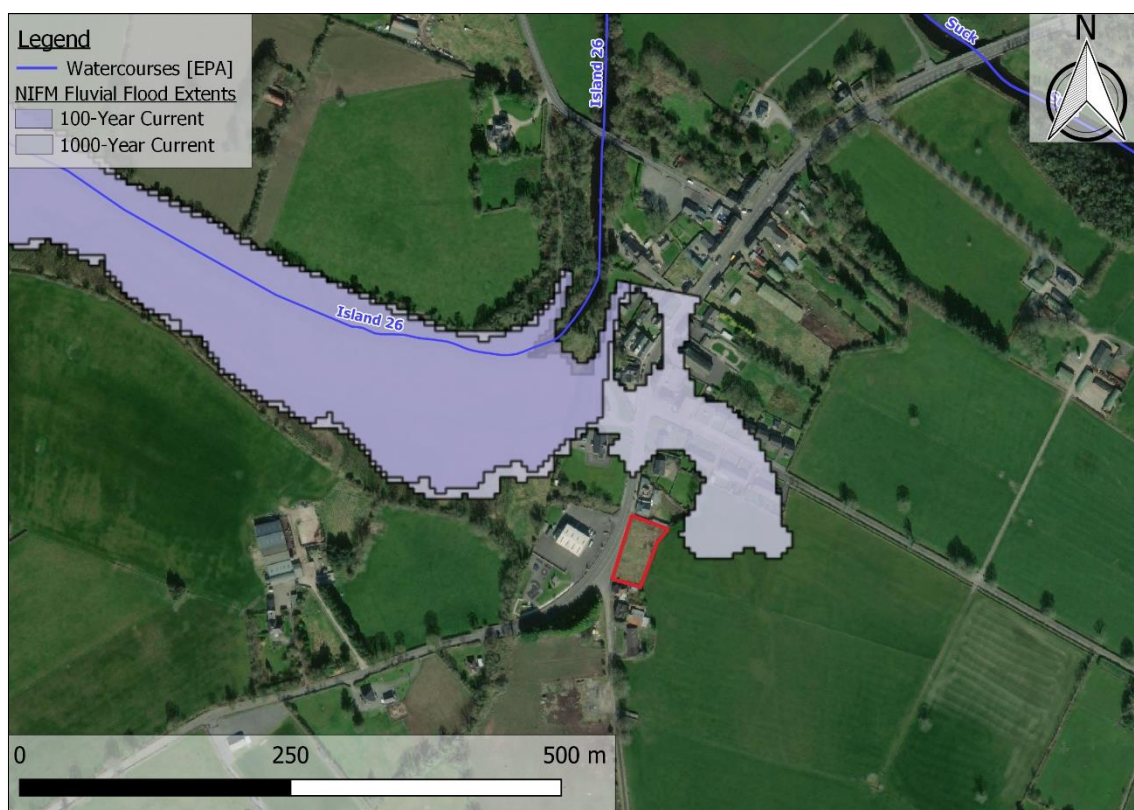


Figure 3-3 National Indicative Fluvial Mapping 2020- Existing Scenario

The NIFM update also included an assessment of the likely impact of climate change on flood risk in the area. The flood extents for a Mid-Range Future Scenario are shown in Figure 3-4.

<sup>3</sup> National Indicative Fluvial Mapping; Applying and Updating FSU Data to Support Revised Flood Risk Mapping for Ireland, Brown et al., Irish National Hydrology Conference 2019

<sup>4</sup> [https://www.floodinfo.ie/map/nifm\\_user\\_guidance\\_notes/](https://www.floodinfo.ie/map/nifm_user_guidance_notes/)



*Figure 3-4 National Indicative Fluvial Mapping 2020- Mid-Range Future Scenario*

The NIFM indicative mapping indicates the area of low topography adjacent to the northeastern site corner (indicated in the PFRA study as liable to pluvial flooding) as potentially liable to the 0.1% AEP fluvial event in Island River in the existing scenario, and the 1% AEP event under a 20% increase in flows during the MRFS.

