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ASHBOURNE SKATE PARK

SITE SPECIFIC FLOOD RISK ASSESSMENT

Prepared for: Meath County Council

comhairle chontae na mí
meath county council

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REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT
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Abstract: Fehily Timoney & Company was commissioned by Meath County Council to prepare a Site Specific Flood Risk Assessment in support of a planning application for the proposed Zone 3 of the Ashbourne Linear Park along the Broadmeadow River in Ashbourne, Co. Meath. The Site Specific Flood Risk Assessment was prepared in accordance with the guidelines produced by the Department of Environment, Heritage and Local Government (DoEHLG) – *"The Planning System and Flood Risk Management -Guidelines for Planning Authorities"* (November 2009).

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1. INTRODUCTION

1.1 Introduction

Fehily Timoney & Company (FT) was commissioned by Meath County Council (MCC) to prepare a Site-Specific Flood Risk Assessment (SSFRA) for the proposed Zone 3 of Ashbourne Linear Park (ALP) along the Broadmeadow River in Ashbourne, Co. Meath, in support of the planning application for the proposed development.

The site-specific flood risk assessment was prepared in accordance with the guidelines produced by the Department of Environment, Heritage and Local Government (DoEHLG) – *"The Planning System and Flood Risk Management - Guidelines for Planning Authorities"* (November 2009).

1.2 Objectives

The objectives of this report are to inform the planning authority regarding flood risk for the potential development of the lands.

The report will provide the following:

- The site's flood zone category.
- Information to allow an informed decision of the planning application in the context of flood risk.
- Appropriate flood risk mitigation and management measured for any residual flood risk.

1.3 Scope

This SSFRA relates to the proposed development lands at the proposed ALP and its immediate surroundings only. This report uses information obtained from various sources, together with an assessment of flood risk for the existing site and proposed development. The report follows the requirements of "*The Planning System and Flood Risk Management - Guidelines for Planning Authorities"* (referred to as the *Guidelines for Planning Authorities* for the remainder of this report).

1.4 National, Regional and Local Spatial Plans

The relevant Development Plan is the Ashbourne Local Area Plan 2009-2015 which was incorporated further amendments in 2015 to be consistent with the objectives of the Meath County development Plan 2013-2019.

The policies and objectives set out in Section 7.8 of this plan relating to flood protection are summarized below:

1.4.1 INF POL 29

To implement the requirements of "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009), or their replacement, in the carrying out of development management functions and in the preparation of any Framework Plans required during the period of this Plan.

1.4.2 INF POL 30

To manage flood risk and development in Ashbourne in line with policies WS 29 – WS 36 inclusive in Volume I of the County Development Plan.

1.4.3 INF POL 31

Where existing development in the development envelop is at potential risk of flooding (A1 'Existing Residential', B1 'Town Centre' & G1 'Community Infrastructure' land use zoning objectives refer) as identified on the land use zoning objectives map, any significant extensions / change of use / reconstruction shall be subject to an appropriately detailed Flood Risk Assessment in line with the policies (WS POL 29 - 36) contained in Volume I of the County Development Plan.

1.4.4 INF POL 32

Any future planning applications lodged with respect to the sites identified on the land use zoning objectives map as having the benefit of an extant planning permission in the general Killegland area to the south west of Ashbourne shall be accompanied by an appropriately detailed Flood Risk Assessment. The Flood Risk Assessment shall clearly assess flood risks, management measures and demonstrate compliance with "The Planning System and Flood Risk Management Guidelines for Planning Authorities" (November 2009). The Flood Risk Assessment shall consider the Sequential Approach within the subject site and would typically involve allocating water compatible development within Flood Zones A and Zone B. Buildings should be sited at an appropriate finished floor level, which should be above the 1 in 100-year flood level, with an allowance for freeboard and climate change.

Section 7.8 of the Ashbourne Local Area Plan 2009-2015 further discusses the objectives of the in relation to flooding in Ashbourne and specifically along the Broad Meador River as follows:

1.4.5 INF OBJ 17

To require a site specific flood risk assessment to be carried out for all development proposals falling within areas identified as being at risk of flooding in accordance with the Ashbourne Strategic Flood Risk Assessment recommendations.

1.4.6 INF OBJ 18

To seek to implement the recommendations of the Fingal East Meath Flood Risk Assessment and Management Study (FEMFRAMS) as applicable to the River Broadmeadow with particular regard to ensuring that the existing culverts of the river in Ashbourne are maintained and kept clear of obstructions at all times and that a defence asset monitoring and maintenance programme is undertaken.

1.5 Approach

The Flood Risk Assessment Methodology is presented in Section 2 of this report and it considers the *Guidelines for Planning Authorities* as they relate to the proposed application.

The Stage 1 Flood Risk Identification is presented in Section 3.

The Stage 2 Flood Risk Assessment is included in Section 4.

The Stage 3 detailed assessment of specific flood risks and residual risks relating to the proposed development is presented in Section 5.

Conclusions and recommendations are presented in Chapter 6.

1.6 Existing Site

Refer to Figure 1-1 and Figure 1-2 below for the site location and existing water features respectively.

The proposed greenfield site comprises approximately 2.9 hectares situated in a suburban area, approximately 500 m southwest of Ashbourne town centre. The site borders a housing estate to the south, a local road to the north and east, and the Donaghmore Ashbourne GAA Club to the west.

The confluence of the Broadmeadow River and Dunshaughlin Stream occurs within the site and comprises:

- The Broadmeadow River, a designated EPA watercourse, crosses the site coming from the south-western end continuing to the eastern end of the site.
- The Dunshaughlin Stream, also a designated EPA watercourse, enters the site from the north-western end and discharges into the Broadmeadow river on the western end of the site.
- The Broadmeadow River discharges into the Rogerstown Estuary approximately 15 Km south-east from the Site.

The site is located within the Nanny-Delvin Catchment (ID: 08) and the Broadmeadow Sub-Catchment (EPA Broadmeadow_SC_010 , ID: 08_3).

Topographic surveys of the site indicate that ground falls across the site towards both the Broadmeadow River and the Dunshaughlin Stream.

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Legend

Site Boundary

TITLE:	Site Location		
PROJECT:	Ashbourne Skate Park		
FIGURE NO:	1.1		
CLIENT:	Meath County Council		
SCALE:	1:50000	**REVISION:**	0
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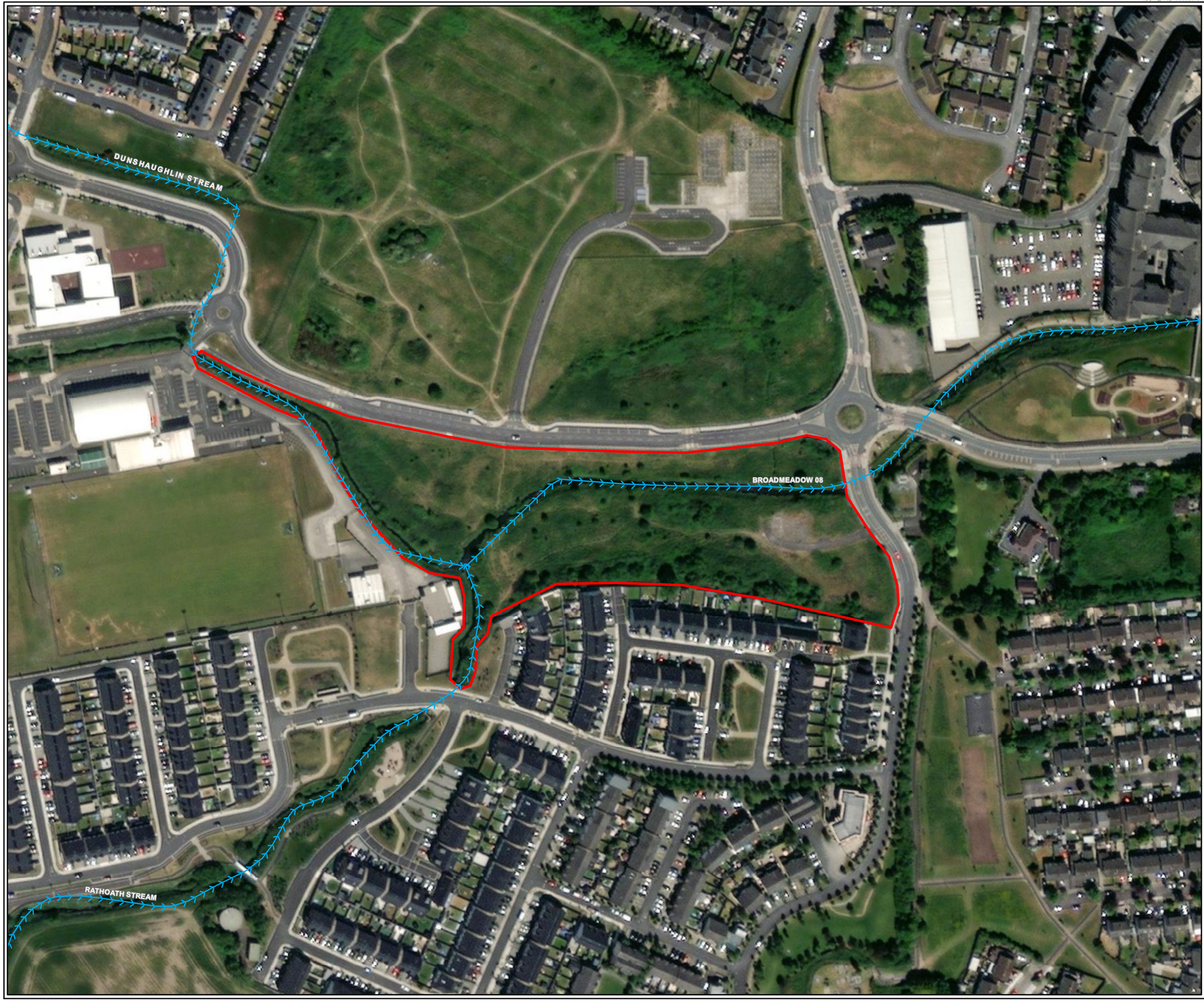

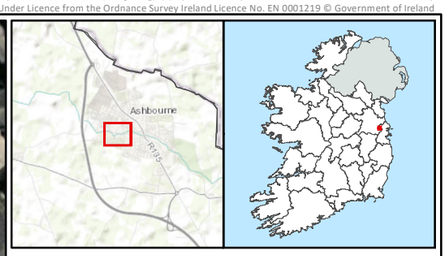

Legend

- Site Boundary
- Rivers

TITLE:	Existing Water Features		
PROJECT:	Ashbourne Skate Park		
FIGURE NO:	1.2		
CLIENT:	Meath County Council		
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1.7 Existing Services

A site walkover was carried out on the 25th of March 2021. Key features, see Figure 1-3, observed were:

- Manholes and chambers possibly associated with existing watermains and sewers in the southern end of the site. Not shown on Figure 1-3.
- Culvert 1 on the Dunshaughlin Stream at the GAA club.
- Culvert 2 upstream on the Broadmeadow River at the Churchfield housing development.
- Culvert 3 downstream on the Broadmeadow River at the local road to the East of the Site.

Figure 1-3 site boundary is indicative only.

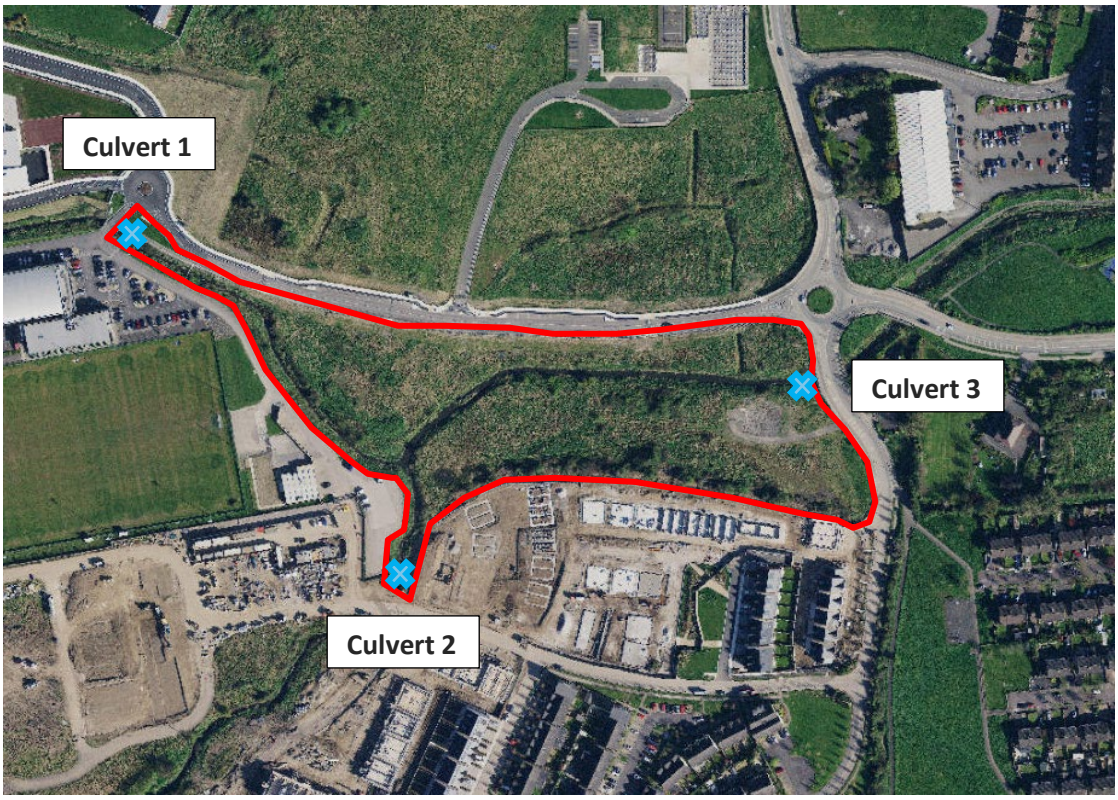

Figure 1-3: GeoHive Mapping Overview of Existing Culverts

1.8 Proposed Development

Refer to Appendix 1 Drawing P20-343-0100-0002 for the Ashbourne Park Site Layout.

