ARUP

Barry's Field Ltd

Barry's Field Development

Flood Risk Assessment

Reference: Issue

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1. Introduction

1.1 Project Background

Arup has been commissioned by Barrys Field Ltd to undertake a Flood Risk Assessment (FRA) as part of the planning application for a proposed Large-scale Residential Development (LRD) at Barry's Field in Douglas.

This report details the Flood Risk Assessment carried out as part of the planning application. It has been undertaken in accordance with the Guidelines for Planning Authorities on the 'The Planning System and Flood Risk Management' published in November 2009, jointly by The Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG).

The purpose of the FRA is to identify and quantify the risk of flooding of the proposed development and, if necessary, identify a series of measures to mitigate the risk.

1.2 Scope of Study

The scope of study includes the following:

- Review of all relevant information and data from:
  - Available topographical information for the site;
  - Any historic flood information for the area and/ or any relevant studies;
  - Drawings of the proposed development;
  - Flood maps and reports produced as part of the Douglas Flood Relief Scheme project;
  - The Office of Public Works (OPW) Preliminary Flood Risk Assessment Mapping;
- Review of the risk of coastal, fluvial, pluvial and groundwater flooding;
- Undertake a site visit to assess ground elevations across the site and the overland flow routes which present a risk to the site;
- Recommendation of suitable finished floor level for the development as well as any additional measures required to mitigate the residual risk of flooding at the site;
- Preparation of a flood risk assessment report.

1.3 Summary of Data Used

In preparing this report, the following data was collated and reviewed:

- Flood history of the site from the OPW (available to view at www.floodinfo.ie);
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW (www.floodinfo.ie);
- Flood maps and engineering reports produced by the Douglas Flood Relief Scheme Project (available to view at https://www.floodinfo.ie/frs/en/douglas/home/)
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG);
- Cork City Development Plan 2022 – 2028 and Strategic Flood Risk Assessment and maps of the same; (Cork)
- Site Geological and hydrogeological data from the Geological Survey of Ireland website (www.gsi.ie);

- The Irish Coastal Wave and Water Level Modelling Study maps and reports (ICWWS): (https://www.floodinfo.ie/publications);
- Data from the site investigations carried out sites in the vicinity of the site location;
- Topographical data from the vicinity of the site;
- Architectural drawings/circulation drawings of the proposed development;
- Aerial photography and mapping from Bing Maps and Google Maps.

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum unless otherwise stated.

1.4 Site Description

The site of the proposed LRD is located at Barry's Field in Douglas as indicated with the red circle in Figure 1. The site is presently greenfield and is bounded by residential/commercial buildings to the North along Church Street. The site is bounded by Churchyard Lane and St. Luke's Cemetery to the West to the South the site is bounded by a commercial building (operated by Eircom). The Old Carrigaline Road bounds the site to the East.



Figure 1 Location of subject site (© Bing Maps and © Vexcel Imaging)

Existing ground elevations in the vicinity of the site and also within the site are presented in Figure 2 and Figure 3 respectively. It can be seen that along Church Street ground levels vary from circa 3.26mOD to circa 4.81mOD. Along the Old Carrigaline Road the ground levels vary from circa 3.26mOD to circa 5.30mOD while along Churchyard Lane ground levels vary from circa 3.90mOD to circa 5.80mOD. Existing ground levels in the site vary from circa 6.2mOD to 5.2mOD such that the site is elevated above the surrounding area.



Figure 2 Aerial view of the site location spot heights of the streets surrounding the site (Google Satellite)



Figure 3 Ground levels within the site

1.5 Site Visit

Arup undertook a site visit as part of the FRA to assess the potential overland flow routes across the site as well as to inspect the existing ground levels both within and adjacent to the site. It was evident from the site visit that there is no route for any overland flow from Churchyard Lane to get onto the site given that there are existing walls along both the southern and western boundaries of the site. Arup inspected both walls in detail and no gaps or low points were observed in them.

Figure 4 presents the view looking down Churchyard Lane with the entrance to the Eircom site on the right. Figure 5 presents the view from further North along Churchyard Lane looking towards Church Street with the boundary wall of the site shown on the right. Figure 6 presents a close up view of the wall and as seen in the image, there is thick vegetation growing on the wall. No gaps and/or holes in the wall were observed on the visit.

Figure 7 presents the view of the wall along the southern boundary of the site from inside the Eircom site and Figure 8 presents a close up view of this wall. It can be seen that there is also vegetation growing on this wall. No gaps or holes in the wall were observed.



Figure 4 Looking down Churchyard Lane. Entrance to the Eircom site is on the right



Figure 5 Looking down Churchyard Lane with the site and its boundary wall on the right.



Figure 6 Close up view of boundary wall on Churchyard Lane



Figure 7 Southern boundary wall within the eircom site



Figure 8 Close up view of southern boundary wall within the eircom site

1.6 Proposed development

Barry's Field Ltd intends to apply for a Large-scale Residential Development (LRD) at Barry's Field which will comprise of the construction of 124 no. residential units (consisting of 120 no. apartments and 4 no. duplexes), providing a mix of 1, 2 and 3 bed units in 2 no. blocks ranging from 1 to 5 storeys, 1 no. cafe unit and 2 no. office units at ground floor (within Block 1) and all associated site development works include footpaths, car and bicycle parking, drainage, bicycle and bin stores, lighting, landscaping/amenity areas, ESB substation and switchroom and a plant room at ground floor level at Carrigaline Road and Churchyard Lane, Douglas, Cork. Please refer to the planning documents by McCutcheon Halley Planning Consultants for further details.

A section running East West through the development is shown in Figure 9 while Figure 10 presents the ground floor plan and proposed external landscaping of the development.



Figure 9 Cross section through the development (O'Mahony Pike Architects/Urban Design)

