Cork County Council

Carrigaline Main Street - TPREP

Flood Risk Assessment

Draft | 20 April 2022

285392-00

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ARUP

Document Verification

ARUP

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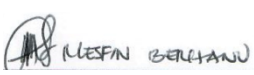
		Signature			
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Executive Summary

Arup was commissioned by Cork County Council to prepare a site-specific Flood Risk Assessment (FRA) to support a planning application for a proposed redevelopment of Carrigaline Main Street as part of the Carrigaline Transportation and Public Realm Enhancement Plan (TPREP).

This FRA was undertaken in accordance with the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), herein referred to as 'the Guidelines'.

Carrigaline town has historically been prone to tidal flooding with significant events occurring in recent years. The site is at risk of both fluvial and tidal flooding from the Owenabue River. The risk of pluvial and groundwater flooding to the site is considered high and moderate, respectively.

The proposed development consists of more than 900m of road infrastructure, cycle lane and pedestrian walkway upgrades and therefore interfaces with watercourses such as the Owenbue River. The site ground levels vary throughout.

Having reviewed the various sources of flooding in Stage 1 it was determined that the site is at risk of flooding, with much of the site being within Flood Zones A and B and hence Stage 2-FRA is required.

Stage 2 identified flood extents within Flood Zones A and B from tidal flood source up to a maximum flood depth of 1m are encountered within the site. Additional flood extents are seen from pluvial and fluvial sources. The proposed development is considered 'highly vulnerable' as it involves road infrastructure and therefore a Justification Test was required.

As sections of the Study Area are located within Flood Zones A and B and are deemed vulnerable, a Justification Test for the development was completed as part of the site-specific Flood Risk Assessment (FRA) and it was determined that the development proposal satisfied all the requirements.

The scope of the proposed development is in keeping with the existing road profile and does not increase the risk of flooding elsewhere. In keeping with this, the design of the drainage system imbedded measures (i.e., provision of additional green area and SUDs) and ensured access and egress to emergency vehicles is not restricted in the event of flooding.

Construction staff of the proposed development will maintain awareness of flood and weather forecasts on an ongoing basis as well as receiving warnings from Cork Council and *Met Eireann* as appropriate. During operation, roadway, bike, and pedestrian users will have sufficient notice through social media and news reports as part of weather warnings to avoid affected areas in advance of a possible flood.

This FRA has demonstrated that the risks relating to flooding can be managed and mitigated to acceptable levels and therefore comply with DoEHLG / OPW and Cork County Council planning guidance.

1 Introduction

1.1 Background

Arup was commissioned by Cork County Council to prepare a Site-Specific Flood Risk Assessment (SSFRA) to support a planning application for a proposed development along Carrigaline Main Street under the Carrigaline Transportation and Public Realm Enhancement Plan (TPREP).

This FRA was undertaken in accordance with the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), and Circular PL 2/2014 herein referred to as 'the Guidelines'.

1.2 Scope

This FRA contained the following information:

- Confirmation of the sources of flooding which may affect the site,
- A qualitative assessment of the risk of flooding to the site and to adjacent areas because of the proposed development,
- A Justification Test of the development proposal, and
- Identification of possible measures which could mitigate the flood risk to acceptable levels, where possible.

1.3 Summary of Data Sources

Data relating to flood risk relevant to the proposed development and surrounding area was obtained from the following sources:

- Cork County Development Plan 2022 – 2028 including its Strategic Flood Risk Assessment.
- Lee CFRAM Hydrology and Hydraulics Reports and predictive flood mapping (https://www.floodinfo.ie/publications/).
- Lee CFRAM Catchment Flood Risk Management Plan (https://www.floodinfo.ie/publications/).
- OPW National Flood Hazard Mapping Website (www.floodinfo.ie).
- Preliminary Flood Risk Assessment (PFRA) mapping produced by the OPW (https://www.floodinfo.ie/publications/).
- Proposed development planning application drawings.

1.4 Site Location

The proposed development is located along Main Street, Carrigaline, Co. Cork at approximate Irish Transverse Mercator (ITM) reference E: 572946, N: 562402. The location of the proposed development is shown in Figure 1.

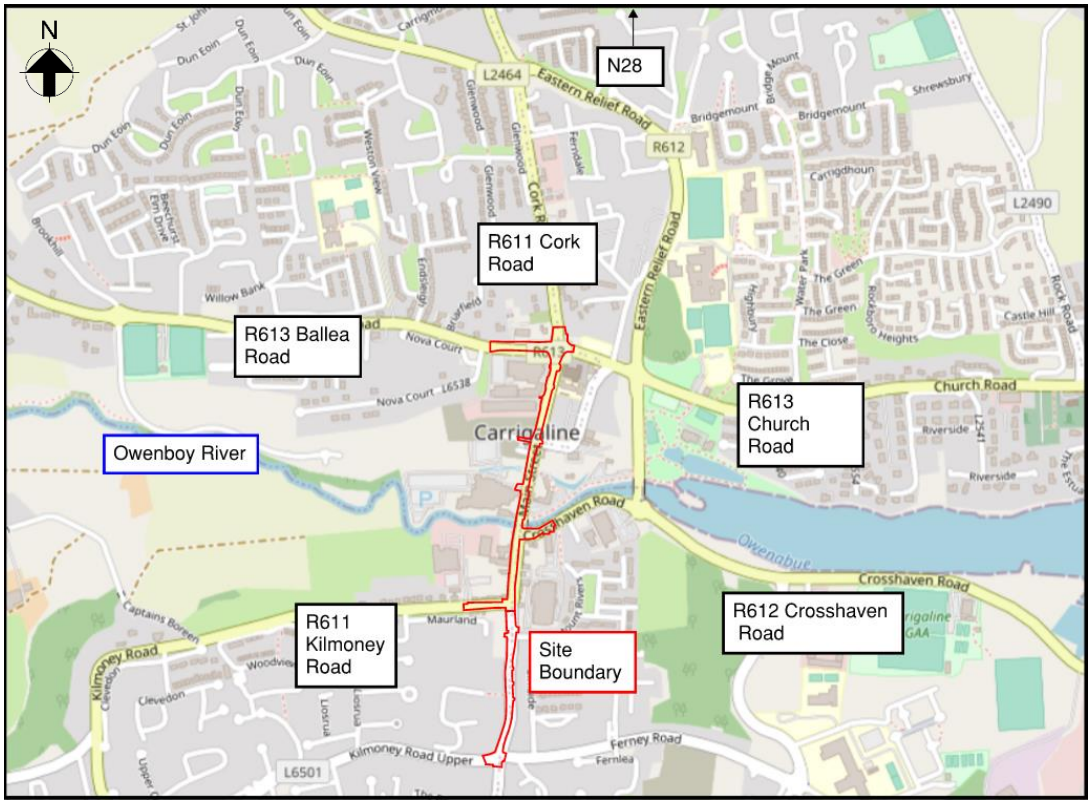


Figure 1: Site location (© Open Street Map (and) contributors)

The site is approximately 900m in length and is located along the lower portion of R611 Cork Road and Main Street Carrigaline.