### 3.3 Catchment Flood Risk Assessment and Management Study

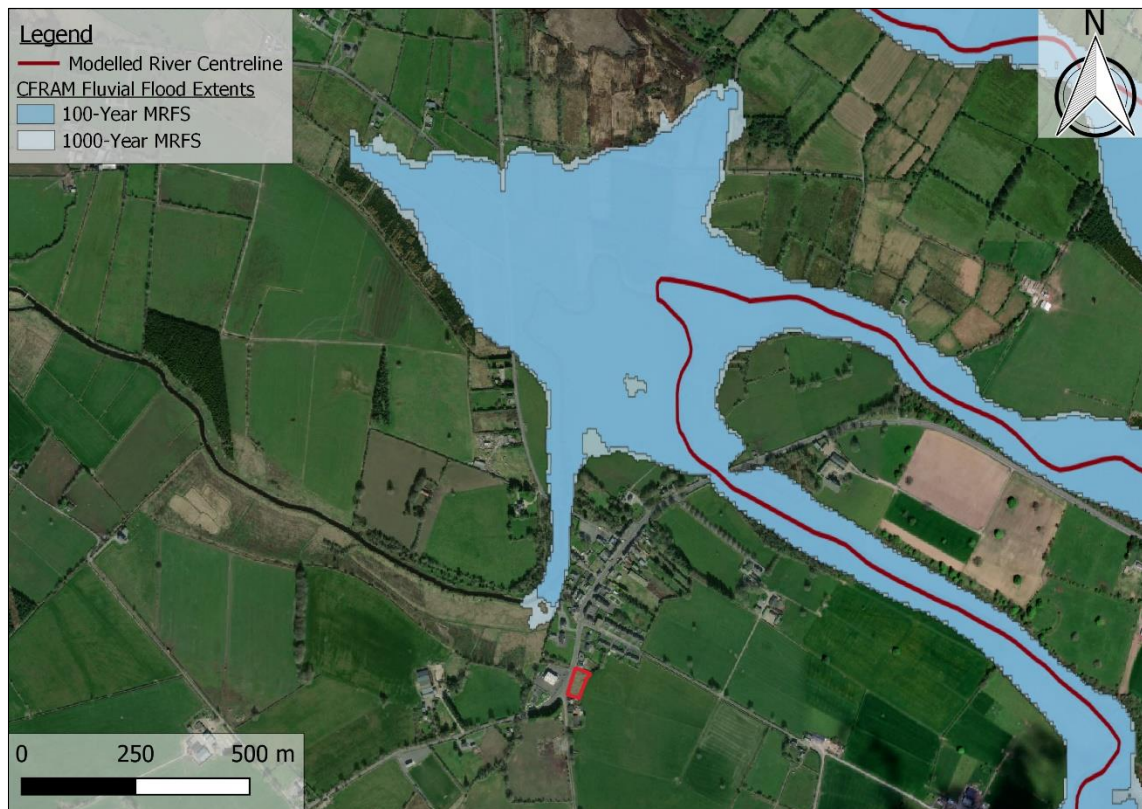
In 2015, the OPW produced flood maps<sup>1</sup> as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study. The flood extents in these maps are based on detailed modelling of Areas for Further Assessment identified by the National Preliminary Flood Risk Assessment.

Modelling of the River Suck was carried out as part of the Shannon CFRAM Study, with the reach flowing through Ballymoe identified as a medium priority watercourse. CFRAM modelling of the River Suck does not include the Island River tributary.

The Shannon CFRAM Study also included an assessment of the likely impact of climate change on flood risk in the area.

CFRAM mapping of the Mid-Range Future Scenario (MRFS) 100-Year and 1000-Year fluvial flood extents, presented in the Figure 3-5 below, indicates significant flooding of lands north of Ballymoe on the western banks of the River Suck at the confluence with Island River.

Mapping indicates the subject site is not at risk of fluvial flooding from the River Suck during a 0.1% AEP MRFS event.