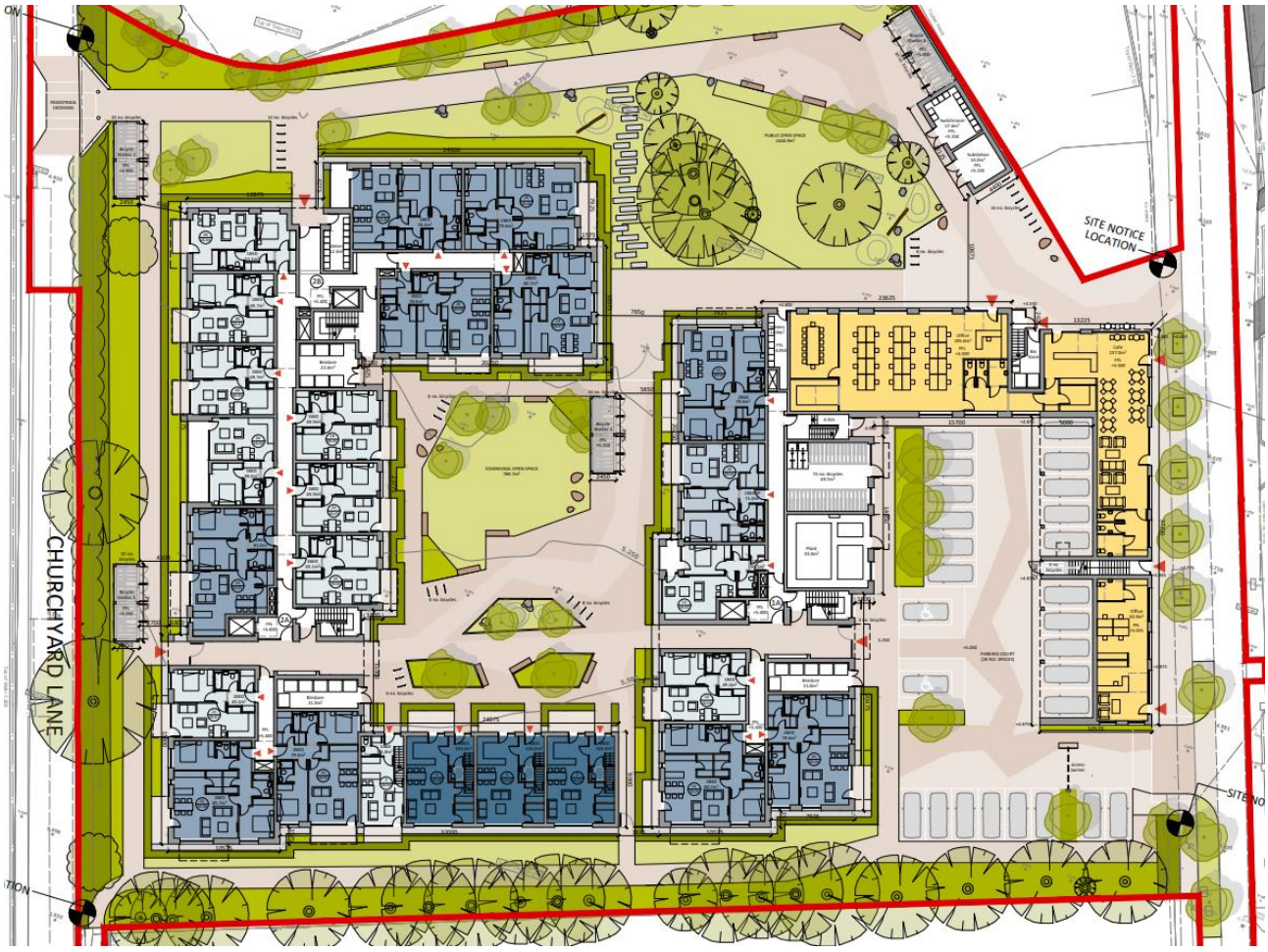

Figure 10 Drawing of the ground floor of the development and external landscaping (O'Mahony Pike Architects/Urban Design)

2. Douglas Flood Relief Scheme

2.1 Introduction

As a consequence of severe flooding in Douglas in June 2012, Cork County Council, in collaboration with the OPW, commissioned a project to develop a Flood Relief Scheme (FRS) for Douglas and Togher. The objective of the scheme was to offer both areas a standard of protection against flood risk equivalent to the Q100 event plus an allowance for freeboard. Arup were commissioned to develop all stages of the scheme which involved hydrological estimation, hydraulic modelling, optioneering, environmental impact assessment, detailed design, constriction supervision and handover of the works.

The scheme was fully completed in Summer 2022 and was officially opened in November 2022.

2.2 Overview of the scheme

There are various components of the scheme which can be summarised as:

Permanent defences (flood defence walls and embankments)

- 333m RC walls
- 180m sheet piled walls
- 116m embankment
- 183m gabion walls
- 4No. RC Box Culverts
- 2No. Roughing Screens
- Stop Logs over Irish Water (IW) trunk main
- 13No. Tideflex in-line valves
- 4No. Ductile Iron flap valves
- 38No. Cast Iron Gully's connected to new and existing drainage network

Conveyance improvements

- Channel widening and deepening along the Ballybrack Stream both upstream and downstream of the Church Street Culvert
- 4No. new RC Box Culverts
- 2No. new Roughing Screens which limit the transport of heavy debris downstream of the screens

The key areas of the scheme are presented in the following figure.

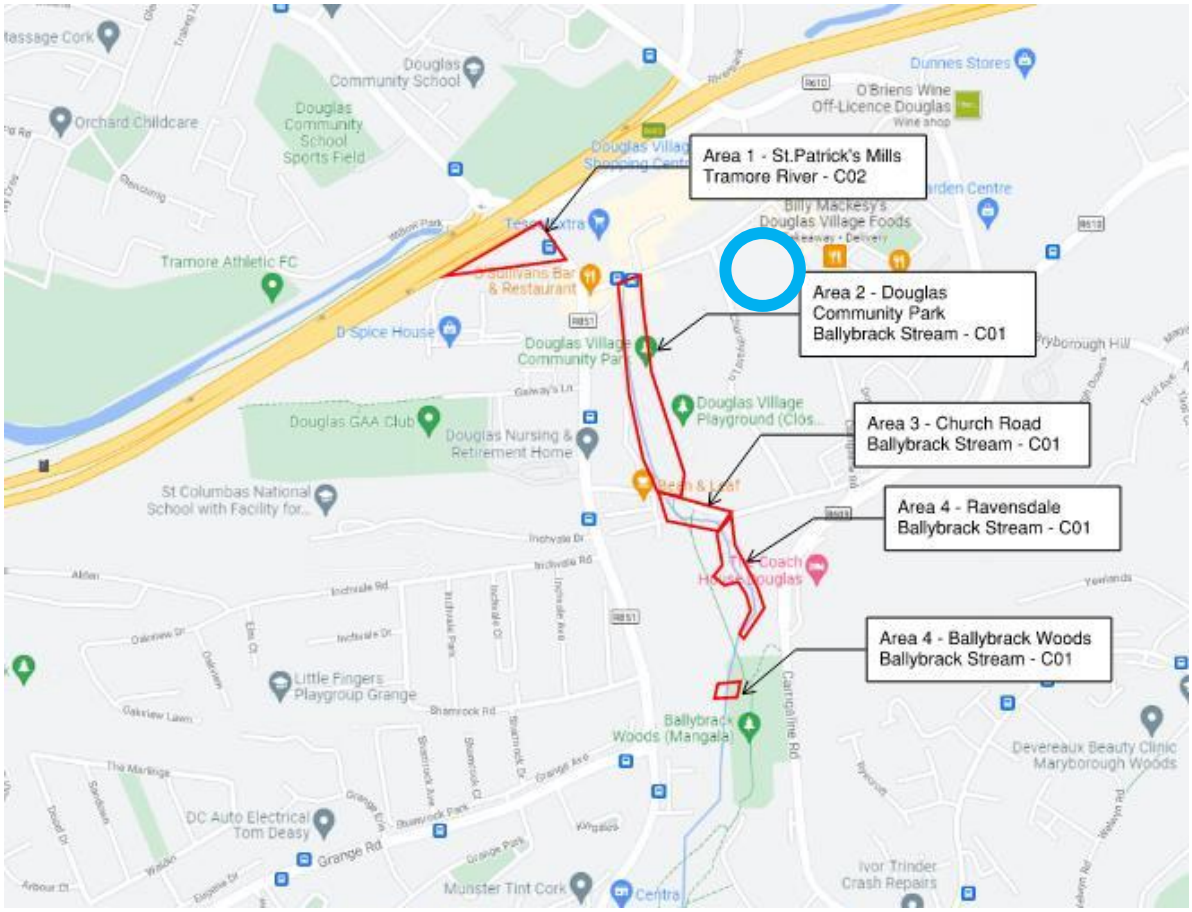

Figure 11 Douglas Flood Relief Scheme Outline. The site of the development at Barry's Field is indicated with the blue circle.

2.3 Photographs of the scheme

Figure 12 and Figure 13 present photographs of some of the engineering measures which form part of the Douglas Flood Relief Scheme. Figure 12 presents:

- a photo of the coarse trash screen which is located upstream of main works along the Ballybrack;
- a photo of the direct defences along the Ballybrack Stream adjacent to Church Road.

Figure 11 presents a photograph of the conveyance improvements and amenity enhancement works along the Ballybrack within Douglas Community Park.



Figure 12 Douglas Flood Relief Scheme Measures – Roughing Screen (left) and Defence Wall along Ballybrack Stream in Church Road (right) (Arup)



Figure 13 Douglas Flood Relief Scheme Measures – Conveyance improvements to Douglas Community Park

2.4 Residual Flood Risk associated with the scheme

The Douglas FRS is a fully passive flood scheme such that there are no demountable elements that need to be installed prior to a flood event (as is the case on the Mallow FRS). The absence of the need for any demountable defences ensures that the risk of failure of the scheme during an event is extremely remote.

There are however residual risks associated with the scheme:

- Flood events greater than the design standard of the scheme (i.e. an event in excess of the Q100 event) may lead to the direct defences of the scheme to be overtopped which in turn may lead to overland flow across Douglas;

- Impact of climate change which can lead to an increase in the flow rate of events less than the design standards i.e. the flow rate associated with a Q80 event in a climate change scenario may be greater than the flow rate associated with a Q100 event in the current scenario and may therefore also lead to overtopping of the defences.

Both of these residual risks are considered further later in the report.