The Owenabue River flows in an easterly direction through the central site boundary. The location of the Owenabue River is indicated in Figure 1. Works will take place on the existing bridge on Main Street over the Owenabue River.

1.5 Proposed Development

Cork County Council intend to redevelop an approximately 1.6ha site bound by Cork Road, Church Hill, Church Road, Crosshaven Road, Ballea Rd, Kilmoney Rd. The proposal involves the redevelopment of the current road, pedestrian, and public realm infrastructure.

Construction works within the proposed development area will include excavation of the street surfacing and sub-base, removal of existing surface materials, installation of new utilities, build-up of the street, repaving the street to include installation of new high quality public realm, planting trees and other decorative

plants, and installation of new street furniture, street lighting and rain gardens. No demolition works will be required to facilitate the proposed development.

A site plan and typical sections of the proposed development are included in the planning application.

2 Stage 1 – Flood Risk Identification

2.1 Definition of Flood Risk Zones

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public works jointly published a Guidance Document for Planning Authorities entitled "The Planning System and Flood Risk Management". The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

As part of these guidelines, levels of flood zones have been defined. Flood zones are geographical areas within which the likelihood of flooding is in a particular range.

There three types of flood zones defined in the Guidelines are listed in Table 1:

Table 1: Definition of Flood Zone Categories

Zone Category	Description
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.2 Past Flood Events

Records of past fluvial and tidal floods were obtained from the OPW National Flood Hazard Mapping website (www.floodmaps.ie) and reports produced as part of the Lee CFRAMS.

An extract from the National Flood Hazard Mapping website report summary, indicating the locations of recorded flood events, is shown in Figure 2. Five flood events have been recorded on or in proximity to the site. These events are centred around the banks of the Owenabue River and Carrigaline Bridge. Refer to Appendix A for the full report.

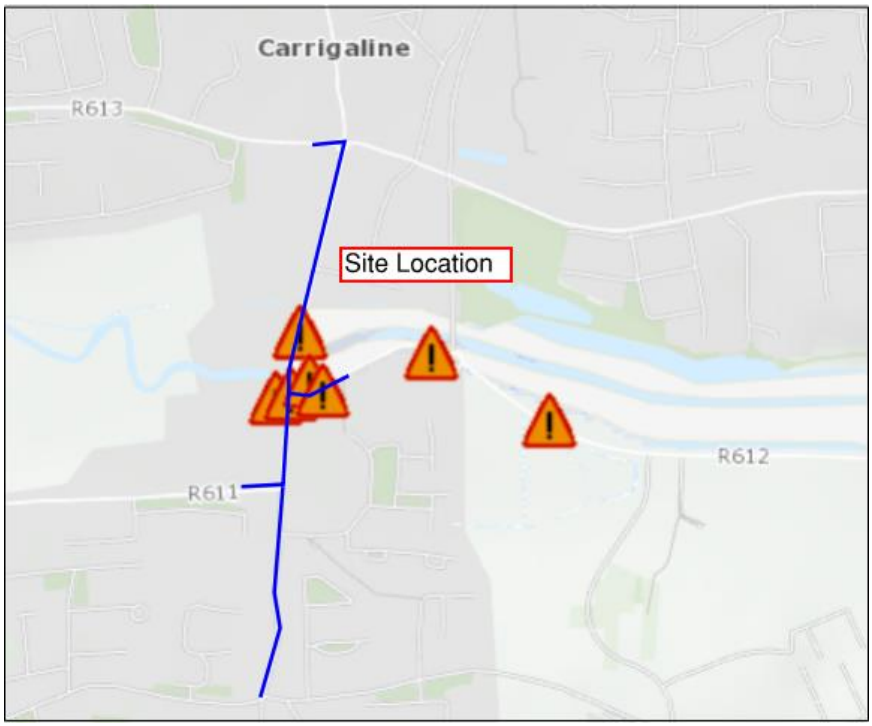


Figure 2: Extract from the National Flood Hazard Mapping Website

A summary of the flood events that have occurred near the subject site are included in Table 2.

Table 2: Summary of recorded flood events near the subject site (Source: OPW National Flood Hazard Mapping website).

Date of flood event	Flood mechanism
January 2014	Tidal
December 2012	Tidal
October 2012	Tidal / Pluvial
November 2009	Pluvial
October 2004	Fluvial / Tidal

2.3 Fluvial Flood Risk

The Lee Catchment Flood Risk Assessment Management Study (Lee CFRAM) indicates sections of the proposed site are within 1:1000 or 0.1% AEP Flood Extent indicating that the site is within Flood Zone B, as per Table 1.

However, it is noted in this section of the Lee CFRAM Maps that fluvially influenced flooding does not extend this far downstream of the Owenabue River. Given the proximity of the site to the Owenabue Estuary, flood predictions in this region have been determined as entirely tidal. Tidal flood risk is evaluated in section 2.4.

2.4 Tidal Flood Risk

The Lee Catchment Flood Risk Assessment Management Study (Lee CFRAM) was carried out in recent years and provided predicted tidal flood extents and water levels in Dublin City for a range of return periods.

An extract from the Lee CFRAMS tidal flood extent map is displayed in Figure 3. The predicted extents for three separate return period events, i.e., the 1 in 10-, 200- and 1000-year tidal flood events are shown. Refer to Appendix B for further details of the flood extent map.

The flood map in Figure 3 indicates that the site is partially located within the 0.5% and 0.1% AEP Flood Extent. This results in these sections falling within Flood Zones B and C, as per Table 1.

The nodes closest to the site on the Owenabue River is 1BOY_1630. The 1 in 200-year tidal water level at this node (1BOY_1630) is 2.82m OD.

