

Variation 2 of the Navan Development Plan 2009-2015

SFRA Report

March 2017



comhairle chontae na mí
meath county council

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This report describes work commissioned by Meath County Council, under a signed services contract, dated August 2016. Ross Bryant and Joanne Cullinane of JBA Consulting carried out this work.

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Purpose

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Abbreviations

1D.....	One Dimensional (modelling)
AEP.....	Annual Exceedance Probability
AFA.....	Area for Further Assessment
CDP	County Development Plan
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
DTM	Digital Terrain Model
EPA.....	Environmental Protection Agency
FRA.....	Flood Risk Assessment
HEFS.....	High End Future Scenario
JFLOW	2-D hydraulic modelling package developed by JBA
LA	Local Authority
LiDAR.....	Light Detection And Ranging
MRFS.....	Medium Range Future Scenario
NDP	Navan Development Plan
OPW.....	Office of Public Works
OSi.....	Ordnance Survey Ireland
PFRA.....	Preliminary Flood Risk Assessment
SAC.....	Special Area of Conservation, designated under the Habitats Directive
SEA.....	Strategic Environmental Assessment
SFRA.....	Strategic Flood Risk Assessment
SPA.....	Special Protection Area for birds, protected under the EU Birds Directive
SPR.....	Standard percentage runoff
SUDS	Sustainable Urban Drainage Systems
Tp.....	Time to Peak

1 Background to the Study

1.1 Commission

JBA Consulting was commissioned by Meath County Council (MCC) to provide assistance in the preparation of the Strategic Flood Risk Assessment (SFRA) to incorporate the provisions of Variation 2 of the Navan Development Plan 2009-2015

The SFRA is a live document that is designed to be updated as further flood risk information becomes available and changes to the development plan are proposed under a formal variation. This version of the SFRA therefore supersedes version 1.4 which was adopted in 2014 under Variation 1.

1.2 Scope of the Study

Under the "Planning System and Flood Risk Management" guidelines, the purpose for the SFRA is detailed as being *"to provide a broad (wide area) assessment of all types of flood risk to inform strategic land-use planning decisions. SFRAs enable the LA to undertake the sequential approach, including the Justification Test, allocate appropriate sites for development and identify how flood risk can be reduced as part of the development plan process"*.

The Navan Development Plan (as varied) is the key document for setting out a vision for how Navan should develop during the plan period.

It is important that the NDP is consistent with the Meath County Development Plan 2013-2019 SFRA (Variation 3), and therefore "The Planning System and Flood Risk Management Guidelines for Planning Authorities" (OPW/DoEHLG, 2009), which states that flood risk management should be integrated into spatial planning policies at all levels to enhance certainty and clarity in the overall planning process.

In order to ensure that flood risk is integrated into the NDP, Meath CC has issued a brief to consultants for the provision of a Flood Risk Assessment. As laid out in the tender documents, the main requirements are:

1. Undertake a flood risk assessment for Navan,
2. Produce fluvial flood mapping for Navan Town & Environs,
3. Prepare a flood risk management plan.

1.3 Background

The SFRA considers the broader settlement strategy of the Greater Dublin Regional Planning Guidelines and the countywide policies and objectives of the County Development Plan. It is intended to be read in conjunction with the SFRA for the County Development Plan (2013-2019) as there is a degree of overlap between the two studies and in order to avoid excessive repetition some chapters of this study refer to the county scale SFRA report.

On a more local level, this study considers the development strategy that will form part of the Development Plan for Navan. The context of flood risk in the Navan area is considered with specific reference to people, property, infrastructure and the environment. A range of flood sources are considered including fluvial, pluvial and groundwater.

A two stage assessment of flood risk was undertaken, as recommended in 'The Planning System and Flood Risk Management' guidelines, for the area that lies within the development boundary of the Development Plan. The first stage is to identify flood risk. Historical records and recent events demonstrate that the Navan area has a significant history of flooding on the Blackwater River, River Boyne and Swan River and confirms that a proportion of zoned lands are at flood risk.

The second stage and the main purpose of this SFRA report is to appraise the adequacy of existing information, to prepare flood zone maps, based the County Meath SFRA and the Swan River FRA, and to highlight potential development areas that require more detailed assessment on a site

specific level. The SFRA also provides guidelines for development within areas at potential risk of flooding, and specifically looks at flood risk and the potential for development within the key sites in Navan.

1.4 Report Structure

Section 2 of this report, provides an introduction to the study area and Section 3 discusses the concepts of flooding, Flood Zones and flood risk as they are incorporated into the Planning System and Flood Risk Management.

In Section 4, the available data related to flooding is summarised and appraised, it also outlines the sources of flooding to be considered, based on the review of available data.

Following this, Section 5 provides guidance and suggested approaches to managing flood risk and development; the contents of this section will be of particular use in informing the policies and objectives within the development plan. In Section 6, specific responses to flood risk are discussed in relation to a number of key development sites within Navan. Triggers for the ongoing monitoring and future review of the SFRA are detailed in Section 6.4.

2 Study Area

2.1 Introduction

The area of interest comprises the development plan boundary of Navan Town which covers the existing urban area and greenfield periphery sites.

Navan is situated in the centre of County Meath. Navan is bypassed by the N3 Dublin to Cavan route and is located on the N51 Drogheda to Mullingar National Secondary route. Navan is circa 50 km from Dublin City and is the county town in Meath. It has a number of key land-use activities in the town including the Local Authority, Local Government, Court Service, Health Service Executive, schools and employment uses.

This section of the report will provide an overview of the study area, the drainage catchment, the population and the nature of settlement, to give context to the study.

2.2 People, Property and Infrastructure

Based on the available census figures the population of the Navan town and environs area has increased to 28,399 in 2016 from 24,851 in the 2006 census. The population change demonstrates a growth of 7%.

Table 2-1 Census Population Figures¹

Area	2011	2016	% Change
1. Navan Urban	3,168	3,608	+6.1
2. Navan Rural (Part Urban)	23,367	24,791	+13.9
Navan Town	26,535	28,399	+7

2.3 Drainage Catchments & Representation

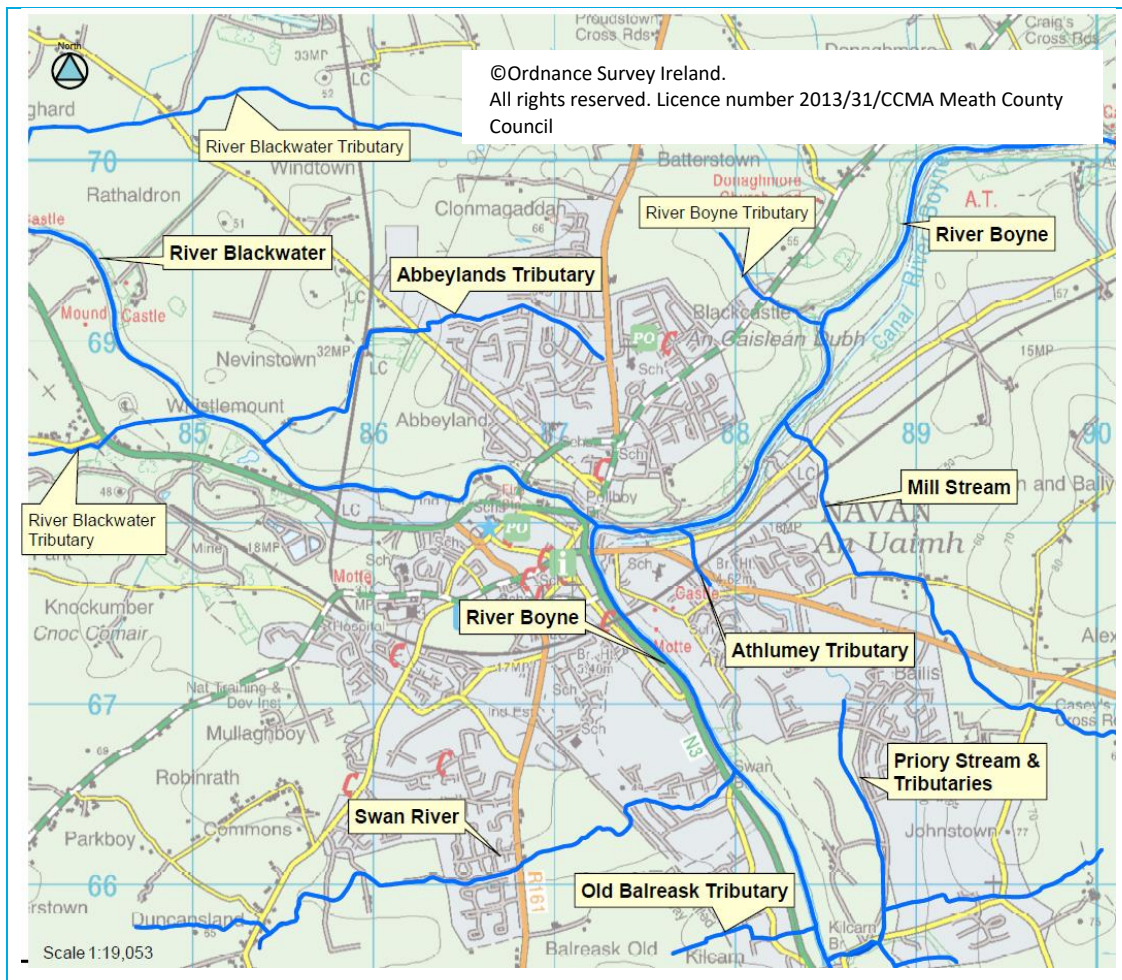
Navan is located at the confluence between the River Blackwater and the River Boyne. The River Blackwater catchment covers approximately 350km² with a significant upper catchment area located in County Cavan that drains in to Lough Ramor before discharging and flowing into County Meath, close to Carnaross. The total length of the River Blackwater flowing through County Meath is approximately 32km.

The entire River Boyne catchment covers approximately 2,695 km² and includes parts of counties Louth, Cavan, Meath, Westmeath, Offaly and Kildare. The River Boyne flows through Trim and Navan to its estuary in Drogheda, the catchment area in Navan is approximately 1,600km².

In addition, there are a large number of tributaries. The main tributary is the River Blackwater, which has a small tributary (Abbeylands). Moving upstream to downstream, the other tributaries are the Priory Stream also called Athlumney House Tributary (Which has three main tributaries), Old Balreask Tributary, Swan River (also known as the Trim Road Tributary), Athlumney Tributary and Mill Stream (also known as Bailis Tributary). Figure 2-1, over page, provides a graphical representation of the Navan watercourses.

¹ Source: Central Statistics Office, CSO; www.cso.ie
2016s4699 Navan DP SFRA v1.5.docx

Figure 2-1 Navan Watercourses



2.4 Environment

Relevant Natura 2000 sites within the local area are summarised below:

- River Boyne and Blackwater candidate Special Area of Conservation (cSAC)
- River Boyne and Blackwater Special Protection Area (SPA)

Under Article 6(3) of the EU Habitats Directive, an “appropriate assessment” (AA) is required where any plan or project, either alone or ‘in combination’ with other plans or projects, could have an adverse effect on the integrity of a Natura 2000 site.

The management of flood risk within such areas must have regard to potential negative impacts to this environment. Further information is provided in the full Strategic Environmental Assessment (SEA) and AA for the NDP.

3 The Planning System and Flood Risk Management Guidelines

This chapter is replicated from the Meath County Development Plan 2013-2019 SFRA document; it is fundamental to understanding the SFRA process and has therefore been repeated.

3.1 Introduction

Prior to discussing the management of flood risk, it is helpful to understand what is meant by the term. It is also important to define the components of flood risk in order to apply the principles of the Planning System and Flood Risk Management in a consistent manner.

The Planning System and Flood Risk Management: Guidelines for Planning Authorities, published in November 2009, describe flooding as a natural process that can occur at any time and in a wide variety of locations. Flooding can often be beneficial, and many habitats rely on periodic inundation. However, when flooding interacts with human development, it can threaten people, their property and the environment.

This Section will firstly outline the definitions of flood risk and the Flood Zones used as a planning tool; a discussion of the principles of the planning guidelines and the management of flood risk in the planning system will follow.

3.2 Definition of Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship:

$$\text{Flood Risk} = \text{Probability of Flooding} \times \text{Consequences of Flooding}$$

The assessment of flood risk requires an understanding of the sources of water, the flow path of floodwater and the people and property that can be affected. The *source - pathway - receptor model*, shown below in Figure 3-1, illustrates this and is a widely used environmental model to assess and inform the management of risk.

Figure 3-1 Source Pathway Receptor Model

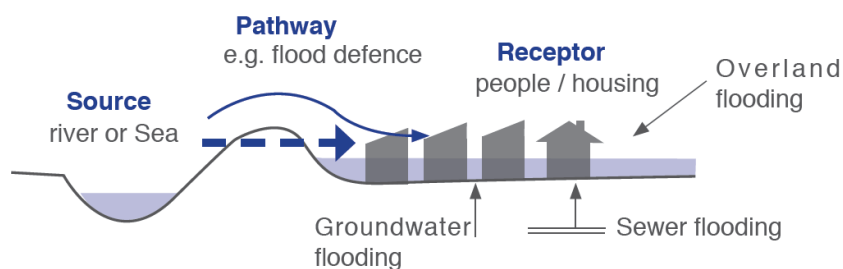


Fig. A1: Sources, pathways and receptors of flooding

Source: Figure A1. The Planning System and Flood Risk Management Guidelines Technical Appendices

Principal sources of flooding are rainfall or higher than normal sea levels while the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. Receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures, such as defences or flood resilient construction, have little or no effect on sources of flooding but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk.