2.5 Site of the proposed development

The site of the proposed development at Barry's Field lies within the defenced area of the Douglas FRS. It is therefore defended to a SoP equivalent to the Q100 event with an additional allowance for freeboard which is generally set at 0.5m across Douglas.

3. Planning context

The following planning policy documents are relevant to the assessment of the proposed development:

- The national planning guidelines published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled 'The Planning System and Flood Risk Management Guidelines for Planning Authorities';
- Cork City Development Plan 2022 – 2028;

Both are now considered in the report.

3.1 The Planning System and Flood Risk Management Guidelines

3.1.1 Introduction

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 guidelines are issued under Section 28 of the Planning and Development Act 2000 and Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to the guidelines is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

3.1.2 Definition of Flood Zones

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range.

There are three types of flood zones defined in the Guidelines as follows:

Table 1 Flood zone definitions

Zone	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 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year 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.

3.1.3 Definition of Vulnerability Classes

The following table (Table 2) summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each.

Table 2 Vulnerability classes definition

Type of Vulnerability	Definition
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

3.1.4 Types of Vulnerability classes appropriate to each zone

The following table (Table 3) illustrates the different types of Vulnerability Class appropriate to each Zone and indicates where a Justification Test will be required.

Table 3 Justification test requirements

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

3.2 Cork City Development Plan (2022 - 2028)

3.2.1 Introduction

The Cork City Development Plan 2022 – 2028 contains the policies and objectives to guide development and land use in Cork City. The plan has effect from 2nd December 2022 and is to be used for the determination of all planning applications from this date. The plan put forward a vision of the future growth of the City and its environs over a six-year period and beyond.

3.2.2 Strategic Flood Risk Assessment for CCiC Development Plan

To inform land-use zoning for the Cork City Development Plan 2022 – 2028, a Strategic Flood Risk Assessment (SFRA) report has been developed. It aims to support the adoption of policies in relation to the zoning of lands in flood prone areas. The report was prepared in accordance with the requirements of The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) and Circular PL02/2014 (August 2014).

The SFRA provides an assessment of all types of flood risk within the City of Cork and assisted CCiC to make informed strategic land-use planning decisions and formulate flood risk policies. A two-stage assessment of flood risk was undertaken for the area that lies within the development boundary of the Development Plan. The first stage is to identify flood risk and is based on a variety of data sources, which have been collated into a Flood Zone map for the City and County. Settlements identified as requiring the Justification Test were carried through to Stage 2.

3.2.3 Flood zoning for the site as per the development plan

The flood zoning for the site as per the development plan is presented in the following figure. It can be seen that the site is shown to be outside of both Flood Zone A and B. It is therefore classified as Flood Zone C as per the development plan.

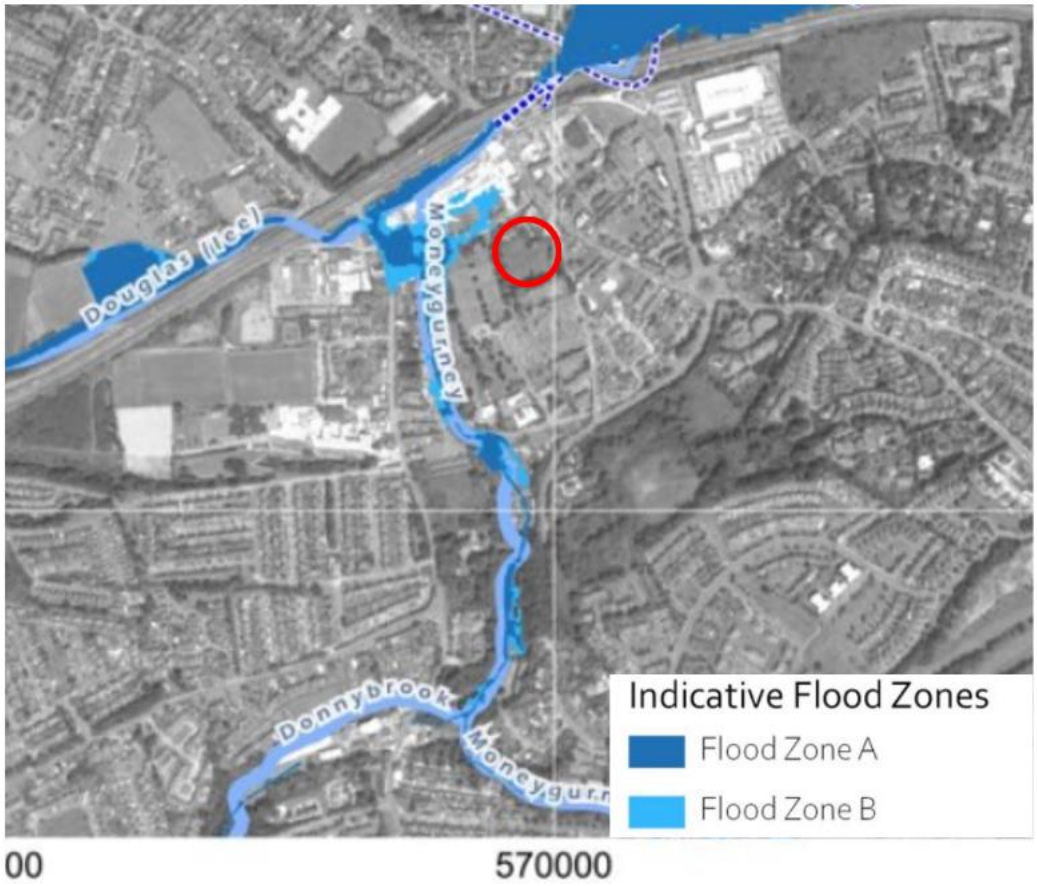

Figure 14 Flood Zoning for the site as per the Cork City Council Development plan (site location indicated with red circle)

The flood zoning for the site will be considered further later in the report.

3.2.4 Requirements of an FRA as per the CCiC Development Plan

The development plan report outlines a broad overview of the requirements for a Flood Risk Assessment which should accompany planning applications including:

- All developments, including in Flood Zone C, must consider the impacts of surface water flood risks on drainage design.
- Flood risk from sources other than fluvial and Tidal should be reviewed, as should the impacts of climate change
- Groundwater flood risk reported in a surface water assessment and management report
- Use of the sequential approach and a justification test, if necessary, as per The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009)
- As well as assessing the surface water management risk for a site, all development including that in Flood Zone C, should consider residual risk factors which could influence the potential mitigation measures for a site.
- It is recommended that any planning applications in flood risk areas are accompanied by a supporting appropriately detailed flood risk assessment. This is to ensure a conservative approach and that consideration is given to new development within Flood Zones where mitigation measures may still be required to ensure an appropriate level of flood protection and/or resilience. The detailed assessment should include at a minimum Stage 1 - Identification of Flood Risk. Where flood risk is identified a

Stage 2 - Initial FRA will be required and depending on the scale and nature of the risk at Stage 3, detailed FRA may be required.

3.3 Conclusion

This FRA report acts as the flood risk assessment for the proposed development at Barry's Field and considers all of the criteria listed in both the OPW Planning Guidelines and the CCiC development plan (2022 – 2028). The planning application for the development is therefore in full compliance with the various planning requirements as regards the assessment of flood risk to the development including the residual risks of flooding.

4. Historic Flood Data

4.1 Overview

The OPW's National flood information portal (https://www.floodinfo.ie/) summarises all recorded flood events across the country. The portal indicates that a number of recorded historic flood events have occurred in Douglas in recent years. All of these event however occurred before the implementation of the Douglas Flood Relief Scheme in 2022.