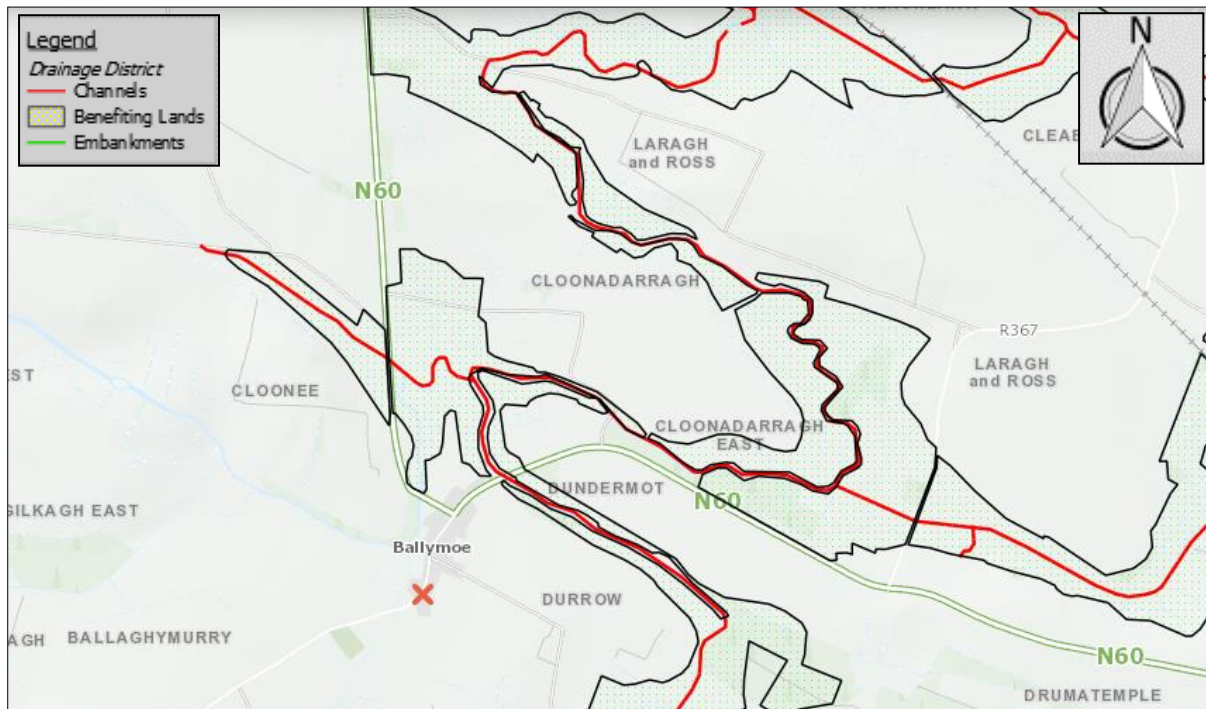


*Figure 3-5 Shannon CFRAM MRFS Fluvial Flood Extents*

### 3.4 OPW Drainage Districts and Arterial Drainage Schemes

From 1842 to the 1930s, the OPW carried out Drainage Districts to mitigate flooding and improve agricultural land<sup>5</sup>. Drainage Districts cover approximately 10% of the country, and are maintained by local authorities under the Arterial Drainage Act, 1945. Works included the deepening and widening of channels and lakes, removal of weirs, improvements to bridges, and construction of embankments.

Works were carried out in the River Suck Drainage District between 1926 and 1929<sup>6</sup>, benefitting Ballymoe, as shown in Figure 3-6.



*Figure 3-6 River Suck Drainage District*

<sup>5</sup> [https://www.floodinfo.ie/about\\_drainage/](https://www.floodinfo.ie/about_drainage/)

<sup>6</sup> Dáil Éireann debate -Tuesday, 24 May 1932 Vol. 41 No. 17



### 3.5 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping<sup>7</sup> with data related to Ireland’s subsurface. Based on the map shown in Figure 3-7, there are no karst feature (caves, springs, turloughs, etc.) or recorded or predicted<sup>8</sup> (GW Flood SAR Mapping) areas of groundwater flooding in the surrounding 500m area of the subject site.

The area to the southwest of the subject site is characterised by a series of enclosed depressions and springs. The nearest karst feature (an enclosed depression) is indicated approximately 550m southwest of the subject site.

Based on area topography, any groundwater arising at local karst features would drain towards adjacent watercourses and are, therefore, not considered a flood risk to the proposed development site.



Figure 3-7 GSI Mapping of Karst Features and Predicted Groundwater Flooding

<sup>7</sup> <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>

<sup>8</sup> McCormack, T., Naughton, O., Bradford, R., Companyà, J., Morrissey, P., Gill, L., Lee, M., (2020) *GW Flood Project: Monitoring, Modelling and Mapping Karst Groundwater Flooding in Ireland*, Geological Survey Ireland Report

GSI further provides mapping of the historic flooding experienced across Ireland in the Winter of 2015/2016. As shown in Figure 3-8, flooding was not experienced at the subject site, and was constrained to the floodplain of the River Suck. The nearest reported area of groundwater influenced flooding is located approximately 2.7km south of the subject site, consistent with predicted GW Flood predictive mapping.

