Draft Limerick Development Plan 2022-2028

Strategic Flood Risk Assessment

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Limerick City and County Council

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Revision History

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Contract

This report describes work commissioned by Sinead Kennedy, on behalf of Limerick City and County Council, by a letter dated 18 June 2020. Elizabeth Russell and Fiona Byrne of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
CC	Climate Change
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
DTM	Digital Terrain Model
ESB	Electricity Supply Board
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FRS	Flood relief scheme
GIS	Geographical Information System
HEFS	High End Future Scenario
ICPSS	Irish Coastal Protection Strategy Study
JFLOW	2-D hydraulic modelling package developed by JBA
LA	Local Authority
LAP	Local Area Plan
mOD	Meters above Ordnance Datum
MRFS	Medium Range Future Scenario
MWRDP	Mid-West Regional Development Plan
OPW	Office of Public Works
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
SAC	Special Area of Conservation, protected under the EU Habitats Directive
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SPR	Standard percentage runoff
SUDS	Sustainable Urban Drainage Systems
Tp	Time to Peak

1 Study Background

JBA Consulting was appointed by Limerick City and County Council to carry out the Strategic Flood Risk Assessment (SFRA) for the Draft Limerick Development Plan 2022-2028.

This report details the SFRA for this area and has been prepared in accordance with the requirements of the DoEHLG and OPW Planning Guidelines, The Planning System and Flood Risk Management[1]; these guidelines were issued under the Planning and Development Act 2000 (as amended) and recognise the significance of proper planning to manage flood risk.

1.1 Scope of Study

Under the "Planning System and Flood Risk Management" guidelines, the purpose for the FRA 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 Limerick Development Plan 2022-2028 (DP) will be the key document for setting out a vision for the development of Limerick during the plan period.

It is important that the DP fulfils the requirements of the document "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.

To ensure that flood risk is integrated into the DP, the main requirements of this document are to:

- Produce Flood Zone mapping.
- Prepare a Stage 2 - Flood Risk Assessment of Limerick City and County with reference to location and type of zoning and land-use proposals.
- Prepare a Flood Risk Management Plan in compliance with OPW/DoEHLG – "The Planning System and Flood Risk Management –Guidelines for Planning Authorities (OPW/DoEHLG, 2009)".
- Advise on zonings/land use-proposals, assess and report on any submissions received as part of both the preparation and the public consultation stage of the plan, as they relate to flood risk.

1.2 Report Structure

This study considers the development strategy that will form part of the Development Plan for Limerick City and County. The context of flood risk in Limerick is considered with specific reference to a range of flood sources, including fluvial, tidal, pluvial, groundwater, sewer and artificial reservoirs and canals.

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 and is based on a variety of data sources, which have been collated into a Flood Zone map for the City and County. There are numerous settlements which have an extremely limited risk of flooding and land use zoning can be progressed without regard to flooding. However, historical records and recent events demonstrate that parts of the county have a risk of flooding and confirms that a proportion of zoned lands are at flood risk.

Settlements identified as requiring the Justification Test were carried through to Stage 2. In this part of the report, areas of potential development that require more detailed assessment on a site specific level have been discussed.

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 county settlements.

Section 2 provides an overview of the Planning System and Flood Risk Management and outlines some of the core concepts related to flood management.

Section 3 of this report gives an introduction to the study area and Section 4 the available data related to flooding is summarised and appraised.

[1] DoHELG and OPW (2009) The Planning System and Flood Risk Management: Guidelines for Planning Authorities

In Section 5 the policy response is described. This section provides guidance and suggested approaches to managing flood risk to development; the contents of this section will be of particular use in informing the policies and objectives within the Development Plan.

In Sections 6, 7 and 8 the application of the Sequential Approach and Justification Test is described with particular reference to specific sites across the City and county.

Finally, triggers for the ongoing monitoring and future review of the SFRA are detailed in Section 8.3.13.

2 The Planning System and Flood Risk Management

2.1 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.

The following paragraphs will 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 follows.

2.2 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:

Flood Risk = Probability of Flooding x Consequences of Flooding

The assessment of flood risk requires an understanding of the sources, the flow path of floodwater and the people and property that can be affected. The *source - pathway - receptor model,* shown below in Figure 2-1, illustrates this and is a widely used environmental model to assess and inform the management of risk.

Figure 2-1: Source Pathway Receptor Model

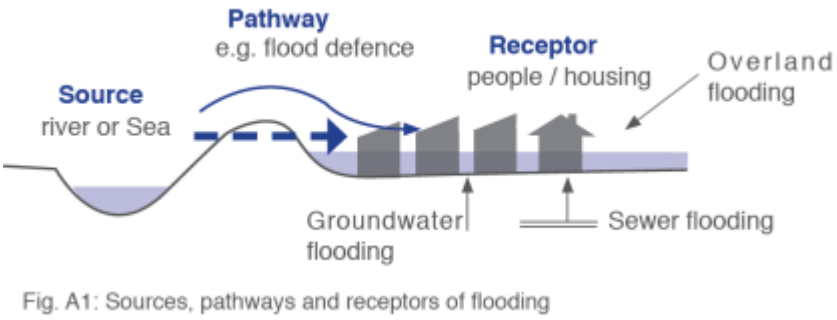


Fig. A1: Sources, pathways and receptors of flooding

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.

2.2.1 Likelihood of Flooding

Likelihood or probability of flooding or 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 2-1.

Table 2-1: 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.

2.2.2 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 Guidelines provide three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and shown in Table 2-2 below.

Table 2-2: Classification of vulnerability of different types of development

Vulnerability Class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities

Vulnerability Class	Land uses and types of development which include*:
	such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merit	

2.3 Definition of Flood Zones

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

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. 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 2-3: 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).

2.4 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.*' SFRAs 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.

2.5 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 plan boundary. 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 2-2: 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, which is undertaken for a number of development opportunity sites within the various settlements of this SFRA, 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 2-4 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 2-4: Matrix of Vulnerability versus Flood Zone

Development vulnerability	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

2.6 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:

- **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.

3 SFRA for Limerick City and County

3.1 Study area

Limerick is located in the Mid-West region of Ireland and has population of over 194,000. The county borders four other counties: Kerry to the west, Clare to the north, Tipperary to the east and Cork lies to the south. It is the fifth largest of Munster's six counties in size, and the second largest by population. The River Shannon flows through the City of Limerick and along the county's northern boundary and then into the Atlantic Ocean. The Shannon estuary is shallow and has extensive mud flats. This has implications for navigation in that the major Port is over 20 kilometres west of the city, at Foynes. Limerick City Metropolitan Area forms Ireland's third largest City. It also serves as a regional centre and is an employer of regional significance. The significant settlements are Newcastle West, Kilmallock, Abbeyfeale, Castleconnell and Rathkeale.

The county is generally low lying but has uplands to west the south and the east. The main land use outside the City is agricultural. A number of rivers cross the county, including the Shannon, the Maigue, the Deel, the Mulkear, the Feale and the Allaughaun and their tributaries. Their catchments define the drainage patterns of much of the county. In the south east, the Funshion, which drains into Cork is also an important drainage feature.

3.2 Planning Policy

3.2.1 Mid-West Area Strategic Plan 2012-2030

The Mid West Area Strategic Plan (MWASP) builds upon the MWRDP and includes a number of mitigation measures and objectives as part of its SEA to facilitate the management of flooding within the Planning, Land Use and Transportation Strategy.

Mitigation measures which directly address flooding are:

- MI-26 - The zoning of land areas for specific land use types will be required to comply with the requirements of The Planning System and Flood Risk Management - Guidelines for Planning Authorities (November, 2009).
- MI-28 - Each of the BRT (Bus Rapid Transit)/QBC (Quality Bus Corridor) routes will traverse areas where flood events have been recorded in the past. The provision of any additional infrastructure in these areas should be avoided with particular reference to passenger facilities such as platforms, bus stops etc. In the event that it is necessary to provide facilities at such locations, the infrastructural elements should be designed appropriately. Planning approval for any development will have to be considered in terms of the requirements of the DoECLG guidance document The Planning System and Flood Risk Management - Guidelines for Planning Authorities (November, 2009).
- MI-30 - Planning approval for any development will have to be considered in terms of the requirements of the DoECLG guidance document The Planning System and Flood Risk Management - Guidelines for Planning Authorities (November, 2009).

The SEA also included an objective on flood management:

- T-W-02 - The Strategy should ensure that development occurs in areas not prone to flooding in the absence of appropriate mitigation and should be undertaken to ensure no risk of future flooding.

3.2.2 Limerick and Shannon Metropolitan Area Transport Strategy (LSMATS)

The draft LSMATS sets out a framework for investment in transport for the Limerick Shannon Metropolitan Area for the next 20 years and includes proposals for the significant development of the cycle network and enhancement of bus services and infrastructure. The SEA for the draft LSMATS recognises that "Transport and strategic utilities infrastructure can be particularly vulnerable to flooding pressure as interruption of their function can have widespread effects well beyond the area that is flooded. For example, flooding of roads or railways can deny access to large areas beyond those directly affected by the flooding for the duration of the flood event, as well as causing long term damage to the road or railway itself." Specific projects progressed under the LSMATS will be subject to detailed FRA and should be referred to the guidance within this SFRA.

3.2.3 Draft Limerick Development Plan 2022-2028

County Limerick falls within the planning context of the Limerick Development Plan (DP) and the plan period relevant to this SFRA is 2022-2028.

The draft Limerick Development Plan 2022-2028 sets out the strategy and hierarchy for settlements in Limerick, in accordance with the Core Strategy. The Core Strategy and population targets are in compliance with the designated target populations and households targets for Limerick as set out in the National Planning Framework, Regional Spatial and Economic Strategy for the Southern Region and Section 28 guidance document "Housing supply Target Methodology for Development Planning", (DHLGH, December 2020). The Settlement hierarchy sets out the overall tiered approach to growth through the various levels identified. The Development Plan sets out compliance with the National Planning Framework and Regional Spatial and Economic Strategy for the Southern Region and relevant Section 28 Guidelines. The Development Plan requires compliance with The Planning System and Flood Risk Management (and Technical Appendices) Guidelines for Planning Authorities (DoEHLG, OPW, 2009) through the Development Management process.

Within the Development Plan, a number of Flood Risk Management policies have been identified covering:

- Coastal erosion and flooding;
- Strategic flood risk assessment;
- Catchment Flood Risk Assessment and Management Studies;
- Storm water management;
- Green infrastructure and flood management;
- Maintenance of rivers.

3.2.4 Settlement Hierarchy

The settlement hierarchy, as set out in the Draft Development Plan has 7 levels, which are listed in Table 3-1.

Table 3-1: Settlement Hierarchy

Hierarchy Level	Settlement	Local Area Plan date (if applicable)	Settlement included in the SFRA of the Development Plan 2022-2028
Level 1 Limerick City Metropolitan area	Limerick City and environs including Mungret and Annacotty	N/A	Yes
	Southern Environs	Draft plan 2021-2027	Yes
	Castletroy	2019-2025	Yes
Level 2 Key Town	Newcastle West	2014-2020 (extended to 2024)	No
	Kilmallock	2019-2025	No
Level 3 Towns (>1400 population)	Abbeyfeale	2014-2020 (extended to 2024)	No
	Caherconlish	2012-2018	Yes
	Castleconnell	2013-2019 (extended to 2023)	No
	Rathkeale	2012-2018 (extended to 2022)	No
Level 4 Large Villages (>500 population)	Askeaton	2015-2021 (extended to 2025)	No
	Adare	2015-2021 (extended to 2024)	No
	Ballingarry	N/A	Yes
	Bruff	2012-2018 (extended to 2022)	Yes
	Bruree	N/A	Yes
	Cappamore	2011-2017 (extended to 2022)	Yes
	Croom	2020-2026	No
	Doon	N/A	Yes
	Dromcoliher	N/A	Yes
	Foynes	N/A	Yes
	Glin	N/A	Yes
	Hospital	2012-2018 (extended to	Yes

Hierarchy Level	Settlement	Local Area Plan date (if applicable)	Settlement included in the SFRA of the Development Plan 2022-2028
		2022)	
	Murroe	N/A	No
	Kilfinane	2012-2018 (extended to 2022)	Yes
	Pallasgreen	N/A	Yes
	Pallaskenry	N/A	Yes
	Patrickswell	2015-2021	No
Level 5 Small Villages	Ardagh, Athlacca, Athea, Ballyagran, Ballyhahill, Ballylanders, Ballyneety, Broadford, Carrigkerry, Castlemahon, Clarina, Croagh, Fedamore, Galbally, Herbertstown, New Kildimo, Kilteely, Knocklong, Loghill, Oola, Montpelier, Mountcollins, Nicker, Shanagolden, Templeglantine, Tournafulla		Yes, under the general policy response section
Level 6 Rural Clusters	Anglesboro, Ardpatrick, Ashford, Ballybrown, Ballyorgan, Ballysteen, Banogue, Caherline, Cappagh, Castletown, Crecora, Dromkeen, Elton, Feenagh, Feohanagh, Glenbrohane, Glenosheen, Glenroe, Granagh, Kilbeheny, Kilcolman, Kilcornan, Kilfinny, Kilmeedy, Knockaderry, Knockainy, Knockdown, Martinstown, Meanus, Monagea, Old Pallas, Raheenagh, Strand		Yes, under the general policy response section
Level 7 Open Countryside			Yes, under the general policy response section

3.3 Flood Relief Schemes

Within Limerick City and County there are a number of settlements where flood relief schemes are either completed, under design and development or proposed for the future. Although the Flood Zones do not include the benefit of defences, it is important to know where a flood relief scheme is in place, and how the scheme moderates flood risk, both in 'normal' circumstances when the defence is functioning as designed, and also for the less frequent situations when the defence may breach or be overtopped. A summary of the defences in Limerick is provided in Table 3-2.