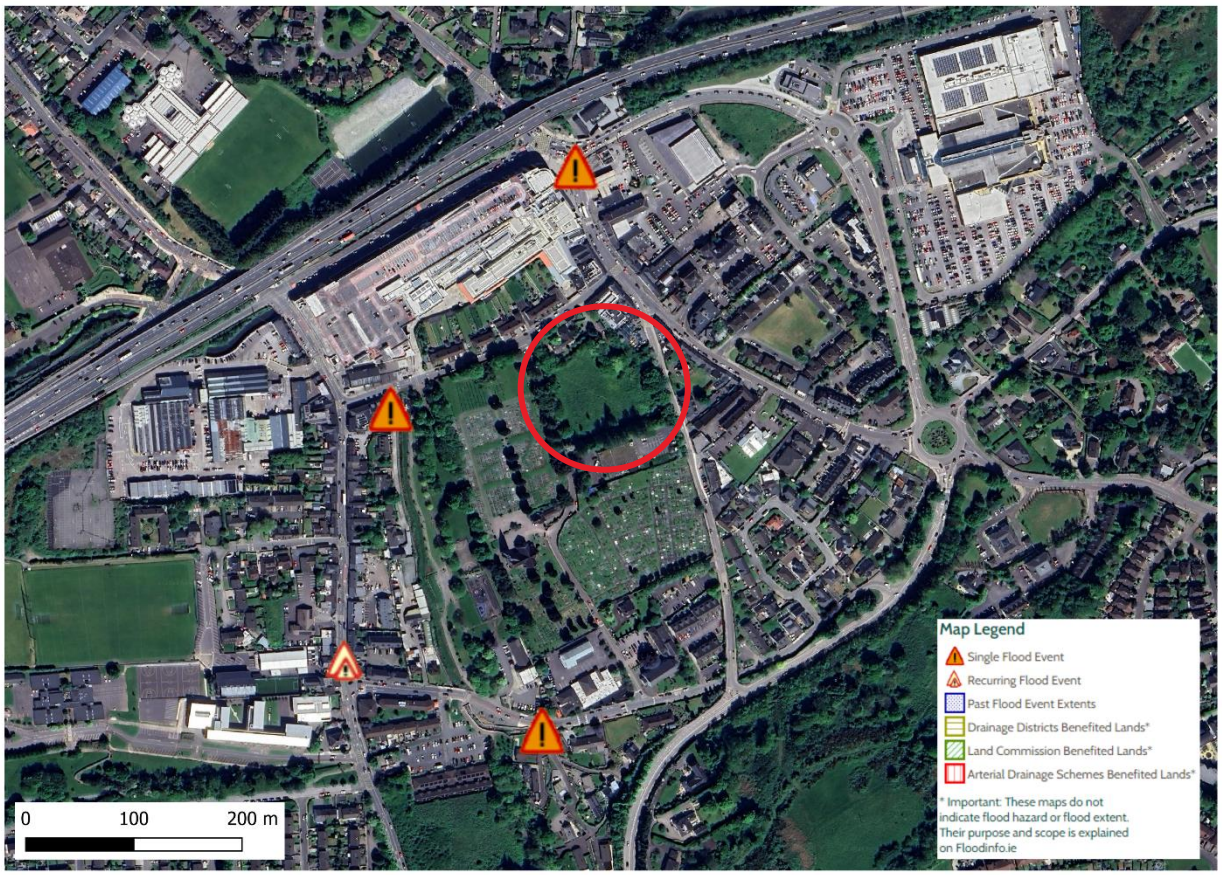

Figure 15 Record of historic flooding in the vicinity of the site (floodmaps.ie)

One of the most significant recent flood events occurred in June 2012 and was caused by a blockage of the trash screen on the Ballybrack Stream just upstream of Church Street as well as a channel capacity issue at multiple locations upstream of Church Road. Both of these mechanisms lead to overtopping of banks of the stream and lead to very significant flooding of Douglas village.

The observed maximum extent of the flood event is presented in Figure 16. It can be seen from the image that Churchyard lane was inundated during the event. The site of the proposed development was not however inundated. The maximum flood depth along Churchyard Lane during the event is unknown. It is however likely that the presence of the boundary walls around the site prevented flood water from entering the site of the development.

Even in the absence of these walls however the site of the development may still not have been flooded during the event given that:

- the existing ground levels across the site are elevated above the ground levels along Churchyard Lane which offers protection against surface water ingress from Churchyard Lane;
- Ground levels along Churchyard Lane fall towards Church Street such that any surface water/overland flow on the road is conveyed in that direction and does not collect on Churchyard Lane for events below a certain magnitude.

It cannot however be determined if the site would have been flooded during the event in the absence of the boundary walls as the maximum flood levels along Churchyard Lane during the event are unknown.

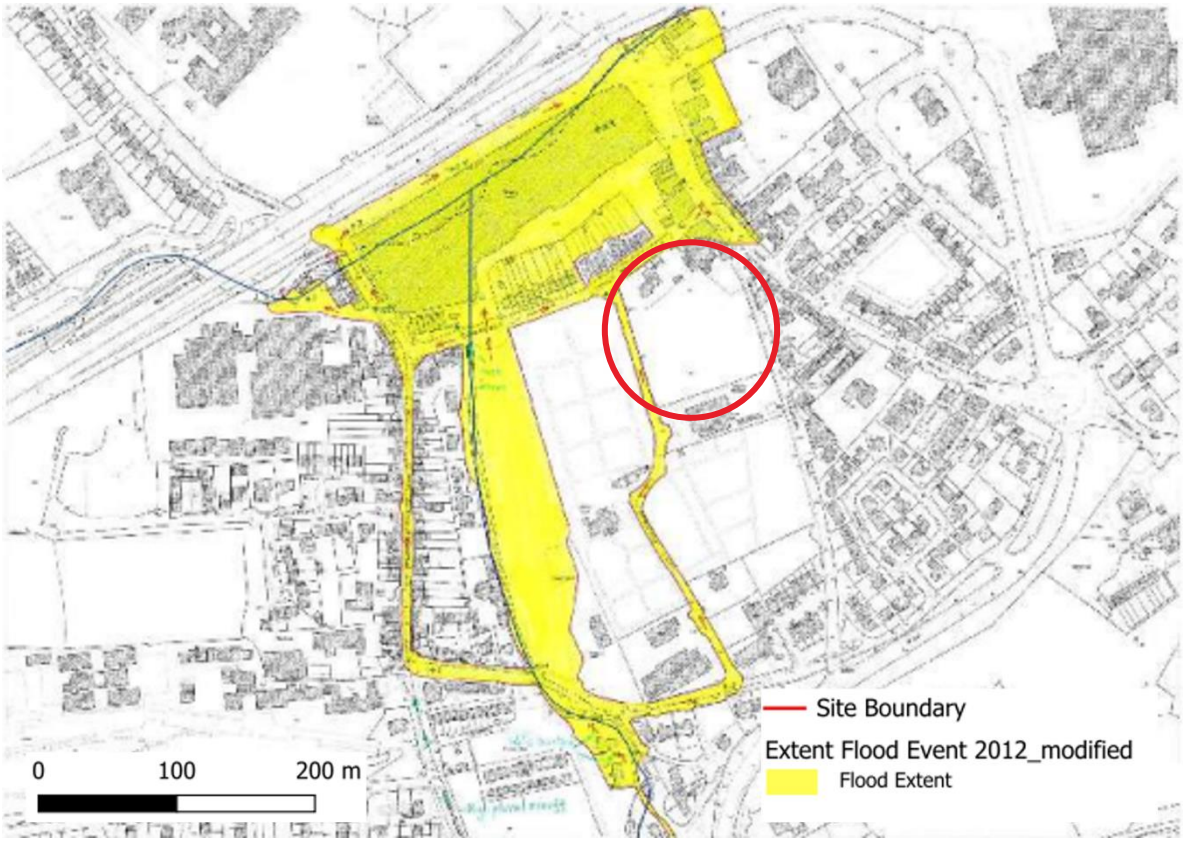

Figure 16 Flood Extent Historic Flood Event 2012 (OPW)

The impact of the June 2012 flood event on Church Street in the aftermath of the event is presented in Figure 17. It can be seen that water entered the properties along the street during the event. It is noted that Church Street would have been inundated by flood water travelling from both Churchyard Lane but also from the Community Park.



Figure 17 Photographs of the historic Flood Event 2012 – Church Street (OPW)

5. Coastal Flood Risk

5.1 Existing Scenario

As part of the identification of coastal flood risk to the site of the proposed development, maps and reports from the Irish Coastal Protection Strategy Study (ICPSS) have been assessed.