3.3 Likelihood of Flooding

Likelihood or probability of flooding of a particular flood event is classified by its annual exceedance probability (AEP) or return period (in years). A 1% AEP flood indicates the flood event that will occur or be exceeded on average once every 100 years and has a 1 in 100 chance of occurring in any given year.

Return period is often misunderstood to be the period between large flood events rather than an average recurrence interval. Annual exceedance probability is the inverse of return period as shown in Table 3-1 below.

Table 3-1 Probability of Flooding

Return Period (Years)	Annual Exceedance Probability (%)
2	50
100	1
200	0.5
1000	0.1

Considered over the lifetime of development, an apparently low-frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 22% (1 in 5) chance of occurring at least once in a 25-year period - the period of a typical residential mortgage;
- And a 53% (1 in 2) chance of occurring in a 75-year period - a typical human lifetime.

3.3.1 Consequences of Flooding

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc).

The Planning System and Flood Risk Management guidelines provide three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- **Highly vulnerable**, including residential properties, essential infrastructure and emergency service facilities;
- **Less vulnerable**, such as retail and commercial and local transport infrastructure;
- **Water compatible**, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

3.4 Definition of Flood Zones

In the Planning System and Flood Risk Management guidelines, Flood Zones are used to indicate the likelihood of a flood occurring. These Zones indicate a high, moderate or low probability of flooding from fluvial or tidal sources and are defined below in Table 3-2.

It is important to note that the definition of the Flood Zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments constructed as part of the Mornington District Surface Water and Flood Protection Scheme. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.

It is also important to note that the Flood Zones indicate flooding from fluvial and tidal sources and do not take other sources, such as groundwater or pluvial, into account, so an assessment of risk arising from such sources should also be made.

Table 3-2 Definition of Flood Zones

Zone	Description
Zone A High probability of flooding.	This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).
Zone B Moderate probability of flooding.	This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000).
Zone C Low probability of flooding.	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

3.5 Objectives and Principles of the Planning Guidelines

The 'Planning System and Flood Risk Management' describes good flood risk practice in planning and development management. Planning authorities are directed to have regard to the guidelines in the preparation of Development Plans and Local Area Plans, and for development control purposes.

The objective of the 'Planning System and Flood Risk Management' is to integrate flood risk management into the planning process, thereby assisting in the delivery of sustainable development. For this to be achieved, flood risk must be assessed as early as possible in the planning process. Paragraph 1.6 of the Guidelines states that the core objectives are to:

- *"avoid inappropriate development in areas at risk of flooding;*
- *avoid new developments increasing flood risk elsewhere, including that which may arise from surface run-off;*
- *ensure effective management of residual risks for development permitted in floodplains;*
- *avoid unnecessary restriction of national, regional or local economic and social growth;*
- *improve the understanding of flood risk among relevant stakeholders; and*
- *ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management".*

The guidelines aim to facilitate *'the transparent consideration of flood risk at all levels of the planning process, ensuring a consistency of approach throughout the country.'* SFRA therefore become a key evidence base in meeting these objectives.

The 'Planning System and Flood Risk Management' works on a number of key principles, including:

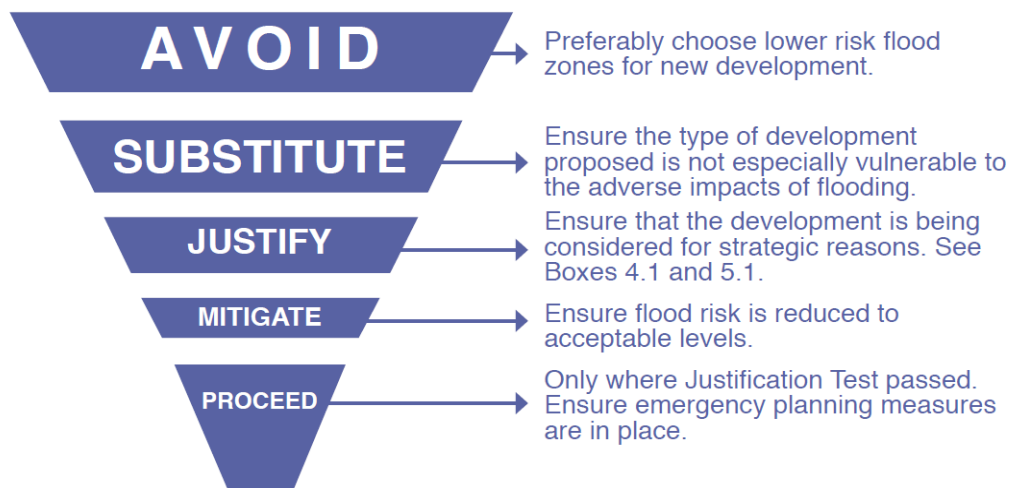
- Adopting a staged and hierarchical approach to the assessment of flood risk;
- Adopting a sequential approach to the management of flood risk, based on the frequency of flooding (identified through Flood Zones) and the vulnerability of the proposed land use.

3.6 The Sequential Approach and Justification Test

Each stage of the FRA process aims to adopt a sequential approach to management of flood risk in the planning process.

Where possible, development in areas identified as being at flood risk should be avoided; this may necessitate de-zoning lands within the development plan. If de-zoning is not possible, then rezoning from a higher vulnerability land use, such as residential, to a less vulnerable use, such as open space may be required.

Figure 3-2 Sequential Approach Principles in Flood Risk Management



Source: The Planning System and Flood Risk Management (Figure 3.1)

Where rezoning is not possible, exceptions to the development restrictions are provided for through the Justification Test. Many towns and cities have central areas that are affected by flood risk and have been targeted for growth. To allow the sustainable and compact development of these urban centres, development in areas of flood risk may be considered necessary. For development in such areas to be allowed, the Justification Test must be passed.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of such developments. The test is comprised of two processes; the Plan-making Justification Test, and the Development Management Justification Test. The latter is used at the planning application stage where it is intended to develop land that is at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be considered inappropriate for that land.

Table 3-3 shows which types of development, based on vulnerability to flood risk, are appropriate land uses for each of the Flood Zones. The aim of the SFRA is to guide development zonings to those which are 'appropriate' and thereby avoid the need to apply the Justification Test.

Table 3-3 Matrix of Vulnerability versus Flood Zone

	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

Source: Table 3.2 of The Planning System and Flood Risk Management

The application of the sequential approach and Justification Test in the context of specific development sites in the NDP is discussed in Section 6.

3.7 Scales and Stages of Flood Risk Assessment

Within the hierarchy of regional, strategic and site-specific flood-risk assessments, a tiered approach ensures that the level of information is appropriate to the scale and nature of the flood-risk issues and the location and type of development proposed, avoiding expensive flood modelling and development of mitigation measures where it is not necessary. The stages and scales of flood risk assessment comprise of:

- **Regional Flood Risk Appraisal (RFRA)** – a broad overview of flood risk issues across a region to influence spatial allocations for growth in housing and employment as well as to identify where flood risk management measures may be required at a regional level to support the proposed growth. This should be based on readily derivable information and undertaken to inform the Regional Planning Guidelines.
- **Strategic Flood Risk Assessment (SFRA)** – an assessment of all types of flood risk informing land use planning decisions. This will enable the Planning Authority to allocate appropriate sites for development, whilst identifying opportunities for reducing flood risk. This SFRA will revisit and develop the flood risk identification undertaken in the RFRA, and give consideration to a range of potential sources of flooding. An initial flood risk assessment, based on the identification of Flood Zones, will also be carried out for those areas, which will be zoned for development. Where the initial flood risk assessment highlights the potential for a significant level of flood risk, or there is conflict with the proposed vulnerability of development, then a site specific FRA will be recommended, which will necessitate a detailed flood risk assessment.
- **Site Specific Flood Risk Assessment (FRA)** – site or project specific flood risk assessment to consider all types of flood risk associated with the site and propose appropriate site management and mitigation measures to reduce flood risk to and from the site to an acceptable level. If the previous tiers of study have been undertaken to appropriate levels of detail, it is highly likely that the site specific FRA will require detailed channel and site survey, and hydraulic modelling.

4 Flood Risk in Navan

4.1 Overview

There are a number of valuable sources of flood data available for the Navan area. The following sections list the core datasets used to compile the flood map for the NDP area and gives an assessment of the data quality and the confidence in its accuracy.

4.1.1 Flood Zone Mapping

There are a number of sources of flood data available for the Navan area. The following table lists the core datasets used to compile the flood map for the Navan Development Plan and gives an assessment of the data quality and the confidence in its accuracy.

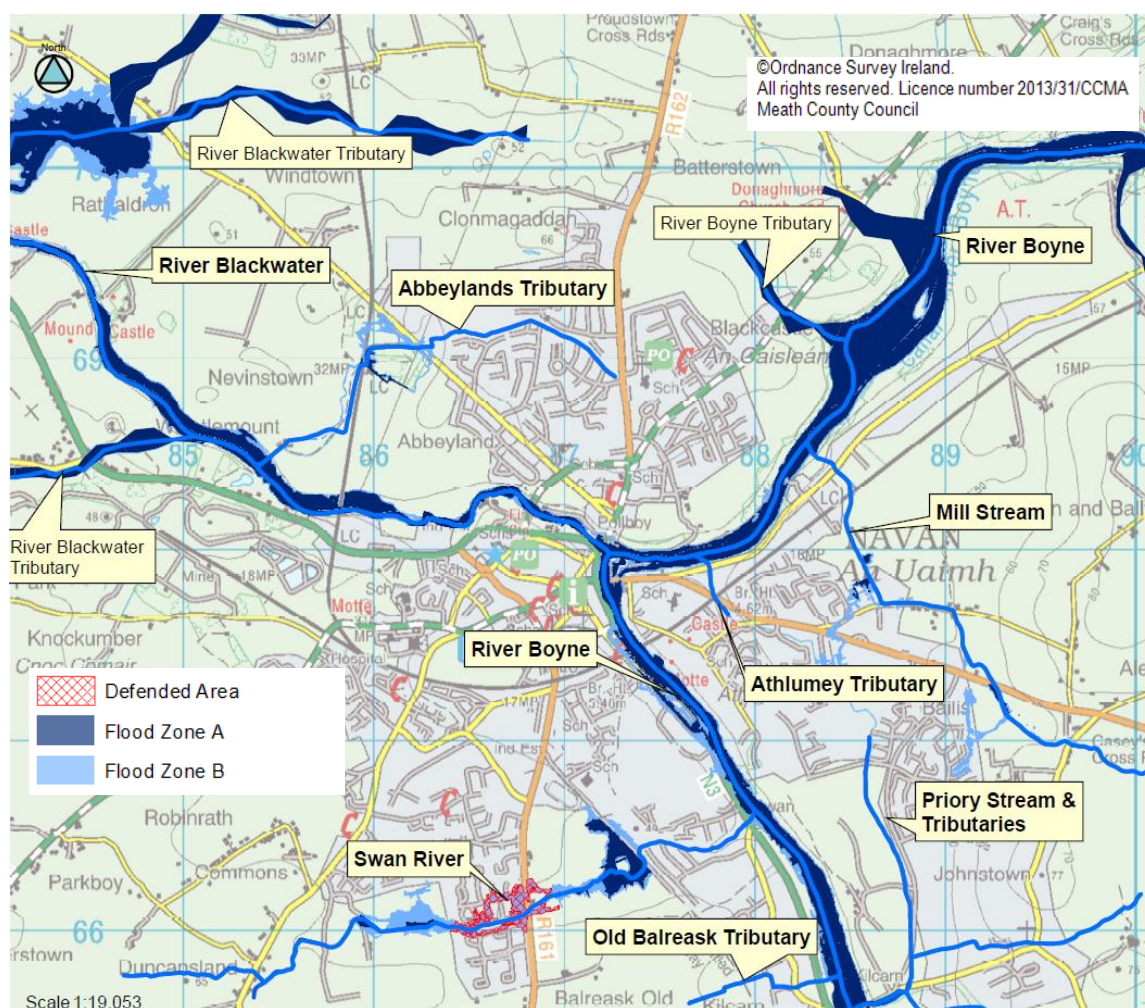
Table 4-1 Flood Data Sources

Description	Coverage	Quality/Confidence	Used
Eastern CFRAM Final Flood Mapping	Covers the rivers Blackwater, Boyne, Mill Stream, Priory Stream and the Swan	High	Yes
Swan River Flood Study and CFRAMS modelling	Swan River - Balreask area	High/Moderate-High	Yes
1D hydraulic model using ISIS software, OPW CFRAM channel survey, OPW LiDAR and revised FSU flow estimates	Mill Stream	High/Moderate-High	Yes
National PFRA Study Flood Outlines	River Blackwater and River Boyne (mainly outside settlement area)	Moderate/Low	Yes
Eastern CFRAM FRR (Verified PFRA)	Within Navan Town for River Blackwater and River Boyne	Moderate/Low-Moderate	Yes
Historical Flood Records and Consultation with Meath CC Engineer	Navan area	Various	Yes indirectly to validate Flood Zones & identify other flood sources
Walkover Survey	Navan	Moderate/Low	Yes, to validate Flood Zones & identify other flood sources

The Flood Zone mapping represents a combination of the above flood sources. The Eastern CFRAM mapping, has formed the core source of the final Flood Zones for all watercourses as they have all been subject to detailed analysis under this project. All flood mapping has been site verified by walkover and consultation with the Local Authority Area Engineer. There has also been a thorough review of historic flood records. The result is Flood Zone mapping that presents the best available data for the study area.