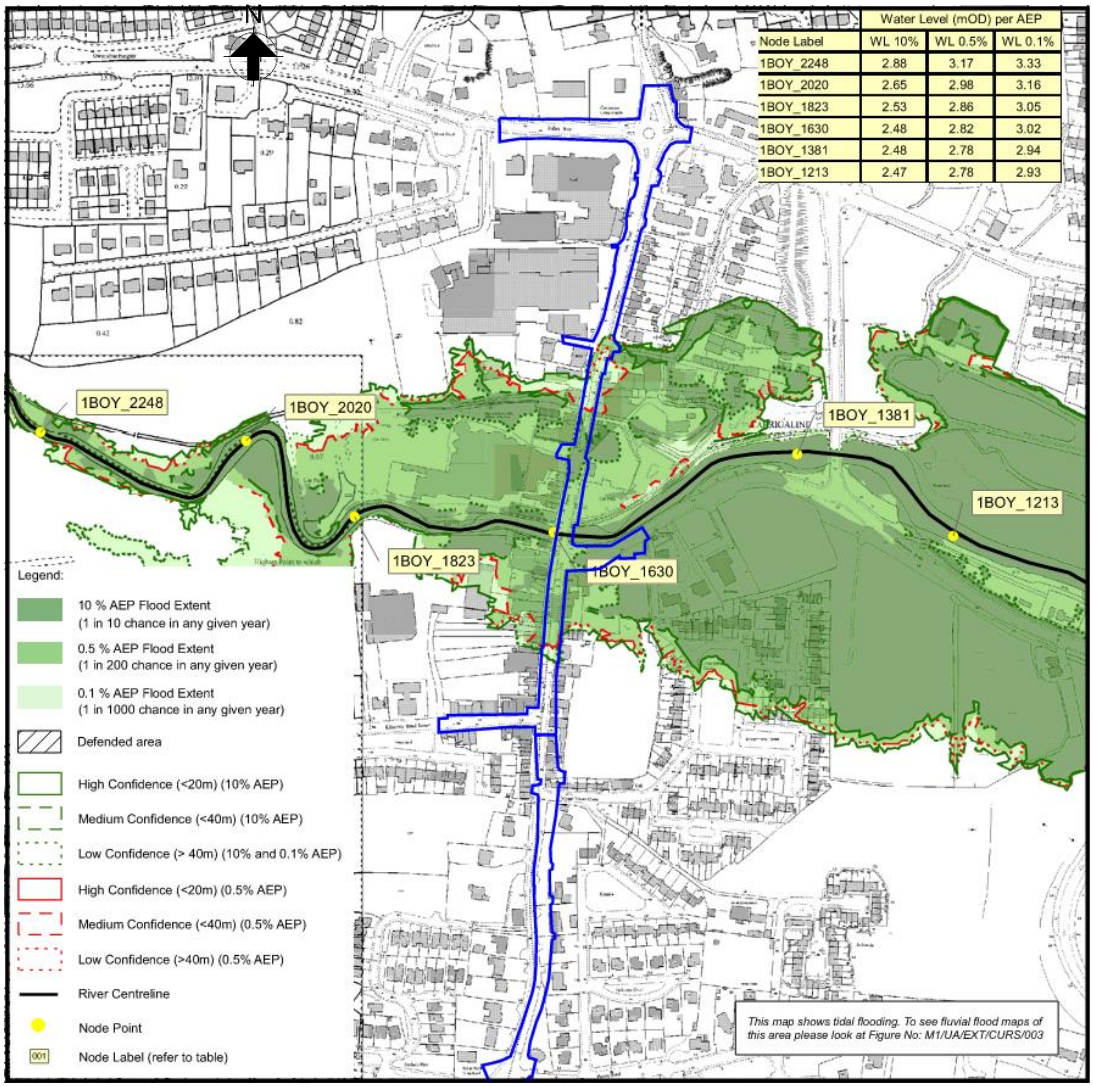


Figure 3: Extract from the Lee CFRAM tidal flood extent map, current scenario

2.5 Pluvial Flooding

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography. To assess the risk of pluvial flooding to the development, the Draft Pluvial Flood Risk Assessment (PFRA) mapping undertaken by the OPW was reviewed. The Draft OPW PFRA map is included in Appendix C, an extract of which is also presented in Figure 4.

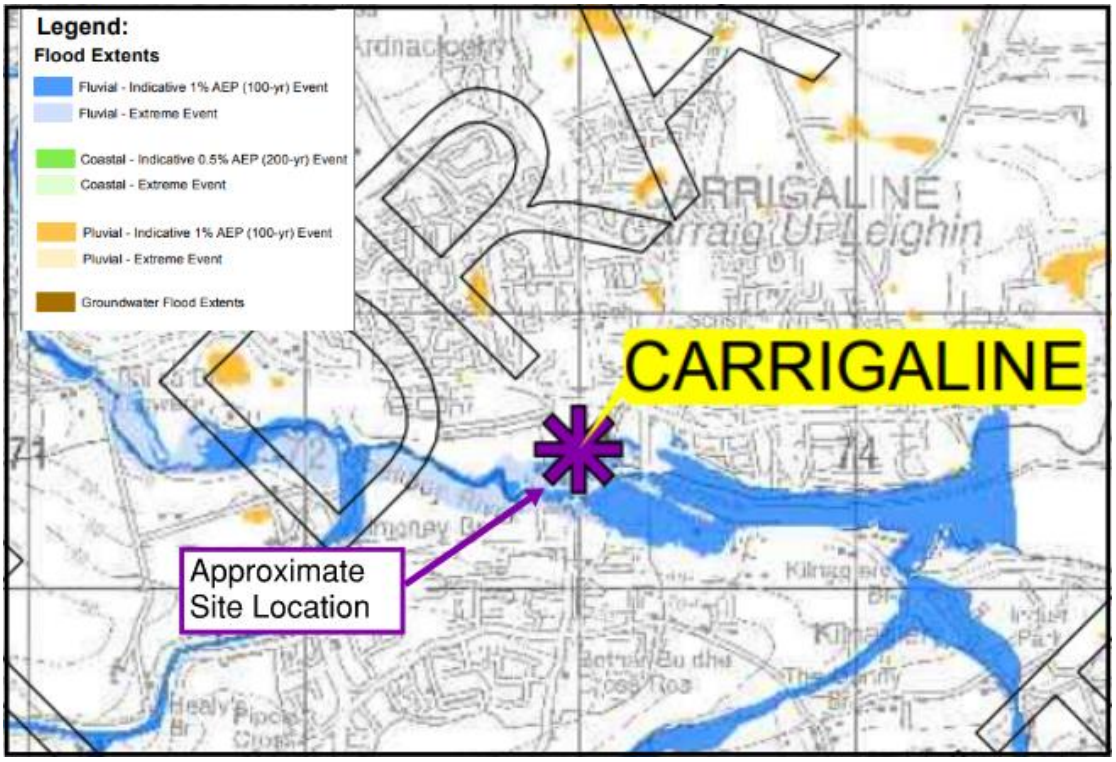


Figure 4: Extract from OPW PFRA pluvial flood map (www.myplan.ie)

PFRA map indicates the site and many of the roads in the vicinity of the site are not within areas at high risk of pluvial flooding. This map is however a draft version and is only indicative of large areas rather than site specific locations.