Figure 18 presents the ICPSS tidal flood extent for the 1 in 100-year, 1 in 200-year and 1 in 1000-year return period event for Cork. It can be seen that the site of the proposed development is not located in the predicted tidal flood extent given that the ground levels across Douglas (including the site) are very well elevated above the design tidal levels. The risk of tidal flooding to the site is therefore very remote.

We note that the predicted 1 in 1000-year design extent at node 6DOU_89 on the figure is an anomaly and can be discarded from the analysis.

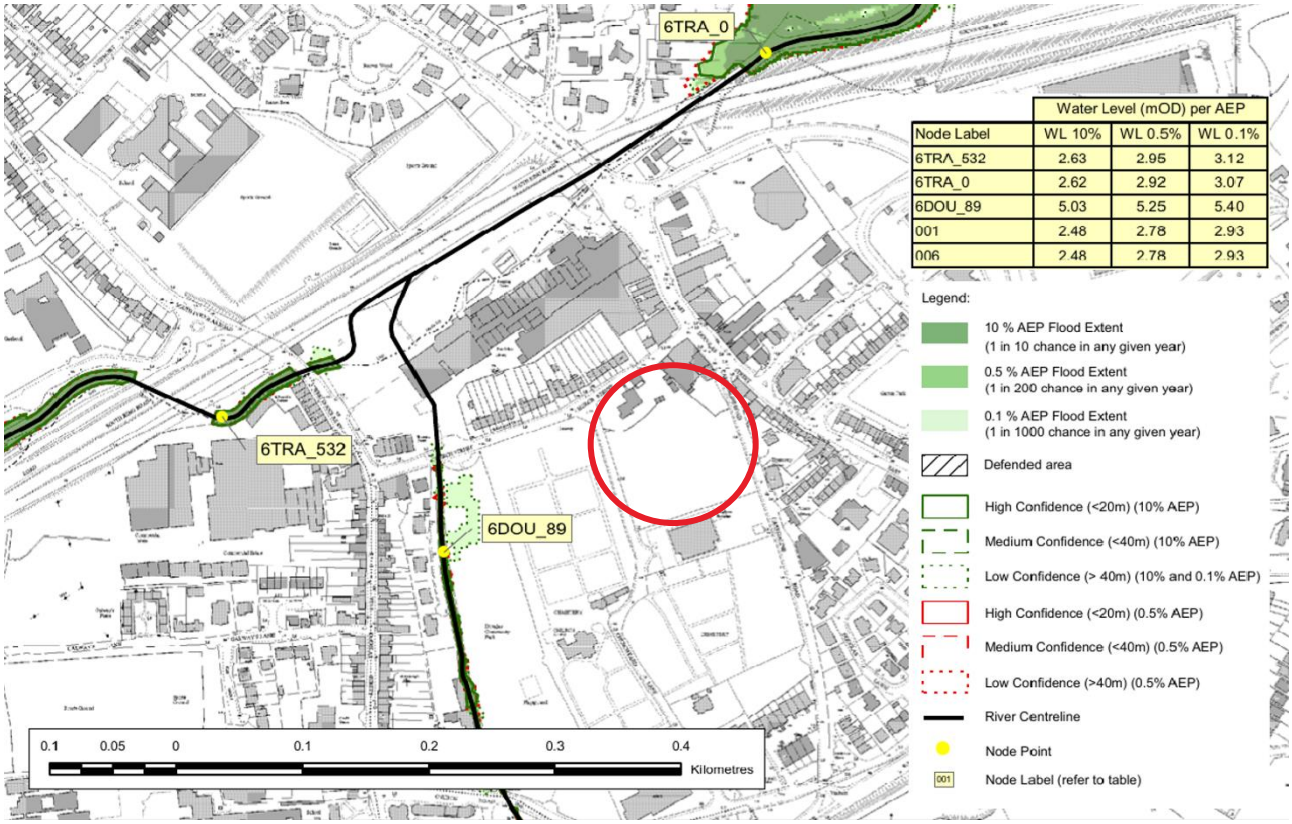

Figure 18 Detailed ICPSS Coast Flood Extent Map for Cork City (floodmaps.ie)

5.2 Climate Change Scenario

The OPW recommend accounting for the impact of climate change on tidal flood levels by considering a 500mm increase in water levels as per the Mid-Range Future Scenario.

An increase of 0.5m therefore needs to be added to the 0.5% water level from the 6TRA_0 node (i.e. 2.92mOD). The MRFS design water level is therefore estimated as circa 3.42m, which is still more than 1m lower than the average ground level of the proposed site (circa 4.5m). The risk of tidal/coastal flooding to the site in the MRFS is therefore also very low.

6. Fluvial Flood Risk

6.1 Existing fluvial flood risk to the site

The site of the proposed development lies within the defended area of the Douglas FRS and is therefore defended to an SoP of the Q100 event with an additional allowance for freeboard of 0.5m. There is therefore no risk of flooding to the site up to the Q100 event.

As noted earlier in the report however, there remains a residual risk of flooding from the following sources:

- Scheme failure;
- Design exceedance event;
- Climate Change scenario.

Each of these are now considered.

6.1.1 Scheme failure

The risk of scheme failure is very remote given that the scheme has been designed and constructed in the very recent past and follows best international practice as regards structural and geotechnical design. As noted earlier in the report, the scheme is also a totally passive scheme such that there is therefore no need for any demountable barrier and/or flood gate to be deployed in advance of an event in order to maintain the defence line during the event. The risk of scheme failure during an event is therefore very remote.

6.1.2 Design exceedance event

Should a flood event with a return period in excess of the Q100 event occur there is a risk of water overtopping the defences and leading to overland flow across Douglas. The risk of this occurring however is very low given the low probability of any such event from occurring. The freeboard allowance of the scheme, which is set at circa 0.5m, is deemed to be conservative and will therefore which also reduce the impact of any design exceedance event.

The risk associated with a design exceedance event cannot however be discounted and measures to address it are therefore considered later in the report.

6.1.3 Climate Change Scenario

Similar to a design exceedance event, a climate change scenario may result in a flood event with a return period lower than the Q100 event, exceeding the capacity of the channel and causing overland flow. While the risk of any such event is very low due to the low probability of its occurrence as well as the additional protection offered by the scheme freeboard allowance, it cannot be discounted as a risk and is therefore also considered further later in the report.

6.2 Historic Flood Risk / Undefended scenario

6.2.1 Q100 event – no flood scheme in place

It is informative to consider the risk of fluvial flooding to the site for the scenario in which no flood relief scheme has been constructed in Douglas i.e. the scenario that existing pre-2022. The pre-scheme maximum flood extent map for the Q100 event produced as part of the Douglas FRS have therefore been assessed as part of the FRA and is presented in Figure 19. It can be seen from the figure that the site is at risk from overland flow from the Churchyard Lane when no flood scheme is in place. From an inspection of the maps produced by the scheme it is evident that in this scenario Churchyard Lane receives overland flow from Church Road due to overtopping of the left bank of the Ballybrack Stream in the vicinity of the ICA Hall.

The maximum flood extent across the site is however limited. The maximum flood depths are not plotted on the figure but it can be inferred from the maximum flood extent that the maximum flood depths are shallow across the site.