Table 3-2: Formal flood defence infrastructure

Scheme	Target SOP	Status
Foynes Flood Relief Scheme (tidal)	0.5% AEP	Complete, but only benefit the Port and houses immediately adjacent.
King's Island Flood Relief Scheme	0.5% Coastal AEP + Freeboard and Adaptation for CC (where possible)	Planning Permission granted.
Castleconnell Flood Relief Scheme	1% Fluvial AEP + Freeboard and Adaptation for CC	At design stage.
Athea Flood Relief Scheme	To be determined	At design stage.
Limerick City and Environs Flood Relief Scheme	To be determined	At design stage.
Rathkeale Flood Relief Scheme	To be determined	At design stage.
Adare Flood Relief Scheme	To be determined	At design stage.
Newcastle West Flood Relief	To be determined	Included in CFRAM 10 Year Programme (2018). No current

Scheme	Target SOP	Status
Scheme		approval to progress to design stage received from OPW
Foynes Flood Relief Scheme (fluvial)	To be determined	
Askeaton Flood Relief Scheme	To be determined	

3.4 Flood Forecasting

Limerick City and County Council Operations Department prepare a Weekly Weather Assessment which includes a review of the impact of predicted tides at Limerick Dock, Parteen Weir flows, rainfall and wind direction and speed, to determine the risk of flooding. Where trigger levels are predicted, Operations deploy demountable flood barriers in Limerick City Quays and Atlas Avenue. The Weekly Weather Assessment also allows the Council to prepare for potential flood events to at-risk locations e.g. Merchants Quay, Sarsfield House, Mountshannon Road, Annacotty, Castleconnell and Montpelier.

OPW provide a High Tide Advisory Notices (e-mail) to Local Authorities and Government Departments and Agencies. These Advisory Notices provide information on forecasted tidal surges at Shannon Estuary. The Limerick City and County Council weekly weather update is reviewed following receipt of a High Tide Advisory Notice.

ESB provide a Text Notification system for property owners located adjacent to the River Shannon who may be affected by increased managed discharges to the Shannon over Parteen Weir. This text alert is also circulated to Limerick City and County Council Operations Staff to provide notice of potential flood events at Castleconnell and Mountshannon Road/Annacotty. Any unexpected increase in discharge will be assessed and provided as a revision to the Limerick City and County Council Weekly Weather Update.

There is provision within the Flood Relief Schemes for the inclusion of Flood Forecasting systems. This will include a review of the existing systems. These would be particularly important where there are non-permanent flood installations which may need to be deployed as part of the Schemes.

4 Identification of Flood Risk (Stage 1)

4.1 Data Sources

This section of the SFRA will review the availability of data relating to flood risk in Limerick City and County. There are a number of datasets which record historical and/or predicted flood extents. The aim of the review is to identify flood risk based on the data available, including historical records, considering all sources of flooding, and to appraise the quality and usefulness of the data. Table 4-1 summarises the data available and its quality, includes an assessment of confidence in its accuracy (when attempting to incorporate it into the flood zone map) and gives an indication of how it was used in the SFRA study.

Table 4-1: Dataset review

Dataset / Owner	Description / coverage	Robustness	Comment on usefulness
Shannon CFRAM study (OPW)	Areas for further assessment (AFAs), or settlements falling along modelled lengths, in County Limerick are: Abbeyfeale, Adare, Askeaton, Athea, Cappamore, Castleconnel, Clarina, Croom, Dromcolliher, Foynes, Limerick City and Environs, Milford, Montpelier, Newcastle West and Rathkeale.	High - Modelling is 'best available' and outputs will allow informed decisions to be made on zoning objectives. However, in some locations, such as Cappamore, there are questions over the accuracy of the outputs. Modelled water levels will inform decisions relating to raising land and setting finished floor levels, but all mapping and levels to be reviewed prior to use in informing planning design.	This data was reviewed on site as part of the CFRAM Study process to verify its quality. Site specific FRAs will still be required for planning applications, but information on water levels can form the basis of decision in relation to finished floor levels.
National Indicative Fluvial Mapping (OPW)	'Predictive' flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence. The study did not model catchments <5km^2. See OPW user guide for more details.	Moderate - The National Indicative Fluvial Maps provide an indication of areas that may flood during a flood of an estimated probability of occurring and are based on certain assumptions. The National Indicative Fluvial Maps are not the best achievable representation of flood extents and they are not as accurate as the Flood Maps produced under the National Catchment Flood Risk Assessment and Management (CFRAM) Programme. The maps should not be used to assess the flood risk associated with individual properties or point locations, or to replace a detailed site-specific flood risk assessment.	This data is broadscale and based on remotely sensed ground models. It has been used to form the basis of Flood Zones where CFRAM or other detailed modelling study is not available. Has been used as an initial screening tool for flood extents and should be reviewed as part of site specific FRAs. There is no modelled water level or depth associated with this dataset.
Irish Coastal Protection Strategy Study (ICPSS): Flood extent maps	Still water tidal extents for 200 year and 1000 year events for the whole coastline	High, but does not include wave overtopping/ breaking so does not represent storm damage.	Used to define the tidal risk element of Flood Zone A and B in non CFRAM settlements. The ICPSS data is incorporated within

Dataset / Owner	Description / coverage	Robustness	Comment on usefulness
(OPW)			CFRAM mapping discussed above. Where direct translation of tide levels inshore is appropriate (i.e. where the town is on the coast, not up an estuary) these levels can be used to set finished floor levels.
Irish Coastal Protection Strategy Study (ICPSS): Coastal erosion maps (OPW)	Predicted line of the coast in 2030 and 2050.	Low	Reviewed but no areas of erosion risk in County Limerick were highlighted.
OPW Preliminary Flood Risk Assessment (PFRA) flood maps – Fluvial	The PFRA was a national screening exercise that was undertaken by OPW to identify areas at potential risk of flooding. Fluvial, coastal, pluvial and groundwater risks were identified at an indicative scale.	Low	Superseded by the CFRAM and National Indicative Fluvial Mapping.
PFRA Maps - Coastal		Moderate	This was based on ICPSS flood extents.
PFRA Maps – Pluvial and groundwater		Low	Not used as withdrawn by OPW. See GSI mapping.
Limerick County Development Plan (2010-2016) Flood Zone Map	Broadscale Flood Zone maps (fluvial and tidal) produced for the whole county, including all watercourses with a catchment area greater than 3km^2.	Low-Moderate	Covers nearly all watercourses. Supplements/informs flood risk in non-CFRAM settlements.
Historical event outlines and point observations and reports	Various. Includes records from LCCC sources, www.floodmaps.ie.	Indicative	Can be indirectly used to validate flood zones and identify non-fluvial and tidal flooding, and particularly sections of coast vulnerable to storm damage.
Arterial Drainage Benefiting land maps	Shows land which would (or has) benefit from a drainage scheme. This is not based on a 'design flood' (i.e. the events do not have a return period), but indicate low-lying, poorly drained land. It is not the same as lands which are protected by a flood relief scheme.	Low	Superseded by the data sources listed above.
Project specific FRAs (various originators)	Varies by project	Varies	Depending on source and purpose, may have been used to inform the Flood Zone review and development.
Flood relief scheme details,	Various across the County	High, but some schemes are still in early design	Varies and depends on the stage the scheme has

Dataset / Owner	Description / coverage	Robustness	Comment on usefulness
including locations and lengths, standard of protection and areas which are protected		stages	progressed to. See Section 3.3 for summary.
Groundwater Flood Probability Maps (GSI)	Shows the probabilistic flood extent of groundwater flooding in limestone regions. Maps are limited to locations where the flood pattern was detectable and capable of being hydrologically modelled to a sufficient level of confidence.	Moderate where ground water risk is mapped.	Reviewed but areas of groundwater risk were outside settlements. To be reviewed by applicants where prepared site specific FRAs in rural locations.
OSi mapping (particularly 6" maps with land liable to flood notations)	Countywide coverage	Low	Very indicative. Based on historical information with no return period or extent associated.
Site walkover	As needed	Low	Used to corroborate Flood Zones with ground topography.

The data collection exercise allows Flood Zone maps to be developed. The Flood Zones relate to risk arising from fluvial (river) and coastal flooding. Other sources of flooding, such as surface water and groundwater, are also taken into account through the SFRA but are not part of the initial assessment process.

It is important to note that the Flood Zones do not take into account the benefits of flood defences. The sequential approach and Justification Test should be applied using the undefended outlines, but the benefits of the defences can be used to inform the requirements for detailed flood risk assessment and development design, if the Justification Test for plan making has been passed.

The Flood Zone maps have been developed using the most appropriate and up to date data available for Limerick City and County at the time of preparing the Development Plan. The Flood Zone maps have been created specifically to inform the application of the Justification Test for Plan Making and to guide development policy within the County and have been through several iterations of review and are now considered to be fit for purpose. However, it should be borne in mind that the input data was developed at a point in time and there may be changes within the catchment that mean a future study, or more localised assessment of risk may result in a change in either flood extent or depth. This means a site-specific flood risk assessment should begin with a review of flood data, including more recently published predictive mapping and flood events occurring since the Flood Zones were developed. This may result in locally appropriate information which could show a greater or lesser level of risk than is included in the Flood Zone maps. This is to be expected and it will require discussion between the developer and Limerick City and County Council planning and engineering sections to ensure the assessment is appropriate and relevant to the site in question.

The Flood Zone maps show Flood Zones A and B, with all land outside these areas being Flood Zone C. Flood Zone A refers to areas where the probability of flooding from rivers is greater than 1% AEP or 1 in 100 year for river flooding, or 0.5% AEP or 1 in 200 for coastal flooding. Flood Zone B refers to areas where the probability of flooding from rivers and seas is up to 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding. The rest of the map shows Flood Zone C, where there is less than a 0.1% AEP or 1 in 1000 chance of flooding.

4.2 Summary of Sources of Flooding

This SFRA has reviewed flood risk from fluvial, tidal, pluvial and groundwater sources. It also considers flooding from drainage systems, reservoirs and canals and other artificial or man-made systems.

4.2.1 Fluvial Flooding

Flooding of watercourses is associated with the exceedance of channel capacity during higher flows. The process of flooding on watercourses depends on a number of characteristics associated with the catchment including; geographical location and variation in rainfall, steepness of the channel and surrounding floodplain and infiltration and rate of runoff associated with urban and rural catchments. Generally, there are two main types of catchments; large and relatively flat or small and steep, both giving two very different responses during large rainfall events.

In a large, relatively flat catchment, flood levels will rise slowly and natural floodplains may remain flooded for several days or even weeks, acting as the natural regulator of the flow. This is typical of the River Shannon as over its 260km course from source to the Shannon estuary the river falls less than 200m in elevation. In small, steep catchments local intense rainfall can result in the rapid onset of deep and fast-flowing flooding with little warning, such as was experienced in Newcastle West and Athea in 2008. Such “flash” flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

The form of the floodplain, either natural or urbanised, can influence flooding along watercourses. The location of buildings, roads and other infrastructure can significantly influence flood depths and velocities by altering flow directions and reducing the volume of storage within the floodplain. Critical structures such as bridge and culverts can also significantly reduce capacity creating pinch points within the floodplain. These structures are also vulnerable to blockage by natural debris within the channel or by fly tipping and waste.

Flood risk to specific potential development sites is discussed in Sections 7 and 8 and has been used to inform the zoning objectives for the Limerick Development Plan. Where zoning for development is proposed within Flood Zones A or B, the Justification Test must be applied, and passed.

4.2.2 Tidal and Coastal Flooding

County Limerick is bounded to the north by the tidal River Shannon estuary. There are numerous settlements along this coastal margin which are vulnerable to tidal inundation, particularly when coupled with low pressure systems, westerly winds and a storm surge. This was demonstrated over the winter of 2013/2014. Limerick City was worst affected when the Shannon overtopped its banks at peak tide and flooded 300 homes, mainly in the St. Mary’s Park and King’s Island areas. Although much of the City benefits from varying levels of flood protection, this is largely as a result of arterial drainage embankments rather than schemes with a known standard of protection.

4.2.3 Flooding from Flood Defence Overtopping or Breach

As detailed in Section 3.3, there are a number of flood relief schemes in Limerick City and County, which provide some flood protection, but also have inherent risks associated with them, which is termed residual risk.

Residual risk is the risk that remains after measures to control flood risk have been carried out. Residual risk can arise from overtopping of flood defences and/or from the breach from structural failure of the defences.

The concept of residual risk is explained in ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' as follows:

"*Although flood defences may reduce the risk of flooding, they cannot eliminate it. A flood defence may be overtopped by a flood that is higher than that for which it was designed, or be breached and allow flood water to rapidly inundate the area behind the defence. In addition, no guarantee can be given that flood defence will be maintained in perpetuity. As well as the actual risk, which may be reduced as a result of the flood defence, there will remain a residual risk that must be considered in determining the appropriateness of particular land uses and development. For these reasons, flooding will still remain a consideration behind flood defences and the flood zones deliberately ignore the presence of flood defences*."

Overtopping of flood defences will occur during flood events greater than the design level of the defences. Overtopping is likely to cause more limited inundation of the floodplain than if defences had not been built, but the impact will depend on the duration, severity and volume of floodwater. However, and more critically, overtopping can destabilise a flood defence, cause erosion and make it more susceptible to breach or fail. Recovery time and drainage of overtopping quantities should also be considered. Overtopping may become more likely in future years due to the

impacts of climate change and it is important that any assessment of defences includes an appraisal of climate change risks.

Breach or structural failure of flood defences is hard to predict and is largely related to the structural condition and type of flood defence, with impacts of breach linked to local topography and proximity to the breach location. 'Hard' flood defences such as solid concrete walls are less likely to breach than 'soft' defence such as earth embankments. Breach will usually result in sudden flooding with little or no warning and presents a significant hazard and danger to life. There is likely to be deeper flooding in the event of a breach than due to overtopping.

The Shannon CFRAM looked at the impacts of a defence breaching in a number of locations across the City and has included outlines for such scenarios, although only for a number of limited locations. In April 2019, there was a breach of the Shannon embankments behind the Clondell Road, which saw flood waters come as far in as Clondrinagh and Na Pairsaigh GAA pitch.