Past Flood events examined in section 2.1 indicated that pluvial flooding has often been recorded during tidal flood events and is a significant risk to the area.

2.6 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

To assess the risk of groundwater flooding to the site, the Geological Survey of Ireland (GSI) mapping undertaken by the OPW was reviewed. An extract of

which is presented in Figure 5. It should be noted that the GSI maps are only indicative.

The map suggests that the site or the areas in the vicinity of the site as not being at risk of groundwater flooding.

Figure 6 presents information on the GSI groundwater vulnerability for the proposed development. It can be seen from the figure that the groundwater vulnerability is indicated as a range of moderate to high for the site. This suggests that highly permeable soils are present at the location and ground water levels may be relatively close to the surface due to the site's proximity to the river. This may cause issues during construction.

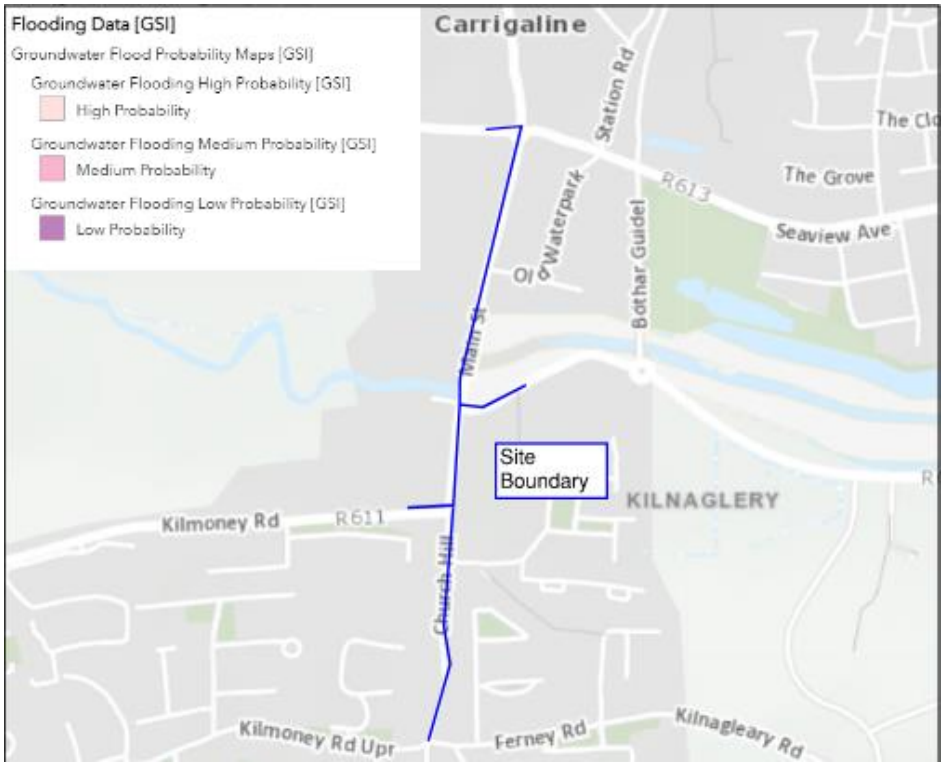


Figure 5: Extract from OPW PFRA groundwater flood map (FLOODINFO.IE)

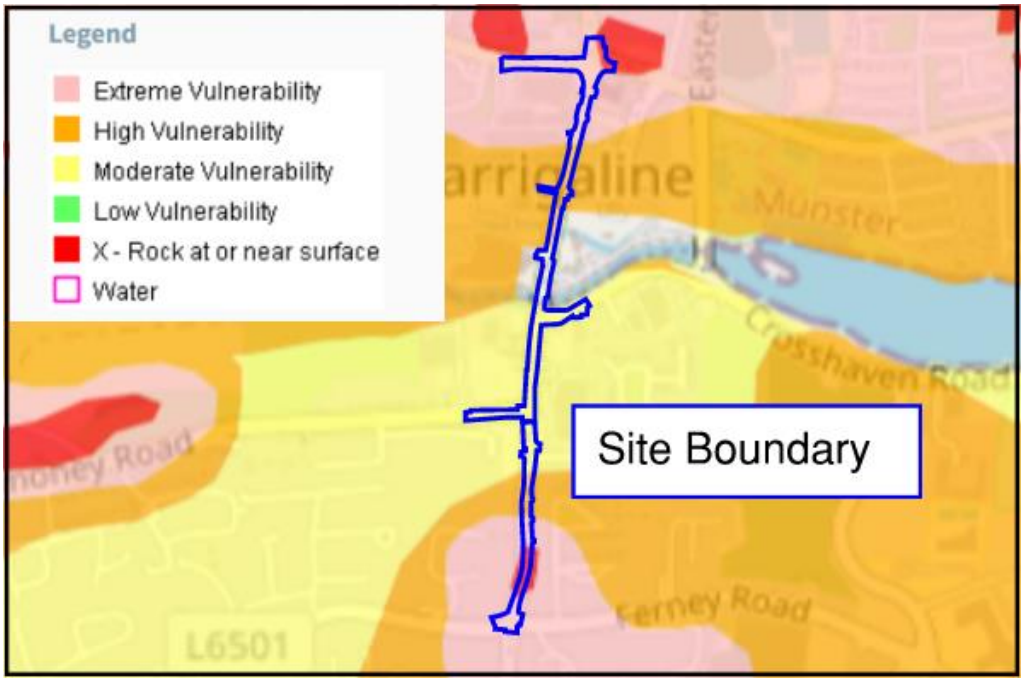


Figure 6 Extract from GSI Spatial Resources Groundwater Mapping

2.7 Conclusion of Stage 1

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources was assessed and is summarised as follows:

- The site is at high risk of tidal flooding. The respective water levels indicate that tidal flooding should be expected. The site is affected by fluvial flooding, but tidal influence is more dominant as seen in the tidal flood levels.
- The risk of pluvial flooding to the site is considered high with a documented history of pluvial flooding in the area.
- The risk of groundwater flooding to the site is currently considered low. However, groundwater table can be shallow due to the site's proximity to the river.