The proposed development, comprises an open landscaped recreational area including:

- Footpaths, cycleways and a riverside walkway.
- A Plaza Style skate park (approximately 500 m^2) to the north-western end of the site.
- A Car park (364 m^2, 14 no. car parking spaces) in the south-eastern end of the site and associated vehicular access.

- A new pedestrian footbridge over the Broadmeadow River to connect northern and southern areas of the site, subject to a Section 50 Application to the OPW.
- A service vehicle entrance will also be included to the Northern end of the site.
- Public lighting and associated services.

2. FLOOD RISK ASSESSMENT METHODOLOGY

2.1 General

The *Guidelines for Planning Authorities* and its Technical Appendices outline the requirements for a Site-Specific Flood Risk Assessment. The *Guidelines for Planning Authorities* requires that works:

- Avoid development in areas at risk of flooding.
- Substitute less vulnerable uses, where avoidance is not possible.
- Mitigate and manage the risk, where avoidance and substitution are not possible.

The key principles of the *Guidelines for Planning Authorities* are to apply the **Sequential Approach** to the planning process. Figure 2-1 of this report describes the mechanism of the sequential approach for use in the planning process.

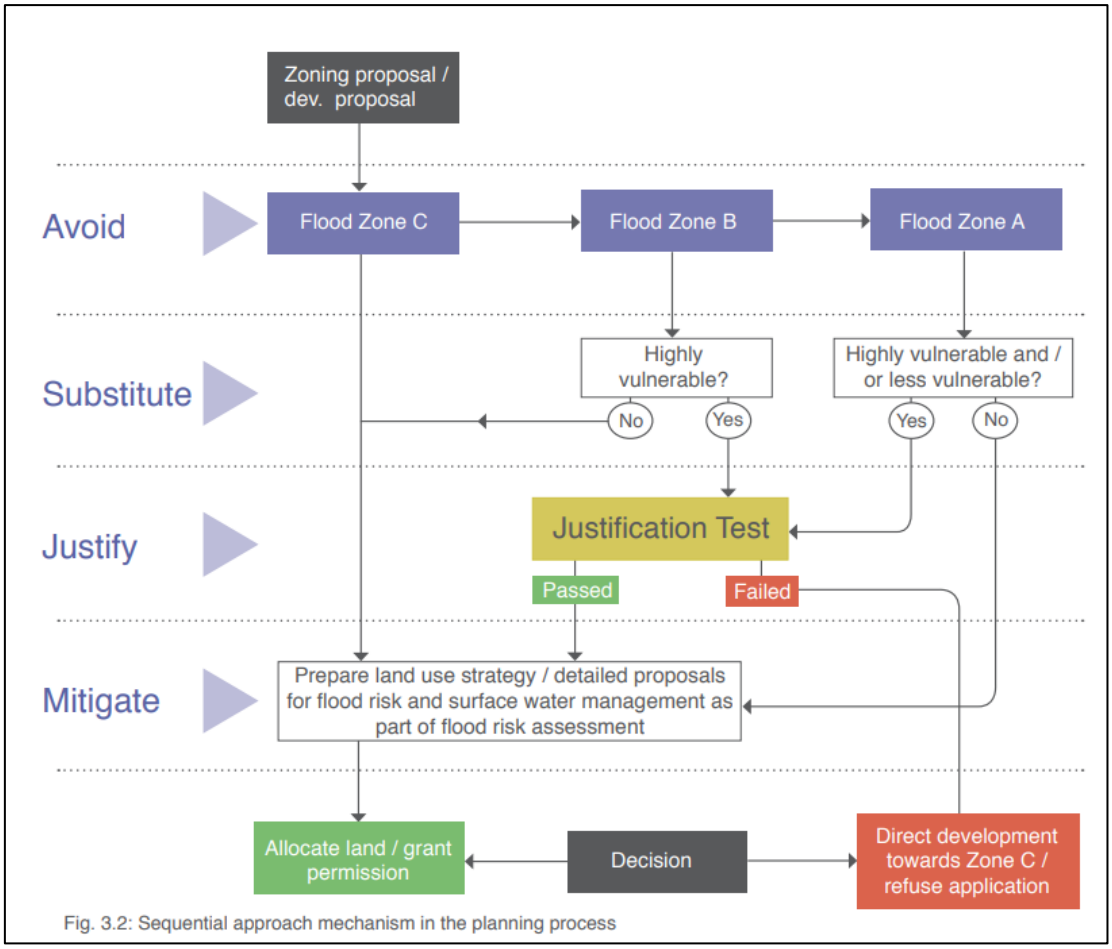

Figure 2-1: Sequential Approach Mechanism[1]

[1] Figure 3.2 of the *Guidelines for Planning Authorities*.

2.2 Source-Pathway-Receptor Model

The assessment of flood risk requires a thorough understanding of:

- The sources of flood water (e.g., high sea levels, intense or prolonged rainfall leading to runoff and increased flow in rivers and sewers)
- The pathways by which the flood water reaches those receptors (e.g., river channels, river and coastal floodplains, drains, sewers and overland flow).
- The people and assets affected by flooding (known as the receptors).

The Source-Pathway-Receptor (S-P-R) Model illustrated in Figure 2-2 has become widely used to assess and inform the management of environmental risks.

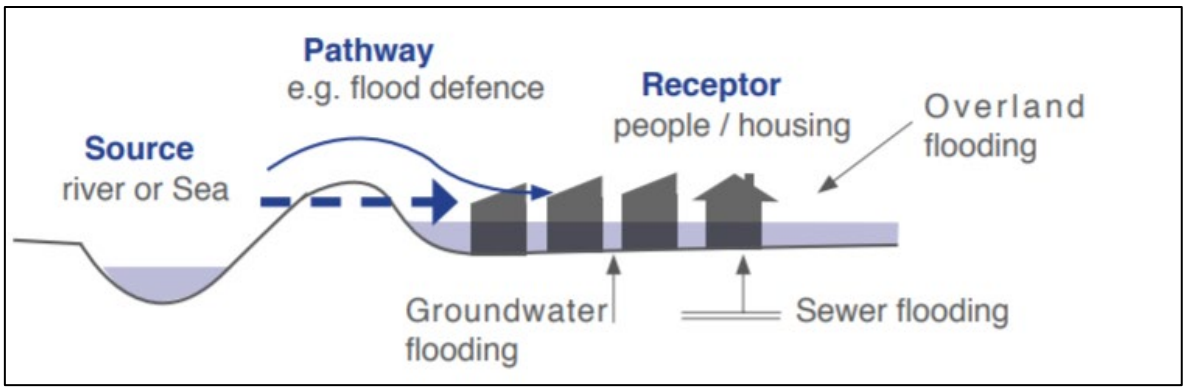

Figure 2-2: Source-Pathway- Receptor Model[2]

2.3 Likelihood of Flooding and Definition of Flood Zones

The *Guidelines for Planning Authorities* define the likelihood of flooding as the percentage probability of a flood of a given magnitude occurring or being exceeded in any given year. Likelihood of flooding is expressed as a return period or annual exceedance probability (AEP).

Flood Zones are graphical areas within which the likelihood of flooding is in a particular range. They are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. These flood zones are split into three categories in the *Guidelines for Planning Authorities*.

- **Flood Zone A** – where the probability of flooding from rivers and the sea is high (greater than 1% AEP for river flooding or 0.5% AEP for coastal flooding).
- **Flood Zone B** – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP and 1% AEP for river flooding and between 0.1% AEP and 0.5% AEP for coastal flooding).
- **Flood Zone C** – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding).

[2] Source: Fig 2.2 of the *Guidelines for Planning Authorities*.

2.4 Classification of the Proposed Development and Justification Test

The *Guidelines for Planning Authorities* categorises all types of development as either:

- Highly Vulnerable (garda, ambulances, schools, hospitals, dwelling houses, student halls…).
- Less Vulnerable (buildings used for: retail leisure, warehousing, commercial, industrial, and non-residential institutions,…).
- Water Compatible (flood control infrastructure, docks, marinas, amenity open spaces,...).

Full list of types of development and related vulnerability classes are provided in Table 3.1 of the *Guidelines for Planning Authorities*. Uses which are not listed in the table should be considered on their own merits.

The Sequential Approach restricts development types to occur within the flood zone appropriate to their respective vulnerability classes. Table 2-1 identifies the types of development appropriate for each flood zone and those that will require a Justification Test.

Table 2-1: Matrix of Vulnerability Versus Flood Zone[3]

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

The Justification Test has been designed to rigorously assess the appropriateness of developments that are being considered in areas of moderate or high flood risk. The test comprised the following two processes:

- The first is the Plan-making Justification Test which is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test which is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

2.5 Flood Risk Assessment Stages

The *Guidelines for Planning Authorities* outline that a staged approach should be adopted when carrying out a SSFRA.

[3] Source: Table 3.2 of the *Guidelines for Planning Authorities*.

These stages, see also Figure 2-3 below are:

- Stage 1 Flood Risk Identification.
- Stage 2 Initial Flood Risk Assessment.
- Stage 3 Detailed Flood Risk Assessment.

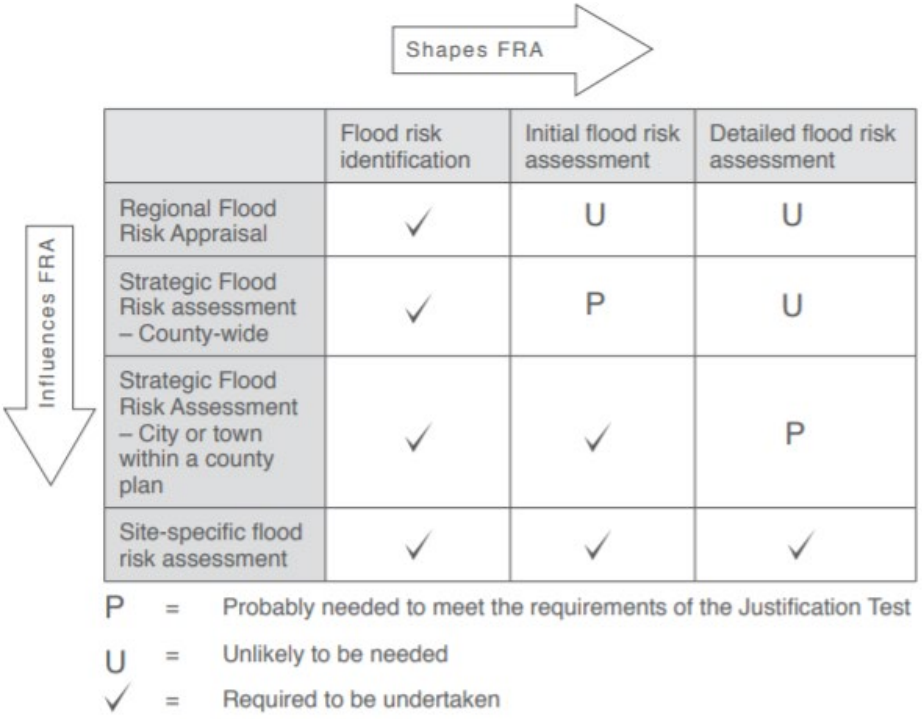

Figure 2-3: Flood risk assessment stages required per scale of study undertaken[4]

Stage 1: Flood risk identification – to identify whether there may be any flooding or surface water management issues relating to the proposed development site that may warrant further investigations. Flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site. Flood risks identified in this stage are then addressed in Stage 2.

Stage 2: Initial flood risk assessment – to confirm sources of flooding that may affect the development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of data addressed in Stage 1. Data where the flood risk at the site is recognized as being low is screened out and it is not further addressed in the report, data which recognized the flood risk on the site to be medium or high is further analyzed in the report.

Stage 3: Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

[4] Source: Appendix A of *Guidelines for Planning Authorities*, Table A3.

3. STAGE 1 – FLOOD RISK IDENTIFICATION

3.1 Information Sources

The flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site.

Data required for the flood risk identification was obtained from various sources, as listed in Table 3.1 below.

Table 3-1: Information Sources

Information Type	Source Consulted
OPW PFRA maps – Pluvial;	Available on: data.gov.ie
OPW PFRA maps – Fluvial;	Available on: data.gov.ie
Predictive and historic flood maps, and Benefiting Lands Maps;	Available on: www.floodinfo.ie
Predictive flood maps produced under the CFRAM Studies;	Available on: www.floodinfo.ie
Ashbourne Flood Alleviation Scheme Flood Map	Available on: www.floodinfo.ie
River Basin Management Plans and reports;	OPW Flood Risk Management Plan for River Basin 08 (2018)
Existing Flood Risk Assessments;	SSFRA for Zone 4 of ALP (Fehily Timoney & Co. (FT), 2016) Flood Risk Assessment and Management Plan for the Meath CDP 2020-2026 (JBA, 2019) ALP Bridge Section 50 Application for Zone 4 (RPS, 2019). Included in Appendix 5.
Expert advice from OPW who may be able to provide reports containing the results of detailed modelling and flood-mapping studies, including critical drainage areas, and information on historic flood events, including flooding from all sources;	Historic flood hazard maps and information obtained from OPW's website www.floodinfo.ie
Consultation with Local Authorities who may be able to provide knowledge on historic flood events and local studies etc.;	MCC
Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;	Updated 2021 Topographical Survey of the Site
Alluvial deposit and groundwater flooding maps of the Geological Survey of Ireland (GSI);	Available at https://www.gsi.ie
'Liable to flood' markings on the old '6 Inch' maps;	Historic OSI maps

Information Type	Source Consulted
Walkover survey to assess potential sources of flooding, likely routes for flood waters and the site's key features, including flood defences, and their condition; and	Walkover survey conducted
National, regional and local spatial plans, such as the National Spatial Strategy, regional planning guidelines, development plans and local area plans provide key information on existing and potential future receptors.	Ashbourne Local Area Plan (LAP) 2009-2015

3.2 Coastal/Tidal Flooding

The site is located approximately 20 km west of the Irish sea and over 60 m above sea level, therefore coastal/tidal flooding is not considered relevant to the site.