Whilst it is important that residual risks are recognised and appropriate management measures put in place, it is also important to acknowledge the benefits that a flood relief scheme provides to those living and working behind it. In this regard, although 'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' requires that "the presence of flood defences should be ignored in determining Flood Zones" and although consideration should be given to the benefit provided by flood defences, that is only done once the Justification Test has been applied and passed.

It should be noted that whilst existing development clearly benefits from the construction of defences, it is against sustainability objectives, and the general approach of the OPW, to construct defences with the intension of releasing land for development. It is also not appropriate to consider the benefits of schemes which have not yet been constructed, and which may only be at pre-feasibility or design stage.

Guidance on the incorporation of breach modelling into flood risk assessment is provided in Section 5.

4.2.4 Pluvial Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. The resulting water follows along natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains. Any areas at risk from fluvial flooding may also be at risk from surface water flooding, but surface water flooding can, and does, operate in isolation from other sources of flooding.

The Development Plan includes policies on surface water management, and will be supported by a forthcoming 'Strategic Assessment of Storm and Surface Water Collection Networks' which should be referred to in relation to its application to site specific developments. There is further discussion on the assessment of surface water risks in Section 5.7.

4.2.5 Flooding from Drainage Systems

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, it becomes blocked or it cannot discharge due to a high water level in the receiving watercourse.

Flooding in urban areas can also be attributed to sewers. Sewers have a finite capacity which, during certain load conditions, will be exceeded. In addition, design standards vary and changes within the catchment areas draining to the system, in particular planned growth and urban creep, will reduce the level of service provided by the asset. Sewer flooding problems will often be associated with regularly occurring storm events during which sewers and associated infrastructure can become blocked or fail. This problem is exacerbated in areas with under-capacity systems. In the larger events that are less frequent but have a higher consequence, surface water will exceed the sewer system and flow across the surface of the land, often following the same flow paths and ponding in the same areas as overland flow.

Foul sewers and surface water drainage systems are spread extensively across the urban areas with various interconnected systems discharging to treatment works and into local watercourses.

4.2.6 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from underground, and is particularly common in karst landscapes. This can emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local and unlike flooding from rivers and the sea does not generally pose a significant risk to life, due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and pose further risks to the environment and ground stability.

Groundwater 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, although the impact on buildings can be mitigated against through various measures.

Error! Reference source not found. and **Error! Reference source not found.** show an extract of mapping produced by GSI of historical groundwater flooding across the county. The historic groundwater flood map is a national-scale flood map presenting the maximum historic observed extent of karst groundwater flooding. The map is primarily based on the winter 2015/2016 flood event, which in most areas represented the largest groundwater flood event on record. The map was produced based on the SAR imagery of the 2015/2016 event as well as any available supplementary evidence. The floods were classified by flood type differentiating between floods dominated by groundwater (GW) and floods with significant contribution of groundwater and surface water (GWSW).

Some parts of Limerick County are vulnerable to groundwater flooding, with the area between the N69 road and Croom, eastwards to Fedamore and almost as far westward as Shanagolden, showing patches of historical groundwater or groundwater and surface water flooding. A review has been carried out to identify settlements where groundwater risk is within the settlement boundary, or in close proximity to the settlement node. From this review it has been noted that the Tier 6 node of Cappagh has an area of groundwater flooding in proximity to existing residential development. There are also several areas of historic groundwater flooding in Mungret in the Limerick Southern Environs area (**Error! Reference source not found.**). One area is to the west of St. Paul's GAA grounds and is zoned as Semi-Natural Open Space. The other is designated as a pNHA, but borders a land parcel zoned for New Residential; it will be important that the proposals for development in this location include an adequate assessment of groundwater risks. Elsewhere, the historic flooding is in rural (unzoned) locations.

Although this source of flooding does not form part of the Flood Zone Maps it is an important consideration in flood risk assessments, even for sites in Flood Zone C. Where groundwater flooding is known, or suspected to be a risk, the flood risk assessment should assess and propose mitigation for these risks. In most cases, the most appropriate approach will be to avoid areas which are vulnerable to groundwater flooding.

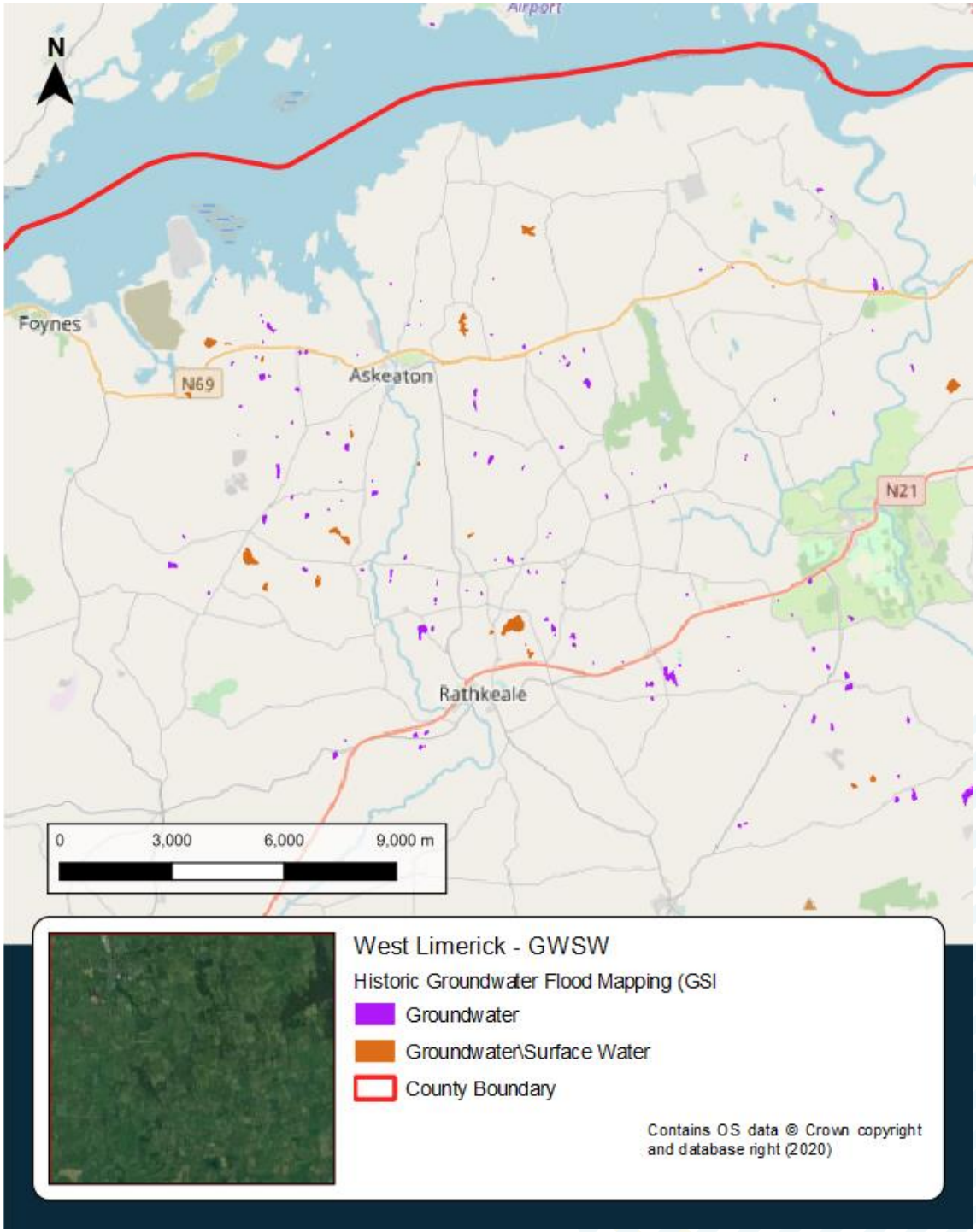


Figure 4-1: Groundwater/Surface Water map West Limerick

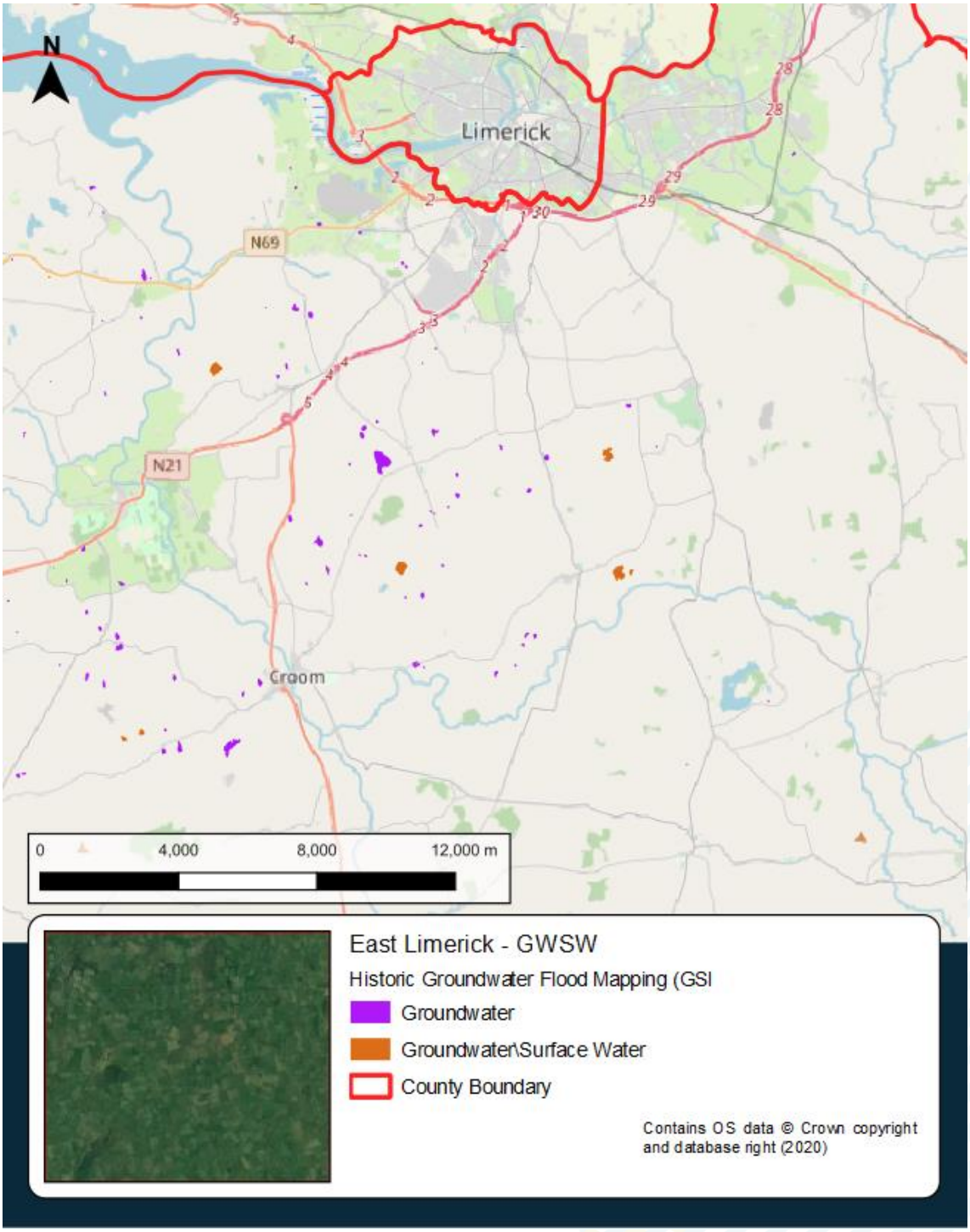


Figure 4-2: Groundwater/Surface Water map East Limerick

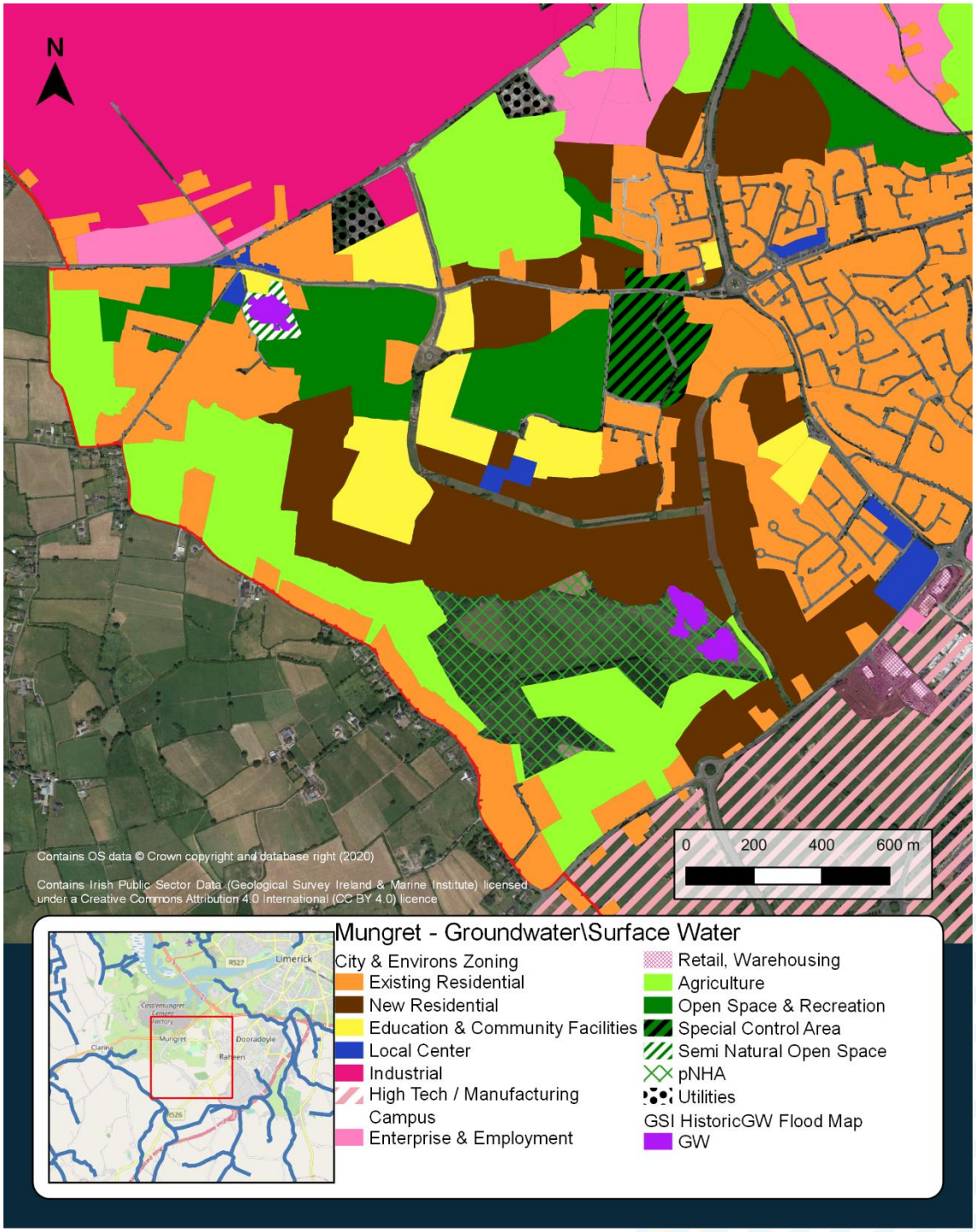


Figure 4-3: Historic groundwater flooding in Mungret

4.3 Settlement Classification

The Flood Zones were overlaid on the settlement boundaries to allow a preliminary review to be made of those towns and villages which are removed from flood risk, or where flood risk can be managed through surface water and drainage system design.