Having reviewed the various sources of flooding it was determined that the site is at risk of flooding, with much of the site being within Flood Zones A and B and hence Stage 2-FRA is required.

3 Stage 2 – Initial Flood Risk Assessment

Stage 1 flood risk assessment has identified the primary sources of flooding to the site. The Source-Pathway-Receptor model outlined in Section 3.1 below shows the appraisal of these sources.

3.1 Source-Pathway-Receptor Model

The purpose of Stage 2-FRA is to confirm flooding sources, appraise the adequacy of existing information and to scope the extent of the risk of flooding and assess possible mitigation measures.

A Source-Pathway-Receptor model was developed to assess the risks from the various sources of flooding. The model provides the likelihood of flooding happening from the specified source and its consequence takes account of the vulnerability classification of the development and mitigation measures in place.

Table 3-3 Source-Pathway-Receptor Model[1]

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Fluvial	Overbank Flow	People/ Property	Unlikely (2)	Medium (2)	Medium (4)
Tidal	Sea Level Rise	People/ property	Possible (3)	Medium (2)	Medium (6)
Surface water	Blockage/ Overflow	People/ Property	Possible (3)	Medium (2)	Medium (6)
Groundwater	Rising Water Table	People /Property	Remote (1)	Medium (2)	Low (2)
Human/ Mechanical Error	Gates remain open	People/ property	Remote (1)	Medium (2)	Low (2)

The risk of tidal, and pluvial flooding is appraised as “medium”. Therefore, it will be necessary to further assess the risk of flooding from these sources. The risk from fluvial sources is also rated as “medium.” However, the tidal flood is more

[1] Basis of Scores:
- Likelihood:
  - Remote (1): less the 0.1% AEP
  - Unlikely (2): 0.1% AEP
  - Possible (3): 1% AEP
  - Likely (4):10% AEP
- Consequence:
  - Minimal (1): inconvenience
  - Medium (2): damage to property
  - High (3), damage to property and injury
  - Major (4) – Loss of life and damage to property
- Risk: Low (<=3), Medium (b/n 3and 6), High (9), Very High > (16)

dominant and hence the risk assessment hereafter will not consider fluvial sources.

3.2 Assessment of Tidal Risk

A review of the site boundary on the Lee CFRAMS Tidal Assessment shows that a section of the site falls within Flood Zone A and B.

Further extracts from the Lee CFRAMS detailed in Figure 7 details the depth of flooding along the site at the 0.5% AEP flood extent.

Tidal flooding is seen to affect an approximately 250m length stretch of the proposed site with flood depths predominantly in the 0-0.25m range. Additionally, flood depths are seen to rise to the 0.5-1m range in pockets along the site extent. This is particularly seen at the Main St and Crosshaven Rd junction.

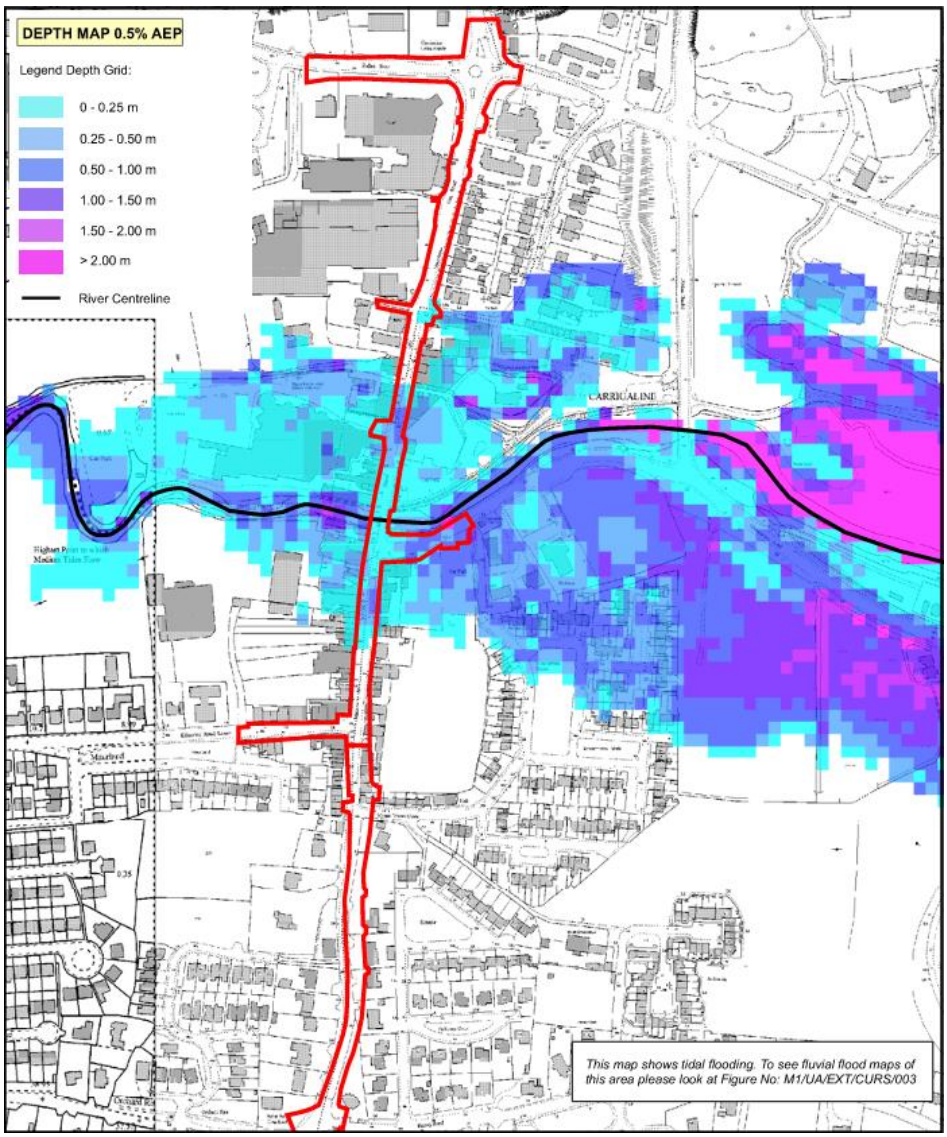


Figure 7:Extract from the Lee CFRAM tidal flood extent map, 0.5% AEP Flood Depth

3.3 Assessment of Pluvial Risk

Flooding which occurred in November 2009 along Main Street and Crosshaven Rd, as shown in Figure 8, was stated by Cork County Council to be a result of 'Heavy Rainfall-Short Duration' and 'Lack of adequate surface water drainage system to the South of Carrigaline Village' which coincided with high tide and was therefore unable to drain into the estuary. Flood depths during this event were 0.25m at a flood level of 2.62m OD.