3.3 Groundwater Flooding

There are no indications of groundwater flooding in the subject site from the GSI data available and any of the sources listed in Table 3-1.

3.4 Fluvial Flooding

3.4.1 OPW Predictive and Historic Flood Maps, and Benefit Lands Maps and Flood Hazard Information

The OPW website www.floodinfo.ie advises the sections of the Broadmeadow River (reference: C1) and the Dunshaughlin Stream (reference: C1/8) within the Site are part of the Broadmeadow and Ward Arterial Drainage Scheme (ADS).

Arterial Drainage Schemes are schemes the OPW has a statutory duty to maintain. These schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. The purpose of the schemes was to improve land for agriculture, to ensure that the 3 – year flood was retained in bank this was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. The last schemes were completed in the 1990s.

The OPW Past Flood Event Local Area Summary Report included in Appendix 2 highlights previous flood events within a radius of 2.5 km of the subject site. The report lists a total of 4 flood events, 2 being single flood events and 2 being recurring flood events.

The two single flood events occurred in the Broadmeadow River in:

- November 2002, when a water depth of 2.62 m was measured from the Station 08003 in Fieldstown,
- August 1986 when a water depth of 2.32m was recorded at Station 08003 in Fieldstown and a water depth of 1.97m was recorded at Station 8007 in Ashbourne.

However, no flooding impacts were confirmed on the site from the information available on the events.

3.4.2 Preliminary Flood Risk Assessment Mapping (PFRA)

The Preliminary Flood Risk Assessment (PFRA) was a national screening exercise undertaken in 2011 by the OPW to identify area at potential flood risk. The country was divided in 420 map tiles for purposes of disseminating the output of the Preliminary Flood Risk Assessment (PFRA). These maps indicate the extent of the predicted 0.5% AEP (annual exceedance probability) coastal flooding, 1.0% AEP fluvial flooding and 1.0% pluvial flooding.

According to the PFRA map included in Appendix 3, Ashbourne is indicated as *Probable Area for Further Assessment* and the subject site is located within fluvial floodplain.

3.4.3 Strategic Flood Risks Assessments & Predictive Flood Maps

The following information was gathered from previous strategic flood risk assessments and predictive flood maps:

- Predictive Flood Maps from OPW's website (www.floodinfo.ie): CFRA mapping is currently 'under review' according to the OPW's website and only one fluvial extent map, prepared as part of the Ashbourne Flood Alleviation Scheme, is available on the website (refer to appendix 4).

  The Ashbourne Flood Relief Scheme was initiated in 2015 following major flooding in November 2014. The scheme comprises the construction of an overflow weir to divert flow to the Broadmeadow River and the improvements of channel and culvert capacity along channel C1/7 of the Broadmeadow and Ward Scheme to provide protection against a 1% AEP for 69 properties.

  The flood map identifies flood zones A and B within the subject site. The 1% AEP water levels at node points 4Ba16315 (south-western end of the Site) and 4Ba15720 (approximately 350 m downstream of the Site) are 64.42 mAOD and 63.5 mAOD respectively.
- SSFRA for Zone 4 of ALP (FT, 2016): Zone 4 of ALP is located approximately 70 m upstream of the subject site. Flood Zones A were identified in the development lands however the assessment concluded that the development was suitable for the flood risk present at the site. The development was constructed and no flooding has been recorded since its opening in October 2019.
- Flood Risk Assessment and Management Plan for the Meath CDP 2020-2026 (JBA, 2019): the report states that the Ashbourne Flood Relief Scheme would be completed by the end of 2020 and the pre-scheme flood map in OPW's website (www.floodmaps.ie) was the best flood risk estimate at the time of the assessment.

After consultation of OPW's website for this assessment the status of predictive flood maps covering the subject site are currently under review and the pre-scheme flood map (see Appendix 4) is still the best estimate available. Flood Zones A and B are identified within the Flood Risk Assessment carried out by JBA in 2019.

- ALP Bridge Section 50 Application for Zone 4 (RPS, 2019. See Appendix 5): large extents of the Broadmeadow River and Dunshaughlin Stream, including the sections within the subject site, were modelled as part of this assessment. The report provides a re-evaluated 1% AEP level of 64.102mAOD at 57m upstream of the currently constructed bridge in Zone 4 of ALP development located to the east of subject site.

3.4.4 Other Sources

Other information sources consulted for the flood risk identification exercise are outlined in Table 3-2 below.

Table 3-2: Other Information Sources Consulted

Information Source	Identified Flood Risks	Flood Risks at Site
River Basin Management Plans and reports - OPW Flood Risk Management Plan for River Basin 08 (2018)	The report lists two additional flood events in Ashbourne in August 2008 (Pluvial/Fluvial) and November 2014 (Fluvial).	Possible
Local Authorities – MCC	No additional flood risks identified for this source.	None indicated
Topographical Survey	Generally consistent topographic fall across site and towards watercourses except for two isolated depression areas. Depression areas are located in the south-eastern corner of the site, where the proposed car park is located (refer to Appendix 1), and in the western end of the site to the north of the confluence between the Broadmeadow River and Dunshaughlin Stream.	Possible
GSI maps	Topsoil in the vast majority of the Site is classified as *Alluvium*, except for a section of the south-eastern corner of the site where topsoil is classified as *Till derived chiefly from limestone*. Similarly sub-soil in the vast majority of the Site is classified as *Alluvium* while a section of the south-eastern corner of the site is classified as *Till derived from limestones.*	None indicated
Historic OSI Maps	None	None indicated

Information Source	Identified Flood Risks	Flood Risks at Site
Walkover survey	A site walkover was carried out on the 25th of March 2021 and no signs of flooding were identified within the Site.	None indicated
National, regional and local spatial plans – Ashbourne Local Area Plan (LAP) 2009-2015.	The Site is within the objective Zone F1 of Ashbourne LAP: '*to provide for and improve open spaces for active and passive recreational amenities*'.	None indicated

3.5 Source-Pathway- Receptor Model

A Source-Pathway-Receptor model, see Table 3-3 summarizes the possible sources of floodwater, the receptors that maybe affected by potential flooding and the pathways by which flood water may reach the receptors. These sources, pathways and receptors will be assessed further in the Stage 2 the initial flood risk assessment.

Table 3-3: Source-Pathway-Receptor Analysis

Source	Pathway	Receptor	Likelihood	Risk
Tidal/Coastal	Broadmeadow River	Future Development and Pedestrians.	Unlikely	Low
Fluvial	Dunshaughlin Stream and Broadmeadow River	Future Development and Pedestrians.	Likely	Medium
Pluvial	Increased runoff from developed site increasing flood levels	Future Development and Pedestrians.	Likely	Medium
Groundwater (GW) flooding	Rising GW level on the site	Future Development and Pedestrians.	Unlikely	Low
Human/mechanical error (pluvial)	Existing Services	Future Development and Pedestrians.	Unlikely	Low

3.6 Development Classification

The proposed development is listed as a 'water-compatible development' in the *Guidelines for Planning Authorities* under the following description: 'amenity open space, outdoor sports and recreation and essential facilities such as charging rooms'. Hence the proposed development is appropriate for Flood Zones A, B and C without the need for a justification test.

4. STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

Flood risks identified during *Stage 1 – Flood Risk Identification* and outlined in Table 3-3 are noted below.

- Risk of fluvial flooding from the Dunshaughlin Stream and Broadmeadow River;
- Risk of pluvial flooding.

These risks are assessed further in this section of the SSFRA.

4.1 Fluvial Flood Risk Assessment

The *Stage 1 – Flood Risk Assessment Identification,* identified *fluvial* flooding as the most likely flood risk at the subject site.

The predictive fluvial flood map (see Appendix 4) developed as part of the Ashbourne Flood Alleviation Scheme (AFAS) provides the predicted extents of 0.1% AEP (low risk), 1% AEP (medium risk) and 10% AEP (high risk) fluvial flooding within the subject site.

The flood map shows flood zones A and B within the subject site. Flood zone A is mainly located in the south-western and north-eastern ends of the Site and a section of the north-western end of the Site. Flood zone B is located across the north-western and south-eastern ends of the site.

There are two relevant node points indicated in the flood map: 4Ba16315 (south-western end of the Site) and 4Ba15720 (approximately 350m downstream of the Site). Water levels at 1% AEP and 0.1% AEP are presented in Table 4-1 below. Flood levels for future scenario are not available therefore for the purpose of this exercise it is assumed that 0.1 % AEP current scenario is the equivalent to 1% AEP Mid-Range Future Scenario (MRFS).

Table 4-1: Flood levels at relevant node points

Water Level	Node 4Ba16315	Node 4Ba15720
1% AEP	64.42 mAOD	63.50 mAOD
0.1% AEP (1% MRFS)	64.93 mAOD	64.16 mAOD

A Section 50 Application prepared by RPS in 2019 (see Appendix 5) for the pedestrian bridge constructed as part of Zone 4 of ALP provided a re-assessment of flood levels in the Broadmeadow River. These re-evaluated flood levels made provision for a 20% increase in flow (MRFS) to accommodate the climate change expectation.

Flood levels at Node 4Ba15720 assessed in the Section 50 application concluded that the proposed 1% AEP flood level at this point based on the bridge constructed in Zone 4 of ALP is 63.841 mAOD. This proposed level is 319 mm lower than the estimated 0.1% AEP MRFS flood level in the AFAS flood map.

It is also noted that flood extents within the site from the modelling carried out under the Section 50 application are considerably less than extents defined in the AFAS flood map. See Figure 4-1 below (site boundary indicative only) and Appendix 5 for full report.

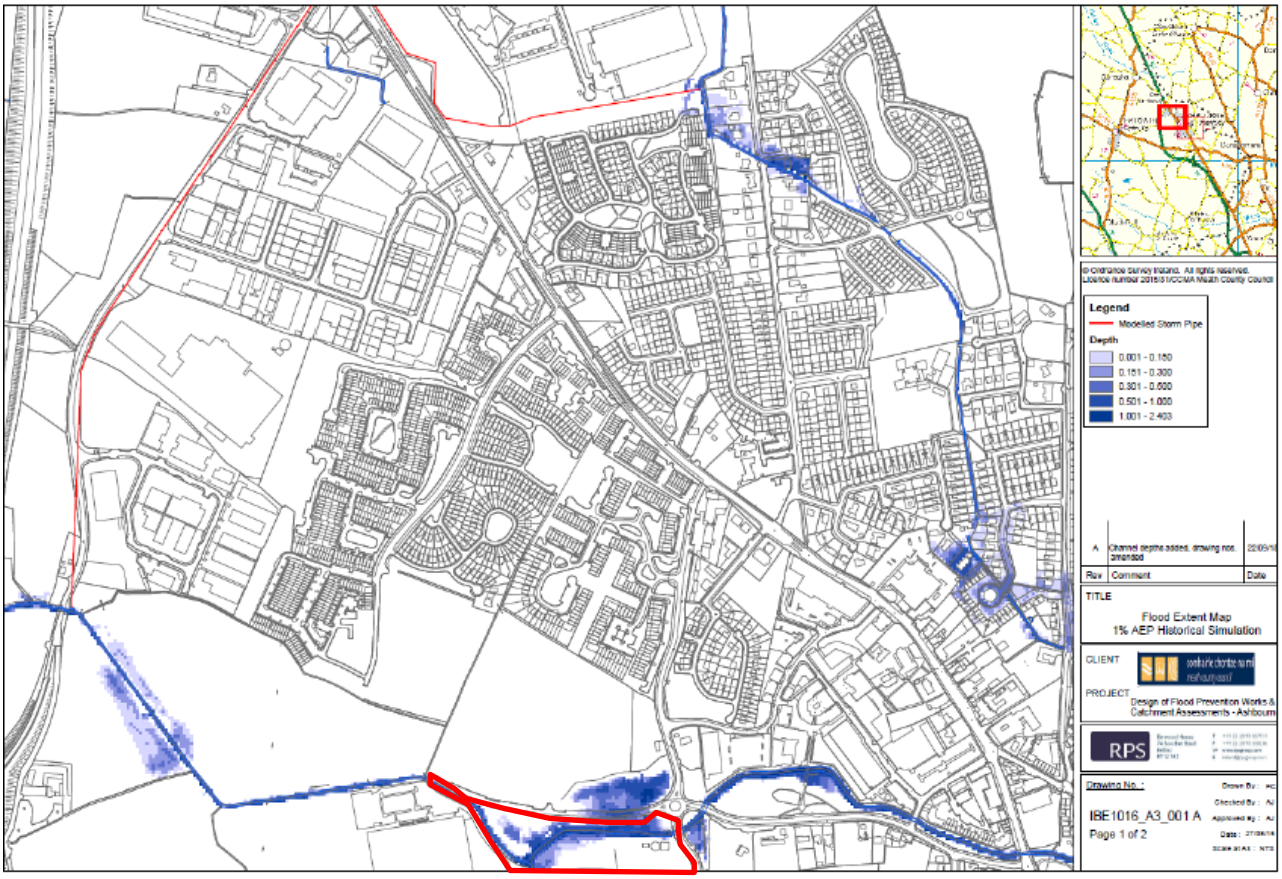

Figure 4-1: Flood Extents from Section 50 Application (1% AEP Historical Simulation)

The Section 50 application report also provides a proposed 1% AEP MRFS flood level of 64.102 mAOD at cross section marker 4Ba15849. This cross section is located 57 m upstream of upstream bridge deck, making it the closest downstream node to the site. Hence it was considered more appropriate to utilize this 1% AEP MRFS water level instead of the water level provided in node 4Ba15720 in the predictive flood map for the purpose of this Initial Flood Risk Assessment.

Relevant water levels for 1% AEP MRFS are summarised in Table 4-2 below. The assessment of the fluvial flood risk for the proposed development was carried out applying two different 1% AEP MRFS flood levels in the western half of the development (upstream) and the eastern half of the development (downstream). The 1% AEP MRFS flood level assigned upstream and downstream of the development are 64.93 mAOD and 64.102 mAOD respectively.