Figure 4-1 over the page presents an overview of the Flood Zones and watercourses. Each of the sources of flood information is discussed in more detail below.

Figure 4-1 Flood Zone mapping with watercourse annotation



4.2 National PFRA Study Fluvial Flood Outlines

The Preliminary Flood Risk Assessment (PFRA) is a national screening exercise that was undertaken by the OPW to identify areas at potential flood risk. The PFRA was a requirement of the EU Floods Directive and the publication of this work informed the more detailed assessment that is being undertaken as part of the Catchment Flood Risk Assessment and Management (CFRAM) studies. The PFRA study considered flooding from a number of sources; fluvial, tidal, pluvial and groundwater and resulted in production of a suite of broadscale flood maps.

For the preparation of the PFRA fluvial flood maps, flood flow estimates were calculated at nodes every 500m along the entire river network. (The river network is the EPA 'blue-line' network, which, for the most part, matches the rivers mapped at the 1:50,000 scale Discovery Series OS mapping). This flow estimation was based on the OPW Flood Studies Update research programme. An assumption was made that the in-channel flow equates to the mean annual flood and so the out of bank flow for a particular AEP event was determined by deducting the mean annual flood from the flood flow estimate for that probability event.

Using a 5m national digital terrain model (DTM) a cross section was determined at 100m spacings. The Manning's equation, a hydraulic equation for normal flow, was used to calculate a flood level which was then extrapolated across the DTM to determine the flood extent. This exercise was completed by the OPW for all river catchments greater than 1km².

This methodology did not take into account defences, channel structures or channel works. Potential sources of error in the mapping include local errors in the DTM or changes to the watercourse flow route due to an error in mapping or new development. In Navan the PFRA

mapping has largely been superseded by more detailed mapping. It remains for two tributaries of the Boyne and a single tributary of the Blackwater.

4.3 National CFRAM Programme

Following on from the PFRA study, the OPW commenced appointment of consultants to carry out a more detailed flood risk assessment for key flood risk areas. This work is being undertaken under the national CFRAM programme across seven river basin districts in Ireland. The CFRAM programme commenced with three pilot studies covering the River Lee, Fingal East Meath area and the River Dodder. A further 6 studies are currently underway in the East, South-East, South-West, West, North-West and Neagh-Bann regions.

County Meath mainly falls under the jurisdiction of the Eastern CFRAM but also falls under the study area of the Fingal East Meath (FEM FRAMS), the North West and Neagh Bann CFRAM and the Shannon CFRAM. The FEM FRAMS was a pilot study which produced detailed model output and flood maps. However, the study did not cover Navan or the surrounding area. The initial Flood Risk Review (FRR) stage of the Eastern CFRAM has been completed and this included a site based review of the PFRA flood outlines in Navan, which was forwarded as an Area for Further Assessment (AFA).

The area was subject to the full analysis under Eastern CFRAM. This included a detailed 1D-2D hydraulic model of the Boyne River and its main tributaries (Blackwater River, Swan River, Mill Stream, Priory Stream, Old Balreask Tributary, Athlumney Tributary and Abbeylands Tributary). CFRAM mapping is available for all these watercourses. The CFRAM mapping represents a significant improvement compared to the accuracy provided by the PFRA mapping and the CFRAM mapping has been verified by a site walkover and consultation with the local authority.

The CFRAM Draft Flood Risk Management Plan (FRMP) and Preliminary Options Report (POR) confirms that a total of 125 properties are potentially at risk of flooding with an overall benefit cost ratio of less than 1 (0.71). The FRMP recommends progression of the Navan Flood Relief Scheme, comprising hard defences (889m of flood walls, 340m of embankments, 986 m of road to be raised and clearance of a 500m reach of the Abbeylands Tributary). The potential options have been screened for potential impacts on land use zoning. CFRAM measures are currently recommendations and no formal commitment has been made for progression towards project-level development. This would typically include the assessment for refinement and preparation for planning / Exhibition and, as appropriate, implementation.

4.4 Swan River Flood Risk Assessment

The Swan River Flood Risk Assessment study was commissioned by Meath County Council to assess flood risk associated with the Swan River. The initial study assessed current flooding and was followed by a scenario impact analysis which looked at measures to alleviate flooding upstream of the old railway embankment. Options proposed included the replacement of under-capacity culverts and the construction of flood defences. The culvert upgrading works are now complete and offer a 1 in 100 year standard of protection for the Balreask Manor Estate. However, under the Planning Guidelines, the flood zones consider an 'undefended' scenario, and red hatching has been used to identify the area benefitting from the Swan River defences in the Flood Zone maps. The modelling study originally carried out for the Swan River FRA has been re-modelled under the Eastern CFRAM and CFRAM mapping has been provided by the OPW and used in the compilation of the Flood Zone mapping for this watercourse. The CFRAM uses linked 1D-2D hydraulic modelling, detailed hydrological analysis and mapping is composed using LiDAR data.

4.5 Historic Flood Review and Consultation with Area Engineer

Records of past flooding are useful for looking at the sources, seasonality, frequency and intensity of flooding. Historical records are mostly anecdotal and incomplete, but are useful for providing background information.

4.5.1 OPW Floodmaps.ie

The OPW hosts a National Flood Hazard Mapping website² that makes available information on areas potentially at risk from flooding. This website provides information on historical flood events across the country and formed the basis of the Regional Flood Risk Appraisal.

Information is provided in the form of reports and newspaper articles which generally relate to rare and extreme events. Since the establishment of the hazard mapping website, more records are available which identify more frequent and often recurring events. These tend to include memos and meeting records from local authority area engineers, often relating to road flooding.

4.5.2 Consultation

A meeting with the MCC Area Engineer helped to clarify and improve on the general appreciation of flood risk in Navan. This includes for appropriate screening of the historic and potential flood risk from un-modelled watercourses within the settlement boundary.

The following observations were noted.

- Along the Old N3 there was flooding in the past. However, the flood defences limited the impacts. These defences have been removed in places due to further development and damage. These defences have not been taken into account in the mapping for the Boyne.
- Academy Street backs up in a storm event. It is thought that flooding here could be from a combination of fluvial and pluvial sources. The stormwater system in the area outfalls to the Boyne.
- Athlumney road was noted as an area at risk from flooding.
- In the flood history, the Newgrange hotel was noted as being impacted. This was attributed to a blockage in the sewer pumping station which has since been rectified.
- Cannon Row has flooded in the past, most recently in 2013. This is thought to be due to flash flooding and the inability of the storm water system to take account of all surface water. There is a low point in the road at this area as the junction with Abbey road.
- Commons Lane has flooded in the past and it is thought that this is also due to flash flooding and surface water problems.
- Kilcarn estate is impacted by the Swan River and the Swan report outlined the measures to mitigate this. The headwall upstream of Balreask Manor Estate has been constructed, but the culvert under the railway will remain as is for the time being.

4.5.3 Summary of Historic Flood Risk

The pertinent flood risk history from both the consultation and OPW floodmaps.ie sources are summarised in Figure 4-2 and Table 4-2 over the page.

² www.floodmaps.ie
2016s4699 Navan DP SFRA v1.5.docx

Figure 4-2 Historic Flood Mapping; Spatial Representation

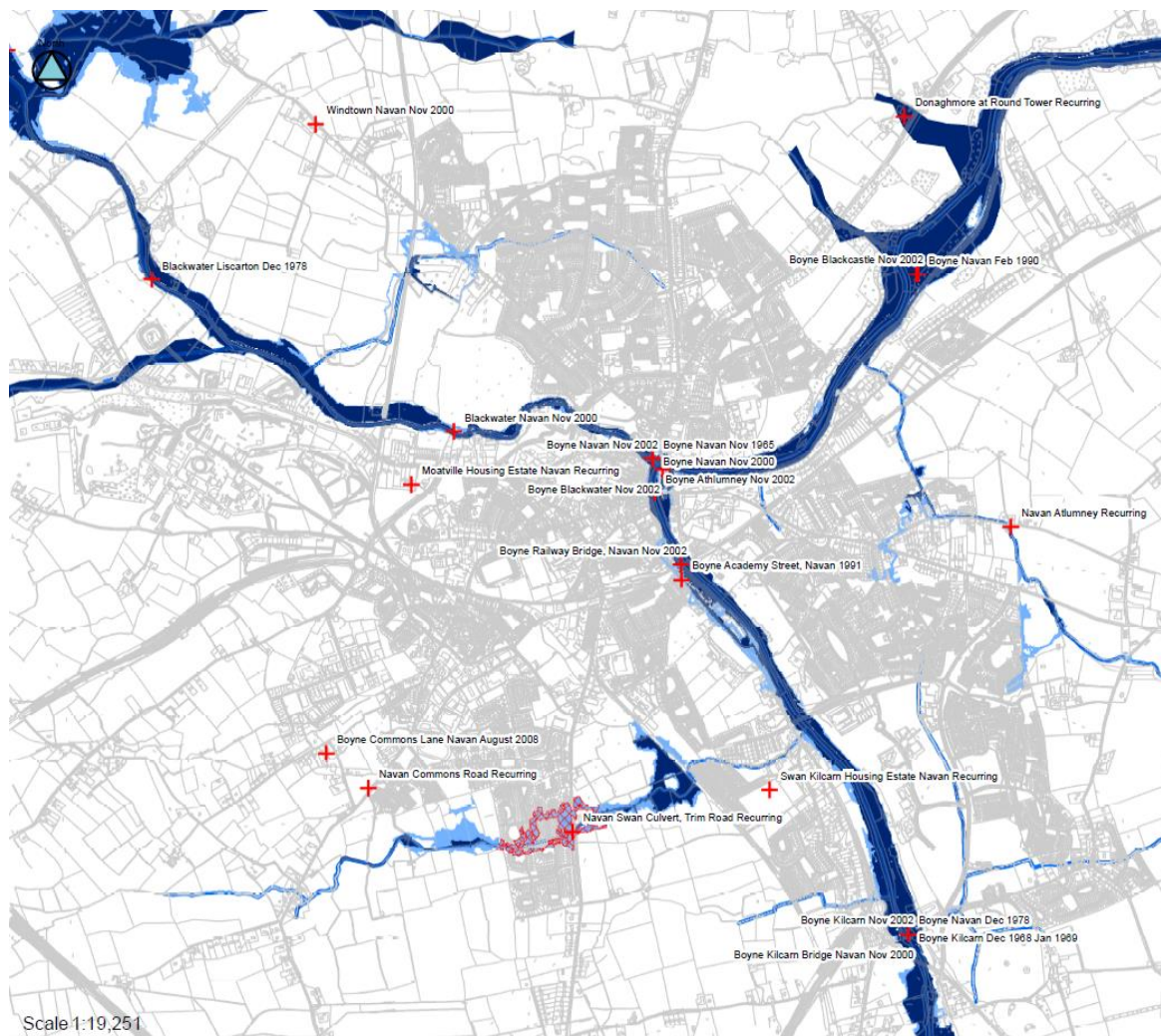


Table 4-2 Historic Flooding Information - quoted from Eastern CFRAM Inception Report³ and the consultation with MCC Engineer

Date of Flood	Description
December 2015	Parts of the Commons Road impassable due to flooding following persistent rainfall.
2013	Cannon Row has flooded in the past, most recently in 2013. This is thought to be due to flash flooding and the inability of the storm water system to take account of all surface water. There is a low point in the road at this area as the junction with Abbey road.
November 2009	Flooding occurred in Navan on 19th-20th November following torrential rainfall on November 19th. A press article states how firemen in Navan pumped water from Academy Street and on the Commons Road throughout the night to keep floodwaters at bay. However, no information on flooding of the other AFAs was available, nor were there any details of flood extents, levels or the source of flooding.
August 2008	Heavy rainfall on 16th August resulted in the River Boyne overtopping its banks in Navan. Flooding also resulted due to sewers being overwhelmed by the rainfall. The Newgrange Hotel in Navan was flooded (blockage of sewage pumping station) and some roads/streets including Cannon Row, Circular Road, Commons Road and roads at Ardsallagh, Cannistown and Bloomsbury Bridge were also flooded. Information available on the OPW hydrometric website indicated that an average daily flow of 233m ³ /s was recorded at the Navan Weir station on August 17th, which was the largest average daily flow of 2008.
November 2002	In Navan and in Trim, more extensive fluvial flooding occurred as a result of the River Boyne overflowing in both towns, while in Navan, the River Blackwater also overflowed. It was estimated in a Consultant's report "Flood Risk Assessment Study of Mill Lane and Convent Road Sites, Navan" ⁴ that the flood event in Navan had an AEP of 10%. Flooding occurred in the Townparks, Academy Street, Claremont and Moatlands areas of Navan. Flow information is available from the OPW hydrometric website for the hydrometric

³ Eastern CFRAM Study HA07 Inception Report, RPS/OPW June, 2012.