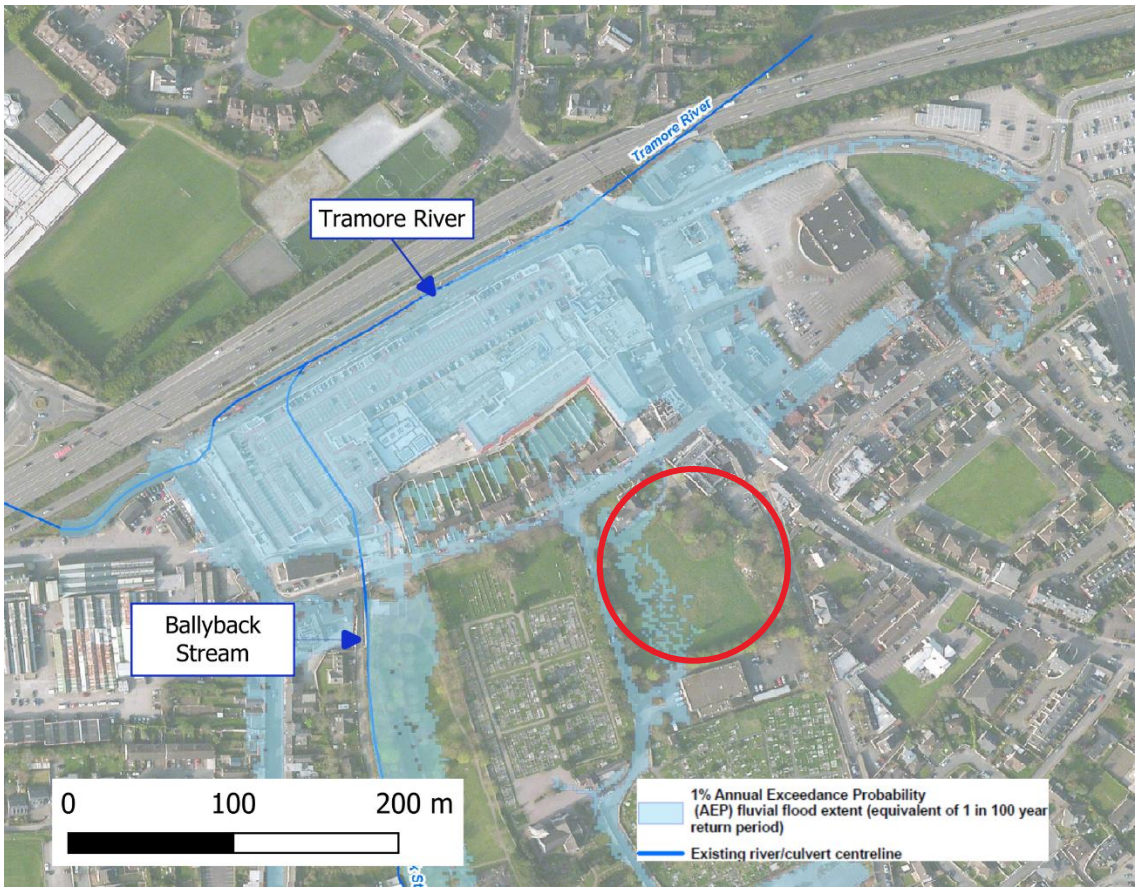

Figure 19 Pre-scheme Q100 flood extent in Douglas

In needs to be considered however that the hydraulic model used to produce the pre-scheme flood extent map presented in Figure 19 assumed that all garden and boundary walls have been removed due to uncertainty over the structural integrity of these walls in the design event. The walls that border the site (and which were described earlier in the report in Chapter 1) do not therefore exert any influence on overland flow routes in the model and their deflecting of flood water during an event is ignored in the flood map.

The depths of flooding along Churchyard lane are relatively low in this scenario and it is very reasonable to assume that the structural integrity of the walls which border the site would not in fact be compromised during the Q100 event. The assumption adopted in the Douglas FRS report is therefore deemed to be very conservative. Should the boundary walls along the western and southern boundary of the site have been included in the model, the overland flow route into the site from Churchyard Lane would have been cut off and the site would not have been included in the modelled flood extent.

The implications of this finding are considered later in the report.

7. Pluvial and Groundwater Flood Risk

7.1 Pluvial risk - existing Scenario

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.

As part of the overall CFRAM study, Preliminary Flood Risk Assessment (PFRA) mapping was undertaken as a screening exercise to identify areas at risk of pluvial flooding. Figure 20 presents the PFRA map for the area around the subject site. It can be seen from the figure that the proposed site does not lie in a pluvial flood extent for either the 100-year event or the extreme event.

This finding is in keeping with the surveyed levels across the site and its immediate vicinity which indicate that any surface water would not collect on the site but instead be conveyed in a Northerly/North East direction towards Church Street. The risk of pluvial flooding is therefore very low.

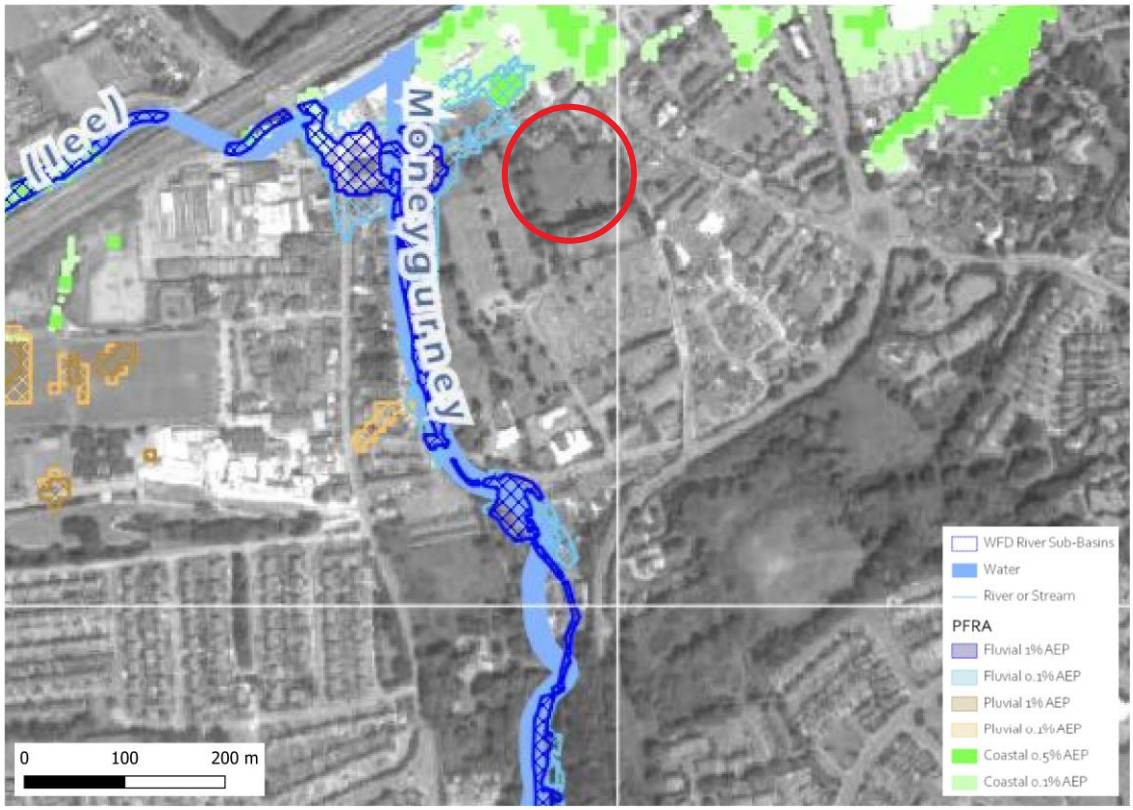

Figure 20 PFRA Flood Extents Map - Cork City SFRA (Page 57)

7.2 Pluvial Risk - Climate Change Scenario

The risk of pluvial flooding to the site in a climate change scenario is also likely to be very low.

7.3 Groundwater risk – existing scenario

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

The Geological Survey Ireland Spatial Resources webportal suggests that the is not at risk of groundwater flooding. This finding is in keeping with the general historic risk of flooding to the general Douglas area which has not experienced any groundwater related flood events. The risk of groundwater flooding in both the current and climate change scenario is therefore deemed to be low.

8. Management of Residual Flood Risk

8.1 Flood risk in a design exceedance/climate change event

As noted earlier in the report, flood risk to the site in the present day (i.e. with the Douglas FRS in place) is limited to a design exceedance and/or a climate change event.

There are no floodmaps available for Douglas which highlight the areas at risk in a design exceedance/climate change event. In the absence of such maps, an alternative approach to assess the risk is to adopt the pre-scheme Q100 flood extent map as a surrogate measure of the risk in the design exceedance/climate change scenario. Such an approach is noted as being quite conservative given that the volume of overland flow in a design exceedance event will be considerably less than the volume associated with the design event from the pre scheme scenario. The mechanisms of flooding will also be different given that the locations at which water exits the channel are not likely to be the same in both scenarios.