Table 4-2: 1% AEP MRFS Water Levels at Points of Interest

Water Level	AFAS Flood Map Node 4Ba16315 (mAOD)	Section 50 Application Cross Section Marker 4Ba15849 (mAOD)
1% AEP MRFS	64.93	64.102

Table 4-3 below compares the proposed levels at the proposed infrastructures for the development with the flood levels presented in Table 4-2. The proposed car park, located on the eastern half of the development, is approximately 400 mm above the 1% AEP MRFS water level. The proposed skate park and footbridge, both located on the western half of the development, are 200 mm and 600 mm above the 1% AEP MRFS water level respectively.

Table 4-3: Proposed and Existing Levels

Location	Average Existing Ground Level (mAOD)	Proposed Level (mAOD)	1% AEP MRFS Water Level (mAOD)
Proposed Skate Park	64.75	65.13	64.93
Proposed Car Park	64.50	64.50	64.10
Proposed Footbridge	64.20	65.53 (soffit level)	64.93

The proposed car park is considered to be located within Flood Zone C as per assessment carried out in the Section 50 application report.

The proposed skate is considered to be located within Flood Zone B as the fluvial flood extents map (Appendix 4) indicate 0.1% AEP fluvial flood extents in the north-western end of the site and the Section 50 application report (Appendix 5) also shows flood risk in the same area of the site (Figure 4-1).

The proposed footbridge is located within Flood Zone A, however the construction of the footbridge is subject to a Section 50 application.

4.2 Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for pluvial flood risk with the development related to the increase of impermeable surface within the subject site.

The impermeable area of the development results in approximately 2200 m^2 including the proposed skate park, footpaths, riverside walk and vehicle access to the proposed parking area. This area only represents approximately 7.6% of the site area. This impermeable area is not considered to have significant impact on the development as runoff from these surfaces will drain to the surrounding landscaped areas and excess runoff will follow the natural falls to the Broadmeadow River. In addition, the design of the proposed parking area build-up involves Sustainable Drainage Systems (SuDS) by including a surface of reinforced gravel to allow natural infiltration of surface water.

It is expected that existing services identified within the site during the site walkover as described in Table 3-2 will be decommissioned as part of the construction works, reducing further flood risk at the site.

The two depressed areas mentioned in Table 3-2 are two isolated areas covering approximately 1400 m^2 which represent 4.83% of the site area and therefore these areas are not considered to have an impact on the proposed development.

In conclusion it is considered in this *Stage 2 - Initial Flood Risk Assessment* that the pluvial flood risk within the site is not significant and therefore will not be further assessed in *Stage 3 – Detailed Flood Risk Assessment*.

5. STAGE 3 – DETAILED FLOOD RISK ASSESSMENT

Since pluvial flooding was considered negligible in *Stage 2 – Initial Flood Risk Assessment* the Detailed Flood Risk Assessment will only consider fluvial flooding within the proposed development in relation to the following:

- Proposed development.
- Impact on adjacent areas.
- Any residual risks.
- Flood mitigation measures.

5.1 Proposed Development

In *Stage 2 – Initial Flood Risk Assessment* it was established a 1% AEP MRFS water levels upstream and downstream of the site were 64.93 mAOD and 64.10 mAOD respectively.

The proposed levels at the proposed car park (64.50 mAOD) and the skate park (65.13 mAOD) as indicated in Appendix 1, are both above the 1% AEP MRFS water level.

The proposed car park will have approximately 400 mm freeboard. Vehicular access to the proposed car park from the existing local road to the east of the subject site will be higher than the proposed level at the car park which will provide safe access and egress to and from the car park in case of flooding within the site.

The proposed skate park will have 200 mm freeboard. It is noted that the proposed structure will require further build-up of existing levels to achieve the proposed level presented in Appendix 1, therefore compensation works will be required as the proposed skate park was identified within Flood Zone B in *Stage 2*. Table 5-1 presents an estimated compensatory volume required for the proposed skate park.

Table 5-1: Estimated Compensatory Volume for Proposed Skate Park

Area of Skate Park (m^2)	Average Existing Ground Level (EGL) (mAOD)	1% AEP MRFS WL (mAOD)	1% AEP MRFS WL – EGL (mm)	Compensation Volume (m^3)
500	64.75	64.93	180	90

The proposed footbridge is identified in Stage 2 as being within Flood Zone A. The construction of the footbridge will potentially increase flood levels and reduce the floodplain area available within the site. Hence, 'level for level' compensation will be required to provide additional storage volume for flood water within the proposed development. Specific impacts on flood levels and compensation volumes required from the construction of the footbridge will be assessed at detailed design for the submission of a Section 50 application.

Potential areas for compensation purposed are identified in the proposed layout included in Appendix 1.

5.2 Impact on Adjacent Areas

It is noted in the flood map available in Appendix 4 and the Section 50 Application in Appendix 5 that some areas of the local roads bounding the site to the north and east are subject to flooding. These areas may be at risk of flooding if water reach the 1% AEP MRFS water levels presented in Table 4-2. However, the provision of compensation volumes within the subject site should neutralise any potential increase in the flood risks to adjacent areas from the proposed development.

5.3 Residual Risk

Remaining residual flood risks following the detailed assessment include the following:

- Areas subject to flooding within the subject site up the 1% AEP MRFS flood levels presented in Table 4-2.
- Blockage of existing culverts described in Section 1.7 of this report.

5.4 Flood Mitigation Measures

Proposed mitigation measures to address residual flood risks are summarized below:

1. Provision of flood warnings and evacuation plans including coordination with relevant emergency services.
2. Ensuring public awareness of flood risks to local residents.
3. Regular supervision and maintenance of existing culverts.

It is considered that the flood mitigation measures listed above if implemented are sufficient to provide a suitable level of protection to the proposed development.

6. CONCLUSION

The SSFRA for the proposed development at Ashbourne was undertaken in accordance with the requirements of the guidelines produced by the Department of Environment, Heritage and Local Government (DoEHLG) – *"The Planning System and Flood Risk Management -Guidelines for Planning Authorities"* (November 2009).

The proposed development is listed as a 'water-compatible development' in the *Guidelines for Planning Authorities* under the following description: 'amenity open space, outdoor sports and recreation and essential facilities such as charging rooms'.

The proposed developments includes three main infrastructures: a car park, a skate park and a footbridge. Following the flood risk assessment stages it was determined the proposed car park is within Flood Zone C, the proposed skate park is within Flood Zone B and the proposed footbridge is within Flood Zone A.

Compensation works were assessed for the construction of the proposed skate park concluding that an estimated compensatory volume of 90 m^3 will be required.

The construction of the proposed footbridge will potentially increase flood levels and will reduce the floodplain area available within the site. Therefore, 'level for level' compensation will be required to provide additional storage volume for flood water within the proposed development. Specific impacts of the footbridge on the Site and compensation volumes required will be assessed at detailed design for the submission of a Section 50 application.

It is concluded that:

- The proposed development is appropriate for the Site's flood zone category.
- The *Guidelines for Planning Authorities* sequential approach is met and the 'Avoid' principal achieved.
- A Justification Test is not required for the proposed development.

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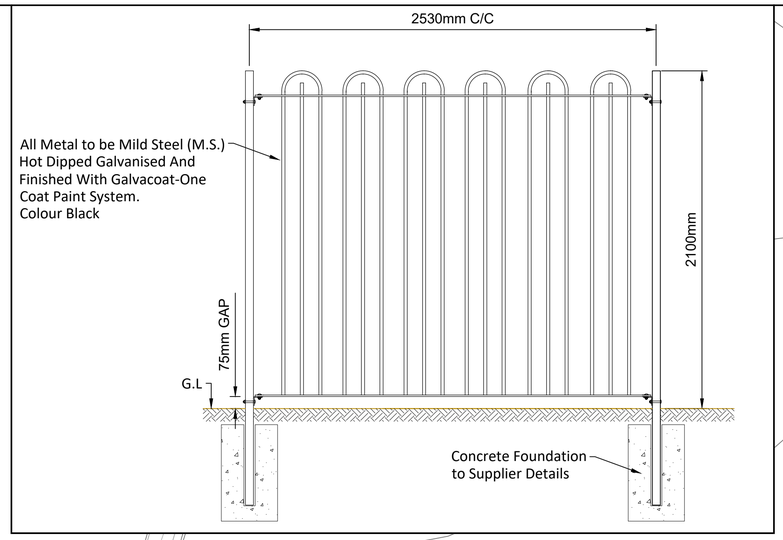
APPENDIX 1

PROPOSED LAYOUT



TYPICAL RAILING DETAIL 1

Scale 1:75

PLAN

Scale 1:750

Legend

- Site Boundary
- +64.750 — Proposed Design Level - Subject to Section 50 Application and Detailed Design
- * — Potential Area for Compensatory Flood Plain (Subject to Detailed Design and Section 50 Application)
- SuDS Paving System
- Proposed Bike Rack
- Existing Water Feature
- Proposed Landscape Screening
- Proposed Upgrade of Existing Fence to Bow Top Railing as per Typical Detail
- Proposed Gate

0m 8m 15m 23m 30m 38m 45m 53m 60m 68m 75m

Scale 1:750

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Rev.	Description	App By	Date
A	Issue For Comment	JON	15.07.21
B	Issue For Planning	JON	19.08.21

PROJECT: **ASHBOURNE SKATE PARK**

CLIENT: **MEATH COUNTY COUNCIL**

SHEET: **SITE LAYOUT**

Date: 15.07.21

Project number: P20-343

Scale (@ A1-): 1:750

Drawn by: NS

Checked by: GL

Drawing Number: **P20-343-0100-0002**

Rev: **B**

O:\ACAD\2020\P20-343\P20-343-0100-0002

Wednesday 1 December 2021

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APPENDIX 2

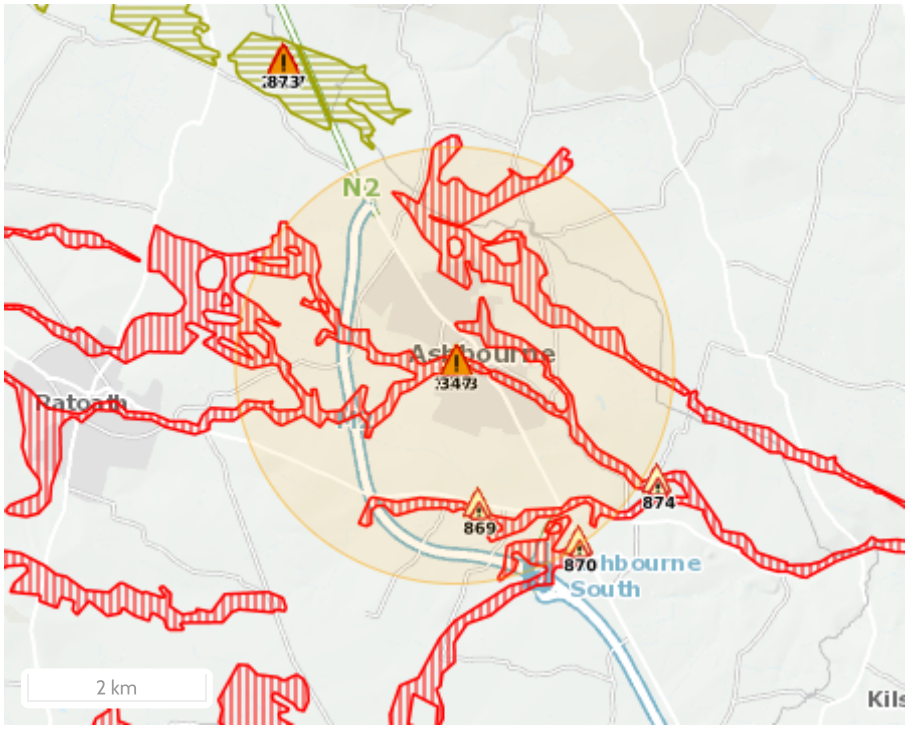
OPW PAST FLOOD EVENT LOCAL AREA SUMMARY REPORT

Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: **14/7/2021 11:53**

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



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

4 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Broadmeadow Ashbourne Nov 2002 (ID-347)	15/11/2002	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Fairyhouse Baltrasna Recurring (ID-869)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (1)		
3.	Fleenstown Recurring (ID-870)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
4.	Broadmeadow Ashbourne Aug 1986 (ID-1693)	25/08/1986	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		

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APPENDIX 3

OPW PFRA MAP

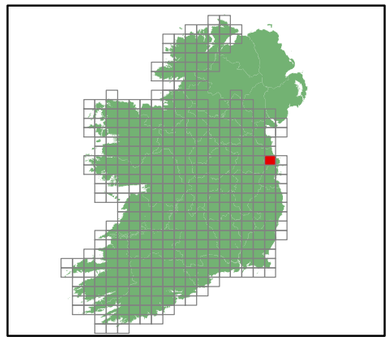
BALBRIGGAN

OLDTOWN

ASHBOURNE

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 / 274 / A

Revision 0

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

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APPENDIX 4

OPW ASHBOURNE FLUVIAL EXTENT MAP

Node Label	Water Level (mOD) 10% AEP	Flow (m3/s) 10% AEP	Water Level (mOD) 1% AEP	Flow (m3/s) 1% AEP	Water Level (mOD) 0.1% AEP	Flow (m3/s) 0.1% AEP
BR1279	67.88	8.34	68.5	12.27	69.13	16.71
BR0774	65.78	9.02	66.07	13.91	66.31	16.83
BR0275	64.31	9.35	64.78	15.2	65.18	21.21
4Ba16658	64.62	12.08	65.1	20.15	65.43	27.19
4Ba15720	62.82	19.47	63.5	31.65	64.16	41.98
4Bau2584	77.31	1.53	77.49	2.56	77.64	3.69
4Bau2085	72.35	1.71	72.73	3.04	73.13	4.38
4Bau1610	66.87	2.83	66.98	3.44	67.05	3.48
4Ba16315	63.93	12.39	64.42	21.06	64.93	28.96

303500 304000 304500 305000 305500 306000

253500 253000 252500 252000 251500

FINGAL EAST MEATH CFRAM MODEL ENDS

ASHBOURNE MODEL BEGINS

4Bau2584

4Bau2085

4Bau1610

COOKSTOWN
(CO KILDREW)