Settlements which have zoning objectives mapped within the Development Plan are:

- Ballingarry
- Bruff
- Bruree
- Cappamore
- Doon
- Dromcolliher
- Foynes
- Glin
- Hospital
- Kilfinane
- Limerick City and Environs
- Murroe
- Pallasgreen
- Pallaskenry

All other settlements will be indicated by reference to the centre of the settlement and a policy promoting growth from the centre out; this policy will be supported by following the sequential approach within those settlements and avoiding development in areas of flood risk. In these cases, the Plan Making Justification Test has not been applied so it is not possible for the Development Management Justification test to be passed and all new development should be located in Flood Zone C, with the exception of minor development (Section 5.28 of the Planning Guidelines).

Of the settlements that showed some level of risk of flooding (from fluvial, groundwater or coastal sources) a more detailed assessment of the quality and coverage of the flood data available was made, including overlaying the current zoning objectives and considering the required level of intensification of development that will be required to meet the Core Strategy. A comment on all sources of flood risk has been provided in the following sections, although it is the fluvial and tidal risks which are the main focus of the Flood Zones and zoning objective review process.

4.4 Climate Change Risk

In addition to the current level of flood risk (either fluvial or coastal), this screening has identified a number of settlements which could be at significantly greater risk when future (climate change) scenarios are considered. These settlements are mainly located along the Shannon Estuary and tidal extents of the River Shannon, where between a 0.5m (medium range future scenario) and 1m (high end future scenario) rise in sea level should be allowed for, based on current OPW guidance.

Where land is to be zoned for development, it is important that the long term viability of the area is understood and can be managed. In the main, this will involve moving zoning objectives inland, rather than targeting new development along the areas at high future risk of flooding.

As with the other areas of risk, the CFRAM and IPCSS both provided future flood extents for its AFAs and coastal margins. As sea level rise will have potentially damaging consequences, the impact of this for both the MRFS and HEFS should be understood for coastal settlements.

Where the OPW and Limerick City and County Council are designing flood relief schemes for an area consideration will be given to the management of climate change risks within the scheme design. However, this may follow an adaptive approach, such as on the King's Island Flood Relief Scheme, whereby the defence height is based on current design levels but, where possible, the foundations of new walls and embankments are designed to take additional loading should the defences be raised in the future.

Where the impact of climate change is likely to be significant a comment has been provided in the relevant settlement review.

5 Policy Response

5.1 The Strategic Approach

A strategic approach to the management of flood risk is important in County Limerick as the risks are varied and disparate, with scales of risk and scales of existing and proposed development varying greatly across the county.

Following the Planning Guidelines, development should always be located in areas of lowest flood risk first, and only when it has been established that there are no suitable alternative options should development (of the lowest vulnerability) proceed. Consideration may then be given to factors which moderate risks, such as defences, and finally consideration of suitable flood risk mitigation and site management measures is necessary.

It is important to note that whilst it may be technically feasible to mitigate or manage flood risk at site level, strategically it may not be a sustainable approach.

A summary of flood risks associated with each of the zoning objectives has been provided in Table 5-1 below. It should be noted that this table is intended as a guide only and should be read in conjunction with the detailed assessment of risks in Section 6. However, when applications are being considered it is important to remember that not all uses will be appropriate on flood risk grounds, hence the need to work through the Justification Test for Development Management on a site by site basis and with reference to Section 6. For example, a zoning objective for City Centre, Town or Village Core or District Centre could include a highly vulnerable crèche, less vulnerable shops and water compatible car parking but they are not all equally appropriate on the ground floor within Flood Zone A or B and require differing levels of mitigation, potentially including elevating a vulnerable use to first floor or higher.

Table 5-1: Zoning objective vulnerability

Land Use Zoning	Indicative primary vulnerability	Water compatibility
City Centre	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
Town/ Village Core	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
District Centre	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
Local/ Neighbourhood Centre	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
Existing Residential	Highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A. Consideration also to be given to areas requiring ongoing flood protection, as PL2/2014.
New Residential	Highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
Education and Community Infrastructure	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
University	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.

Land Use Zoning	Indicative primary vulnerability	Water compatibility
Mixed Use	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
High Tech / Manufacturing	Less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A. Depending on the nature of the development it may be deemed that it is highly vulnerable rather than less vulnerable which could cover less high-tech or high-value investments.
Enterprise and Employment	Less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
Industry	Less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A. Depending on the nature of the development, and type of emissions and outputs, it may be deemed that it is highly vulnerable rather than less vulnerable which could cover non-Seveso sites.
Retail Warehousing	Less vulnerable	Less vulnerable use which must pass the Justification Test in Flood Zone A but is appropriate in Flood Zones B and C.
Sports Arena	Less vulnerable	Less vulnerable use which must pass the Justification Test in Flood Zone A but is appropriate in Flood Zones B and C.
Open Space & Recreation	Water compatible	Appropriate for all Flood Zones. Any ancillary developments to be assessed in accordance with the sequential approach.
Semi Natural Open Space	Water compatible	Appropriate for all Flood Zones.
Groody Valley Wedge	Highly / less vulnerable / water compatible	The opportunity site should be assessed under the sequential approach, and Justification Test applied if necessary. Water compatible wildlife corridor is appropriate for all Flood Zones.
Special Control Area (SCA)	Water compatible	Appropriate for all Flood Zones.
Utilities	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A. Depending on the nature of the utility to be provided, vulnerability may be high, less or water compatible.
Agriculture	Water compatible	Appropriate for all Flood Zones. Any ancillary developments to be assessed in accordance with the sequential approach.

5.2 Development Management and Flood Risk

In order to guide both applicants and planning officials through the process of planning for, and mitigating flood risk, the key features of a range of development scenarios have been identified (relating to the flood zone, development vulnerability and presence or absence of defences). For each scenario, a number of considerations relating to the suitability of the development are summarised below.

Where land has not passed the Justification Test for Development Plans for a particular use, where development is considered premature pending a flood relief scheme, or where flood risk arising from a watercourse is only identified at Development Management Stage, the following sections do not apply and a SSFRA may be premature. In these situations, a discussion with Limerick City and County Council is required to determine an appropriate route forward.

In addition to the general recommendations in the following sections, Sections 7 and 8 should be reviewed for specific recommendations for the watercourses within Limerick City and County.

All applications for development must be accompanied by an appropriately detailed SSFRA. This may be a qualitative appraisal of risks, including drainage design. Alternatively, the findings of the CFRAM, or other appropriately detailed study, may be drawn upon to inform site layout and finished floor levels. In other circumstances a detailed modelling study and flood risk assessment may need to be undertaken. Further details of each of these scenarios, including considerations for the flood risk assessment are provided in the following sections.

5.3 Requirements for a Flood Risk Assessment

An appropriately detailed flood risk assessment will be required in support of any planning application. The level of detail will vary depending on the risks identified and the proposed land use. As a minimum, all proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design. In addition, flood risk from sources other than fluvial and tidal should be reviewed, including groundwater flooding and/or flooding associated with stormwater deficiencies, restrictions or blockages.

For sites within Flood Zone A or B, a site specific "Stage 2 - Initial FRA" will be required, and may need to be developed into a "Stage 3 - Detailed FRA". The extents of Flood Zone A and B are delineated through this SFRA. However, future studies may refine the extents (either to reduce or enlarge them) so a comprehensive review of available data should be undertaken once a FRA has been triggered.

Within the FRA the impacts of climate change and residual risk (including culvert/structure blockage) should be considered and remodelled where necessary, using an appropriate level of detail, in the design of finished floor levels. Further information on the required content of the FRA is provided in the Planning System and Flood Risk Management Guidelines.

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.

The Flood Zone maps are based on watercourses with a catchment area of greater than 5km^2. Where a smaller watercourse is present on a site but flood risk has not been mapped under the SFRA, it does not mean there is no flood risk present. Instead, a site specific flood risk assessment of appropriate level of detail should be carried out to delineate the Flood Zones and/or suitable mitigation measures (such as finished floor levels). In such locations the Justification Test has not been applied, so development must progress in accordance with the sequential approach and avoid Flood Zone A and B.

5.4 Development in Flood Zones A or B

5.4.1 Minor Developments

Section 5.28 of the Planning Guidelines on Flood Risk Management identifies certain types of development as being 'minor works'. In such cases, the sequential approach cannot be used to locate such development in lower-risk areas and the Justification Test will not apply.

Generally, the approach to deal with flood protection would involve raising the ground floor levels above extreme flood levels. However, in some parts of the plan area, which are already developed, ground floor levels for flood protection could lead to floor levels being much higher than adjacent streets, thus creating a hostile streetscape for pedestrians. This would cause problems for infill development sites if floor levels were required to be significantly higher than those of neighbouring properties. In this regard, for the key sites in the plan area it has been recognised that ground floor levels below predicted high tide levels could be allowed, in limited circumstances, on a site by site basis, for commercial and business developments. However, if this is the case, then these would be required to be flood resistant construction using water resistant materials and electrical fittings places at higher levels. For high risk areas it would also be necessary to impose planning restrictions in these areas. Residential Uses would not be permitted at ground flood levels in high risk zones.

It should be noted that for residential buildings within Flood Zone A or B, bedroom accommodation shall not be permitted at basement or ground floor.

For commercial operations, business continuity must be considered, and steps taken to ensure operability during and recovery after a flood event for both residential and commercial developments. Emergency access must be considered as in many cases flood resilience will not be easily achieved in the existing build environment.

The requirement for providing compensatory storage for minor developments has been reviewed and can generally be relaxed, even where finished floor levels have been raised, and particularly where flood risk is primarily tidal or the development is behind defences. This is because the development concerns land which has previously been developed and would already have limited capacity to mitigate flooding, and would particularly be the case in tidal risk areas. However, a commentary to this effect must be substantiated in the FRA and should be discussed with Limerick City and County Council prior to submission of a planning application.

5.4.2 Highly vulnerable development in Flood Zone A or B

Development which is highly vulnerable to flooding, as defined in The Planning System and Flood Risk Management, includes (but is not limited to) dwelling houses, hospitals, emergency services and caravan parks.

5.4.2.1 New development

It is not appropriate for new, highly vulnerable, development to be located in Flood Zones A or B outside the core of a settlement. Such proposals do not pass the Justification Test for Development Plans. Instead, a less vulnerable or water compatible use should be considered.

In some cases, land use objectives which include for highly vulnerable uses have been justified in the Development Plan. This includes zonings focused around an urban core which allow for a mix of residential, commercial and other uses. In such cases, a sequential approach to land use within the site must be taken and will consider the presence or absence of defences, land raising and provision of compensatory storage, safe access and egress in a flood and the impact on the wider development area.

5.4.2.2 Existing developed areas

The Planning Circular (PL02/2014) states that "*notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well established cities and urban centres which will continue to be at risk of flooding. In addition, development plans have identified various strategically important urban centres … whose continued consolidation, growth, development or generation, including for residential use, is being encouraged to bring about compact and sustainable growth*.

In cases where specific development proposals have passed the Justification Test for Development Plans, the outline requirements for a flood risk assessment and flood management measures are detailed in this SFRA in the following sections and the site specific assessments in Section 5, which also detail where such development has been justified. Of prime importance is the requirement to manage risk to the development site and not to increase flood risk elsewhere. It should also be noted that for residential buildings within Flood Zone A or B, bedroom accommodation shall not be permitted at basement or ground floor.

5.4.3 Less vulnerable development in Flood Zone A or B

This section applies to less vulnerable development in Flood Zone A which has passed the Justification Test for development plans, and less vulnerable development in Flood Zone B, where this form of development is appropriate, and the Justification Test is not required. Development which is less vulnerable to flooding, as defined in The Planning Guidelines, includes (but is not limited to) retail, leisure and warehousing and buildings used for agriculture and forestry (see Table 2-2 for further information). This category includes less vulnerable development in all forms, including refurbishment or infill development, and new development both in defended and undefended situations.

The design and assessment of less vulnerable development should begin with 1% AEP fluvial or 0.5% tidal events (depending on dominant flood source) as standard, with climate change and a suitable freeboard included in the setting of finished floor levels. The presence or absence of flood defences informs the level of flood mitigation recommended for less vulnerable developments in areas at risk of flooding. In contrast with highly vulnerable development, there is greater scope for the developer of less vulnerable uses to accept flood risks and build to a lower standard of protection, which is still high enough to manage risks for the development in question. However, any deviation from the design standard of 1%/0.5% AEP, plus climate change, plus freeboard, needs to be fully justified within the FRA and show an appropriate response to the flood risk present and to be agreed with Limerick City and

County Council engineers and planners. However, in County Limerick there are limited locations where formal (non-agricultural) flood defences are present.