Therefore, the risk of pluvial flooding at the site is "medium" and will need to be mitigated. This can be provided by appropriate landscaping and an upgraded drainage system fitted with a non-return valve at the outfall to prevent backflow into the drainage system.

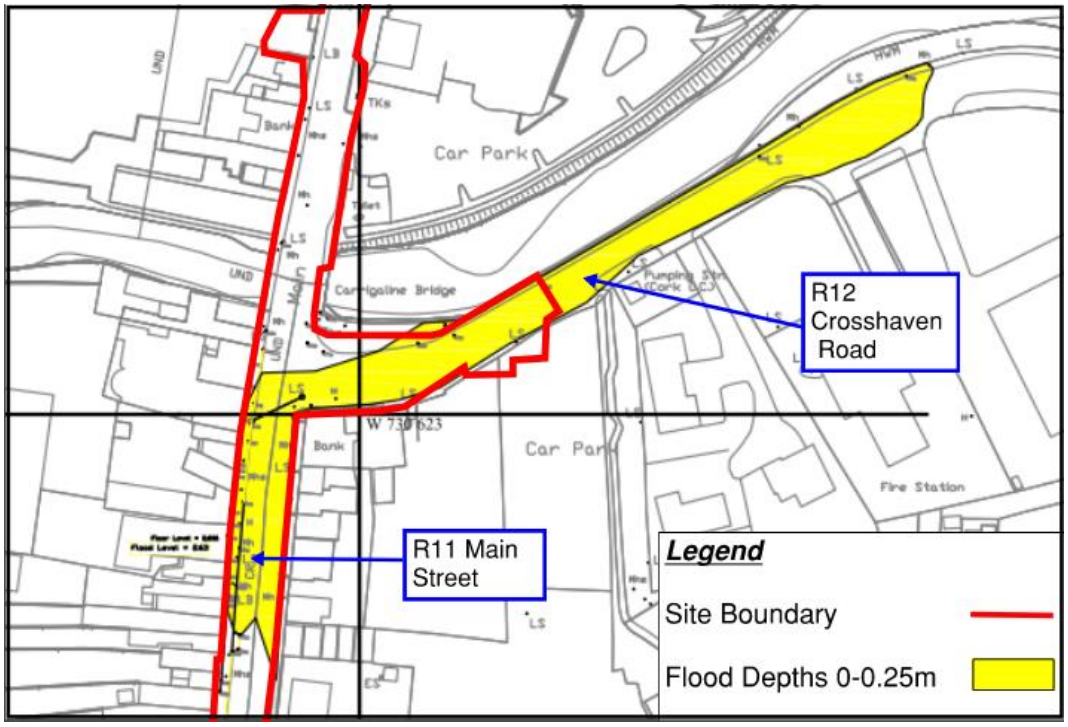


Figure 8: Pluvial Flood Extents November 2009, (Floodinfo.ie)

3.4 Conclusion of Stage 2

The proposed site for redevelopment is classified as within Flood Zones A and B from tidal flood source up to a maximum flood depth of 1m encountered within the site. The site can be accessed from northern and southern directions. However, driving through this is possible only for emergency vehicles and may be too great for cars to ford through.

The site is also affected by fluvial flooding, but tidal flooding causes deeper and wider extents and hence dominant in this area. A worst scenario would be the joint occurrence of the two flood sources.

Additionally, the site is at risk of pluvial flooding with many of the drainage systems failing during periods of heavy rainfall combined with high tides along the Owenabue Estuary and hence upgraded drainage system may be used to mitigate this risk.

As the site is proposed redevelopment of existing road and pedestrian infrastructure, the existing floodplain will remain unaffected and hence no risk to flooding elsewhere. However, the proposed development is considered ‘highly vulnerable’ as it involves road infrastructure and therefore a justification test is required.

4 Stage 3 - Justification Test

4.1 Introduction

A Development Management Justification Test is completed in accordance with the Guidelines (see Box 5.1). This was to ensure the development proposal can manage the risk of flooding to itself without increasing the risk elsewhere. Although not all parts of the development are considered at risk as they are outside of Flood Zone A or B, the Justification Test was applied for the whole development area.

The Justification Test in the Planning Guidelines requires two criteria to be met:

- The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines,
- 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; and
    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.

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 proposed development has been determined to have satisfied all requirements of the justification test as demonstrated in Table 4.

As flood risks are present in some areas, risk reduction measures are proposed as outlined in Section 4.2 which were used to complete the Justification Test.

4.2 Justification Test

Table 4: Justification Test Table for the Proposed Development

No.	Criteria	Response	Criteria Satisfied?
1	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development	The subject road corridor is an existing development. The Cork County Council Development Plan 2022-2028 states, “ *The Carrigaline Transportation and Public Realm Enhancement*	Yes

No.	Criteria	Response	Criteria Satisfied?
	plan, which has been adopted or varied taking account of these Guidelines.	*Plan is focused on deriving/delivering maximum benefit/efficiency/return from the existing road network.*" This development achieves this purpose by providing enhanced roadways, public transport network, and public realm space to Carrigaline.	
2	The proposal has been subject to an appropriate flood risk assessment that demonstrates:		
2(i)	The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.	The FRA completely demonstrated that the proposed development does not increase the risk of flooding to itself or elsewhere. The proposed works do not increase the existing risk. However, mitigation measures in the form of SUDs (oversized pipes and attenuation tanks) are provided to further mitigate the existing flood risk as outlined in Section 4.4.	Yes
2(ii)	The development proposal includes measures to minimise flood risk to people, property, the economy, and the environment as far as reasonably possible.	The development proposal includes a proposed upgraded drainage system (including a non-return valve at the outfall) and additional green area where available to minimise the risk of flooding. The development also includes SUDs such as tree pits, bioretention areas and catchpits to improve the discharge quality. Any possible net increase in impermeable area was compensated by additional green area. Therefore, no overall increase in flooding to the site or elsewhere is expected.	Yes

No.	Criteria	Response	Criteria Satisfied?
2(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	The maximum flood depth in flooded areas can reach up to 1m. Design ensured that access and egress to emergency vehicles is not impacted. The development proposal is designed to include an upgraded drainage system with additional gullies to collect surface water from footpaths and road to connect to surface water network. The development proposal will also contain flood resilient construction methods and materials. The existing flood warning system and routine drainage inspection maintenance plan will reduce the residual risk to an acceptable level.	Yes
2(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 proposed development will facilitate sustainable urban growth through the provision of high-quality pedestrian, cycle, and public transport infrastructure. This is in line with the Cork County Development Plan objectives which states, "Provide an attractive urban environment celebrating the assets of the town and providing space for people to meet, sit, talk, enjoy being outdoors and for businesses to flourish." The development is in keeping with the landscape and visuals of Carrigaline Town.	Yes

4.3 Justification Test Conclusions

The proposed upgrades to Carrigaline Main Street are determined to have satisfied all requirements of the justification test.