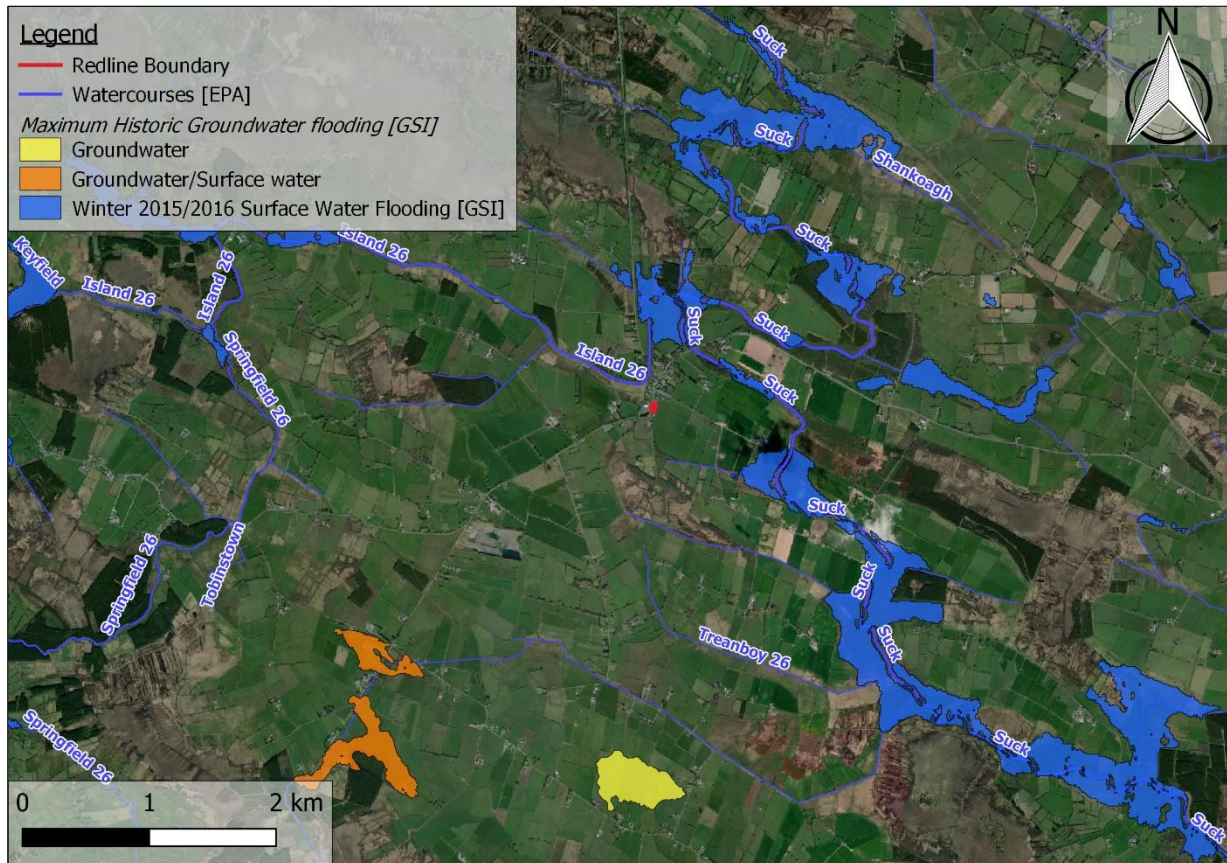


Figure 3-8 GSI Mapping of Historic Groundwater & Groundwater/Surface Water Flooding and Winter 2015/2016 Surface Water Flooding

## 4.0 DETAILED FLOOD RISK ASSESSMENT

The PSFRM Guidelines classify residential development as “highly vulnerable” in terms of its sensitivity to flooding. Such developments should be constructed in Flood Zone C, where there is less than a 0.1% Annual Exceedance Probability (AEP) of fluvial, pluvial, groundwater and coastal flooding.

### 4.1 Fluvial Flooding

The subject site is located approximately 175m southeast of the banks of Island River, and approximately 500m south the River Suck.

Based on the results of OPW modelling (PFRA, NIFM, CFRAM) the developable area is located outside the predicted flood extents of the River Suck and Island River (see Figure 3-2, Figure 3-3, Figure 3-4, Figure 3-5).

The proposed buildings within the residential development are to be located on existing ground at least 0.5m above surveyed ground levels at the northeastern site boundary, adjacent to areas identified in indicative mapping as potentially liable to fluvial flooding from the Island River.

Therefore, it is estimated that risk of fluvial flooding associated with the proposed development is minimal.

### 4.2 Pluvial Flooding

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that an area along the eastern site boundary may be liable to pluvial flooding during an extreme 0.1% AEP pluvial flood event (see Figure 3-2).