5.5 Development in Flood Zone C

Where a site is within Flood Zone C but adjoining or in close proximity of a watercourse, there could be a risk of flooding associated with factors such as future scenarios (climate change), blocking of a bridge or culvert or other residual risk. Risk from sources other than fluvial and coastal must also be addressed for all development in Flood Zone C, including groundwater flooding and/or flooding associated with stormwater deficiencies, restrictions or blockages. As a minimum in such a scenario, an assessment of flood risk should be undertaken which will screen out possible sources of flood risk and where they cannot be screened out it should present mitigation measures. The most likely mitigation measure will involve setting finished floor levels to a height that is above the 1% AEP fluvial event or 0.5% AEP tidal flood event level, with an allowance for climate change and freeboard, or to ensure a step up from road level to prevent surface water ingress. Design elements such as channel maintenance or trash screens may also be required. Evacuation routes in the event of inundation of surrounding land should also be detailed.

Guidance for the assessment of surface water risk is provided in Section 5.7.

The impacts of climate change should be considered for all proposed developments. This is particularly important for development near areas at risk of tidal flooding. A development which is currently in Flood Zone C may be shown to be at risk when an allowance for sea level rise is added to the extreme (1 in 200 year) tide. Details of the approach to incorporating climate change impacts into the assessment and design are provided in Section 5.5.

5.6 Water compatible uses in Flood Zone A or B

Water compatible uses can include the non-built environment, such as open space, agriculture and green corridors which are appropriate for Flood Zone A and B and are unlikely to require a flood risk assessment. However, there are numerous other uses which are classified as water compatible, but which involve some kind of built development, such as lifeguard stations, fish processing plants and other activities requiring a waterside location. In other situations, works to an area of open space may result in changes to the topography which could lead to loss in flood plain storage and/or impacts on flood conveyance. The Justification Tests are not required for such development, but an appropriately detailed flood risk assessment is required. This should consider mitigation measures such as development layout and finished floor levels, access, egress and emergency plans. In line with other highly vulnerable development, sleeping accommodation at basement or ground floor level will not be permitted. Climate change and other residual risks should also be considered within the SSFRA.

5.7 Drainage Impact Assessment

All proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design. In this regard, all the other development scenarios must pass through this stage before completing the planning and development process and should be accompanied by an appropriately detailed flood risk assessment, and drainage impact assessment.

There are extensive networks of surface water runoff routes across the County, with areas vulnerable to ponding indicated on the Flood Zone Maps. Particular attention should be given to development in low-lying areas which may act as natural ponds for collection of runoff.

The drainage design shall ensure no increase in flood risk to the site, or the downstream catchment. Reference should be made to the relevant policies in the Development Plan and forthcoming Surface Water Strategy for details of the assessment process.

Master planning of development sites should ensure that existing flow routes are maintained, through the use of green infrastructure. Where possible, and particularly in areas of new development, floor levels should at a minimum be 300mm above adjacent roads and hard standing areas to reduce the consequences of any localised flooding. Where this is not possible, an alternative design appropriate to the location may be prepared.

5.8 Requirements for a Flood Risk Assessment

An appropriately detailed flood risk assessment will be required in support of all planning applications. The level of detail will vary depending on the risks identified and the proposed land use. As a minimum, all proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design. In addition, flood risk from sources other than fluvial and tidal should be reviewed.

For sites within Flood Zone A or B, a site specific "Stage 2 - Initial FRA" will be required and subject to the outcome may need to be developed into a "Stage 3 - Detailed FRA". The extents of Flood Zone A and B are delineated through this SFRA. However, future studies may refine the extents (either to reduce or enlarge them) and proposed variations to the Flood Zones should be discussed with Limerick City and County Council.

An assessment of the risks of flooding should accompany applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities, particularly for operation and maintenance activities by Limerick City and County Council and OPW. Where possible, the design of built elements in these applications should demonstrate principles of flood resilient design (See Section 4 - Designing for Residual Flood Risk of the Technical Appendices to the DoECLG Flooding Guidelines). Emergency access must be considered, as in many cases flood resistance (such as raised finished floor levels and flood barriers) and retrofitting flood resilience features may be challenging in an existing building. Within the FRA the impacts of climate change and residual risk (including culvert/structure blockage) should be considered and remodelled where necessary, using an appropriate level of detail, in the design of FFL. Further information on the required content of the FRA is provided in the Planning Guidelines.

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 for Development Management (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

5.8.1 Development in Defended Areas

It should be noted that where a site or area is referred to as being defended for the purposes of determining flood mitigation it is assumed that the defences provide a minimum of the 1% AEP (fluvial) or 0.5% AEP (tidal) standard of protection, and have been through a formal detailed design process and approved by OPW or Limerick City and County Council. Informal defences, which may only be at an agricultural standard like many of those around the City, or those developed under the minor works scheme which may provide a lesser standard of protection, are not considered to provide a robust enough standard of protection to allow a moderation in the flood risk mitigation required at a site. The understanding of risks of developing behind defences needs to be explored in the site specific FRA.

The assessment of breach within the scope of a site specific FRA should be proportionate to the likelihood of the defence failing, taking into account the age, maintenance regime, construction type and the presence of any demountable or mechanically operated components. Proximity of the site to the defence and location within the floodplain will also influence the impact of defence breach and overtopping. Defence overtopping during events which exceed the design standard of protection also present a risk to developments and should be addressed regardless of the likelihood of the defence breaching.

There are a number of ways in which breach and overtopping of defences can be investigated, depending on the scale of risk and the nature of the development. Prior to undertaking breach analysis, Limerick City and County Council should be consulted to agree the approach taken.

- The Shannon CFRAM included breach analysis in Limerick City and Environs. This information is available within the CFRAM reports on www.floodinfo.ie and may be used to inform the FRA for sites within the analysis area. However, it is noted that the breach modelling is indicative only and the locations selected for breach under the CFRAM study may not represent the worst case scenarios for the site in question. Therefore, the CFRAM outputs should only be used as part of the initial FRA and should be updated using site specific information.
- As the flood relief schemes progress, breach modelling may also become available which can be used for the purposes of site specific flood risk assessment. As with the CFRAM outputs though, this may not represent the most appropriate location to the site in question.
- Projection of instream water levels across the floodplain – this approach provides a conservative (worst case) estimate of flood risk in the event of defence breach or overtopping as, in reality, water levels across the flood plain would be lower than in the channel. This means the resulting mitigation may be more significant (for example, in terms of ground levels proposed) than if a more detailed modelling approach was taken, particularly if the proposed development site is on the edge of the inundation area. However, in some locations, particularly where a site is partially or fully within Flood Zone A, and /or close to the defence, this conservative approach may be more appropriate.
- Breach modelling – for more complex and higher value developments, bespoke breach modelling can be undertaken in which the overtopping or breach of a flood defence can be investigated with specific reference to a development site. The breach modelling may need to be informed by a detailed understanding of the

structural condition of the defence. Breach modelling will also allow a site specific assessment of finished floor levels to be developed, which may be lower than the default standard set out in Section 5.10. The OPW's Guidance on breach modelling, or other best practice guide, should be referenced and an approach agreed with Limerick City and County Council.

The decision as to which approach is most appropriate to the development, and how this information should be used to inform the development design should be made in conjunction with the Limerick City and County Council Planning and Engineering Departments.

5.8.2 Checklist for Applications for Development in Areas at Risk of Flooding

This section applies to both highly and less vulnerable development in Flood Zone A and highly vulnerable development in Flood Zone B that satisfy the following:

- Meet the definition of Minor Development; or
- Have passed the Justification Test for Development Plans and be able to pass the Justification Test for Development Management to the satisfaction of the Planning Authority.

The following checklist is required for all development proposals:

- The SSFRA be carried out by an appropriately qualified Engineer with relevant FRA experience (as deemed acceptable by the Planning Authority), in accordance with the Limerick City and County Council SFRA and the Planning Guidelines.
- Demonstration that the specific objectives or requirements for managing flood risk set out in Section 5 of this SFRA have been complied with, including an assessment of residual risks.
- Preparation of access, egress and emergency plans which are appropriate to the source of flooding and lead time to issue a warning, vulnerability of the development and its occupiers, the intensity of use and the level of flood risk.
- An assessment of the potential impacts of climate change and the adaptive capacity of the development.
- Compliance with C753 CIRIA SUDS guide, GDSDS and inclusion of SuDS.

5.9 Climate Change

Ireland's climate is changing and analysis of the potential impacts of future climate change is essential for understanding and planning. Climate change should be considered when assessing flood risk and in particular residual flood risk. Areas of residual risk are highly sensitive to climate change impacts as an increase in flood levels will increase the likelihood of defence failure.

The Planning Guidelines recommend 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[2]. However, this guidance is over 10 years old now and climate science, particularly in relation to sea level rise, has developed rapidly. There are many coastal related climate change impacts, these include:

- continued sea level rise;
- potentially more severe Atlantic storms, which could generate more significant storm surges and extreme waves;
- increased water depths lead to larger waves reaching the coast.

The OPW guidance recommend that two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). In all cases, the allowances should be applied to the 1% AEP fluvial or 0.5% AEP tidal levels. Where a development is critical or extremely vulnerable (see Table 5-2) the impact of climate change on 0.1% AEP flows should also be tested.

These climate change allowances are particularly important at the development management stage of planning and will ensure that proposed development is designed and constructed according to current local and national Government advice.

[2] OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance, 2009

Further work on the impacts of climate change on flood levels was undertaken as part of the Shannon CFRAM Study and the ICPSS. The studies provided flood extents for both fluvial and coastal risk, which are available on www.floodinfo.ie.

Assessment of climate change impacts can be carried out in a number of ways. For watercourses that fall within the Shannon CFRAM study area, flood extents and water levels for the MRFS and HEFS have been developed. For other fluvial watercourses a conservative approach would be to take the 0.1% AEP event levels and extent as representing the 1% AEP event plus climate change. Where access to the hydraulic river model is readily available a run with climate change could be carried out, or hand calculations undertaken to determine the likely impact of additional flows on river levels. In a coastal or tidal scenario, a 0.5 or 1m increase to the 0.5% AEP sea level can be assessed based on topographic levels.

Table 5-2: Climate change allowances by vulnerability and flood source

Development vulnerability	Fluvial climate change allowance (increase in flows)	Tidal climate change allowance (increase in sea level)	Storm water / surface water
Less vulnerable	20%	0.5m (MRFS) + 50mm for land movement	The Surface water management plan including details of climate change allowances is under preparation
Highly vulnerable	20%	0.5m (MRFS) + 50mm for land movement	
Critical or extremely vulnerable (e.g. hospitals, major sub-stations, blue light services)	30%	1.0m (HEFS) + 50mm for land movement	
Note: There will be no discounting of climate change allowances for shorter lifespan developments.			

5.10 Flood Mitigation Measures at Site Design

For any development proposal in an area at moderate or high risk of flooding that is considered acceptable in principle, it must be demonstrated that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels. Guidance on what might be considered 'acceptable' has been given in a number of sections in this document.

To ensure that adequate measures are put in place to deal with residual risks, proposals should 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.

Various mitigation measures are outlined below and further detail on flood resilience and flood resistance are included in the Technical Appendices of the Planning Guidelines, The Planning System and Flood Risk Management[3].

It should be emphasised that measures such as those highlighted below should only be considered once it has been deemed 'appropriate' to allow development in a given location. The Planning Guidelines do not advocate an approach of engineering solutions in order to justify the development which would otherwise be inappropriate.

5.10.1 Site Layout and Design

To address flood risk in the design of new development, a risk based approach should be adopted to locate more vulnerable land use to higher ground while water compatible development i.e. car parking, recreational space can be located in higher flood risk areas. Highly vulnerable land uses (i.e. residential housing) should be substituted with less vulnerable development (i.e. retail unit).

The site layout should identify and protect land required for current and future flood risk management. Waterside areas or areas along known flow routes can be used for recreation, amenity and environmental purposes to allow

[3] The Planning System and Flood Risk Management Guidelines for Planning Authorities, Technical Appendices, November 2009

preservation of flow routes and flood storage, while at the same time providing valuable social and environmental benefits.

5.10.2 Ground levels, floor levels and building use

Modifying ground levels to raise land above the design flood level is a very effective way of reducing flood risk to the particular site in question. However, in most areas of fluvial flood risk, conveyance or flood storage would be reduced locally and could have an adverse effect on flood risk off site. There are a number of criteria which must all be met before this is considered a valid approach:

- Development at the site must have been justified through this SFRA based on the existing (unmodified) ground levels.
- The FRA should establish the function provided by the floodplain. Where conveyance is a prime function then a hydraulic model will be required to show the impact of its alteration.
- Compensatory storage should be provided on a level for level basis to balance the total volume that will be lost through infilling where the floodplain provides static storage. There should be no overall loss of floodplain storage volume as a result of the development in the 1% AEP event and impacts of the amended storage should be tested for the 0.1% AEP event to ascertain no significant increase in risks associated with the extreme event.
- The provision of the compensatory storage should be in close proximity to the area that storage is being lost from (i.e. within the same flood cell).
- The land proposed to provide the compensatory storage area must be within the ownership/control of the developer.
- The land being given over to storage must be land which does not flood in the 1% AEP event (i.e. Flood Zone B or C).
- The compensatory storage area should be constructed before land is raised to facilitate development. This is to ensure no temporary loss of flood storage volume during construction.

In some sites it is possible that ground levels can be re-landscaped to provide a sufficiently large development footprint within Flood Zone C. However, it is likely that in other potential development locations there is insufficient land available to fully compensate for the loss of floodplain. In such cases it will be necessary to reconsider the layout or reduce the scale of development, or propose an alternative and less vulnerable type of development. In other cases, it is possible that the lack of availability of suitable areas of compensatory storage means the target site cannot be developed and should remain open space.