4.4 Mitigation Measures

The strategy to mitigate the potential impact of flooding in this section of the works is to reduce the extent of impermeable area and to ensure that sufficient or improved drainage is provided. The following additional measures may also be considered:

- Introduction of tree pits and rain gardens in the design of the road corridor,
- Providing advance warning to the road users if road is expected to flood,
- Upgrade drainage system with a non-return valve at the outfall, and

- Allow adequate space in the design for post flood drainage and access for cleaning.

5 Conclusion and Recommendation

This FRA was carried out as part of the Planning Application for the proposed Carrigaline Main Street upgrades under the Carrigaline TPREP.

Although the majority of the proposed development site is at low risk of flooding (i.e., Flood Zone C) some sections of the proposed development site are at moderate to high risk (Flood Zones A or B) of tidal flooding. Fluvial and pluvial flooding are also a risk, but tidal flooding is dominant in the areas. With the type of development being “essential infrastructure”, the Guidelines define it as highly vulnerable. A justification test was therefore completed and determined that the proposal satisfied all the requirements.

The scope of the proposed development is in keeping with the existing road profile and does not increase the risk of flooding elsewhere. However, since sections of the area are situated in flood risk zones, the design ensures that the impermeable extent of the roadway is not increased, and proposals are in place to upgrade the existing drainage system including provision of additional gullies where required and SUD’s system (tree pits and rain garden) to reduce the risk to acceptable levels.

Reliance is also made that the proposed development will maintain awareness of flood and weather forecasts from Cork County Council and *Met Eireann* as appropriate.

In conclusion, this FRA has demonstrated that the risks relating to flooding to the proposed development are moderate but can be managed and therefore comply with DoEHLG / OPW and Cork County Council planning guidance.

Appendix A

National Flood Hazard Mapping Website Report

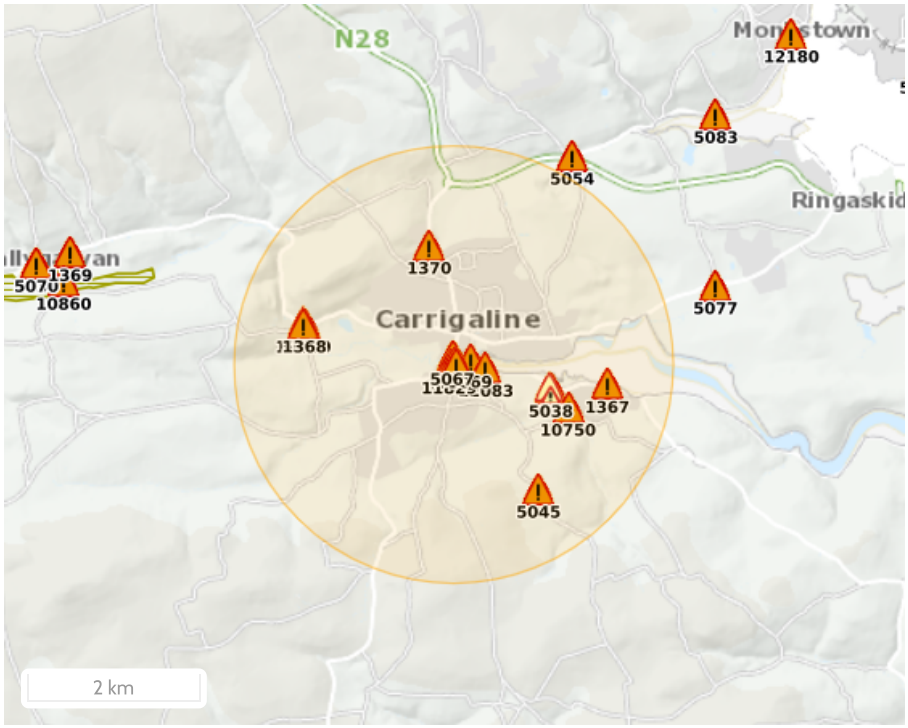
A1

Past Flood Event Local Area Summary Report

Report Produced: **22/3/2022 10:28**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

17 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Shannonpark (R611) Carrigaline Nov 2002 (ID-1370)	27/11/2002	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
2.	Carrigaline walk Owenboy Estuary Cork Nov 1994 (ID-1367)	03/11/1994	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
3.	Owenboy Ballea Bridge, Carrigaline Recurring (ID-1368)	n/a	Approximate Point
	Additional Information: Reports (5) Press Archive (1)		
4.	Crosshaven Road Carrigaline Oct 2004 (ID-5038)	27/10/2004	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
5.	Commeen Hill LP2495 Nov 2002 (ID-5045)	27/11/2002	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
6.	Carrigaline Main Street area Oct 2004 (ID-5067)	27/10/2004	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Carrigaline Strand Road area Oct 2004 (ID-5069) **Additional Information:** Reports (4) Press Archive (0)	27/10/2004	Approximate Point
8.	Ballea Road Nov 2002 (ID-5071) **Additional Information:** Reports (3) Press Archive (0)	27/11/2002	Exact Point
9.	Carrigaline Town Nov 2002 (ID-5074) **Additional Information:** Reports (1) Press Archive (3)	27/11/2002	Approximate Point
10.	Carrigaline Co.Cork 14th.December 2012 (ID-11829) **Additional Information:** Reports (1) Press Archive (0)	14/12/2012	Approximate Point
11.	Flooding at Carrigaline, Co.Cork on 3rd February 2014 (ID-12083) **Additional Information:** Reports (1) Press Archive (0)	03/02/2014	Approximate Point
12.	Carrigaline Co.Cork 2nd January 2014 (ID-12091) **Additional Information:** Reports (2) Press Archive (0)	02/01/2014	Approximate Point
13.	Carrigaline Co.Cork 16th/17th October 2012 (ID-11824) **Additional Information:** Reports (1) Press Archive (0)	16/10/2012	Approximate Point
14.	Kilnaglery Bridge, Carrigaline, Co. Cork Recurring (ID-1575) **Additional Information:** Reports (3) Press Archive (0)	n/a	Approximate Point
15.	Kilnagleary,Carrigaline,Co.Cork (ID-10750) **Additional Information:** Reports (1) Press Archive (0)	11/11/2009	Approximate Point
16.	Ballea Bridge (Lower) Carrigaline,Co.Cork.19th.Nov.2009 (ID-11000) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
17.	Carrigaline Bridge,Co.Cork 19th.Nov.2009 (ID-11034) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point