Surface water arising at the site will be managed by a dedicated stormwater drainage system and on-site infiltration in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates. On this basis, it is predicted that the proposed development will not contribute to flood risk elsewhere in the area, and will mitigate pluvial flooding within the proposed development.

The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

### 4.3 Groundwater Flooding

Based on a review of Geological Survey Ireland (GSI) subsurface mapping of karst features, historic and predicted groundwater flooding in the area (Figure 3-7, Figure 3-8), and the PFRA study (Figure 3-2), there is no evidence to suggest liability to groundwater flooding at the proposed development site.

Karst features and areas of predicted groundwater flooding are noted in the area south of Ballymoe, however, these features are not considered to create risk of groundwater flooding at the proposed development due to their proximity to the local watercourses, which would receive runoff from groundwater before the subject site.

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## 4.4 Coastal Flooding

The proposed site in Tullamore is located more than 50km inland, with site elevations in the region of 60mOD. The nearest predicted 0.1% AEP MRFS coastal flood level at Oranmore Bay is estimated by the Irish Coastal Protection Strategy Study (ICPSS) to be approximately 4.56mOD<sup>9</sup>; therefore, it is estimated that the proposed development is not at risk of coastal flooding.

## 4.5 The Justification Test

With reference to the PSFRM Guidelines, residential developments are classed as “highly vulnerable”, in terms of sensitivity to flooding. Such developments are considered appropriate in Flood Zone C—where there is less than a 0.1% Annual Exceedance Probability (AEP) of flooding.

Based on the findings of this Flood Risk Assessment, it is estimated that all proposed residential dwellings and access roads are appropriately located within Flood Zone C. The Justification Test does not apply.

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<sup>9</sup> Irish Coastal Protection Strategy Study—Phase IV, Figure No: W / RA / EXT / MRFS / 9 (April 2012)

## 5.0 CONCLUSIONS

TOBIN Consulting Engineers were appointed by Galway County Council to undertake a Flood Risk Assessment (FRA) for their proposed residential development at Ballymoe Village, Co. Galway.

The Planning System and Flood Risk Management (PSFRM) Guidelines (OPW/DoEHLG, 2009) classify residential development as “highly vulnerable” in terms of sensitivity to flooding. As such, the proposed development should be constructed in Flood Zone C, where there is less than a 0.1% Annual Exceedance Probability (AEP) of flooding.

### Fluvial Flooding:

Based on previous flood studies in the area by the OPW (CFRAM and PFRA), it is estimated that the proposed development site is not at risk of fluvial flooding from the River Suck or its tributaries.

The risk of fluvial flooding associated with the proposed residential development is minimal.

### Pluvial Flooding:

Based on the results of pluvial modelling by HR Wallingford as part of the OPW’s PFRA study, the subject site is not at risk of pluvial flooding. The site is located in Pluvial Flood Zone C.

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that an area adjacent to the northeastern site boundary may be liable to pluvial flooding.

Surface water arising at the site will be managed by a dedicated stormwater drainage system and on-site attenuation designed in accordance with SuDS limiting discharge from the site to greenfield runoff rates.

The landscaping and topography of the site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with extreme flooding or blockage of the stormwater drainage system, minimizing the potential for pluvial flooding.

### Groundwater Flooding:

There is no evidence to suggest groundwater as a potential source of flood risk to the proposed development site.

### Coastal Flooding:

The site is not at risk of coastal flooding due to its elevation and distance inland.

Based on the findings of this Flood Risk Assessment, the proposed development is designed in accordance with the Planning System and Flood Risk Management Guidelines.

The subject site is not located in an area identified by OPW mapping (PFRA, NIFM, CFRAM) as liable to fluvial, pluvial, groundwater or coastal flooding in an extreme event, including considerations for climate change.

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As the developable area is located outside predicted flow paths and floodplain extents, and surface water arising at the site will be managed by a dedicated stormwater drainage system designed in accordance with SuDS limiting discharge from the site to greenfield runoff rates, it is predicted the development will not increase flood risk elsewhere.

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## Appendix 1

Topographic Survey



**STAGE 1 INFORMATION**



REVISIONS	
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ISSUE	DATE	FOR
01	16.11.21	INFORMATION

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Galway County Council

PROJECT NUMBER  
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PROJECT  
Housing,  
Ballymoe,  
Co. Galway

SCALE	
1:200	⊗ A1
1:400	⊗ A3

GRAPHIC SCALE  
0 40

DRAWING  
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DRAWING NUMBER  
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