BR1279

BR0774

BR0275

Indicative Site Location

BALLYBIN

FINGAL EAST MEATH CFRAM MODEL ENDS

KILLEGLAND

4Ba15720

4Ba16658

4Ba16315

ASHBOURNE MODEL BEGINS

250 0 250 500 750 1000 Meters

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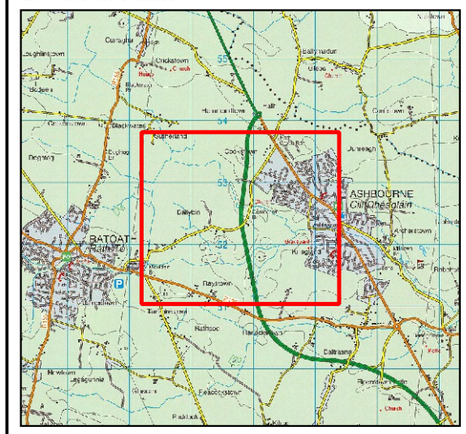
Location Plan:



LEGEND

- AFA Boundary
- Defended Area
- Modelled River Centreline
- Node Point
- 10% AEP Fluvial Extent (High Risk)
- 1% AEP Fluvial Extent (Medium Risk)
- 0.1% AEP Fluvial Extent (Low Risk)
- Flood Defence - Embankment
- Flood Defence - Wall
- Gate
- NODE123 — Node Label
- x.x% AEP — Standard of Protection of Flood Defence

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Project:

ASHBOURNE FLOOD ALLEVIATION SCHEME

Map:	ASHBOURNE FLUVIAL EXTENT MAP		
Map Type:	EXTENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn by:	IH	Date:	Mar - 2019
Checked by:	SH	Date:	Mar - 2019
Approved by:	SH	Date:	Mar - 2019
Map No.:	E08ASH_EXFCD_F0_28		
Revision: F0			
Map Scale: 1:10000		Plot Scale: 1:1 @ A3	

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APPENDIX 5

ASHBOURNE LINEAR PARK
BRIDGE SECTION 50
APPLICATION FOR ZONE 4

ASHBOURNE LINEAR PARK BRIDGE

Section 50 Application

MDW0850 - Linear Park
Section 50 Application
A01
15 May 2019

rpsgroup.com

Document status					
Version	**Purpose of document**	**Authored by**	**Reviewed by**	**Approved by**	**Review date**
A01	For Approval	ROS	PM	VMcA	May 2019

Approval for issue		
Vincent McArdle	Vincent McArdle	May 2019

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Contents

Figures

Appendices

1 INTRODUCTION

RPS was commissioned by Meath County Council to undertake an hydraulic assessment for a proposed bridge crossing the Broadmeadow River to supplement a Section 50 application.

This report has been prepared in order to obtain the consent of the Office of Public Works (OPW) under the Section 50 of the 1945 Arterial Drainage Act (and subsequent amendments), for the construction of this hydraulic structure over the Broadmeadow River. This report includes an outline of the hydrological calculations, methods used and assumptions made relating to the assessment of the hydraulic structure.

The Section 50 Application form completed for the proposed structure is included in Appendix A of this report.

2 PROPOSED BRIDGE

The location for the proposed bridge is over the Broadmeadow River within Linear Park, Ashbourne Co. Meath. The location and the extent of the proposed bridge is indicated in **Figure 2-1** below.

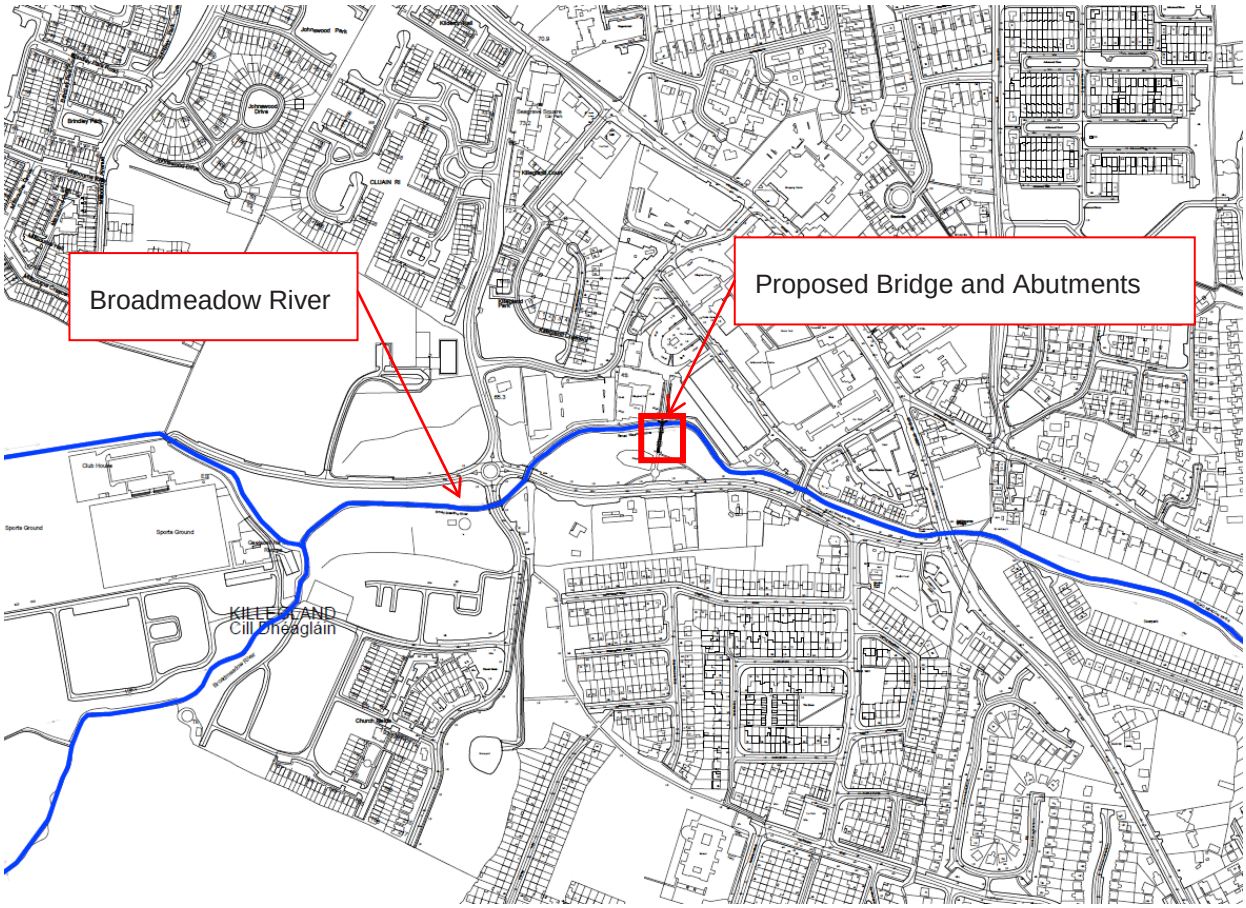


Figure 2-1 Proposed Bridge and Abutment Location

The proposed bridge installation which requires Section 50 approval consists of an open span bridge with 4 abutments to be installed within the river channel. The total span proposed across the Broadmeadow River is 36.104m and the minimum depth above the channel is 3.2m. Further details of the composition of the bridge and relevant dimensions are shown in the drawings included in Appendix B of this report.

3 HYDROLOGY

3.1 Catchment Description

The Broadmeadow River upstream of the proposed bridge location originates at Garretstown / Trevet to the north of Dunshaughlin at an elevation of approximately 125m OD and flows generally in a west to east direction beneath the N2 towards Ashbourne where it is joined by the Ratoath Stream.

The Broadmeadow River downstream of the proposed bridge location then continues east for approximately 13km to its outfall to the Irish Sea near Seatown West. The catchment area upstream of the proposed bridge location is 41.13km^2 and is underlain by low permeability subsoil and an aquifer layer with moderately productive bedrock. This is reflected by a predominantly low bulk recharge coefficient indicating that rainfall landing on the catchment does not readily reach lower bedrock layers. It has an average BFIsoil of 0.42 and so whilst deep groundwater recharge is not high, there is an element of subsurface flow such that the catchment would not be expected to be particularly flashy in terms of response to rainfall under normal conditions.

3.2 Data Collection

Hydrometric and rainfall data was collated from hydrometric stations and rainfall stations within the Broadmeadow River catchment. The locations for the hydrometric and rainfall stations are shown in **Figure 3-1** below.

Figure 3-1 Hydrometric and Rainfall Data Availability

There are three hydrometric stations within the Broadmeadow River Catchment detailed in **Table 3-1** below.

Table 3-1 Hydrometric Stations

Station No:	Comments
8007 (Ashbourne)	Located within Ashbourne town and has been inactive since 1994
8003 (Fieldstown)	Located approximately 7km downstream of Ashbourne and inactive. It was removed from the FEM FRAM Study following consultation with the EPA which indicated that flows had not been checked.

Station No:	Comments
8008 (Broadmeadow at Swords)	Located 10km downstream of Ashbourne and is still in operation

There are daily rainfall stations located within the catchment at Dunshaughlin and Ratoath and nearby at stations Warrenstown and Garristown. Synoptic stations are also located nearby at Dublin Airport and Dunsany.

3.2.1 Previous Flood Event Hydrometric Data

Observed data on the River Broadmeadow for significant flood events were reviewed and their flood event frequency was estimated. It was then determined whether any of the events were sufficiently robust to be used for model calibration. Similarly, return periods were estimated from rainfall data. This allowed an overall picture to be built to identify a design flood event for model simulation and comparison with observed data at the gauging station locations. The recorded water level data from Ashbourne gauging station was compared with simulated water levels at the location of the gauge.

The FSU methodologies for Single Site Flood Frequency Analysis and Depth Duration Frequency (DDF) model where utilised were used to estimate the return periods for hydrometric data and rainfall data respectively.

The only flood event for which observed data was available within the modelled extent was August 1986 which was recorded by the now inactive Station 8007. Therefore, this is the key flood event for model calibration which was estimated as a 20 year return period event. Simulated peak water levels were compared with observed peak water levels to mitigate the impact of any uncertainty with the gauge rating which is only reliable up to Q_{med}. It should also be noted that this gauge has been inactive since 1994 with no spot gauging data or updates to the rating since then.

Subsequent flood events in 2002, 2008 and 2014 were not recorded by the Ashbourne gauge. They were recorded further downstream on the Broadmeadow at Swords. The 2002 and 2014 events are estimated as approximately 1% AEP and there is enough spatial flooding information to enable a reality check on the model by comparing model outputs for the 1% AEP design event with historical flood extents. **Table 3-2** summarises the historical flood events reviewed for model calibration / reality check purposes.

Table 3-2 Summary of Historical Flood Events

Station	Flood Events			
	Date	Peak Flow (m3/s)	Estimated Return Period	Comments
Ashbourne – 8007	25/08/1986	18.8	20	Prolonged heavy rainfall. Gauge located within modelled extent. 20% AEP Design event to be simulated and compared with observed peak water levels at Station.
Swords – 8008	25/08/1986	69.7	5 - 10	Prolonged heavy rainfall. Not located within modelled extent so not used for model calibration.
	13/11/2002	123.7	~100	Highly localised high intensity low frequency storm event. Gauge not located within modelled extent so not used for model calibration. However, indication of 1% AEP will be used for the event will be compared with model outputs for the 1% AEP design event.
	09/08/2008	69.7	5 - 10	Highly localised high intensity low frequency storm event. Not located within modelled extent and lack of flood extent information so not used for model calibration / reality check.

Station	Flood Events			
	Date	Peak Flow (m3/s)	Estimated Return Period	Comments
	14/11/2014	-	~100	Highly localised high intensity low frequency storm event. Not located within modelled extent so not used for model calibration. However, indication of 1% AEP will be used as a reality check whereby spatial flood information for the event will be compared with model outputs for the 1% AEP design event.

3.3 Catchment Boundary

As part of the FSU Programme, catchment data for use in hydrological analysis has been generated at thousands of locations (gauged and ungauged) across Ireland. These locations have been identified by placing node-points at 500m centres along the entire Irish river network (Environmental Protection Agency's blue line river network). Each node-point is provided on a GIS point shapefile with an attribute table containing a range of data including Physical Catchment Descriptors (PCDs) and catchment IDs. Each catchment ID has an associated GIS Polygon Shapefile denoting the catchment boundary and area. These were generated using an automated GIS modelling approach during FSU development. Relevant node-points and catchment boundaries were extracted for the River Broadmeadow and reviewed. The overall catchments used in the Fingal East Meath (FEM) Flood Risk Assessment Management (FRAM) study were reviewed and found to be the same.

The review of catchment boundaries for the River Broadmeadow resulted in updates as shown on **Figure 3-2** as represented based on the catchment area of Hydrometric Station 08007 in Ashbourne. It can be seen that the OPW drainage scheme resulted in changes to the catchment and river network that are not accounted for in the FEM FRAM Study / FSU. Therefore, the catchment boundaries were updated for this Study as shown in yellow for Station 08007 and all associated sub catchments /HEPs.