⁴ Report No.598 v1.1, FRA Study of Mill Lane and Convent Road Sites, Navan, HydroEnvironmental, Jan 2004.

	stations in the Navan and Trim areas. The mean daily flow for this flood event at Blackcastle, Navan Weir and Liscartan Hydrometric Stations was 371m ³ /s, 283.7m ³ /s and 95.2m ³ /s respectively, while at Trim, the mean daily flow for the event was 136m ³ /s.
November 2000	In Navan extensive fluvial flooding occurred as a result of the River Boyne overflowing, the River Blackwater also overflowed. It was estimated in an OPW memo that the flood event had an AEP of 3.33% based on the flow in the River Boyne at Slane Castle. The mean daily flows (as per http://www.opw.ie/hydro) for this flood event at Blackcastle and Liscartan Hydrometric Stations exceeded those for the November 2002 flood, while at Navan Weir (256m ³ /s) and Trim Hydrometric Stations (127m ³ /s), the November 2000 flows were marginally lower than the corresponding November 2002 figures. In Navan, the flooding was evident by roads being impassable and the swimming pool was flooded. The Moatville, Academy Street, Liscartan and Kilcarn Court areas also flooded.
January 1991	Outline information is available for a flood event in Navan in January 1991. No details of cause of flooding, source or flows are available, with the only information reported being of flooding in Academy Street.
December 1978	Academy Street was the worst affected area. Mill Lane, Athlumney Road, Watergate Street and Dublin Road were also flooded. A number of homes, businesses, schools, etc, flooded. However, problems were compounded by freezing and bursting of water pipes but it is not clear how many homes were affected by this. An OPW report on the flood event, entitled "Flood of 27th-29th December, 1978 on Boyne Catchment", estimated AEPs of 16.7% for the River Boyne flow and 5% for the River Blackwater flow. The difference in the two figures is due to heavier rainfall on the northern part of the Boyne catchment.
1968/January 1969	An OPW report indicates that flooding occurred during December 1968/January 1969 in Navan when the River Boyne overflowed. The affected area was Kilcarn, near Navan. However, no exact date or specific details are available for this flood event.
November 1965	In Navan, the River Boyne overflowed. The peak flow at Liscartan Hydrometric Station was estimated to be 65.7m ³ /s in the HydroEnvironmental report ⁴ . Reports indicate that Academy Street worst affected by the flooding where seven families were evacuated. The bridge in Navan flooded and the Dublin Road was also affected.
December 1954	In Navan, the River Boyne and River Blackwater flooded, and twenty families were forced to evacuate their homes on Academy Street which was flooded (the lowest point on Academy Street is approximately 34.75mOD Poolbeg). Four families were evacuated on Bridge Street/Blackcastle Avenue/Flower Hill. Flooding also occurred on Circular Road, Parnell Park, McDermott Villas and Cannon Row. The peak flow at Liscartan Hydrometric Station was 119.6m ³ /s according to the HydroEnvironmental report ⁴ , which is similar to the flow during the November 2000 event. That particular event was calculated to have an AEP in the region of 3.33%.

4.6 Sources of Flooding

A review of the historical event data and predictive flood information has highlighted a number of sources of potential flood risk to the town. These are discussed in the following sections.

4.6.1 Fluvial Flooding

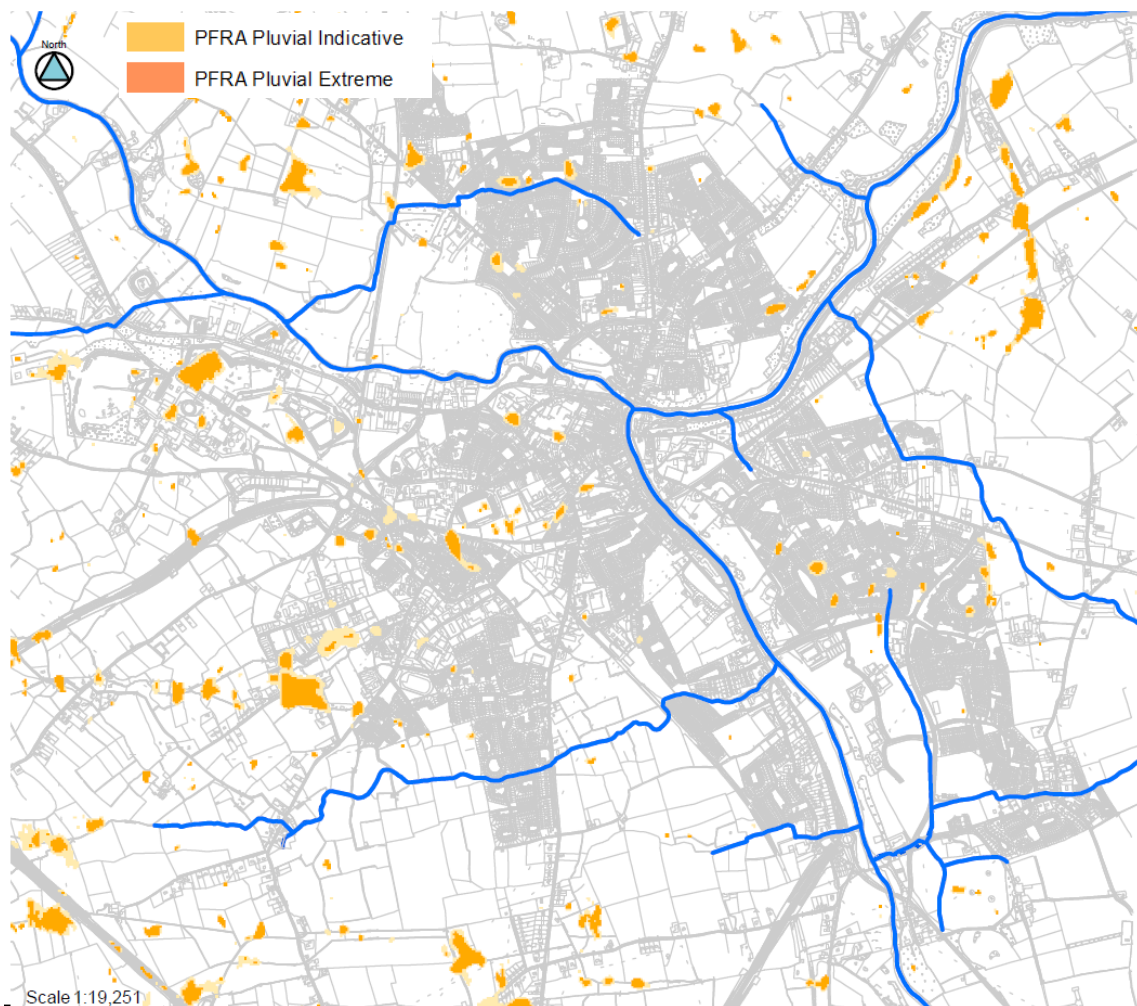
The main sources of historic and potential flood risk to development in Navan are the Rivers Boyne, Blackwater and Swan. Whilst there is a long collection of historic events for Navan a lot of the flood impacts are either from combined surface water/fluvial influences or surface water on its own. The most persistent fluvial related flooding is to the area around Academy Street/Bridge Street/Circular Road. As suggested by the MCC Engineer, the flooding in this area is fluvially influenced but a lot of the impacts are also related to the surface water drainage system. The Swan River and River Boyne have historically impacted property in Balreask and Kilcarn. The risk to property in Balreask Manor has been reduced by the flood alleviation scheme. Most highly vulnerable development is located on lands at lower risk of flooding, away from the Rivers Boyne and Blackwater. The management of fluvial flood risk through the development of appropriate policies and objectives is discussed Section 4. A full review of locations where development is impacted by flood risk is included in Section 6.

4.6.2 Surface Water / Pluvial Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. Areas at risk from fluvial flooding will almost certainly be at risk from surface water flooding. The indicative pluvial map from the OPW PFRA study is presented in Figure 4-3. It has been used to identify development areas at particular risk of surface water and pluvial flooding.

Historic records of surface water flooding in Navan are significant and the OPW PFRA mapping provides clarification of some of the areas. Surface water flooding is prevalent in the area around Academy Street/Bridge Street, as well as Commons Road and Lane, Cannon Row, Townparks Moatlands and Moatville. For high risk areas the management of risk can potentially be addressed by individual works and adequate warning. For new development or redevelopment of existing sites adhering to the policies on the management of surface water will ensure the risk will be adequately managed. This is explained further in Section 4.

Figure 4-3 PFRA Indicative Pluvial Flood Map⁵



4.6.3 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from the subsurface, and is particularly common in karst landscapes. This source of flooding can persist over a number of weeks and poses a significant but localised issue that has attracted an increasing amount of public concern in recent years. In most cases groundwater flooding cannot be easily managed or lasting solutions engineered.

The draft PFRA groundwater flood maps⁶, which entailed an evidence-based approach and considered the hydro-geological environment, such as the presence of turloughs, did not show

⁵ Source: OPW, PFRA Study Draft Data, licensed to Meath County Council

⁶ Reference: Preliminary Flood Risk Assessment Groundwater Flooding, June 2010
2016s4699 Navan DP SFRA v1.5.docx

any significant risk in the NDP area. Based on the PFRA study the risk of groundwater flooding is not considered significant enough to warrant further investigation in this SFRA.

4.7 Climate Change

The Planning System and Flood Risk Management guidelines recommends that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects.

Specific advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW draft guidance. Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "extreme" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change are given in Table 3 4 below.

Table 4-3 Allowances for Future Scenarios (100 Year Time Horizon)

Criteria	MRFS	HEFS
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1000mm
Land Movement	-0.5mm / year*	-0.5mm / year*
Urbanisation	No General Allowance - Review on Case by Case Basis	No General Allowance - Review on Case by Case Basis
Forestation	-1/6 Tp**	-1/3 Tp** +10% SPR***
Notes:		
* Applicable to the southern part of the country only (Dublin - Galway and south of this)		
** Reduce the time to peak (Tp) accordingly; this allows for potential accelerated runoff that may arise as a result of drainage of afforested land		
*** Add 10% to the Standard Percentage Runoff (SPR) rate; this allows for increased runoff rates that may arise following felling of forestry		

4.7.1 Climate Change and Flood Risk Assessment

The Flood Zones are determined based on readily available information and their purpose is to be used as a tool to avoid inappropriate development in areas of flood risk. Where development is proposed within an area of potential flood risk (Flood Zone A or B), a flood risk assessment of appropriate scale will be required and this assessment must take into account climate change and associated impacts. Under the National CFRAM programme, the detailed modelling and assessment stage of each study will include for climate change effects.

Climate change may result in increased flood extents and therefore caution should be taken when zoning lands in transitional areas. **As recommended in the Planning System and Flood Risk Management Guidelines; Flood Zone B, which represents the 0.1% AEP extent, can be taken as an indication of the extent of the 1% AEP flood event with climate change.** In steep valleys an increase in water level will relate to a very small increase in extent, however in flatter low-lying basins a small increase in water level can result in a significant increase in flood extent.

In the design of flood alleviation measures, climate change should be taken into account and design levels of structures, such as flood walls or embankments, must be sufficient to cope with the effects of climate change over the lifetime of the structure or where circumstances permit, be capable of adaptation. Further consideration to the potential future impacts of climate change will be given for specific areas of Navan within Section 6.

5 Flood Risk Management

The Planning Guidelines recommend a sequential approach to spatial planning, promoting avoidance rather than justification and subsequent mitigation of risk. The implementation of the Planning Guidelines is achieved through the application of policies and objectives within specific development plans.

Section 7.15 'Flood Risk Management' of Volume 1 of the Meath County Development Plan (MCDP) 2013-2019 includes a number of policies and objectives which set out the framework for flood management within the County.

The NDP SFRA will build on the overview of flood risk contained within the MCDP 2013-2019 SFRA (under Variation 3) by replicating the policies and objectives contained within the MCDP and adding to them, where necessary, to cater for the specific needs of the NDP area.

5.1 Flood Risk Policies and Objectives

The policies and objectives listed in this section have been considered and applied during the preparation of the variation to the NDP 2009-2015. In particular Policies 49-50 have ensured that the sequential approach has been adopted when considering land use zoning objectives and where necessary the Justification Test has been applied. This has resulted in re-zoning of land to open space in areas at risk of flooding, it has also protected development areas where there is a strategic requirement for town centre expansion. The policies contained within Volume 1, Section 7.15 of the MCDP 2013-2019 have been considered, slightly amended and proposed for inclusion in the NDP as follows.