Appendix B

Lee CFRAMS Flood Extent Maps

B1

N

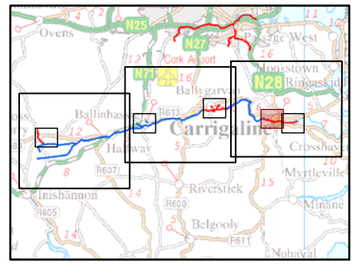
1BOY_2550
1BOY_2376
1BOY_2248
1BOY_2020
1BOY_1823
1BOY_1630
1BOY_1494
1BOY_1381
1BOY_1213

Fluvially influenced flooding does not extend downstream of this point. Please refer to the tidal flood maps.

0.1 0.05 0 0.1 0.2 0.3 0.4
Kilometres

Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
1BOY_2550	4.10	4.25	4.41
1BOY_2376	3.39	3.63	3.77
1BOY_2248	3.03	3.23	3.43
1BOY_2020	2.67	2.88	3.13
1BOY_1823	2.42	2.59	2.85
1BOY_1630	2.31	2.43	2.73
1BOY_1494	2.29	2.41	2.66
1BOY_1381	2.29	2.41	2.65
1BOY_1213	2.28	2.40	2.64

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- 1BOY_1630 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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Ireland

Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CARRIGALINE

Map Type :	FLOOD EXTENT		
Source :	FLUVIAL FLOODING		
Map area :	URBAN AREA		
Scenario :	CURRENT		
Figure By :	Valeria Medina	Date :	21 June 2012
Checked By :	Paul Dunne	Date :	21 June 2012
Approved By :	Clare Dewar	Date :	21 June 2012

Figure No. : M1/UA/EXT/CURS/004
Revision : 1

Drawing Scale : 1:5,000
Plot Scale : 1:1 @ A3

B2

N

Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
1BOY_2248	2.88	3.17	3.33
1BOY_2020	2.65	2.98	3.16
1BOY_1823	2.53	2.86	3.05
1BOY_1630	2.48	2.82	3.02
1BOY_1381	2.48	2.78	2.94
1BOY_1213	2.47	2.78	2.93

Tidally influenced flooding does not extend upstream of this point. Please refer to the fluvial flood maps.

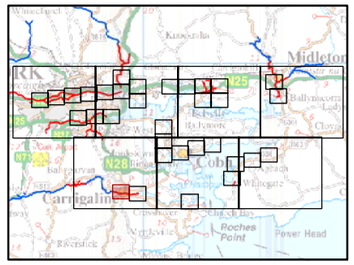
1BOY_2248
1BOY_2020
1BOY_1823
1BOY_1630
1BOY_1381
1BOY_1213

Higher Point to which the Tides Flow

0.1 0.05 0 0.1 0.2 0.3 0.4
Kilometres

This map shows tidal flooding. To see fluvial flood maps of this area please look at Figure No: M1/UA/EXT/CURS/003

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- 001 Node Label (refer to table)

USER NOTE :

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Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CARRIGALINE

Map Type :	FLOOD EXTENT		
Source :	TIDAL FLOODING		
Map area :	URBAN AREA		
Scenario :	CURRENT		
Figure By :	Valeria Medina	Date :	21 June 2012
Checked By :	Paul Dunne	Date :	21 June 2012
Approved By :	Clare Dewar	Date :	21 June 2012

Figure No. : M9/UA/EXT/CURS/027
Revision : 1

Drawing Scale : 1:5,000
Plot Scale : 1:1 @ A3

B3

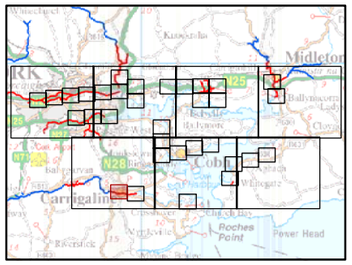
N

Tidally influenced flooding does not extend upstream of this point.
Please refer to the fluvial flood maps.

0.1 0.05 0 0.1 0.2 0.3 0.4
Kilometres

This map shows tidal flooding. To see fluvial flood maps of this area please look at Figure No: M1/UA/EXT/CURS/003

Location Plan :



DEPTH MAP 0.5% AEP

Legend Depth Grid:

- 0 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- > 2.00 m
- River Centreline

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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Ireland

Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CARRIGALINE

Map Type :	DEPTH	
Return Period :	0.5% AEP EVENT	
Source :	TIDAL FLOODING	
Map area :	URBAN AREA	
Scenario :	CURRENT	
Figure By :	Valeria Medina	Date : 19 January 2010
Checked By :	Juan Fernandez	Date : 19 January 2010
Approved By :	Jenny Pickles	Date : 19 January 2010

Figure No. : M9/UA/DEP/200/027
Revision : 0

Drawing Scale : 1:5,000
Plot Scale : 1:1 @ A3

Appendix C

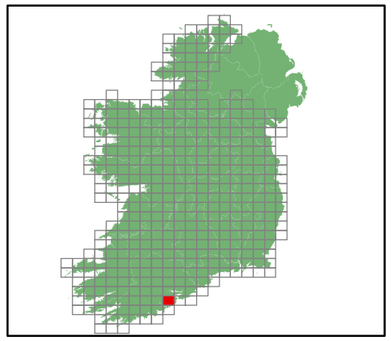
PFRA maps

C1

CARRIGALINE

0.5 0.25 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 Kilometers

Location Plan :



Legend:

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

PFRA Outcomes

- Probable Area for Further Assesment
- Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW Date : July2011
Checked By : MA Date : July 2011

Figure No. : 2019 / MAP / 27 / A
Revision 0

Drawing Scale : 1:50,000 Plot Scale : 1:1 @ A3