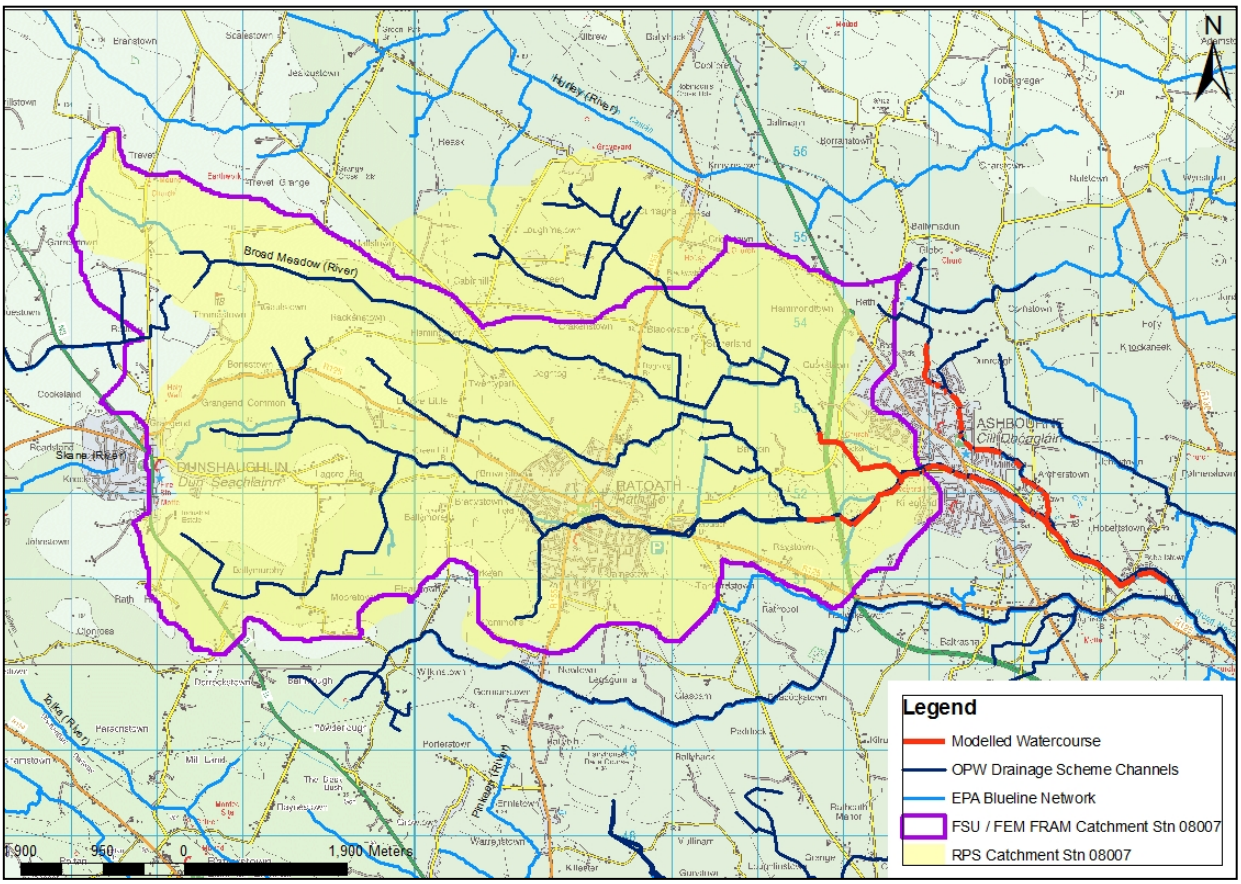


Figure 3-2: Broadmeadow Catchment Review (based on Ashbourne Gauge catchment 08007)

3.4 Estimation of the Design Flood

The estimation of design flows is based on the best practice guidance for Irish catchments generally as outlined in the FSU and compared with other methodologies where these are considered appropriate.

3.4.1 Design Index Flow (Q_{med}) Assessment

Station 8007 was used as the pivotal station for the Hydrological Estimation Points (HEPs) on the Broadmeadow River. Stations 08007 and 08008 were considered as both stations are located within the same watercourse. However, there is a significant difference in the adjustment factor to be applied of 0.73 and 1.8 respectively. This means that the Q_{med} result could be very different depending on the pivotal site chosen.

There is particular uncertainty with the rating at the Broadmeadow gauge (Station 08008) which has a significant effect on the gauged Q_{med} and therefore the pivotal adjustment factor. If the FEM FRAM Study rating is applied to this station, the adjustment factor changes from 1.8 to 1.08. Using 1.8 as an adjustment factor results in a Q_{med} of 21 m^3/s which is well beyond the 68%ile upper confidence limit of 15.22m^3/s for Station 08008. This lack of confidence in the rating and the uncertainty associated with the adjustment factor rules out the use of Station 08008 as a pivotal site.

Using Station 08007 as a pivotal site for the Upstream Limit HEPs on the Ratoath Stream and Broadmeadow upstream of the gauge location is generally preferable as it is on the same watercourse and the incoming flows must tie in with the observed flow at the gauge during model simulation. This means that estimated flows for the Broadmeadow River would be reduced by a factor of 0.73.

.

The locations of the HEPs applied to the Broadmeadow River are indicated in **Figure 3-3** below.

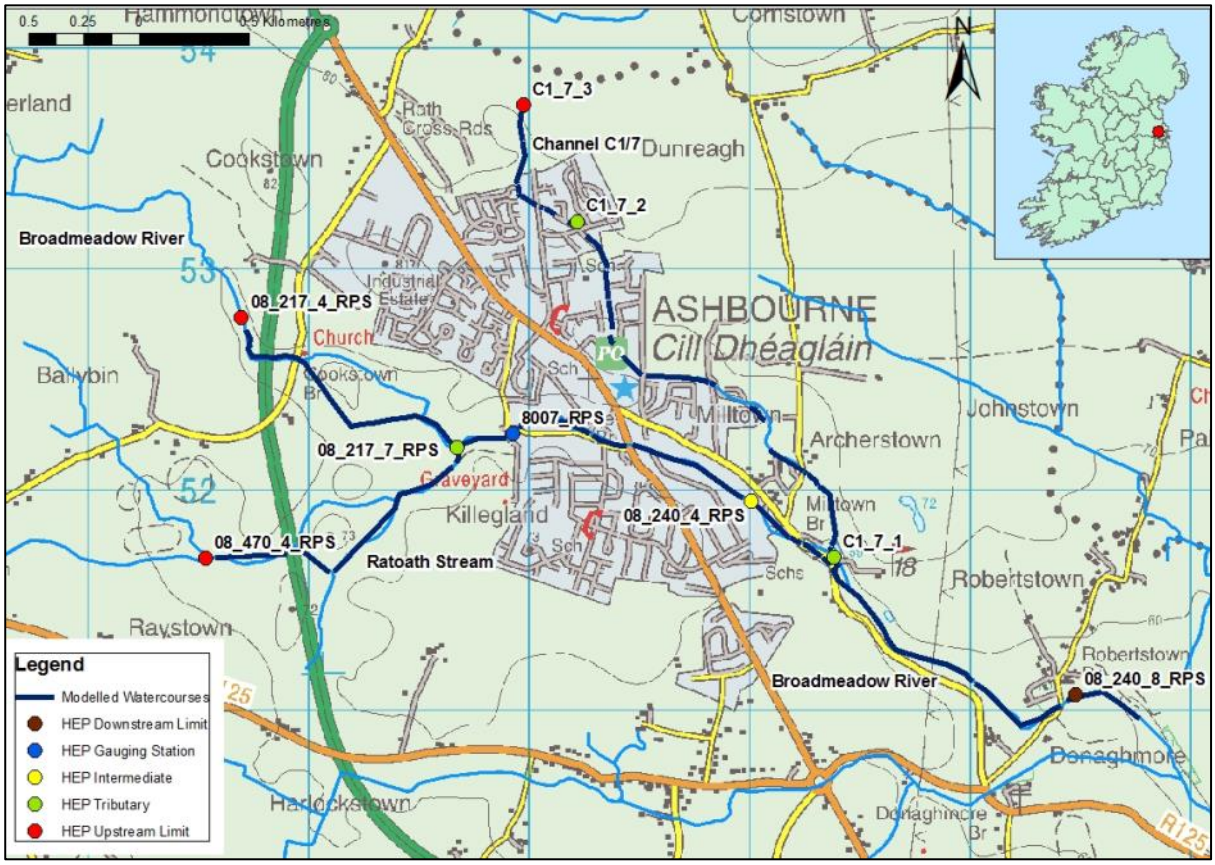


Figure 3-3 Locations of HEPs

Therefore, the Q_{med} values determined using the FSU method for all HEPs on the Broadmeadow River are applied to the hydraulic model for the following reason

- Station 8007 is the most hydrologically and geologically similar pivotal site that produces a Q_{med} result (8.96m^3/s) within the 68%ile confidence limits of that which is based on catchment descriptors;

The Q_{med} values was also obtained for the HEPS on the Channel C1/7 catchment in order to model the spillage from Channel C1/7 at Rathlodge to the Broadmeadow River upstream of the proposed bridge location via an overflow during the 1% AEP event. Further detail on the extent of the overflow at Rathlodge is provided in **Section 4.4** below

To estimate the design flows from the Q_{med} values the FEM FRAM generated growth curves are used as it is considered conservative.

3.4.2 Growth Curve Assessment

Growth curves were developed within the FEM FRAM Study on a regional basis for Hydrometric Area (HA) 09. The results of this analysis have been used in this Study also. Full details of the methodology can be found in the NWNB CFRAM Study Unit of Management 01 Hydrology Report (Rp0006), RSP, July 2013.

A study area growth curve was derived using the FEH pooled group methodology, using AMAX series of the pooling group listed above (seven from HA 08, three from HA 07 and two from HA 09). The study growth curve was compared with those of FSR and Greater Dublin Strategic Drainage Study (GDSDS). **Table 3-3** below lists the growth factors.

Table 3-3 FEM FRAMS Study growth factor compared with FSR and GDSDS

Return Period (years)	2	5	10	25	50	100	200	1000
AEP	50%	20%	10%	4%	2%	1%	0.5%	0.1%
FEM FRAMS	**1.00**	**1.52**	**1.89**	**2.38**	**2.76**	**3.16**	**3.57**	**4.6**
GDSDS	1.00	1.47	1.85	2.23	2.53	2.83	3.15	-
FSR (Ireland)	1.00	1.26	1.44	1.68	1.86	2.06	2.25	2.74

Note: all values are indexed to Q_{med}

The FEM FRAMS growth curve values are consistently higher than those of the FSR. The values are close to that of GDSDS for up to a 10 year return period (10% AEP). However, for events of lower frequency than the 10% AEP, the study area growth factor is consistently higher than that of the GDSDS, by over circa 10%. Adoption of the FEM FRAM growth curve is considered to be conservative and appropriate for use in the hydraulic model since it is specific to this region and is also in keeping with the Eastern CFRAM Study growth factors for a catchment of this size in HA 09.

4 HYDRAULIC MODEL

4.1 Objective

The objective of the Hydraulics section is to detail the hydraulic analysis undertaken for the study. The hydraulic analysis comprises the construction of a calibrated linked 1D-2D fluvial/surface water model to assess and inform and assess proposed culvert installation and upgrade works. This section provides details on the data collected; the way in which the model has been constructed; the calibration, verification, and sensitivity analysis process; the design runs undertaken; and the modelled output.

4.2 Model Conceptualisation

RPS used Infoworks ICM to undertake the modelling of the Broadmeadow River. Infoworks ICM is an integrated hydrological and hydraulic modelling package developed by Innovyze. Infoworks ICM includes full solution modelling of both below and above ground watercourses, floodplains, embankments and hydraulic structures. Additionally, the 2-dimensional areas within Infoworks ICM are modelling through a triangular flexible mesh which allows for high levels of detail in specific areas (for example at river banks and around buildings) and a broader approach in other areas (for example other floodplains). This can give better results compared with a rectangular grid approach utilised in some other packages.

4.3 Survey Information

Channel and structure cross sections survey data from the FEM FRAM Study was made available for this project. Additional survey information was made available from the client to provide fill in data for structures, the river channel and the surrounding plan area of the proposed bridge.

4.4 Model Construction

For 1D/2D modelling, RPS constructed a 1D drainage network model combined (representing the bridges and river sections) with a 2D flood plain model which provides an accurate assessment of both the bridges flow regime and floodplain flow paths adjacent to the river sections.

A digital terrain model was created from the provided LiDAR data to ensure the accurate assessment of 2D flow paths surrounding the Broadmeadow River. Building footprints were defined by a GIS file extracted from national vector mapping and used to create voids in the computational mesh to force water to flow around them. It was considered that preventing flood flows through buildings was a more conservative approach and would ensure flood extents are not underestimated. The extent of the integrated hydraulic model developed by RPS is shown in **Figure 4-1** below.

Figure 4-1 Modelled area and extent

This model includes a 2-dimensional hydrodynamic model of the floodplain with a 1-dimensional integrated model of the storm culvert and the river sections. The 1D network model is connected to the 2D flood plain at manhole nodes and river links. The nodes and links spill water to the floodplain when they become sufficiently surcharged to calculate the flow onto the floodplain.

Upstream boundary conditions and input hydrographs for the model were provided from the hydrology assessment (see section 3 for more detail) and have been introduced directly to the 1D domain as a point inflow. The flows were applied as point flows at the upstream boundary of the Broadmeadow River and the Ratoath Stream upstream of the proposed bridge location.

An existing overflow from another river catchment (C1/7 Channel – included in the model) was incorporated into the hydraulic model to account for additional flow upstream of the proposed bridge location during the 1% AEP event. The location and the extent of the overflow is indicated in **Figure 4-2** below.