INF POL 49	To integrate as relevant the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) assessment of development management proposals and in the preparation of any Framework Plans or Master Plans required during the period of this Plan to include the use of the sequential approach and application of the Justification Tests.
INF POL 50	To continue to implement the findings and recommendations of the current Strategic Flood Risk Assessment prepared as part of the Navan Development Plan Variation No. 1 review. (See Appendix IV).
INF POL 51	To ensure that a flood risk assessment is carried out for all development proposals in accordance with the Navan Strategic Flood Risk Assessment recommendations and the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.
INF POL 52	Any future planning application lodged with respect to any site having the benefit of an extant planning permission or seeking an extension of duration pursuant to Section 42 of the Planning & Development Acts 2000 – 2013 but which is identified on the land use zoning objectives map as having an interface with flood risk zones A / B 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 "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.

INF POL 53	To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and the Council will retain a strip of 10 metres on either side of such channel where required, to facilitate access thereto.
INF POL 54	To consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in Navan.
INF POL 55	To have regard to the recommendations of the Eastern Catchment Flood Risk Assessment and Management Study when finalised and approved in conjunction with the Navan Development Plan.
INF POL 56	Where relevant, the Councils shall adopt appropriate buffer zones to protect features of European, national, regional, county and local importance, including rivers, streams, from development proposals both in terms of visual and ecological importance.
INF POL 57	The Councils recognise European and national objectives for climate adaptation and will work with the EPA, Regional Authorities and neighbouring planning authorities in implementing future Guidance for climate change proofing of land use plan provisions as is flagged in the National Climate Change Adaptation Framework (DECLG, 2012).
INF POL 58	Where practicable, and particularly in areas of new development, floor levels shall be a minimum of 300mm above adjacent roads and hard standing areas to reduce the consequences of any localised flooding.
INF POL 59	To ensure that adequate measures are put in place to deal with residual risks, proposals shall demonstrate the use of flood-resistant construction measures that are aimed at preventing water from entering a building and that mitigate the damage floodwater causes to buildings. Alternatively, designs for flood resilient construction may be adopted where it can be demonstrated that entry of floodwater into buildings is preferable to limit damage caused by floodwater and allow relatively quick recovery.
INF POL 60	To have regard to the recommendations of the Eastern Catchment Flood Risk Assessment and Management Study when finalised and approved.
INF POL 61	To protect water courses, banks and bankside vegetation from interference by inappropriate bridging, draining, culverting or other works which would be detrimental to fisheries, biodiversity and the qualifying interests of Natura 2000 sites.
INF POL 62	To ensure that all new developments have satisfactory drainage systems in the interest of public health and to avoid the pollution of ground and surface waters.
INF POL 63	To require all new large scale developments to provide 'Sustainable Urban Drainage Systems' (SuDS) as part of their development proposals.
INF POL 64	To ensure that all developments have regard to the surface water management policies in the Greater Dublin Strategic Drainage Study (GDSDS). Compliance with the recommendations contained in Technical Guidance Document, Volume 2, Chapter 4 of the Greater Dublin Strategic Drainage Study shall be required in all instances.

The objectives contained within Volume 1, Section 7.15 of the MCDP 2013-2019 have been considered, slightly amended and proposed for inclusion in the NDP as follows:

INF OBJ 47	In areas where there is a high probability of flooding – Zone A refers – it is an objective of this plan to avoid development other than ‘water compatible development’ as described in Section 3 of the ‘The Planning System and Flood Risk Management – Guidelines for Planning Authorities’ issued in November 2009 by the DoEHLG.
INF OBJ 48	In areas where there is a moderate probability of flooding – ‘Zone B and Residual Risk Scenarios refers – it is an objective of this plan to avoid ‘highly vulnerable development’ described in Section 3 of ‘The Planning System and Flood Risk Management – Guidelines for Planning Authorities’ issued in November 2009 by the DoEHLG.
INF OBJ 49	To undertake a review of the ‘Strategic Flood Risk Assessment for Navan’ following the publication of the flood mapping which is being produced as part of the Catchment Flood Risk Assessment and Management (CFRAM) Studies.
INF OBJ 50	To design flood relief measures to ensure appropriate protection for alluvial woodland (i.e. a qualifying interest) along the Boyne.
INF OBJ 51	To design flood relief measures to protect the conservation objectives of Natura 2000 sites and to avoid indirect impacts of conflict with other qualifying interests or Natura 2000 sites.
INF OBJ 52	To promote positive flood relief measures that can enhance habitats in the Boyne floodplain such as swales, constructed wetland basins etc.
INF OBJ 53	To seek to ensure that construction works are designed so as not to result in surface water runoff into cSAC or SPAs either directly or indirectly via a watercourse.
INF OBJ 54	In determining the detailed design and final alignment of the Local Distributor Roads (LDR 3 and 4 refer), a Justification Test shall be applied if alignments being assessed interact with Flood Zone A and / or B. A detailed Flood Risk Assessment will be required to manage the risk and to demonstrate there will be no impact on adjacent lands. The detailed design of this route shall also be subject to as Appropriate Assessment pursuant to the Habitats Directive.
INF OBJ 55	The preparation of a layout for all lands identified as requiring the preparation of a Framework Plan or Master Plan shall also be cognisant of the flood risk mapping produced to inform the land use zoning objectives map of the Navan Development Plan as varied. A Flood Risk Assessment shall be prepared to accompany any planning application lodged with respect to lands contained within FP 1, FP2, FP 3, FP 4 and MP 3, and any planning application shall have regard to and be consistent with the recommendations of said Flood Risk Assessment.
INF OBJ 56	To ensure that existing wetland habitats are adequately protected, managed and where appropriate enhanced where flood protection/management measures are necessary.

5.2 Development Management - Planning Applications in Navan

To clarify the application of INF POL 51 & 52 or in any instances where an FRA is requested the following text outlines the key requirements relating to the management of development and flood risk in Navan:

- Development proposals will require an appropriately detailed flood risk assessment. As a minimum this will include "Stage 1 - Identification of Food Risk". Where flood risk is identified a "Stage 2 - Initial FRA" will be required, and depending on the scale and nature of the risk a "Stage 3 - Detailed FRA" may be required. The requirement for all applications to have an accompanying Stage 1 assessment is important to allow for

effective management of surface water risks. For example, a large site located in Flood Zone C may be appropriate in terms of vulnerability, but might be at potential risk of surface water flooding or residual risk of culvert failure. It is noted that this SFRA effectively deals with Stage 1 and can be referred to as such, although all development proposals must be accompanied by a surface water management plan.

- Under the FRA the impacts of climate change and residual risk (culvert/structure blockage) should be considered in setting the finished floor levels (FFL) of new development. In some cases, this may involve modelling at an appropriate level of detail.
- All development proposals will require the FRA to consider surface water management in line with the GDSDS as stated in INF POL 64.

Any proposal that is considered acceptable in principle shall demonstrate the use of the sequential approach in terms of the site layout and design and, in satisfying the Justification Test (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

Ground levels and FFLs must be clearly defined within the site specific FRA and must take into account the land use vulnerability and flood levels, including the impacts of climate change and additional freeboard. Flood levels for watercourses that are modelled as part of the Eastern CFRAM within Navan will be of use to future site specific FRAs.

The requirement for new development to have an FRA is specified on a site by site basis in Section 6. Further guidance on the requirements of a Flood Risk Assessment are provided under the CDP Variation 3 SFRA under Section 4.4 to 4.11 (contained within an Appendix to Volume 5).

5.3 Existing Development at Risk of Flooding

For existing development it is not feasible to alter the wider land use zoning objective and in most cases will not be possible to re-locate the existing development to an area at lower risk of flooding. For this reason, changes to existing development or reconstruction/new development (within existing developed areas) will require careful management.

Areas of existing development, along with their corresponding land use zoning objective, that are at risk of flooding in Navan are identified in Table 6-2 and also in the Flood Zone mapping.

Any proposal in an area at high or moderate risk of flooding (Flood Zone A or B) that is considered acceptable in principle must demonstrate that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels through the submission of an appropriately detailed FRA as detailed in Section 5.2.

5.4 Extension of Duration

To clarify the application of INF POL 52; for planning applications that were granted prior to the publication of the Planning System and Flood Risk Management Guidelines in 2009, and are subsequently applying for an extension of duration, it is a requirement that an appropriately detailed FRA should be provided as part of the application (see Section 5.2). If the permitted development is found not to conform with the Planning Guidelines then the application should be refused on flood risk grounds and a new application submitted, allowing for appropriate design and FRA.

5.5 Emergency Management Plan

Parts of Navan have been repeatedly flooded as a result of flood events on the Rivers Blackwater and Boyne. The combination of fluvial and surface water flooding is particularly prevalent in the Academy Street/Bridge Street area and the Commons Road/Commons Lane area. To help manage the risk it is recommended that established emergency response plans, such as the Meath Local Authorities Major Emergency Plan, are reviewed, and expanded to assist with the emergency management of a flood event. The plan should include details on the dissemination of warnings, traffic and people management and clear-up procedures.

6 Navan Development Plan Zoning Review

This section presents the land use zoning objectives in the variation to the NDP and reviews the flood risk to these objectives. Where new development is zoned within areas at risk of flooding then more detailed commentary is provided along with details for justification.

6.1 Land Use Zoning

The purpose of zoning is to indicate to property owners and members of the public the types of development which the Planning Authority considers most appropriate in each land parcel.

Zoning is designed to reduce the instances of conflicting uses within areas, to protect resources and, in association with phasing, to ensure that land suitable for development is used to the best advantage of the community as a whole.

The zoning objectives can be related to the vulnerability classifications in the 'Planning System and Flood Risk Management'; highly vulnerable, less vulnerable and water compatible. The vulnerability of the land use, coupled with the Flood Zone in which it lies, guides the need for application of the Justification Test.

Table 6-1 Land Zoning Objectives and Vulnerabilities

Objective/Use	Vulnerability*	Justification Test Required
A1 - Existing Residential	High	For development in Flood Zone A or B
A2 - New Residential	High	For development in Flood Zones A or B
B1 - Commercial/Town or Village Centre	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
B2 - Retail Warehouse	Less	For development in Flood Zone A
C1 - Mixed Use	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
D1 - Tourism	High / Less / Water Compatible	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A Or appropriate - if water compatible
E1 - High Technology	Less	For development in Flood Zone A
E2 - General Enterprise & Employment	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
E3 - Warehousing & Distribution	Less	For development in Flood Zone A
F1 - Open Space	Water Compatible	Development is generally appropriate
G1 - Community Infrastructure	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
H1 - High Amenity	Less / Water Compatible	For less vulnerable development in Flood Zone A or appropriate - if water compatible
R1 - Strategic Rail Corridor	High	For development in Flood Zone A or B
WL - White Lands	n/a	not applicable
* Land Use Vulnerability is expressed in relation to Table 3.1 (p25) of the Planning System and Flood Risk Management Guidelines for Planning Authorities. Some Zoning Objectives include a mix of different vulnerabilities of land use and are therefore presented as such in the table above.		

The land zoning objectives and their respective vulnerabilities are shown in Table 6-1. It is important to note that this table is provided as a general guide and the specific development types within the zoning objective must be considered individually, and with reference to Table 3-1 of the 'Planning System and Flood Risk Management'.

It is noted that whilst the Justification Test has been applied to land use zoning objectives in determining their applicability, there is some degree of variance in the vulnerability of the land uses under certain of the objectives in Table 6-1 above. For example the B1, C1, D1, E2 and G1 zonings can include for high or less vulnerable development. This results in a varying requirement for the application of the Justification Test and potential suitability of the development.

Where such conditions exist the draft zoning map provides clarification of the suitability of land use vulnerability within individual land zonings.

6.2 Development Zoning in Navan

Whilst preparing the variation zoning objectives for new development, the Local Authority has applied the sequential approach and preferentially avoided highly vulnerable or less vulnerable land uses within areas of moderate or high flood probability (Flood Zone A or B). Where land use zonings are subject to flooding, but development pressures remain, the Justification Test has been applied.

The procedure for site specific FRA is outlined in Sections 5.2 to 5.5, with overarching advice provided within CDP Variation 3 SFRA under Section 4.4 to 4.11 (contained within an Appendix to Volume 5). An overview of flood risk to the land use zoning objectives is presented in Table 6-2 below. Detailed commentary then follows for specific sites in Section 6.3.