In the absence of a design exceedance map and due to the conservatism of the approach, it is however deemed valid for the purpose of this FRA to utilise the pre scheme map as a surrogate measure of the risk. Figure 21 presents a close up view of the site and highlights the pre scheme Q100 flood extent. The two boundary walls of interest are also marked up on the figure.

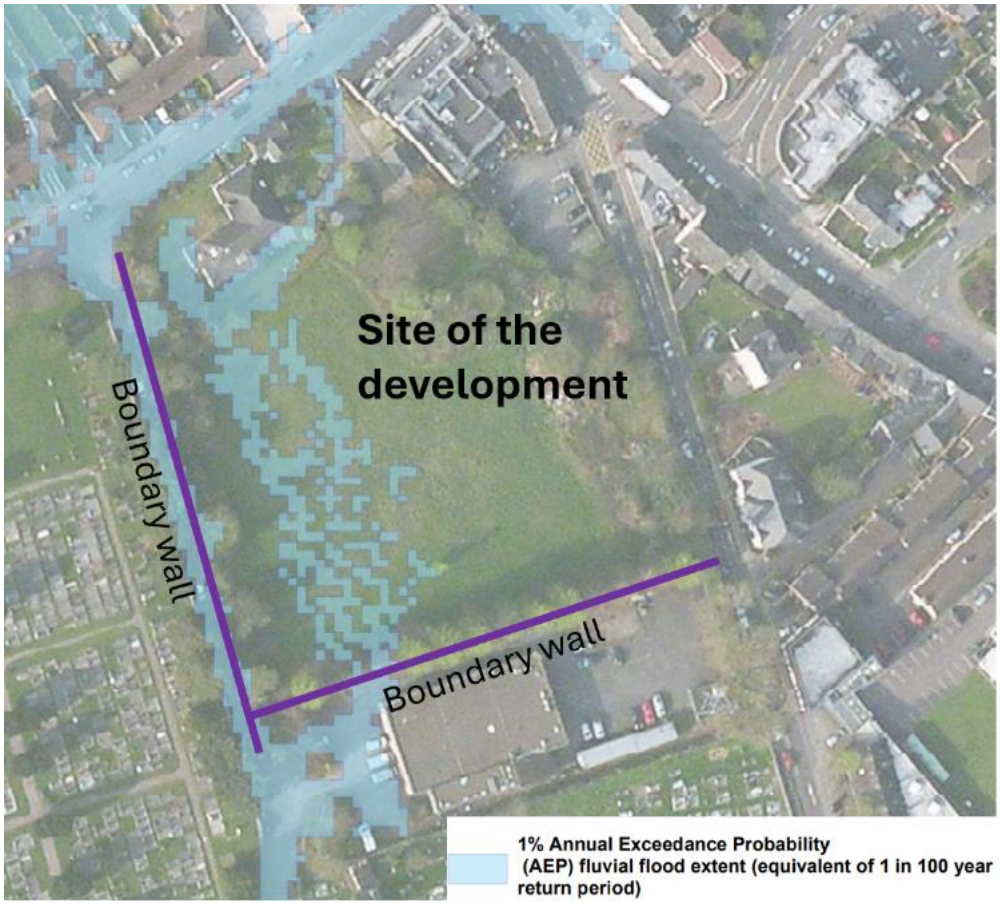

Figure 21 Pre-scheme Q100 flood extent in Douglas – close up view of the site

8.2 Management of the residual risk of flooding

The residual risk of flooding from a design exceedance/climate change event will be managed by:

- ensuring that the existing boundary walls of the site are maintained into the future in order to divert any surface water on Churchyard Lane away from the site (exceptions need to be made to facilitate pedestrian entrances as discussed below);

- ensuring that a high point in the ground levels at the pedestrian entrances to the site is maintained as part of the development in order to ensure that any surface water on Churchyard Lane is prevented from getting onto the site

Two separate pedestrian entrances from Churchyard Lane are proposed as part of the development and both are presented in the following two figures. At the first entrance (i.e. the entrance furthest North and closest to Church Street) the existing ground level on Churchyard Lane at the entrance is circa 4.4mOD (refer to Figure 22). This level is circa 1m below the proposed FFL of the buildings closest to the entrance within the development which are to be set at 5.4mOD. The risk of surface water ingress to the buildings from water getting into the site through the first pedestrian entrance is therefore very low. It is however proposed to incorporate a high ridge in the ground levels at the pedestrian entrance that is set circa 200mm above the existing ground levels on the road. This will be sufficient to ensure that the risk of surface water entering the site via the pedestrian entrance will be very low and ensure that there is no change from the existing scenario which does not allow for any water from Churchyard Lane to get onto the site at this location.



Figure 22 First proposed pedestrian entrance from Churchyard Lane (i.e. entrance closest to Church Street)

At the second entrance (i.e. the entrance closest to Church Road) the existing ground level on Churchyard Lane at the entrance is circa 5.6mOD (refer to Figure 23). This level is comparable with the proposed FFL of the buildings closest to the entrance within the development which are to be set at 5.4mOD. In order to manage the risk of surface water getting onto the site the ground levels at the pedestrian entrance will also be set circa 200mm above the above the existing ground levels on the road. This will be sufficient to ensure that the risk of surface water ingress into the site via this pedestrian entrance is very low.