Raising finished floor levels within a development is an effective way of avoiding damage to the interior of buildings (i.e. furniture and fittings) in times of flood. Finished floor levels should be assessed in relation to the specific development, but the minimum levels set out in Table 5-3 should apply. It should be noted that in certain locations it may be appropriate to adopt a more precautionary approach to setting finished floor levels, for example where residual risks associated with bridge blockage occur, and this should be specifically assessed in the FRA. In other locates detailed modelling may demonstrate a lower finished floor level is acceptable; this should be discussed with Limerick City and County Council on a case by case basis. It is also noted that typically finished floor levels should be set a minimum of 300mm above surrounding ground levels to prevent ingress of surface water.

Table 5-3: Recommended minimum finished floor levels

Scenario	Finished floor level to be based on
Fluvial, undefended	1% AEP flood + climate change (as Table 5-2) + 300mm freeboard.
Tidal, undefended	0.5% AEP flood + climate change (as Table 5-2) + 300mm freeboard (or 500mm where there is risk of storm surge and wave action).
Fluvial, defended	1% AEP flood + 300mm freeboard. Climate change does not need to be included, provided it is included in the defence height or adaption plan for the scheme.

	Where a breach model has been developed to further understand risks, FFL may be set based on model outputs.
Tidal, defended	0.5% AEP flood + 300mm freeboard (or 500mm where there is risk of storm surge and wave action). Climate change does not need to be included, provided it is included in the defence height or adaption plan for the scheme. Where a breach model has been developed to further understand risks, FFL may be set based on model outputs.

Alternatively, assigning a water compatible use (i.e. garage / car parking) or less vulnerable use to the ground floor level, along with suitable flood resilient construction, is an effective way of raising vulnerable living space above design flood levels. It can however have an impact on the streetscape. Safe access and egress is a critical consideration in allocating ground floor uses.

Depending on the scale of residual risk, resilient and resistance measures may be an appropriate response but this will mostly apply to less vulnerable development.

5.10.3 Raised Defences

Construction of raised defences (i.e. flood walls and embankments) traditionally has been the response to flood risk. However, this is not a preferred option on an ad-hoc basis where the defences to protect the development are not part of a strategically led flood relief scheme. Where a defence scheme is proposed as the means of providing flood defence, the impact of the scheme on flood risk up and downstream must be assessed and appropriate compensatory storage must be provided.

5.10.4 Flood Resilient and Resistant Development

Depending on the scale of actual and residual risk, flood resilient and resistant design measures may be an appropriate response but this will mostly apply to less vulnerable development.

Design can include for wet-proofing of a building to make it flood resilient and reduce the impact of flooding. For example, use of water-resistant materials such as tiles on floors and walls that can be easily washed down and sanitised after a flood event, and the installation of electrical sockets and other circuits at higher levels, with power wires running down from ceiling level rather than up from floor level.

Flood resistance measures can also be incorporated such as the provision of temporary and permanent flood barriers, but would not be considered acceptable as the primary means of managing flood risk. Permanent barriers, in the form of steps (or ramps) at doorways, rendered brick walls and toughened glass barriers, can help prevent flood water entering buildings. Alternatively, temporary barriers can be fitted into doorways and windows, with discrete permanent fixings that keep architectural impact to a minimum. However, flood warning becomes a very important issue when dealing with temporary or demountable defences and such measures are only suitable for relatively shallow depths of flooding. The suitability of temporary defences should be assessed on a case by case basis in conjunction with Limerick City and County Council.

Whilst it may be desirable to retro-fit flood resilience and resistance to an existing development, for example as part of a change of use application, it is often difficult and costly to achieve, with options limited depending on the age and construction of the existing building.

Demountable or temporary barriers are not an appropriate means of managing climate change risks, which should be addressed through either site and building design, or as part of a completed Flood Relief Scheme, which provides flood protection to the proposed development.

5.10.5 Emergency Flood Response Plans

In some instances, and only when all parts of both the Plan Making and Development Management Justification Tests have been passed, it may be necessary for an emergency flood response plan to be prepared to support other flood management measures within the context of a less vulnerable or water compatible development. An emergency response plan may be required to trigger the operation of demountable flood defences to a less vulnerable development, evacuation of a car park or closure of a business or retail premises.

The emergency plan will need to detail triggers for activation, including receipt of a timely flood warning, a staged response and to set out the management and operational roles and responsibilities. The plan will also need to set out arrangements for access and egress, both for pedestrians, vehicles and emergency services. The details of the plan should be based on an appropriately detailed assessment of flood risk, including speed of onset of flooding, depths and duration of inundation.

However, just because it is possible to prepare and emergency plan does not mean this is advisable or appropriate for the nature and vulnerability of development and Limerick City and County Council will not accept an emergency response plan as part of a residential development in isolation or in lieu of appropriate mitigation measures to reduce flood risk to an acceptable standard.

5.11 'Green Corridor'

It is recommended that, where possible, and particularly where there is greenfield land adjacent to the river, a 'green corridor', is retained on all rivers and streams. This will have a number of benefits, including:

- Retention of all, or some, of the natural floodplain;
- Potential opportunities for amenity, including riverside walks and public open spaces;
- Maintenance of the connectivity between the river and its floodplain, encouraging the development of a full range of habitats;
- Natural attenuation of flows will help ensure no increase in flood risk downstream;
- Allows access to the river for maintenance works;
- Provides benefit to the ecological functioning of the river system;
- Retention of clearly demarcated areas where development is not appropriate on flood risk grounds, and in accordance with the Planning System and Flood Risk Management.

The width of this corridor should be determined by the available land and topographical constraints, such as raised land and flood defences, but would ideally span the fully width of the floodplain (i.e. all of Flood Zone A).

6 Application of the Justification Test

Having reviewed the level of flood risk within the County and determined appropriate measures for assessing and managing risks to high and low vulnerability development in Flood Zones A, B and C, a more detailed assessment of sites and areas was carried out. The aim of this assessment was to apply the Plan Making Justification Test, taking into account circular PL02/2014 in relation to existing development. The tables in the following sections detail the assessment of risk in relation to all zoned land. The recommendations and observations have been adopted by Limerick City and County Council and used to inform the settlement zoning objectives which are detailed in the Development Plan.

It should be noted that this assessment has focused on settlements with flood risk to undeveloped land, although a comment on appropriateness of water compatible zonings has been provided. No further information has been provided in relation to settlements with no fluvial or tidal flood risk.

6.1 Undeveloped land

With the exception of zoned City Centre, Town or Village Centres, new development within Flood Zones A or B does not pass the Justification Test and will not be permitted. Whilst lands may have retained a zoning objective which would include development, applying the guidance in Section 5 means such development is restricted to Flood Zone C, with water compatible uses located within Zone A and B.

6.2 Existing, developed, zoned areas at risk of flooding

6.2.1 Highly vulnerable uses

Circular PL02/2014 states that "*In some instances, particularly in older parts of cities and towns, an existing land use may be categorised as a "highly vulnerable development" such as housing, be zoned for residential purposes and also be located in flood zone A/B. Additional development such as small scale infill housing, extension or changes of use that could increase the risk or number of people in the flood-prone area can be expected in such a zone into the future. In these instances, where the residential/vulnerable use zoning has been considered as part of development plan preparation, including uses of the Justification Test as appropriate, and it is considered that the existing use zoning is still appropriate, the development plan must specify the nature and design of structural or non-structural flood risk management measures prior to future development in such areas in order to ensure that flood hazard and risk to the area and to other adjoining locations will not be increased or, if practicable, will be reduced".*

There are a number of such areas in the County identified on the Flood Zone maps, including existing housing and established development in settlements such as Limerick City and Environs, Dromcolliher, Ballingarry and Foynes. It is considered that it would be unrealistic to rezone these lands to a less vulnerable use as they are fully developed and constitute core areas of the settlements, despite the settlements being small town or village scale and risk has been addressed at a policy level through the relevant sections of this SFRA.

In applying the Justification Test Part 3, consideration has been given to structural and non-structural measures which may be required prior to further development taking place. In most locations, future opportunities for development are likely to be limited to small extensions, infill houses or small commercial units and changes of use. As such, in most areas flood risk can be addressed through non-structural responses, such as requiring a site specific flood risk assessment which will identify appropriate mitigation measures such as retaining flow paths, flood resilient construction and emergency planning.

There are a small number of locations where flood risk is greater and non-structural responses are not appropriate to the scale of risks. In these locations, structural measures, generally in the form of flood defences, will be required prior to future development occurring. Further detail on the specifics of the flood management measures in these locations are available in the Shannon CFRAM and as detailed in Section 3.3.

The following sections provide more detail on the various flood risk areas within Limerick City and Environs and Limerick County and gives details of the outcome of the Justification Test where this is required.

7 Limerick City and Environs

7.1 Overview

Limerick City and Environs are vulnerable to fluvial flooding from a number of watercourses, including the Shannon and several much smaller tributaries. Tidal flooding risk is present along the Shannon estuary and the lower reaches of the Shannon and some of its tributaries and presents a considerable future risk as sea level rise linked to climate change takes effect.

Although the Shannon CFRAM indicates areas of lands benefiting from flood defences, the vast majority of these defences are of agricultural standard only and cannot be taken into account when assessing flood risk to a development site. Breach analysis needs to be undertaken as part of any flood risk assessment in such a location, and appropriate mitigation measures proposed.

Upon completion of the Limerick Flood Relief Scheme much of this area is likely to be defended and the scheme will provide a long term approach to flood management, including consideration of climate change adaptation. However, until such time as the scheme is complete it is important that individual development proposals still continue to address climate change risks in an appropriate manner.

7.2 Limerick City Centre and surroundings

The primary watercourses in the City Centre include the Shannon and the Abbey River. Several areas across the City are within Flood Zone A and B. In general, where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. Areas of the City Centre within Flood Zones A and B are limited and can be managed by following the sequential approach, guided by an appropriately detailed FRA.

To the north of the city, the King's Island Flood Relief Scheme will address property flooding on the island. Most of King's Island is zoned as Existing Residential which should follow the recommendation above where it is within Flood Zone A or B. Careful consideration should be given to infill development which must be managed appropriately. Much of the area surrounding the King's Island residential areas is designated for Open Space and Recreation and this should be maintained.

The Dock Road area of the City lies within Flood Zones A and B. The area closest to the River Shannon is largely zoned for Industrial and Enterprise and Employment. This is a docklands area of the City and much of this industrial and enterprise use is marine based and therefore exempt from the Justification Test and risks here can be managed by following the sequential approach, guided by an appropriately detailed FRA. Other areas along the Dock Road comprise of Agriculture, Open Space and Recreation and Semi Natural Open Space zonings. These areas should be maintained, with the flood risk for Agricultural built development managed by following the sequential approach and an appropriately detailed FRA.

The sites subject to Justification Tests in the City Suburbs are located at the Dock Road and Greenpark, and the assessment is set out in Appendix 0.