Table 6-2 Land Use Zoning and Flood Risk in Navan

Land Use Zoning	Comment flood risk	Justification Test Required?
A1 - Existing Residential	Areas of existing residential development are at potential risk of flooding. Flood history supports Flood Zone mapping on Academy Street and Bridge Street as well as flooding from the River Swan in Balreask and Kilcarn housing estates. Balreask Manor and Canterbrook estates are now protected up to a 1 in 100 year standard. Flood mapping also highlights potential risk from other watercourses, most notably the Mill Stream. In line with the policies (INF POL 49 to 64) of the NDP, any extensions/change of use/reconstruction should be subject to an appropriately detailed FRA.	No
A2 - New Residential	The majority of new residential zoning objectives follow the sequential approach and preferentially avoid areas within Flood Zone A or B. The exceptions include the area upstream of the Balreask Manor and Canterbrook estate designed for a neighbourhood centre. In all cases, risk can be managed by an appropriately detailed FRA at development management stage (in line with INF POL 49 to 64 of the NDP), which should include allocation of water compatible and less vulnerable uses in Flood Zones A and B respectively. An area to the south of the R153 which is at risk from the Mill Stream, is subject to extant planning permission/part constructed.	No
B1 - Commercial/Town Centre	Most of the B1 lands at risk of flooding have been developed (adjacent to the River Boyne) and risk should be managed in line with the policies (INF POL 49 to 64) of the NDP. Any extensions/change of use/reconstruction should be subject to an appropriately detailed FRA.	No
B2 - Retail Warehouse	Existing retail warehouse development on the R147 adjacent to the River Blackwater is within Flood Zone A/B. However, the ground floor is raised above potential flood levels and the lower levels consist of car parking. Any extensions/change of use/reconstruction should be subject to an appropriately detailed FRA in line with NDP policies.	No
C1 - Mixed Use	There is significant existing C1 development adjacent to the Rivers Boyne and Blackwater located within Flood Zone A/B and risk should be managed in line with the policies (INF POL 49 to 64) of the NDP. Any extensions/change of use/reconstruction should be subject to an appropriately detailed FRA. New areas of C1 development within Flood Zone A or B are located off Metges Road (Priory Stream) and Convent Lane (River Boyne). For the Metges Road site it is recommended that open space is maintained adjacent to the watercourses within Flood Zone A/B. An appropriately detailed FRA will be required to demonstrate that any planning application(s) are employing this approach. Consideration of the future impacts of climate change and the residual risks arising from culvert blockage should also be provided.	No

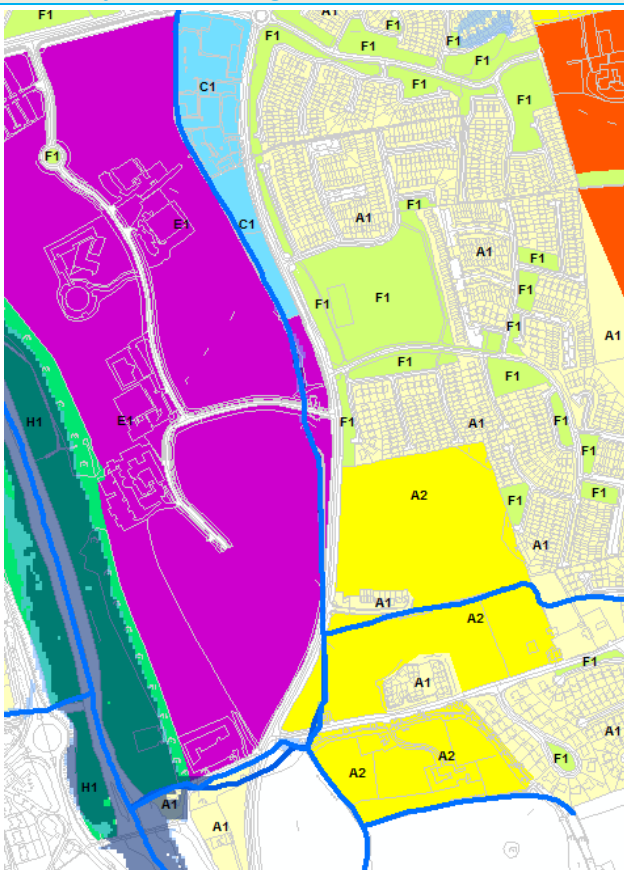
Land Use Zoning	Comment flood risk	Justification Test Required?
	An extant permission is in place on the Convent Lane site and in this case the Justification Test is not applied. Any new applications on the site will be subject to FRA and under the next full review of the land use zoning objectives (if there is no extant permission in place) the zoning should be considered in line with the sequential approach. Any extension of duration application must provide a revised FRA and any subsequent FRAs must be in accordance with policies (INF POL 49 to 64) of the NDP.	
D1 - Tourism	No fluvial risk in this zoning objective.	No
E1 - High Technology	E1 lands primarily relate to the Navan Business and Technology Park (IDA lands) although another area is identified adjoining the Navan - Drogheda rail line to the east of the town. The Priory Stream runs through the lands and risk is predominantly low as defined by the CFRAM mapping. Any future planning applications on the site should be subject to an appropriately detailed FRA at development management stage to demonstrate that the sequential approach has been applied and that the application fully adheres to the Planning System and Flood Risk Management Guidelines.	No
E2 - General Enterprise & Employment	E2 lands are mostly outside Flood Zone A/B and are at low risk of flooding. E2 lands within Flood Zone A/B are found adjacent to the River Blackwater, Boyne and an unnamed tributary of the Boyne in the north of the settlement. All are developed, and risk should be managed in line with the policies (INF POL 49 to 64) of the NDP. Any extensions/change of use/reconstruction should be subject to an appropriately detailed FRA.	No
F1 - Open Space	Open space is water compatible and is an appropriate zoning objective within Flood Zones A and B.	No
G1 - Community Infrastructure	G1 lands at risk of flooding include areas adjacent to the Rail Corridor, adjacent to the Mill Stream and upstream of Balreask Manor and Canterbrook estates. All three areas are currently undeveloped. The margin of Flood Zone A/B within each site is small or localised adjacent to the watercourse. In each case any future planning applications on the sites should be subject to an appropriately detailed FRA at development management stage to demonstrate that the sequential approach has been applied and that the application fully adheres to the Planning System and Flood Risk Management Guidelines (in line with NDP policies). FFLs for highly vulnerable land uses should be set above the 100yr flood level, including an allowance for the potential impacts of climate change and additional freeboard.	No
H1 - High Amenity	Most high amenity uses are water compatible and include cycleways, greenways, trail development and water based recreational activities., H1 is therefore an appropriate zoning objective within Flood Zones A and B.	No
WL - White Lands	It is the general expectation that such lands will not be developed during the life of the NDP and as such no indication of offered regarding the suitability or otherwise of individual uses within the Development Plan. No consideration of the vulnerability of land uses to flood risk pertaining to this zoning objective can be carried out as a result.	No
R1 - Strategic Rail Corridor	The protection of the designated route of the extension of the Clonsilla to Parkway rail line to Navan is catered for by zoning objective R1 "To provide for a strategic rail corridor and associated physical infrastructure." The zoning has a single purpose use which is to protect the designated route from development which would otherwise compromise its future delivery. As such, the Justification Test and more detailed FRA of the corridor is not required. At such a time as the scheme is formally progressed then the detailed design should be subject to further investigation in line with the Planning System and Flood Risk Management Guidelines. For the most part the route	Not at this stage

Land Use Zoning	Comment flood risk	Justification Test Required?
	alignment seeks to utilise an existing de-commissioned railway line and many of the river crossings are already in place. Any new crossings will also need to obtain OPW Section 50 consent. In the area adjacent to Ratholdren Road the opportunity exists for the future railway works to replace/increase culvert and channel capacity and reduce flood risk to adjacent lands.	
Distributor Roads	Proposed road objectives intersect Flood Zones A/B in six locations within the NDP. Three are subject to extant Part VIII planning permissions, a fourth is included within the Strategic Development Zone (SDZ) Planning Scheme and the fifth has been subject to a route selection process. The remaining alignment is currently indicative. Extant planning permissions and the link contained in the SDZ Planning Scheme are not subject to the Justification Test, although two sites may require additional assessment. The indicative sites will require further assessment once the routes are confirmed and intersections with Flood Zone A/B have been identified, in line with the INF OBJ 54 of the NDP. OPW Section 50 consent for all watercourse crossings will be required prior to construction.	Not at this stage

6.3 Zoning Review

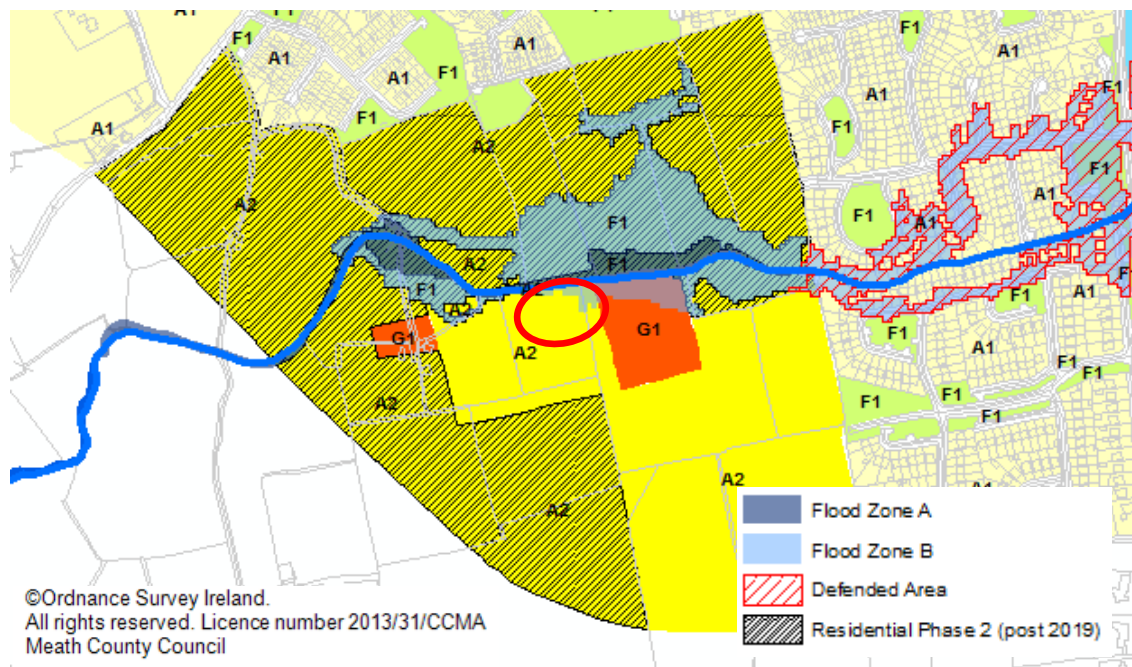
The following review concentrates on undeveloped land use zoning objectives through the presentation of individual tables highlighting areas at potential risk, with comments and further detail on how it is recommended that flood risk is managed.

6.3.1 New Residential (A2), General Enterprise & Employment (E2) and Mixed Use (C1)

Areas adjacent to Metges Road	
 <p>©Ordnance Survey Ireland. All rights reserved. Licence number 2013/31/CCMA Meath County Council</p>	
<p>JBA Comment:</p> <p>Various undeveloped/part developed A2, C1 and E1 lands are located adjacent to a CFRAM modelled watercourse (Prior Stream and tributaries), risk is generally low but FRA is required at planning application stage to manage residual risk.</p> <p>A2 site adjacent to the Metges Road and is now being developed and is subject to extant planning permissions and has therefore retained an A2 zoning. The risk from Prior Stream is largely kept to the channel. In the case of an extant permission the Justification Test is not applied.</p> <p>If any land remains undeveloped and the planning applications lapse, any future planning applications on the site should be subject to an appropriately detailed FRA taking into account the CFRAM mapping with particular attention to residual risk. Under an appropriately detailed FRA it must be demonstrated that the FFLs of all residential dwellings are set above the 100yr flood level, including an allowance for the impacts of climate change and additional freeboard. In adopting this approach it must be demonstrated that there is no increase in risk to neighbouring development.</p> <p>Development of the E1 lands within the Navan Business and Technology Park will also require an appropriately detailed FRA to assess the potential impacts from the Prior Stream. The remaining undeveloped C1 land requires the same approach.</p>	
Conclusions	<p>The Justification Test is not applied for extant permissions. However, any new applications will be subject to FRA. Refer to Eastern CFRAM deliverables when available to assist in the preparation of any future FRAs. Special consideration should be given to residual risk (culvert blockage) when preparing FRAs in this area. Flood risk should be managed in line with approved policies and objectives contained in the NDP.</p>

6.3.2 New Residential (A2) - Undeveloped Zoned Land

Area upstream of Balreask Manor and Canterbrook



JBA Comment:

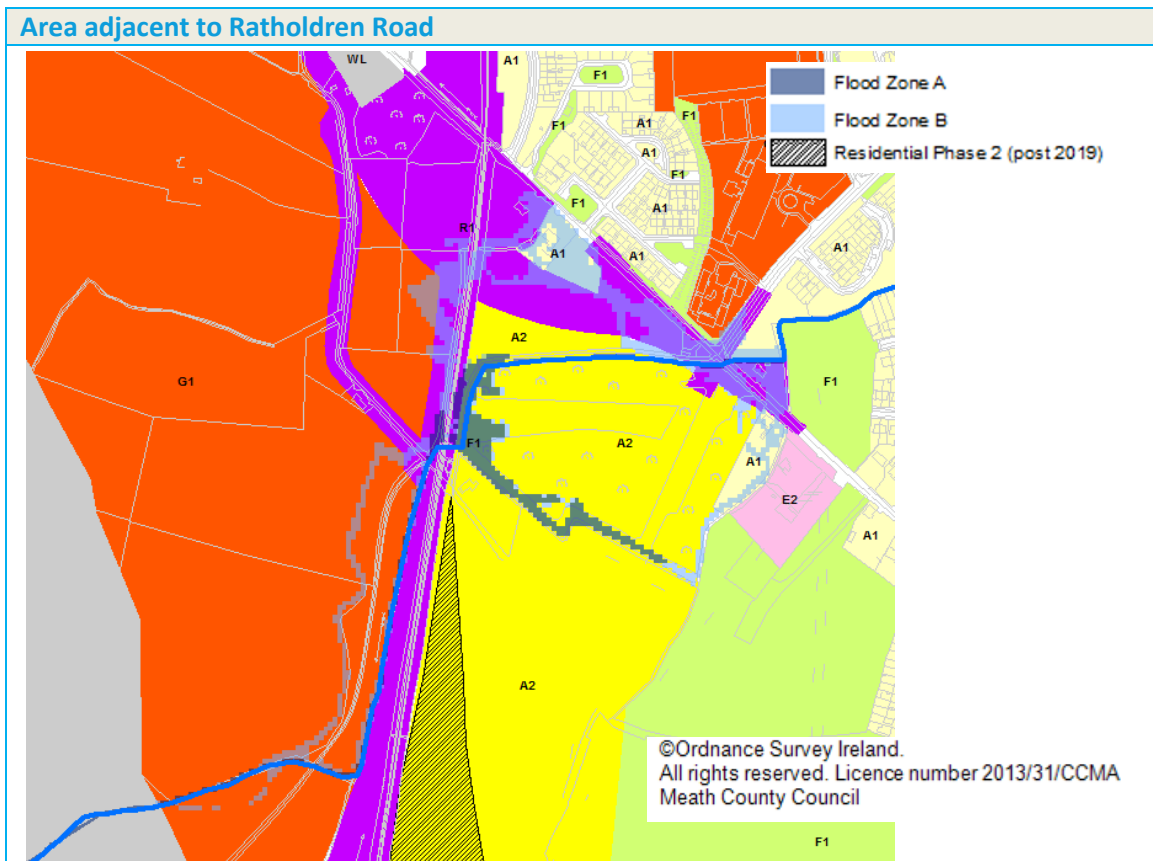
Upstream of the Balreask Manor and Canterbrook Estates are significant greenfield lands zoned for development. The Swan River passes through the land and the extent of flooding from Flood Zone B intersects A2 and G1 land use objectives.

The extent through the A2 lands is limited to a small area of Flood Zone B south of the river channel to the west of the G1 lands, circled red in the image above. This is the area identified for the Neighbourhood Centre. Risk can be appropriately managed by the application of the sequential approach within the zoning objective, which should apply to the building footprint and associated access roads. This will ensure that lands falling within Flood Zone B are used for water compatible or less vulnerable land uses. In addition, an appropriately detailed FRA at development management stage will be required to demonstrate that the application fully adheres to the Planning System and Flood Risk Management Guidelines. The assessment should appropriately set FFLs and consider residual risk from culvert blockage, flood defence assets and climate change.

Conclusions

Application of the sequential approach within the A2 zoning to maintain open space or less vulnerable land use within Flood Zone B lands. Appropriately detailed FRA to demonstrate that any planning applications are employing the required approach. Flood risk should be managed in line with approved policies and objectives contained in the NDP.

6.3.3 New Residential (A2) - Undeveloped Zoned Land



JBA Comment:

Adjacent to Ratholdren Road are undeveloped lands that are zoned for A2 purposes. The Abbeylands Tributary has been modelled by the CFRAM and goes into culvert upstream of the Ratholdren Road and then passes in an open channel through the A2 lands. Culvert capacity appears to generate surcharging at the 0.1% AEP event and results in some overland flow routes (Flood Zone B) looping around to the south and west, towards the Rail Corridor. At this location, a more extensive area of Flood Zone A suggests there may be channel capacity or culvert capacity issues.

A2 lands avoid risk by the application of the sequential approach.

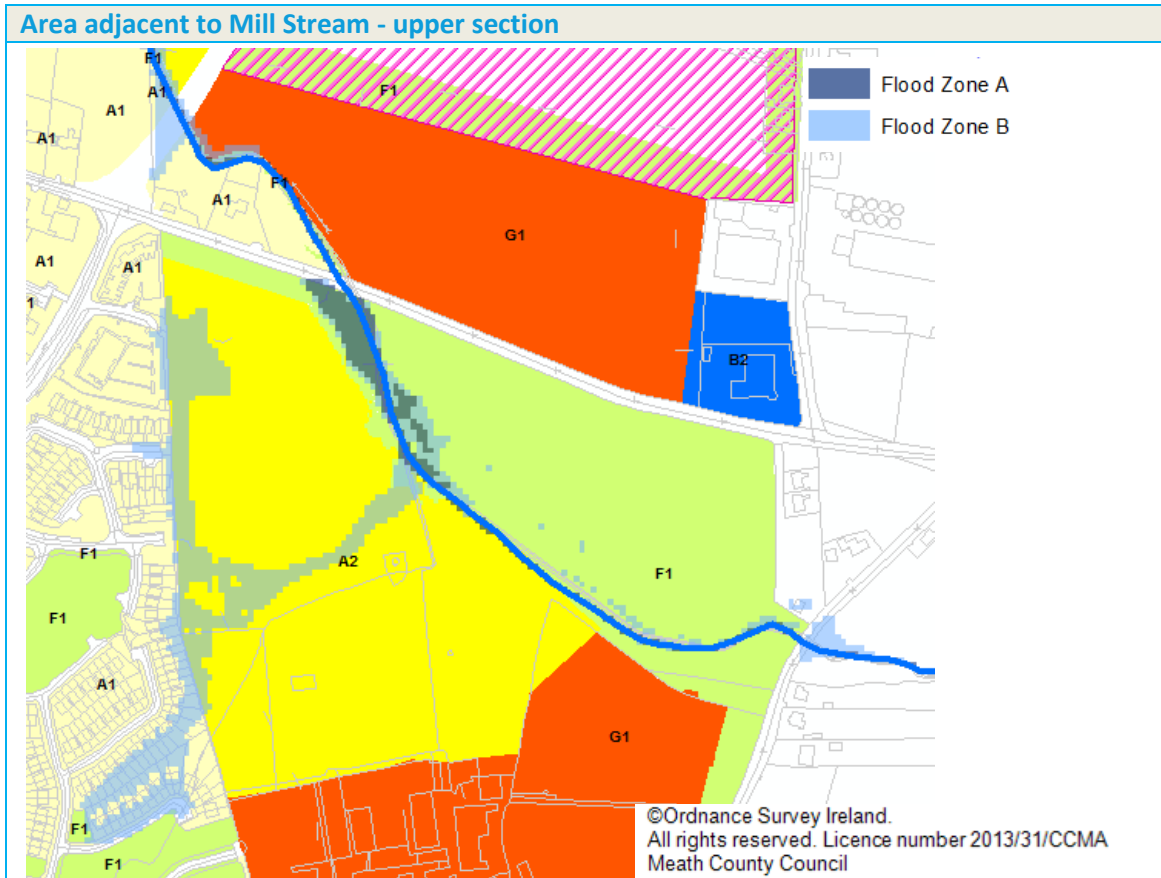
The G1 lands to the west of the Rail Corridor have also applied the sequential approach. G1 land within Flood Zone B is retained on the basis that the use will be less vulnerable.

R1 lands are reserved for the Rail Corridor and at such a time as the scheme is formally progressed then the detailed design should be subject to further investigation in line with the Planning System and Flood Risk Management Guidelines. A significant opportunity exists to upgrade culvert channel capacity issues and therefore mitigate much of the flooding problems in the Ratholdren Road area. The corridor is in a fixed position based on the existing route and the Justification Test does not apply.

An appropriately detailed FRA at development management stage is required to demonstrate that any application on the G1 or A2 land fully adheres to the Planning System and Flood Risk Management Guidelines. Attention should be given to the impacts of future climate change and culvert blockage.

Conclusions	Appropriately detailed FRA to refer to the CFRAM flood mapping and demonstrate that any planning applications are employing the required approach with FFLs set appropriately above the 1% AEP plus climate change level for highly vulnerable use. Consideration of the future impacts of climate change and culvert blockage should also be provided. Flood risk should be managed in line with approved policies and objectives contained in the NDP.
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6.3.4 New Residential (A2) and Community Infrastructure (G1)



JBA Comment:

The Mill Stream is restricted by the culvert underneath the R153 and this causes flooding to the lands upstream. Flood Zone A and B impact a proportion of the A2 lands which are subject to an extant planning permission which has commenced construction and cannot be rezoned, nor Justification Test applied. Any future planning applications on the site should be subject to an appropriately detailed FRA. Under the next full review of the land use zoning objectives contained in the NDP (if there is no extant permission in place) any undeveloped lands and zoning should be considered in line with the sequential approach and Justification Test for Plan Making. Any extension of duration application must provide a revised FRA which must be in accordance with policies (POL 49 to 64) of the NDP.

G1 lands to the north of the R153 are partly impacted by Flood Zone C and any future development on these lands should apply the sequential approach and avoid highly vulnerable use.

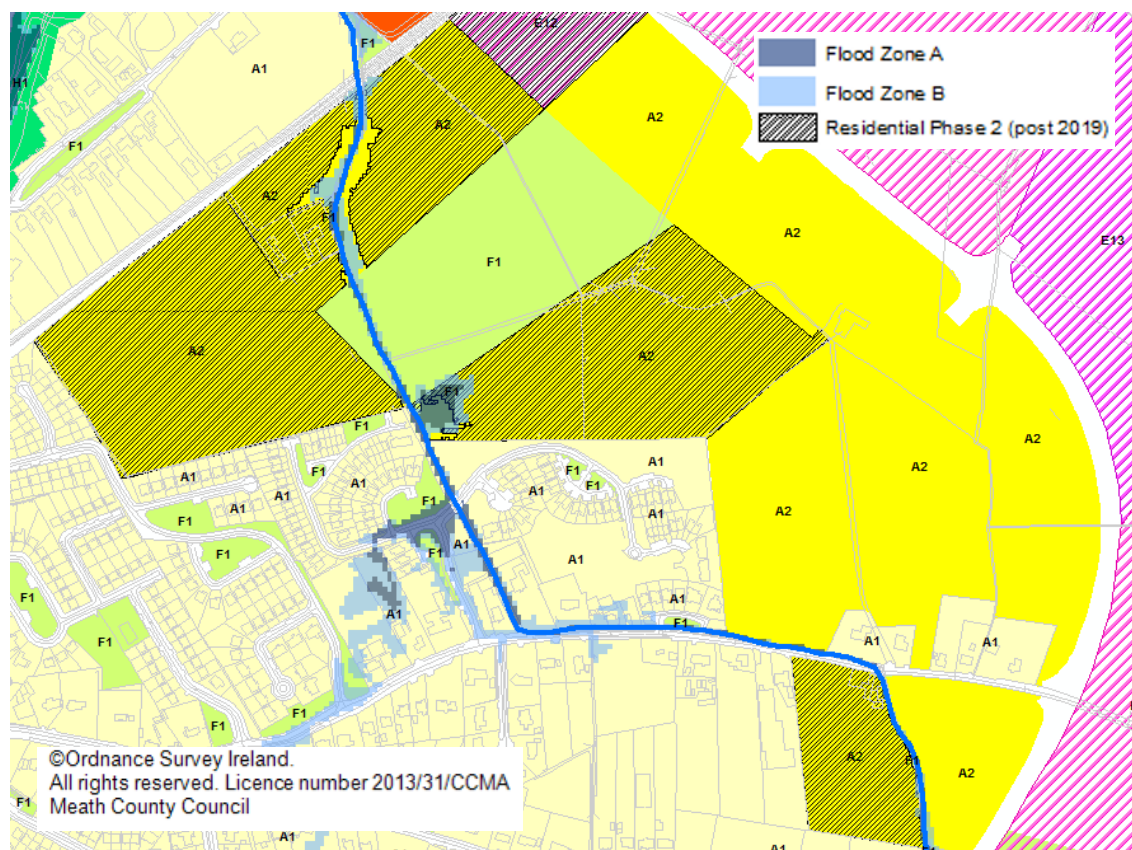
An appropriately detailed FRA at development management stage is required to demonstrate that any new application on the G1 or A2 land fully adheres to the Planning System and Flood Risk Management Guidelines. Attention should be given to the impacts of future climate change and culvert blockage.

Conclusions

Appropriately detailed FRA to refer to the CFRAM flood mapping and demonstrate that any planning applications are employing the required approach with FFLs set appropriately above the 1% AEP plus climate change level for highly vulnerable use. Consideration of the future impacts of climate change and culvert blockage should also be provided. Flood risk should be managed in line with approved policies and objectives contained in the NDP.