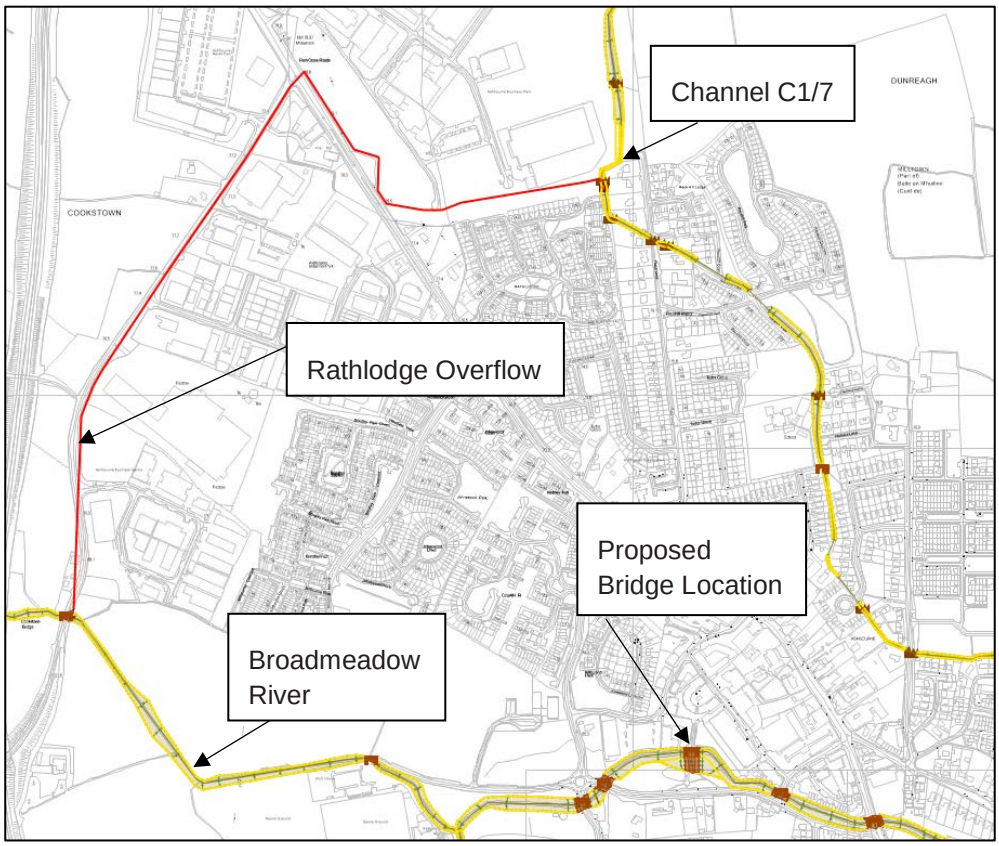


Figure 4-2 Location & Extent of Rathlodge Overflow Upstream of Proposed Bridge Location

4.5 Model Calibration and Verification

As discussed in **Section 3.2.1** full model calibration is not achievable due to the lack of up to date flow information along the Broadmeadow River in Ashbourne. However, it can be considered that the November 2002 flood event was of a frequency in the order of 1% AEP (100 year return period) and the model flows were checked against this to provide a reality check of the model simulated 1% AEP design event.

The only flood event for which observed data is available within the modelled extent is August 1986 which was recorded by the now inactive Ashbourne Gauge at Killegland (Station 8007). Therefore, this is the key flood event that was used for model calibration for the 20 year return period event. Simulated peak water levels were compared with observed peak water levels to mitigate the impact of any uncertainty with the gauge rating which is only reliable up to Q_{med}. This comparison exercise serves as model calibration on the Broadmeadow at Killegland. Flood extent data collected for previous flood events including the November 2014 event were used to verify the hydraulic model outputs.

4.6 Model Results Existing Scenario – 1% AEP

The model was used to simulate the existing scenario at the proposed bridge location for the 1% AEP event as shown in **Figure 4-2**. The model showed flooding in several areas which is consistent with the November 2014 event.

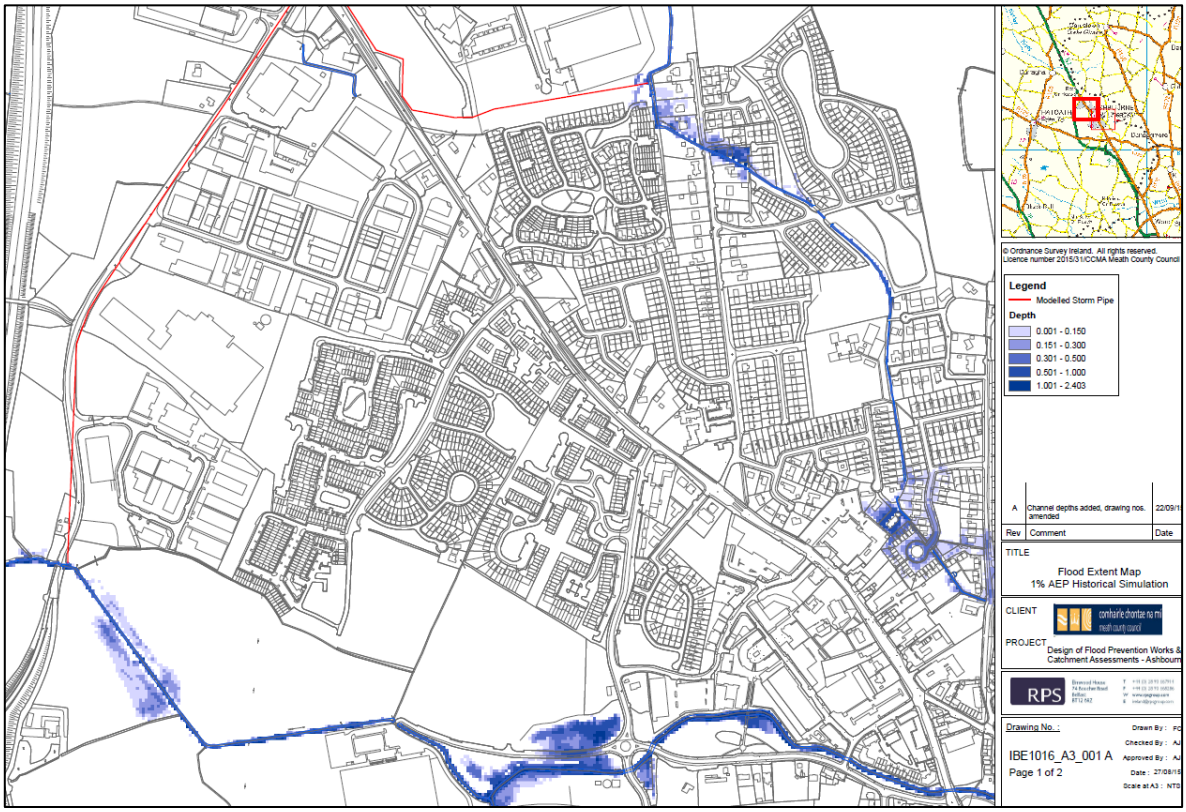


Figure 4-3 Existing Scenario - 1% AEP

4.7 Proposed Bridge and Abutment Installation

The proposed bridge and abutments were incorporated into the existing hydraulic model and simulated for the 1% AEP event. **Table 4-1** below lists the existing and proposed 1% AEP flood levels at the proposed bridge location.

Table 4-1 Proposed Bridge - Existing & Proposed 1% AEP Flood Levels at Cross-sections

Cross Section Marker	Relative Location	Existing 1% AEP Level (m AD)	Proposed 1% AEP Level (m AD)	Difference +/- (mm)
4Ba15849	57m Upstream of Upstream Bridge deck	64.061	64.102	41
4Ba15849-4Ba15720	14m Upstream of Upstream Bridge deck	64.004	64.052	48
US_Bridge	8m Upstream of Upstream Bridge deck	64.002	64.051	49
US_Bridge Deck	Upstream deck of Bridge	63.994	64.001	7
DS_Bridge Deck	Downstream deck of Bridge	63.959	63.991	32
DS_Bridge	9m Downstream of Downstream Bridge deck	63.961	63.953	-8

4Ba15849-4Ba15720-4Ba15720	15m Downstream of Downstream Bridge deck	63.947	63.945	-2
4Ba15720	60m Downstream of Downstream Bridge deck	63.844	63.841	-3

The comparison between the existing and proposed scenarios indicate a maximum increase and decrease of 49mm and 8mm respectively for the 1% AEP event including 20% for climate change. The soffit level for the proposed bridge varies from the left bank to right bank by approximately 1.5m. Hence the freeboard for the 1% AEP event including 20% for climate change varies between 278mm to 1784mm as illustrated in **Figure 4-4** below.

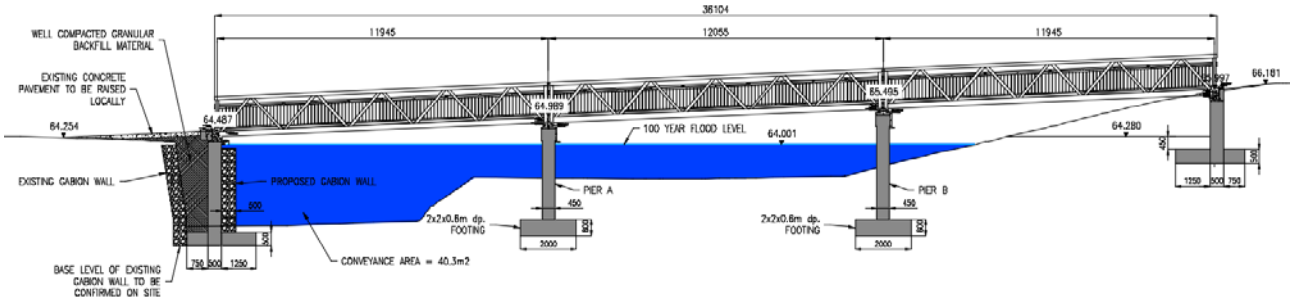


Figure 4-4 Proposed Bridge Cross Section - 1% AEP Event

Figure 4-5 below details the hydraulic profile for the proposed bridge and abutments during the 1% AEP event including 20% for climate change.

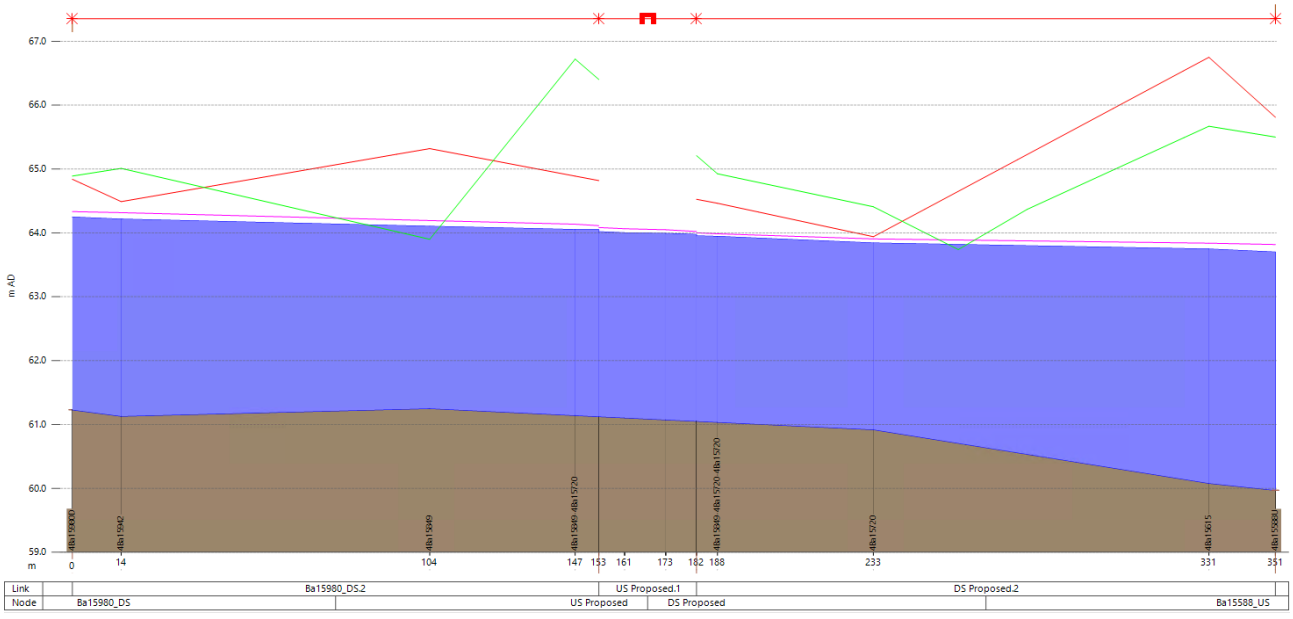


Figure 4-5 Proposed Bridge Long Section - 1% AEP Event

The hydraulic model results show that the proposed bridge shall not adversely impact on the hydrological and hydraulic regime of the Broadmeadow River. Based on this model therefore, it is concluded that the installation of the bridge and abutments in accordance with the design details will provide sufficient capacity for flows in the 1% AEP taking into account 20% for climate change.

5 CONCLUSION

In consideration of the hydrological and hydraulic information, details and analysis presented, the following conclusions are made in respect of the proposed bridge and abutment installation works: -

- This supporting hydrological and hydraulic document has been prepared in accordance with the requirements under Section 50 of the Arterial Drainage Act 1945.
- The design flows for the proposed bridge and abutments were determined using the FSU method and calibrated with the available gauging station data.
- The hydraulic model predicts that the proposed bridge shall not adversely impact on the hydrological and hydraulic regime of the Broadmeadow River. Based on this model therefore, it is concluded that the installation of the bridge and abutments in accordance with the design details will provide sufficient capacity for flows in the 1% AEP taking into account 20% for climate change.