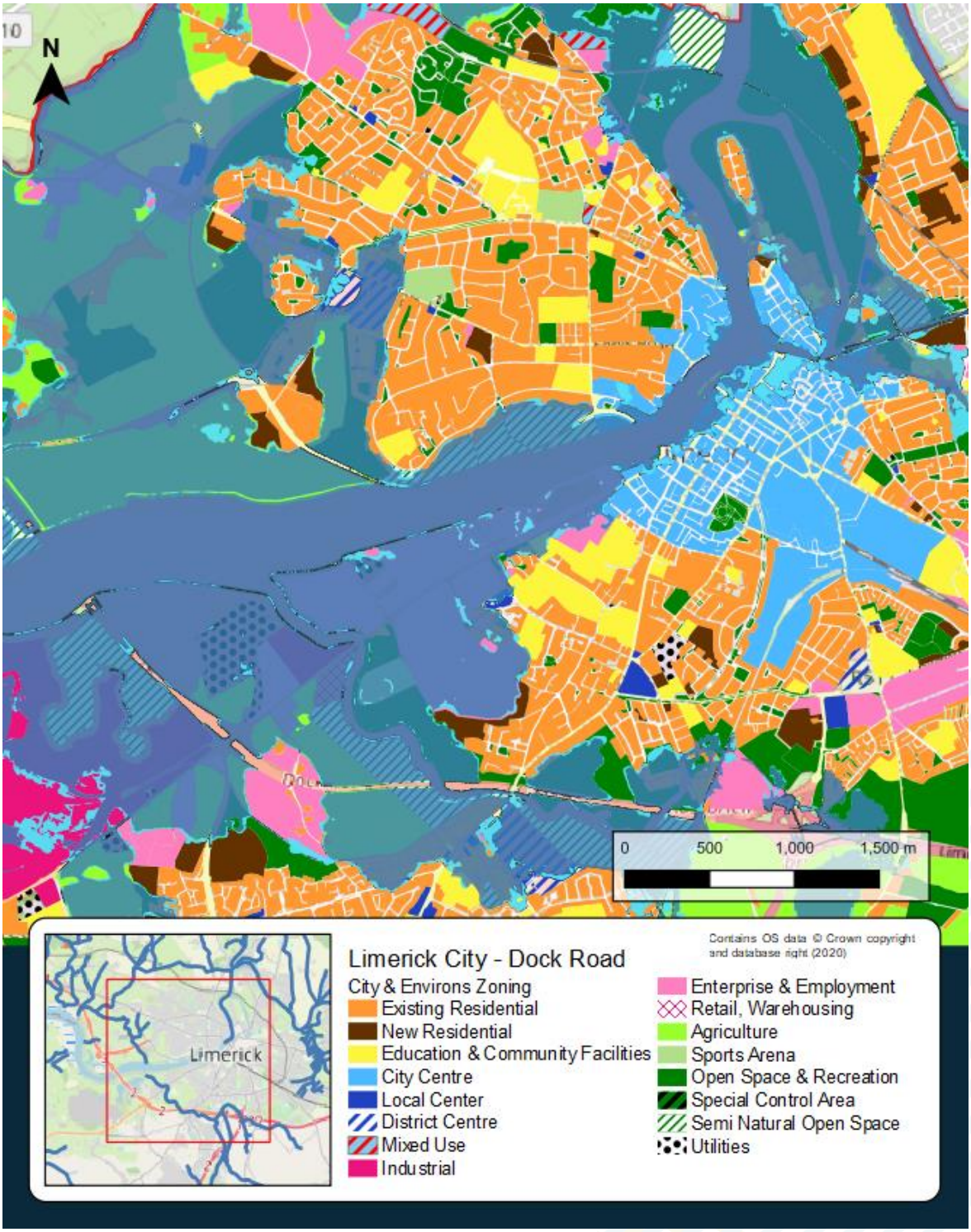


Figure 7-1 Limerick City - Dock Road

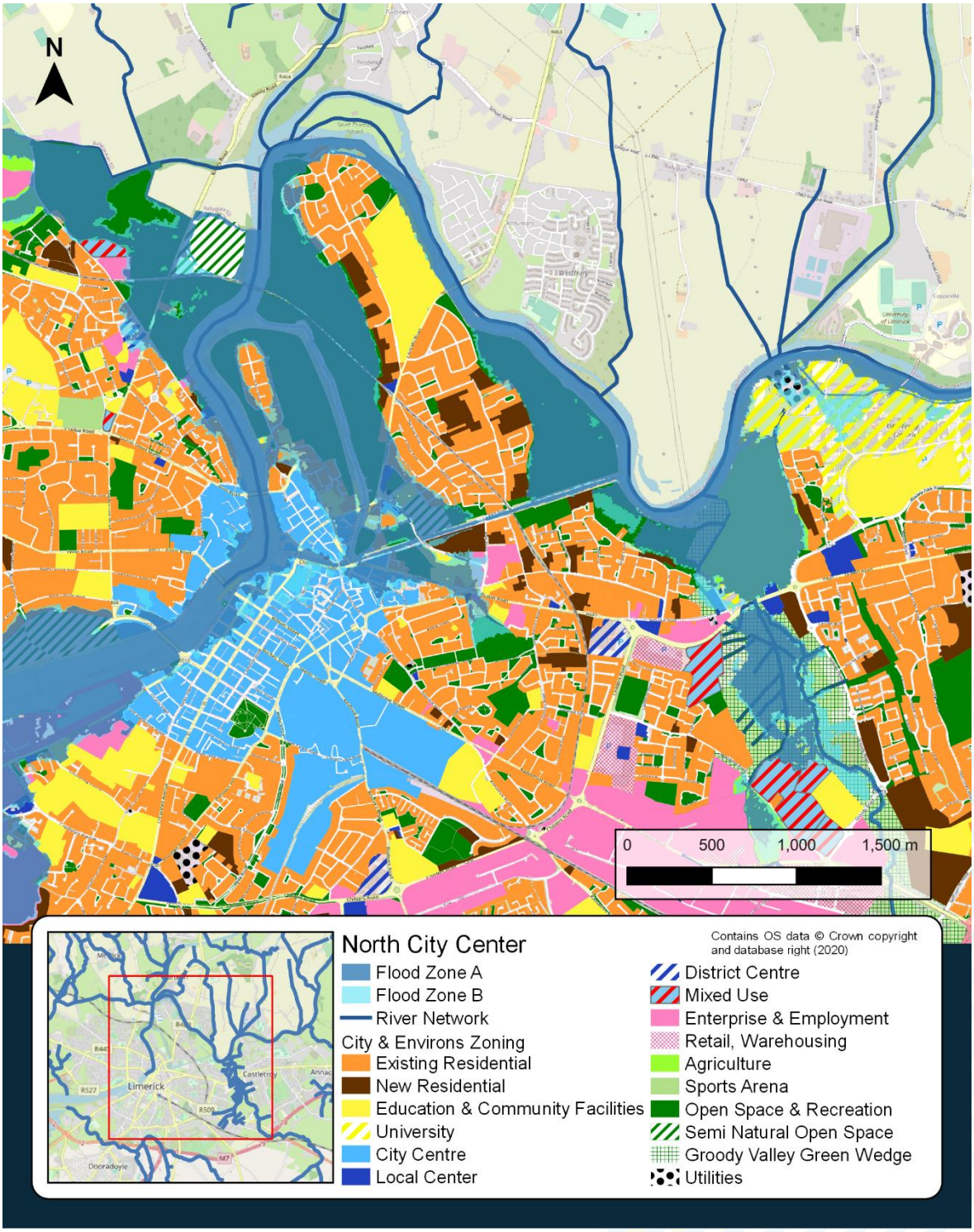


Figure 7-2 Limerick - North City Centre

7.3 Caherdavin\Moyross

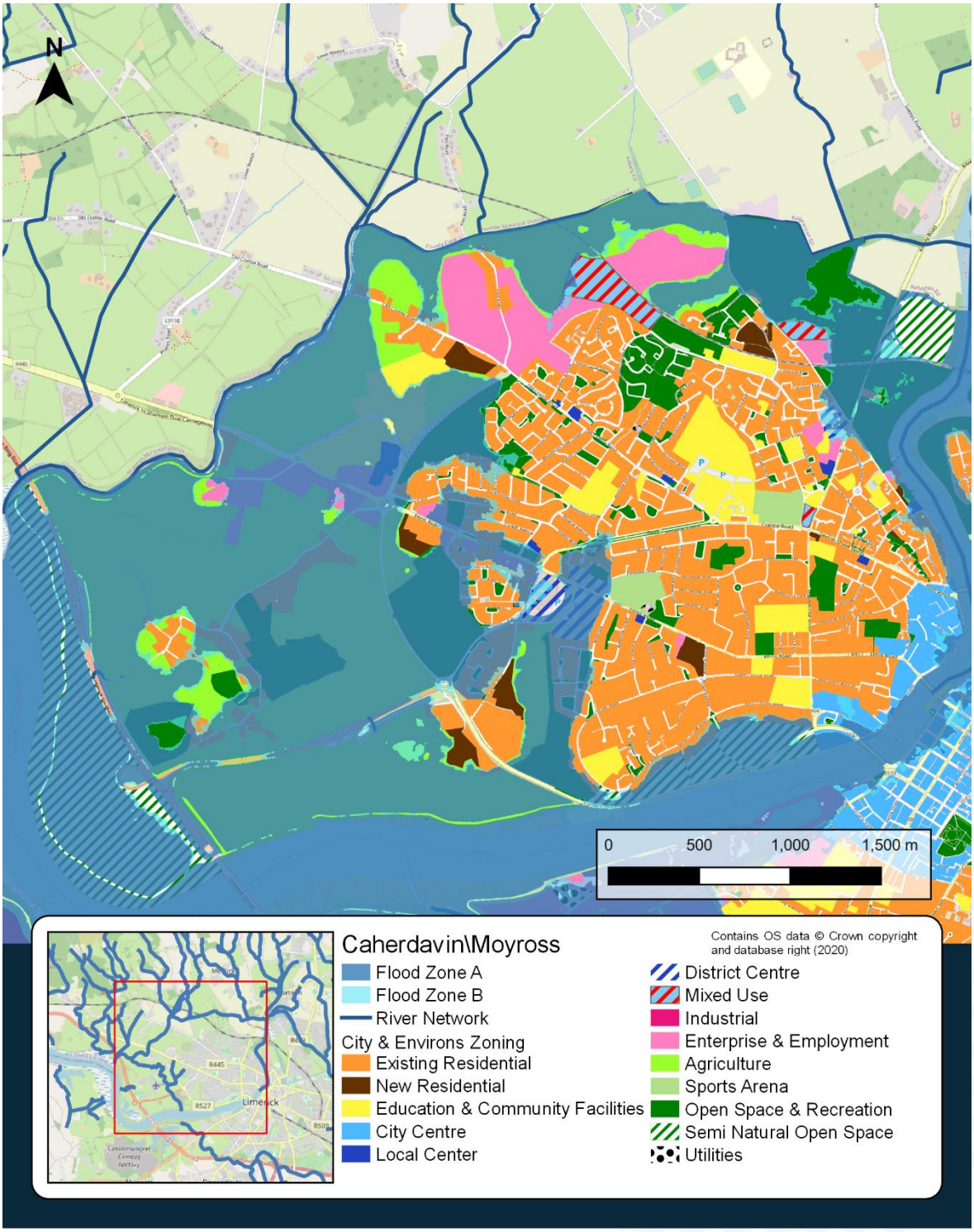


Figure 7-3 Caherdavin/Moyross

The primary watercourses in the area of Caherdavin and Moyross are the Crompaun and its tributaries which flow in a southerly direction towards the Shannon Estuary, the Quinnspool stream which flows east to the Shannon and the Shannon itself. The areas that fall within Flood Zone A and B are designated for several different zoning objectives including Agriculture, Education and Community Facilities, Enterprise and Employment, District Centre Zoning and Existing Residential and Open Space and Recreation. Where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with

no new, major development permitted within this area. Areas of Open Space and Recreation within Flood Zones A and B are water compatible and should be maintained. Where other areas of less vulnerability are within Flood Zones A and B, flood risk should be managed by following the sequential approach, guided by an appropriately detailed FRA.

7.4 Coonagh\Clondrinagh

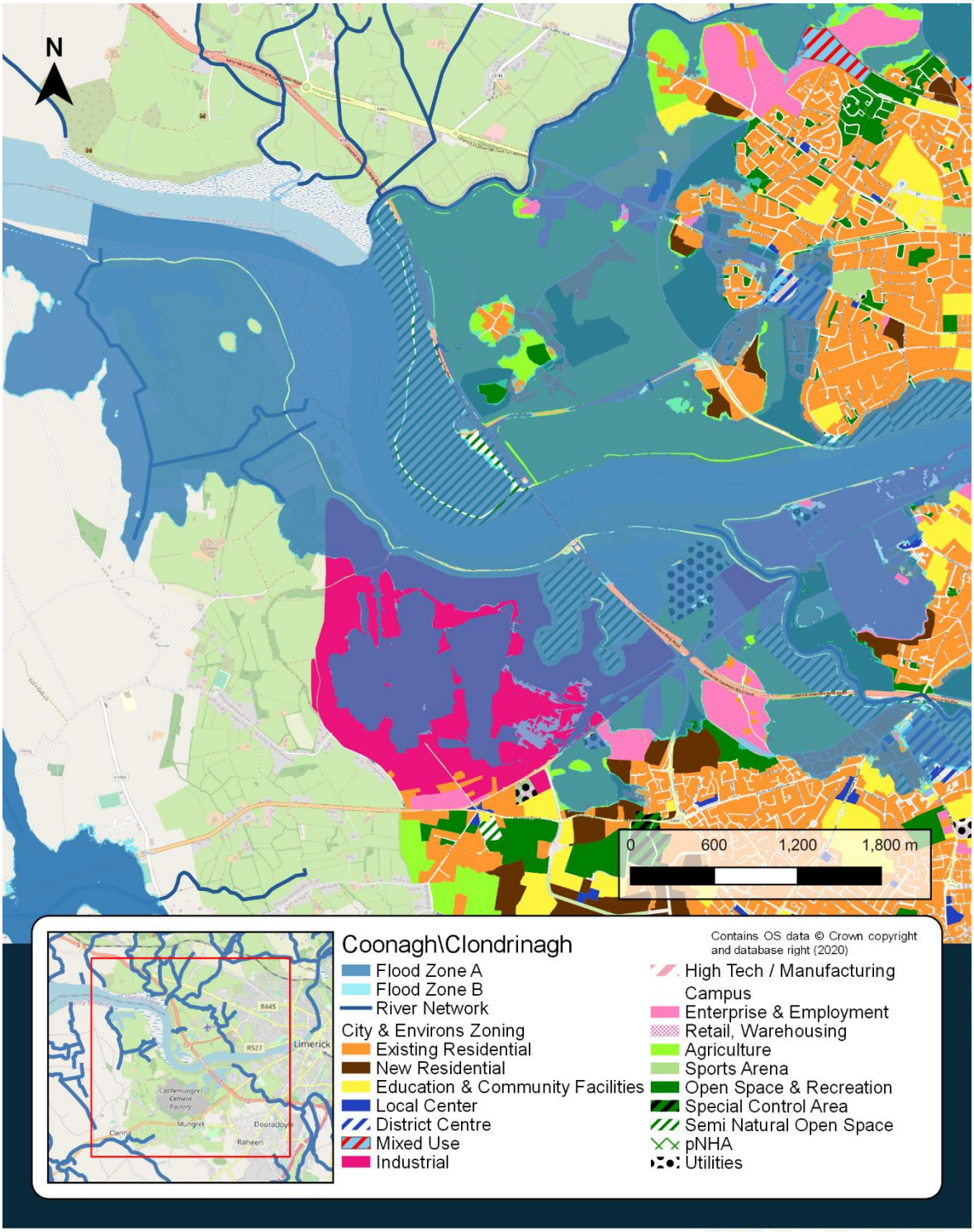


Figure 7-4 Coonagh/Clondrinagh

The primary watercourses in the area are the River Shannon and its adjoining estuary, the Meelick Creek and the Crompaun river. A large part of this area lies within Flood Zones A and B and is covered by several different zoning objectives. A significant proportion of this area is zoned as Agricultural (with the exclusion of any built development), is classed as water compatible and should be maintained. A large area on the banks of the Shannon and the Shannon estuary is designated for Semi Natural Open Space which is also water compatible and should be maintained along with any areas of Open Space and Recreation. Where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. Where other areas of lesser vulnerability are within Flood Zones A and B, flood risk should be managed by following the sequential approach, guided by an appropriately detailed FRA. This includes District Centres, Agriculture and Enterprise and Employment developments.