6.3.5 New Residential (A2)

Area adjacent to Mill Stream - lower section



JBA Comment:

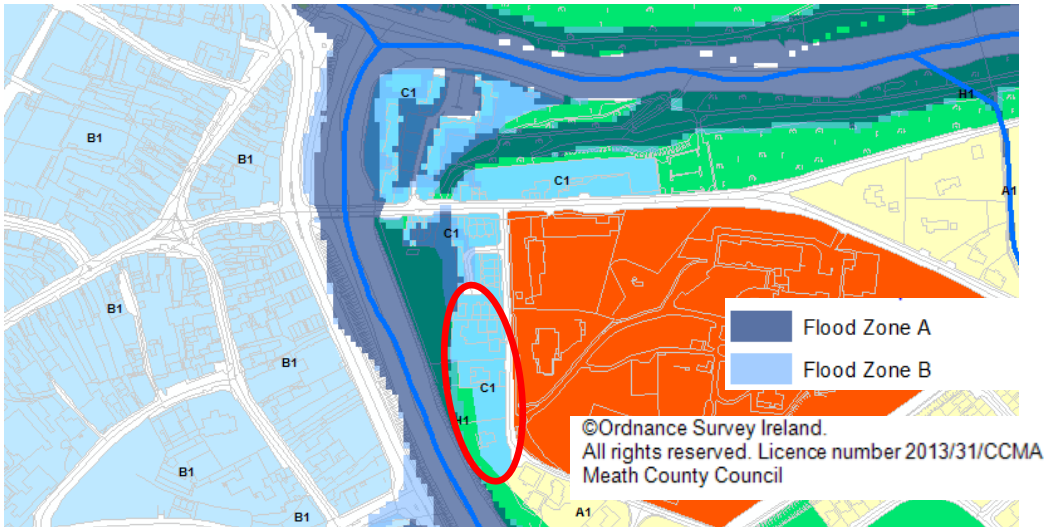
Downstream of the R153 the Mill Stream continues through A2, A1 and then A2 zoned land. Undeveloped A2 lands (the majority of which are Phase 2 lands) have had the sequential approach applied and Flood Zone A/B is retained as a less vulnerable use, unless on existing development (A1).

All new planning applications for development bounding the Mill Stream must provide a revised FRA which must be in accordance with the Planning System and Flood Risk Management Guidelines and policies (POL 49 to 64) of the NDP. Special attention should be given to the impacts of future climate change and culvert blockage.

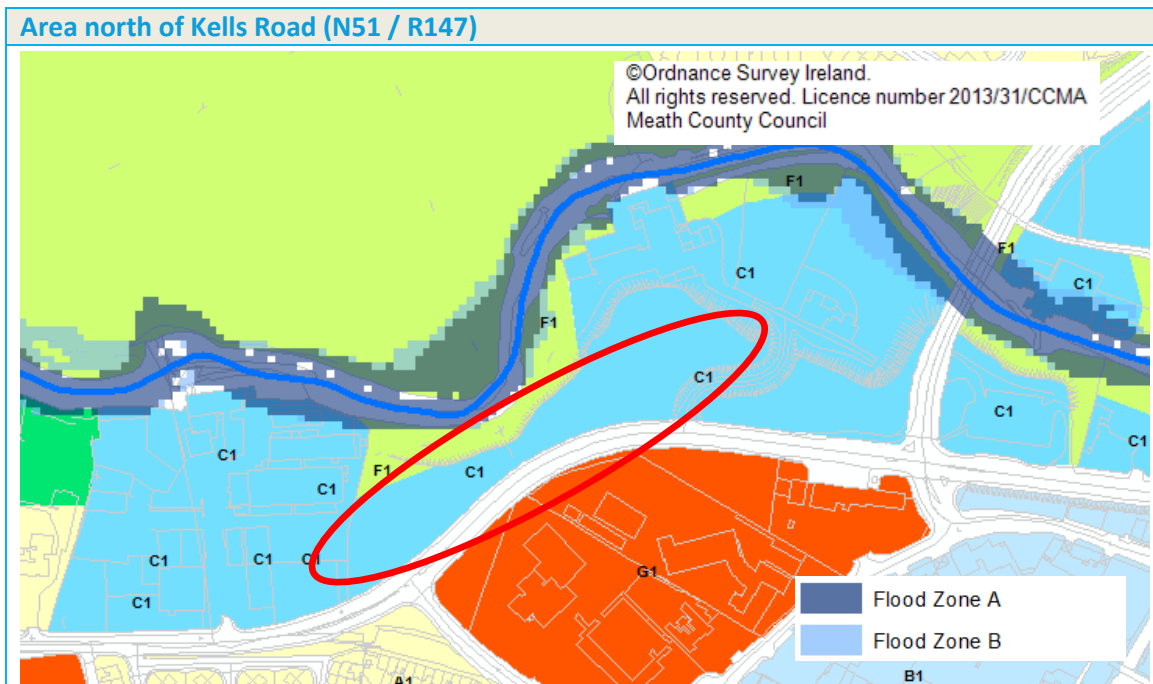
Conclusions

Appropriately detailed FRA to refer to the CFRAM flood mapping and demonstrate that any planning applications are employing the required approach with FFLs set appropriately above the 1% AEP plus climate change level for highly vulnerable use. Consideration of the future impacts of climate change and culvert blockage should also be provided. Flood risk should be managed in line with approved policies and objectives contained in the NDP.

6.3.6 Mixed Use (C1) - Urban Redevelopment Lands

Area off Convent Lane	
	
<p>JBA Comment:</p> <p>A significant amount of C1 lands are located in the area around the confluence of the Boyne and Blackwater Rivers. Most of the C1 lands host existing development and management of risk will be handled at development management stage through the application of NDP policies WS POL 49 to 62.</p> <p>One extant permission exists on Convent Lane (circled red above) and a margin of Flood Zone A and B extends onto the site from the River Boyne. The extant permission relates to a mixed use application for living accommodation, offices and car parking. An FRA was completed in 2004 and was submitted during the application process in 2008 (prior to the Planning System and Flood Risk Management Guidelines of November 2009), living accommodation on the lower floor is unlikely to meet the requirements of the November 2009 Guidelines. In the case of an extant permission the Justification Test is not applied. Eastern CFRAM deliverables indicate that the flood levels have now reduced and there is less risk present to the development, however the risk is not removed.</p> <p>If the sites remain unconstructed and the planning applications lapse, any future planning applications on the site should be subject to an appropriately detailed FRA specific to the revised zoning and it may be found that the site cannot be developed as planned. Under the next full review of the land use zoning objectives contained in the NDP (if there is no extant permission in place) the lands and zoning should be considered in line with the sequential approach and Justification Test for Plan Making. Any extension of duration application must provide a revised FRA which must be in accordance with policies (POL 49 to 64) of the NDP.</p>	
Conclusions	<p>The Justification Test is not applied for extant permissions. However, any new applications will be subject to FRA and under the next full review of the land use zoning objectives contained in the NDP (if there is no extant permission in place) the zoning should be considered in line with the sequential approach. Any extension of duration application must provide a revised FRA which must be in accordance with policies (INF POL 49 to 64) of the NDP. Refer to Eastern CFRAM deliverables to assist in the completion of any future FRAs.</p>

6.3.7 Mixed Use (C1) - Undeveloped Zoned Land



JBA Comment:

A significant amount of C1 lands are also located between the Kells Road (N51) and the River Blackwater. The River Blackwater poses a risk to some of the existing developments and there is little land that is left un-developed. The risk to the area has dropped now that the CFRAM mapping has superseded the previous version. The one remaining area is circled red above and this is located within Flood Zone C.

Under an appropriately detailed FRA it must be demonstrated that the FFLs of any development are set above the 100yr flood level including the impacts of climate change and additional freeboard.

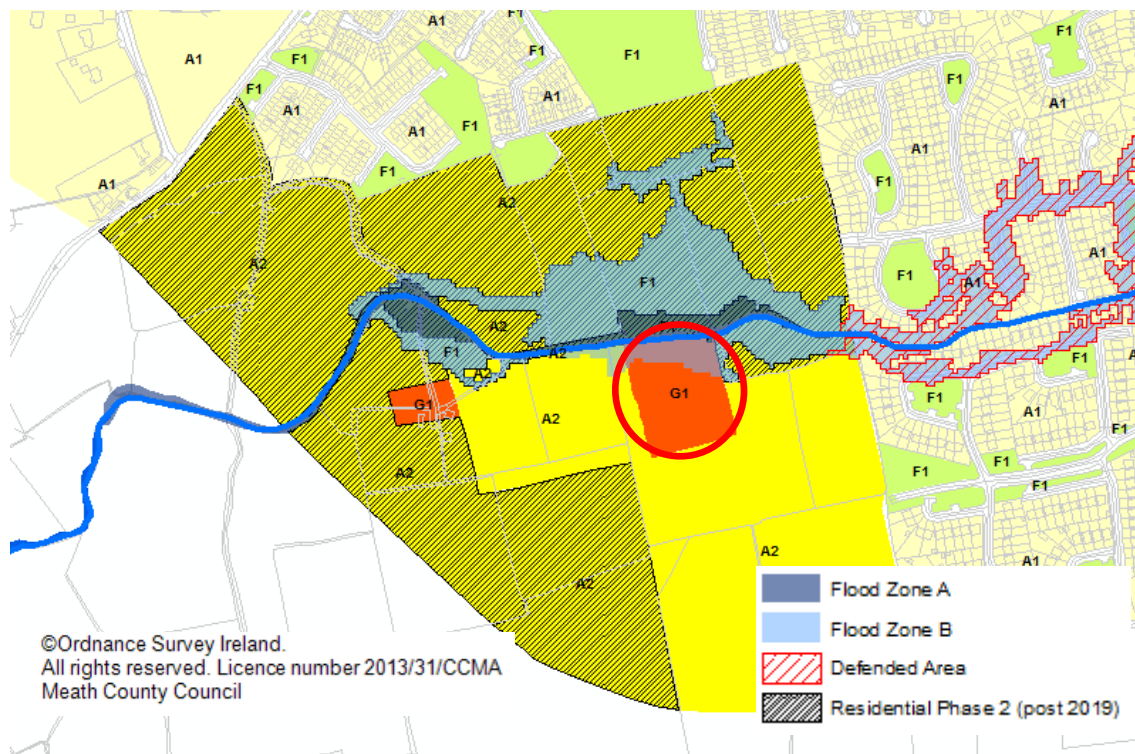
One extant permission exists on the south western edge of the area circled red above, which extends into previously developed C1 lands, and includes proposals to excavate a basement for car parking. A margin of Flood Zone A and B extends onto the site from the River Blackwater, but the proposed development is classed as 'less vulnerable' and it should be possible to manage the potential impacts of flooding on site. In the case of an extant permission the Justification Test is not applied. Eastern CFRAM deliverables will provide additional information when published.

Conclusions

Any future planning applications on the C1 lands adjacent to the River Blackwater should be subject to an appropriately detailed FRA at development management stage in accordance with policies (POL 49 to 64) of the NDP. FFLs should be set above the 100yr flood level including the impacts of climate change and additional freeboard. Refer to Eastern CFRAM deliverables to assist in the completion of any future FRAs.

6.3.8 Community Infrastructure (G1) - Undeveloped Zoned Land

Area upstream of Balreask Manor / Canterbrook



JBA Comment:

Upstream of the Balreask Manor and Canterbrook estates are significant greenfield lands which have been zoned for development. The Swan River passes through the land and the extent of flooding from Flood Zone B intersects A2 and G1 land use objectives.

The extent through the G1 lands is limited to an area of Flood Zone B south of the river channel, circled red in the image above. Risk can be appropriately managed by the application of the sequential approach within the zoning objective. This will ensure that lands falling within Flood Zone B are used for water compatible land uses such as sports/playing pitches or open space. In addition, an appropriately detailed FRA at development management stage will be required to demonstrate that the application fully adheres to the Planning System and Flood Risk Management Guidelines. The assessment should appropriately set FFLs and consider residual risk from culvert blockage, flood defence assets and climate change.

Conclusions

Application of the sequential approach within the G1 zoning to maintain open space within Flood Zone A/B lands. Appropriately detailed FRA to demonstrate that any planning applications are employing the stated approach. Consideration of the future impacts of climate change, flood defence assets and culvert blockage should also be provided. Refer to Eastern CFRAM deliverables to assist in the completion of any future FRAs, which should be in accordance with policies (POL 49 to 64) of the NDP.

6.4 SFRA Review and Monitoring

An update to the SFRA will be triggered by the six year review cycle that applies to Local Authority development plans. In addition, there are a number of other potential triggers for an SFRA review and these are listed in the table below.

There are a number of key outputs from possible future studies and datasets, which should be incorporated into any update of the SFRA as availability allows. Not all future sources of information should trigger an immediate full update of the SFRA; however, new information should be collected and kept alongside the SFRA until it is updated.

Detailed, site specific FRAs may be submitted to support planning applications. Whilst these reports will not trigger a review of the Flood Zone maps of SFRA, they should be retained and reviewed as part of the next cycle of the Development Plan.

Table 6-3 SFRA Review Triggers

Trigger	Source	Possible Timescale
Catchment Flood Risk Assessment and Management (CFRAM) Flood Mapping updates	OPW under the Floods Directive	Already published 2016 and 6 year cycles
Eastern River Basin Flood Risk Assessment and Management (ECFRAM) Plan	OPW	2017 and 6 year cycles
Flood maps of other sources, such as drainage networks	Various	Unknown
Significant flood events	Various	Unknown
Changes to Planning and / or Flood Management Policy	DoEHLG / OPW	Unknown
Detailed FRAs	Various	Unknown

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