Appendix A

Section 50 Application Form

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ashbourne Linear Park**	Structure Ref No.	**Linear Park Bridge**

Applicant (Correspondence will issue to agent)			
Company or Organisation Name:	**Meath County Council**		
Postal Address:	**Buvinda House, Dublin Rd, Navan, Co Meath, C15 Y291**		
Contact Person:	**Fiona Fallon**		
Phone:	**046 9097400**	Fax:	
E-Mail:	**fiona.fallon@meathcoco.ie**		

Agent (Correspondence will issue to agent)			
Company or Organisation Name:	**RPS Group Ltd**		
Postal Address:	**West Pier Business Campus, Dun Laoghaire, County Dublin**		
Contact Person:	**Vincent McArdle**		
Phone:	**+353 (0) 1 488 2900**	Fax:	
E-mail:	**vincent.mcardle@rpsgroup.com**		

Location and Parameters of crossing					
Watercourse:	**Broadmeadow River, Ashbourne**			Catchment:	**Broadmeadow Catchment**
Address (Townland – County):	**Castle Street, Killegland, (Cill Dheagláin), Ashbourne**				
Grid Reference **(Irish Grid)**	X:	**306092**	Y:	**252321**	
Hydrometric Station(s) utilized (including reference number):	**8007 (Ashbourne) & 8008 (Broadmeadow at Swords)**				
Area of Contributing Catchment:	**41.13** km^2		Road Reference:	**Castle Street**	
Design Flood Flow:	**38.08** m^3/s		Annual Exceedance Probability (AEP):	**1** %	

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	**Vincent McArdlce**
Company/Organisation:	**RPS**
Signature:	Vincent McArdle
Date:	**15/05/2019**

Application Check List	☐
COMPLETED APPLICATION FORM	☒
SUPPORTING HYDROLOGICAL AND HYDRAULIC INFORMATION	☒
PHOTOGRAPHS COVERING SITE OF ALL PROPOSED WORKS	☒
SCALED PLAN OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☒
SCALED CROSS SECTION OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☒
SCALED LONG SECTION OF CHANNEL THROUGH BRIDGE/CULVERT	☒
DETAILS OF RELEVANT EXISTING STRUCTURES	☒
COMPLETED STATEMENT OF AUTHENTICITY	☒
PLAN OF CATCHMENT AREA	☒
COPY OF NOTICE OF GRANT OF PLANNING PERMISSION WITH CONDITIONS *1	☐

For OPW use only	*Date of Receipt*	

If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐
Correspondence Number			*OPW Register No:*					
			Consent Issued	☐				

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec) **(Qmed)**
6 – Variable Catchment characteristics		
3 – Variable Catchment Characteristics		
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
Other **(FSU)**	☒	**13.2 m^3/s**
Other	☐	

FSR ☐ FSU ☒ Other ☐

Comments

Factors Applied

Type of Factor	Value Used
Climate Change	**1.2**
Irish Growth Curve **(FEM FRAM)**	**3.16**
Factor for Standard Error	
Drained Channel	
Other	
Adjustment Factor	**0.73**

Tidal ☐

Comments
The design flood flow upstream of the structure is 38.08m3/s (including 1. 5m3/s from the overflow from Rathlodge upstream of the proposed bridge location during the 1% AEP +20%cc event).

Hydraulic/Structure Details

Description of Structure*3	**Channel Bed Invert = 61.074mOD, Soffit Level (left bank) = 64.279mOD, Soffit Level (right bank) = 65.784mOD, Length along Channel = 2.46m, Width Across Channel = 36.104m, Total Conveyance Area = 73.77m2**
Effective Conveyance Area *4	**40.18** m^2
Upstream Invert Level = **61.074** mOD	Downstream Invert Level = **61.074** mOD
Upstream Soffit Level (left bank) = **64.279** mOD	Downstream Soffit Level (left bank) = **64.279** mOD
Upstream Soffit Level (right bank) = **65.784** mOD	Downstream Soffit Level (right bank) = **65.784** mOD
Upstream Design Flood Level = **64.001** mOD	Downstream Design Flood Level = **63.991** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

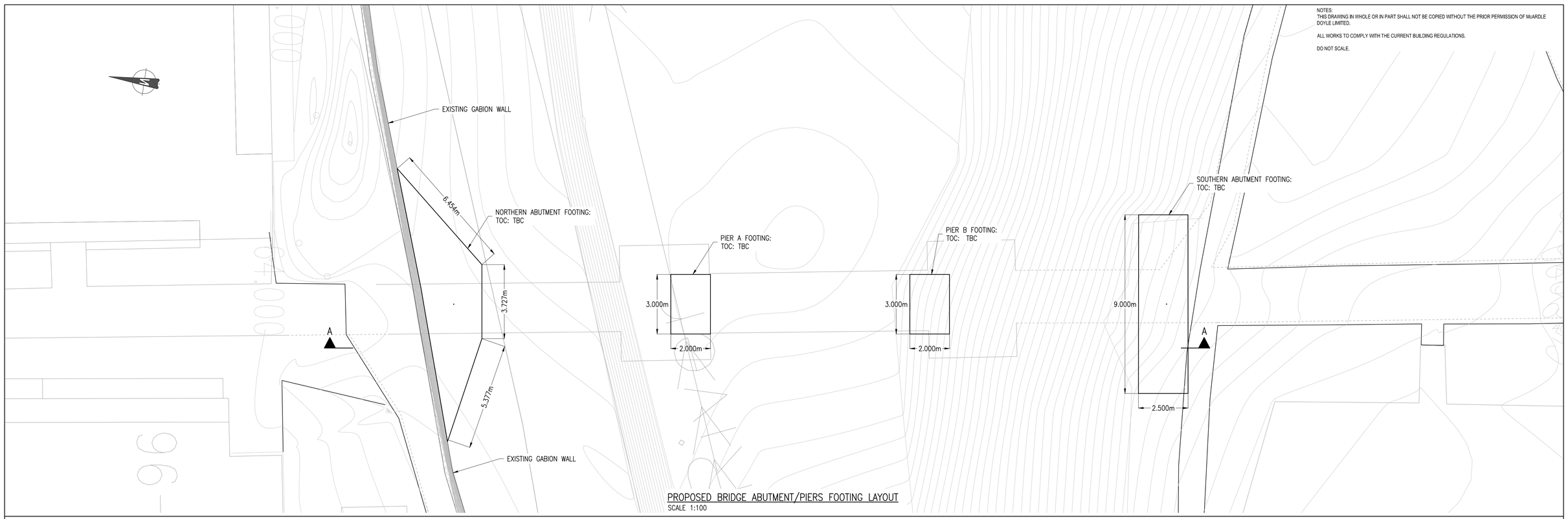
If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

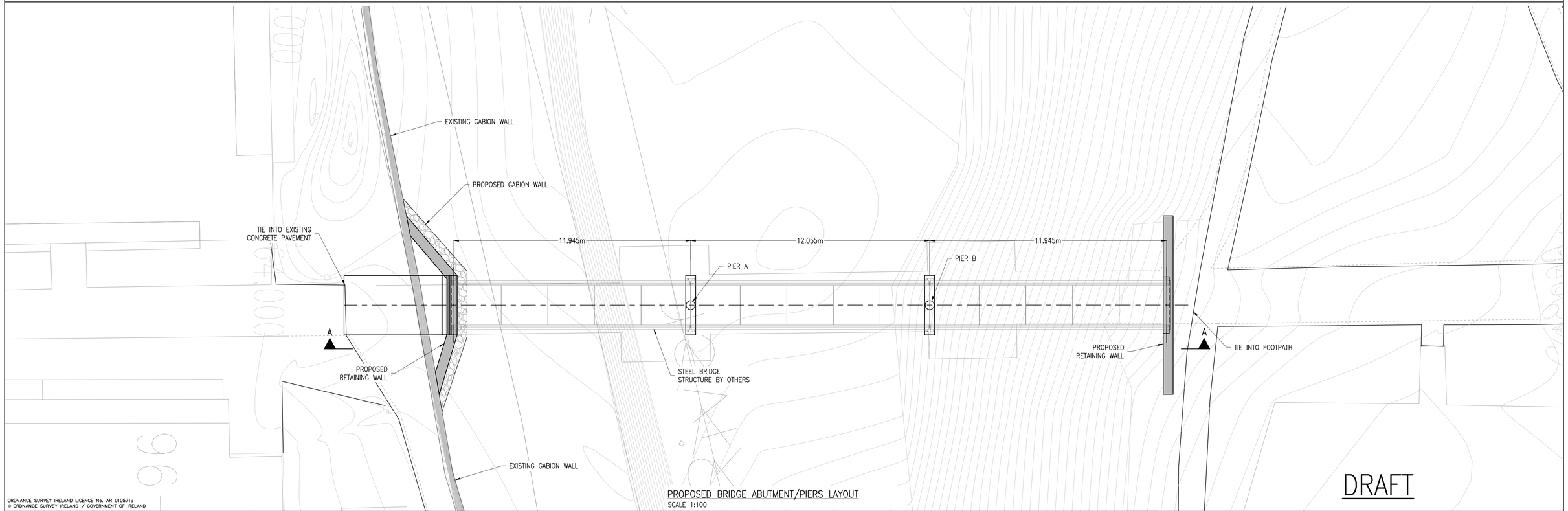
If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

Appendix B

Proposed Bridge Drawings



PROPOSED BRIDGE ABUTMENT/PIERS FOOTING LAYOUT
SCALE 1:100



PROPOSED BRIDGE ABUTMENT/PIERS LAYOUT
SCALE 1:100

DRAFT

Rev.	Description	By	Date	Rev.	Description	By	Date
0	ISSUED FOR INFORMATION	GR	16.04.19				

NOTE:
CATEGORY 2 CERTIFICATION TO BE PROVIDED AS PART OF FINAL DESIGN

REFER TO DRG. P1792.02 FOR DETAILS

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CHARTERED ENGINEERS ARCHITECT & PROJECT MANAGERS
Second Floor, Exchange Building, The Long Walk, Dundalk
t +353 42 9429052 Email:mail@mcardle-doyle.ie

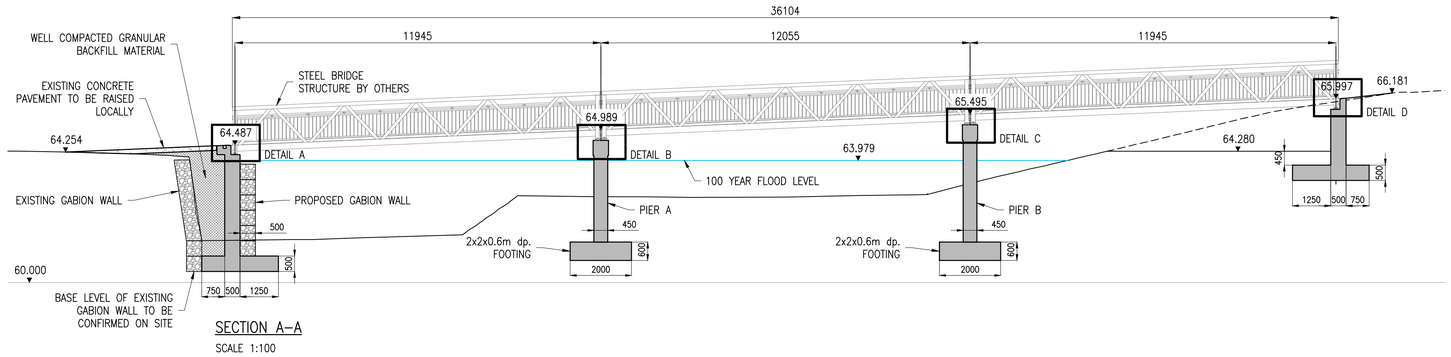
PROJECT:
ASHBOURNE PEDESTRIAN BRIDGE

CLIENT:
McAVOY CONTRACTS

DRAWING TITLE:
PROPOSED BRIDGE ABUTMENT/PIER LAYOUT

Date:	Drawn by:	Checked:	Approved
16.04.19	GR	JF	RMcA

Scale at A1	DRAWING NUMBER:	Status.	Rev.
AS SHOWN	P1791.01	C	0



SECTION A–A
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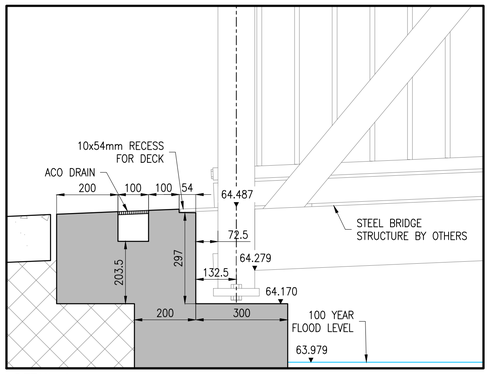

DETAIL A
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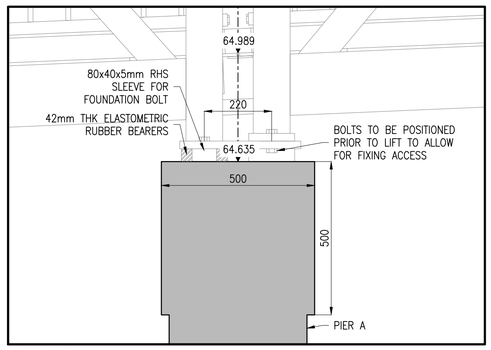

DETAIL B
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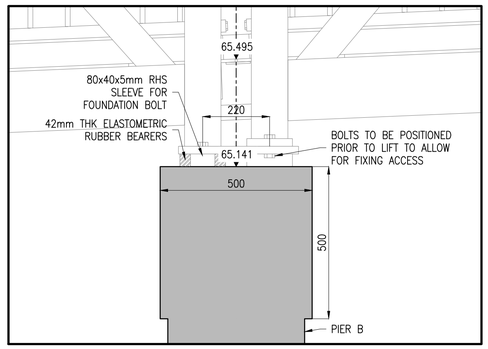
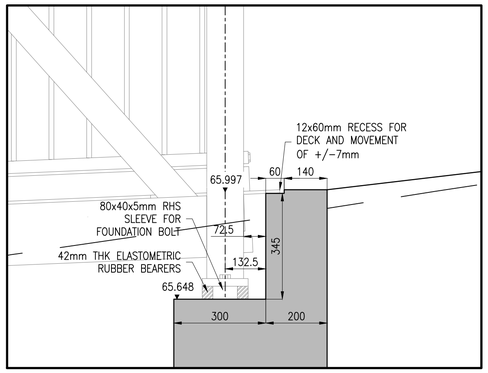


DETAIL C
SCALE 1:10



DETAIL D
SCALE 1:10

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Rev.	Description	By	Date	Rev.	Description	By	Date
0	ISSUED FOR INFORMATION	GR	16.04.19				

NOTE:
CATEGORY 2 CERTIFICATION TO BE PROVIDED AS PART OF FINAL DESIGN

REFER TO DRG. P1792.01 FOR PLAN LAYOUT

100 YEAR FLOOD LEVEL TAKEN FROM DRG. P0743–FTC–ZZ–DR–S–1700–01 REV P02

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PROJECT:
ASHBOURNE PEDESTRIAN BRIDGE

CLIENT:
McAVOY CONTRACTS

DRAWING TITLE:
PROPOSED BRIDGE ABUTMENT/PIER DETAILS

Date:	Drawn by:	Checked:	Approved
16.04.19	GR	JF	RMcA

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