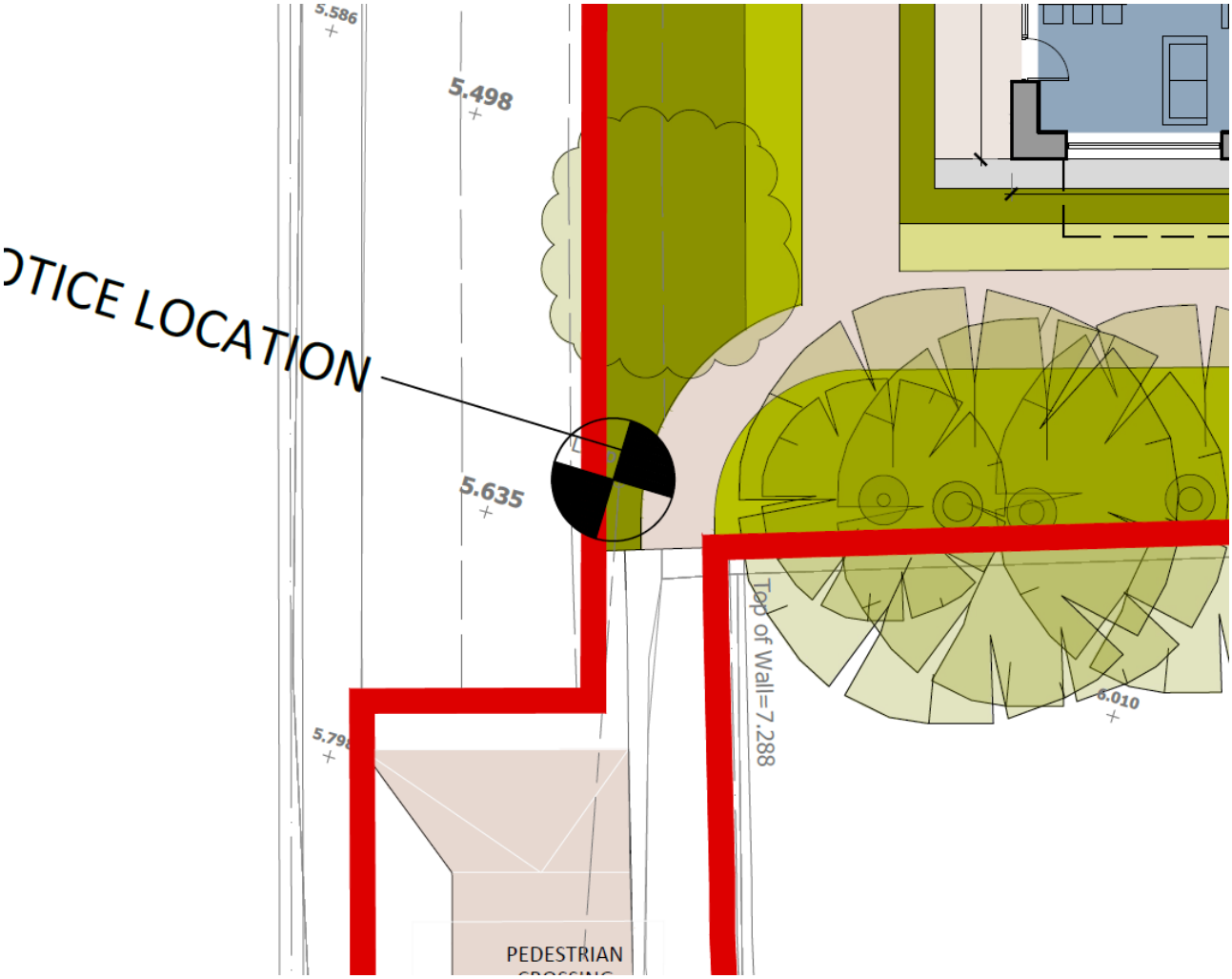

Figure 23 Second proposed pedestrian entrance from Churchyard Lane

8.3 Finished floor level

The minimum FFL is set at 5.4mOD for the residential blocks while the FFL for the office space/café is set at 4.5mOD. These levels are sufficiently elevated to ensure that the flood risk to the buildings in the design exceedance and/or climate change event is very low.

8.4 Access and Egress Routes

Given the absence of significant risk of flooding of the site, access and egress routes are unlikely to be compromised during flood events. In a design exceedence event however Churchyard Lane would be at risk of flooding to shallow flood depths which would limit access/egress routes via this route. Access/egress to the Old Carrigaline Road however is very unlikely to be compromised and can therefore be utilised during any design exceedance event.

8.5 Storage and Conveyance

The proposed development will not have any impact on floodplain storage and conveyance as it is outside a 1 in 100 year floodplain.

8.6 Off-site impact

The proposed development will not increase flood risk to any nearby area given the absence of any significant flood risk to the site. There is therefore no off-site impact associated with the development.

8.7 Site Drainage System/Surface Water Runoff

As detailed in the Infrastructure report which forms part of the planning application for the development:

"The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas etc. The completed development site is a mix of soft landscaping and hard paving or roofing. The existing topography is a single catchment. There will be one no. surface water discharge points to service the developed site and it will discharge to the stormwater network at the junction between East Douglas Street and Church Street.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent network. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site by the usage of SuDs features and by attenuation storage as a last resort.

Surface water discharge rates from the proposed surface water drainage network will be controlled by SUDs features, a vortex flow control devices (Hydrobrakes or equivalent) and associated attenuation tanks. A series of above ground infiltration/detention systems shall also be provided. Surface water discharge will also pass via a full retention fuel / oil separators (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tanks, infiltration/detention systems, flow control devices and separator arrangement as noted above. Surface water runoff from the site's road network will be directed to the proposed pipe network and infiltration/detentions systems via conventional road gullies with additional surface water runoff from roofs also routed to the proposed surface water network."

The drainage system for the development is therefore in full compliance with CCiC runoff guidelines. The reader is referred to the infrastructure report and its drawings for further information.

9. Application of 'Flood Risk Management Guidelines'

9.1 Vulnerability Classification

It is considered that the proposed development should be classed as a 'vulnerable development' as per the vulnerability classification in Figure 24 given that it is primarily a residential development.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 24 Vulnerability Classification

9.2 Flood Zones

Flood zoning is assigned on the conservative basis that there are no flood defences in place. While the site of the proposed development is defended to the Q100 event, in the context of its flood zone, the site is defined as being within the 100 year floodplain and is therefore classified as being within Flood Zone A. It is noted

that this is different to the classification in the Cork City Development Plan as discussed in Section 3. This difference is due to the flood zoning in the development plan being informed by a hydraulic analysis that is less detailed that the modelling undertaken as part of the Douglas FRS and which is used to the inform the flood zoning presented in this report.

As the site is classified as being within Flood Zone A in this FRA, a 'Justification Test' for the proposed development is therefore required and is presented in the following section of the report.

9.3 Justification Test

The Justification Test is adopted by a planning authority when developments vulnerable to flooding are proposed in areas at moderate or high risk of flooding (Flood Zones A and B). Prior to granting permission for the development, the planning authority must be satisfied that the development meets the criteria set out in the Development Management Justification Test in The Guidelines. These criteria are included in the figure below.

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 25 Justification test for development management (extract from The Guidelines)

9.3.1 Justification Test – Part 1

The current Development Plan is the 2022 – 2028 Cork City Development Plan. This was informed by a Strategic Environmental Assessment (SEA) in accordance with The Guidelines.

The site is zoned for Mixed Use Development (Zoning Objective ZO 04) as per the Development Plan. This zoning is to provide and promote a mix of residential and other uses to ensure the creation of a vibrant and sustainable urban area.

A Justification Test was undertaken for Cork City Centre and concluded that the lands and zoning objective for the site satisfies the Justification Test. Therefore, it is considered that the proposed development satisfies Part 1 of the development management Justification Test.

9.3.2 Justification Test Part – 2(i)

It has been demonstrated in this report that the proposed development will not increase flood risk elsewhere due to the site being within the defended floodplain and also due to the risk of ingress in the design exceedance event being very low.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2(i) of the development management Justification Test.

9.3.3 Justification Test – Part 2(ii)

The mitigation measures proposed to minimise flood risk to people, property, the economy and the environment are discussed in detail in this report and relate to ensuring that (1) the FFL of all the buildings on the site are sufficiently elevated to ensure that the risk of ingress in the design exceedance/climate change scenario is very low, and (2) incorporating a high ridge in the ground levels at the pedestrian entrances along Churchyard Lane in order to prevent any surface water from Churchyard Lane from getting onto the site. This is will therefore be in keeping with the existing scenario in which surface water flooding to the site from Church Yard Lane is prevented by the boundary walls of the site.

It is therefore considered that the proposed development satisfies the criteria of Part 2(ii) of the development management Justification Test.

9.3.4 Justification Test – Part 2(iii)

The key mitigation measure as regards flood risk to the site is the Douglas FRS which offers a very high standard of protection to the site. Additional and site specific measures include the specification of the FFL and ensuring that the boundary walls of the site are maintained. There are all deemed to be sufficient to ensure that flood risk to the site, including residual risks, are all appropriately managed.

It is considered that the proposed development satisfies the criteria of Part 2(iii) of the development management Justification Test.

9.3.5 Justification Test – Part (iv)

The proposed development is consistent with the objectives of the Cork City Development Plan 2022 – 2028 in terms of promoting high quality mixed use space while also satisfying the requirements to maintain the landscape and visual character of the area by tying into the existing streetscape levels and being respectful to the existing architecture and heritage of the area.

It is considered that the proposed development satisfies the criteria of Part 2(iv) of the development management Justification Test.

9.4 Conclusion

It is considered that the proposed development satisfies all the criteria of the development management Justification Test and that the risks relating to flooding will be managed to acceptable levels and therefore comply with DoEHLG / OPW and Cork City Council planning guidance.

10. Discussion

Arup has been commissioned by Barrys Field Ltd to undertake a Flood Risk Assessment (FRA) as part of the planning application for a proposed Large-scale Residential Development (LRD) at Barry's Field in Douglas.

The site of the development lies within the defenced area of the Douglas FRS and is therefore defended to a SoP equivalent to the Q100 event with an additional allowance for freeboard. The risk of fluvial flooding to the site is therefore limited to design exceedance fluvial events and possible climate change scenarios which may lead to overland flow along Churchyard Lane. In such an event the risk of ingress to the site will be managed by ensuring the ground levels at the pedestrian entrances are set circa 200mm above the existing road levels which will be sufficient to ensure that water does not enter the site.

The risk of tidal, groundwater and pluvial flooding to the site is very low.

There is no off-site impact associated with the development and access and egress routes to the development will be maintained at all times via the Old Carrigaline Road.

The site is classified as Flood Zone A and a Justification Test for the development has therefore been undertaken. It is considered that the proposed development satisfies all the criteria of the development management Justification Test and that the risks relating to flooding will be managed to acceptable levels and therefore fully comply with DoEHLG / OPW and Cork City Council planning guidelines.