7.5 Southern Environs

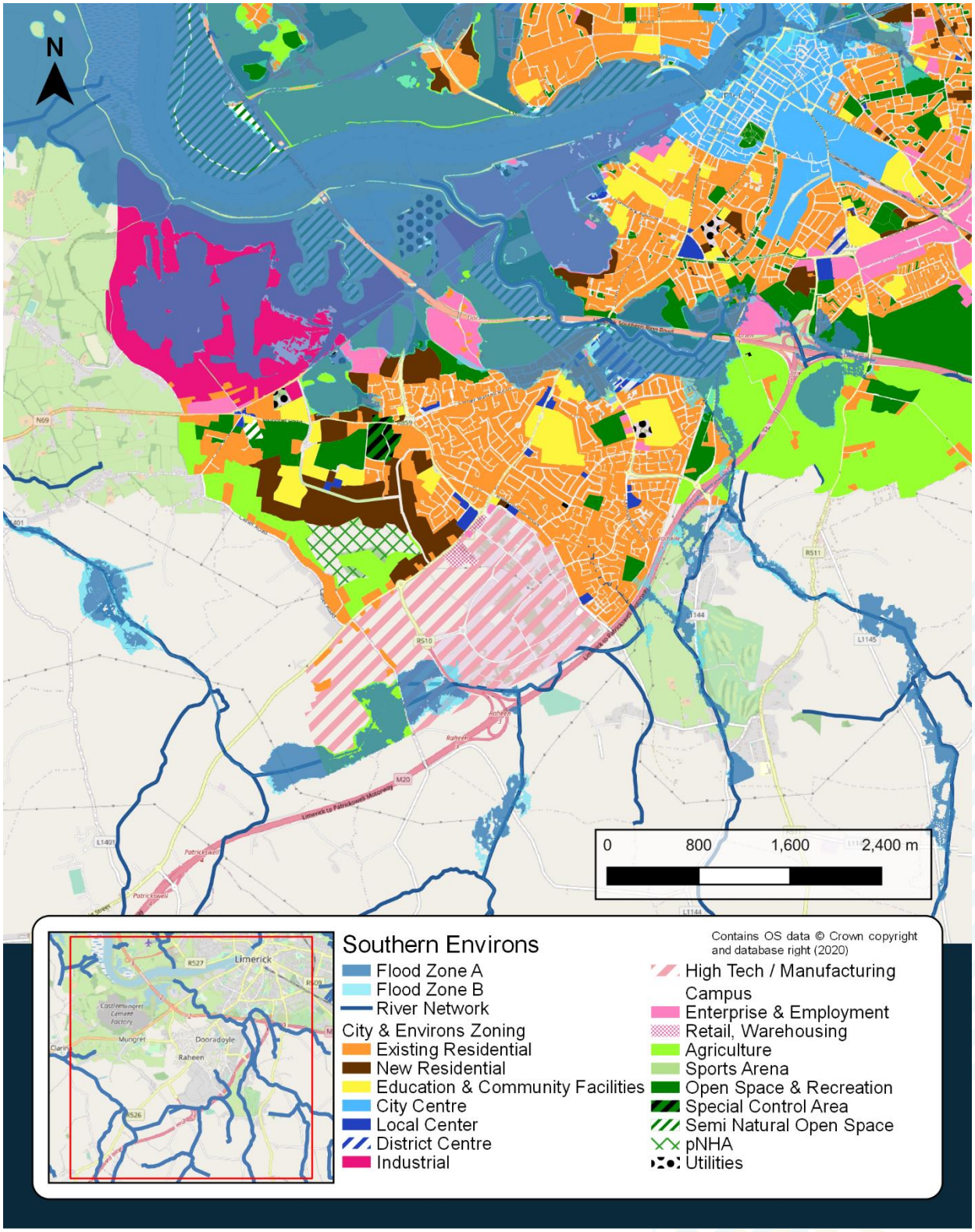


Figure 7-5 Southern Environs

The primary watercourses in the Southern Environs are the River Shannon, the Ballinacurra Creek and the Rossbrien River. The west section of the Southern Environs closest to the Shannon within Flood Zones A and B is designated for industrial use. This is currently in use as the Castlemungret Cement Factory. Any development within this area

should follow the sequential approach, guided by an appropriately detailed FRA. Areas south of the Limerick Southern Ring Road in Dooradoyle and to the east are predominantly zoned for Semi Natural Open Space and Agriculture. This should be maintained until the Limerick Flood Relief Scheme is in place. Where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

The sites subject to Justification Tests in the Southern Environs Area are located at the Dock Road, Raheen Business Park and Enterprise and Employment zoned lands to the northwest of the M20/M7/N18 Junction. The assessments are set out in Appendix 0.

7.6 Castletroy

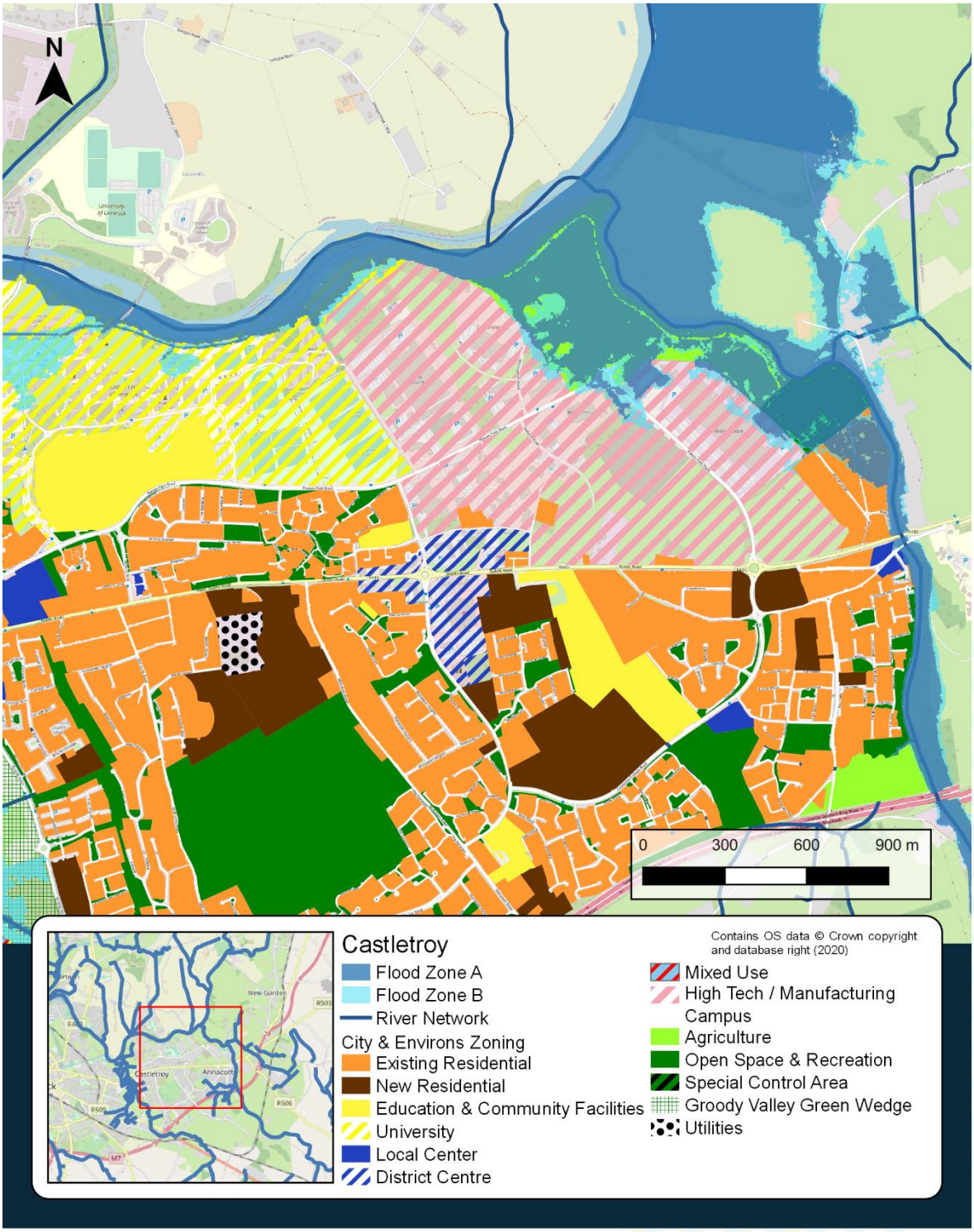


Figure 7-6 Castletroy

The main watercourses in the Castletroy\Annacotty areas are the Shannon, the Groody and the Mulkear. Areas within Flood Zones A and B are predominantly designated for Education and Community Facilities and High Tech\Manufacturing Campus. Both of these zonings could comprise of highly vulnerable or less vulnerable developments. Less vulnerable developments within these areas should follow the sequential approach, guided by an appropriately detailed FRA, whereas highly vulnerable developments are to be located in Flood Zone C only. These areas include the University of Limerick Campus and the IDA lands.

Where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

The Groody Valley Wedge should be assessed under the sequential approach where needed, however a water compatible wildlife corridor is appropriate for all Flood Zones.

8 Settlements in County Limerick

8.1 Overview

Within Limerick City and County the various settlements have differing levels of flood risk and a screening exercise has been carried out to ensure an appropriate level of assessment is provided in each settlement. The majority of settlements have some areas within Flood Zones A and B.

As part of the development of this SFRA, updated Flood Zone maps have been produced for all settlements, and these updated Flood Zone maps may be used to inform site specific flood risk assessment undertaken as part of the Development Management process.

8.2 Settlements in Flood Zone C

An initial screening of flood risk was undertaken to identify which settlements were located wholly within Flood Zone C. Murroe was the only settlement identified that was wholly in Flood Zone C. No fluvial or tidal flood risk was identified, and development proposals should proceed following the approach laid out in Sections 5.5 and 5.7 to ensure all other sources of flood risk, including surface water and groundwater, have been appropriately assessed and, where required mitigated.

8.3 Settlements in Flood Zone A and B

The sites below were identified as lying partly within Flood Zones A, B and C, and have zoning objectives detailed within the Development Plan:

- Ballingarry
- Bruff
- Bruree
- Cappamore
- Doon
- Dromcolliher
- Foynes
- Glin
- Hospital
- Kilfinane
- Pallasgreen
- Pallaskenry

8.3.1 Ballingarry

The Clonshire river flows in a northerly direction through Ballingarry. Flood Zone A and B intersects the town centre at the borders. The extent of Flood Zone A/B across the Town Centre zoning is very limited and risks can be managed by following the sequential approach, guided by an appropriately detailed FRA.

There is a very small area of Existing Residential development that is shown to be within Flood Zones A/B. Future development here should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

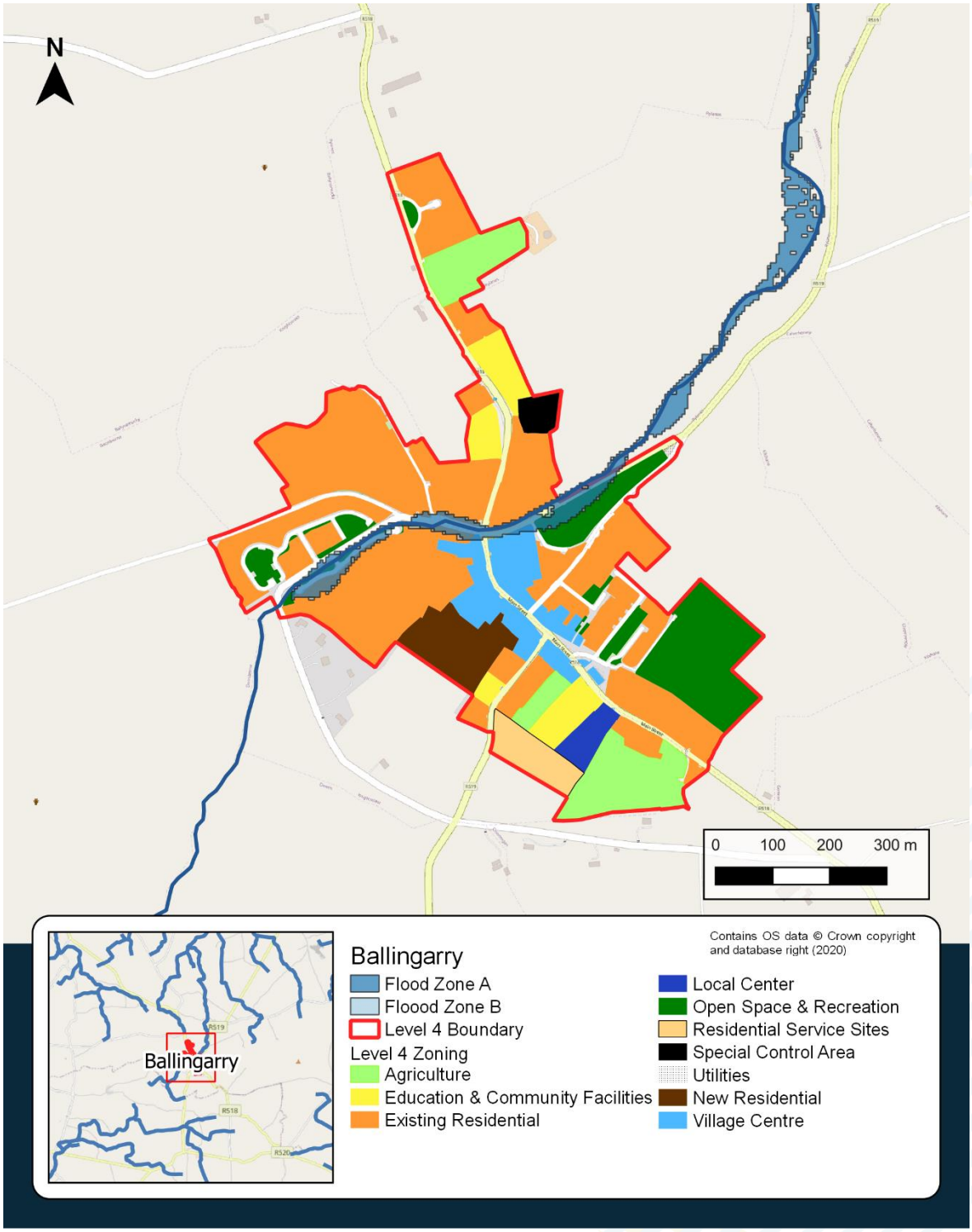


Figure 8-1 Ballingarry

8.3.2 Bruff

The Morningstar River flows through Bruff in an east to west direction. The majority of Flood Zone A and B in Bruff lies in areas zoned as Open Space and Recreation and this should be maintained. There is an area of Existing Residential development that is shown to be within Flood Zones A/B. Future development here should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

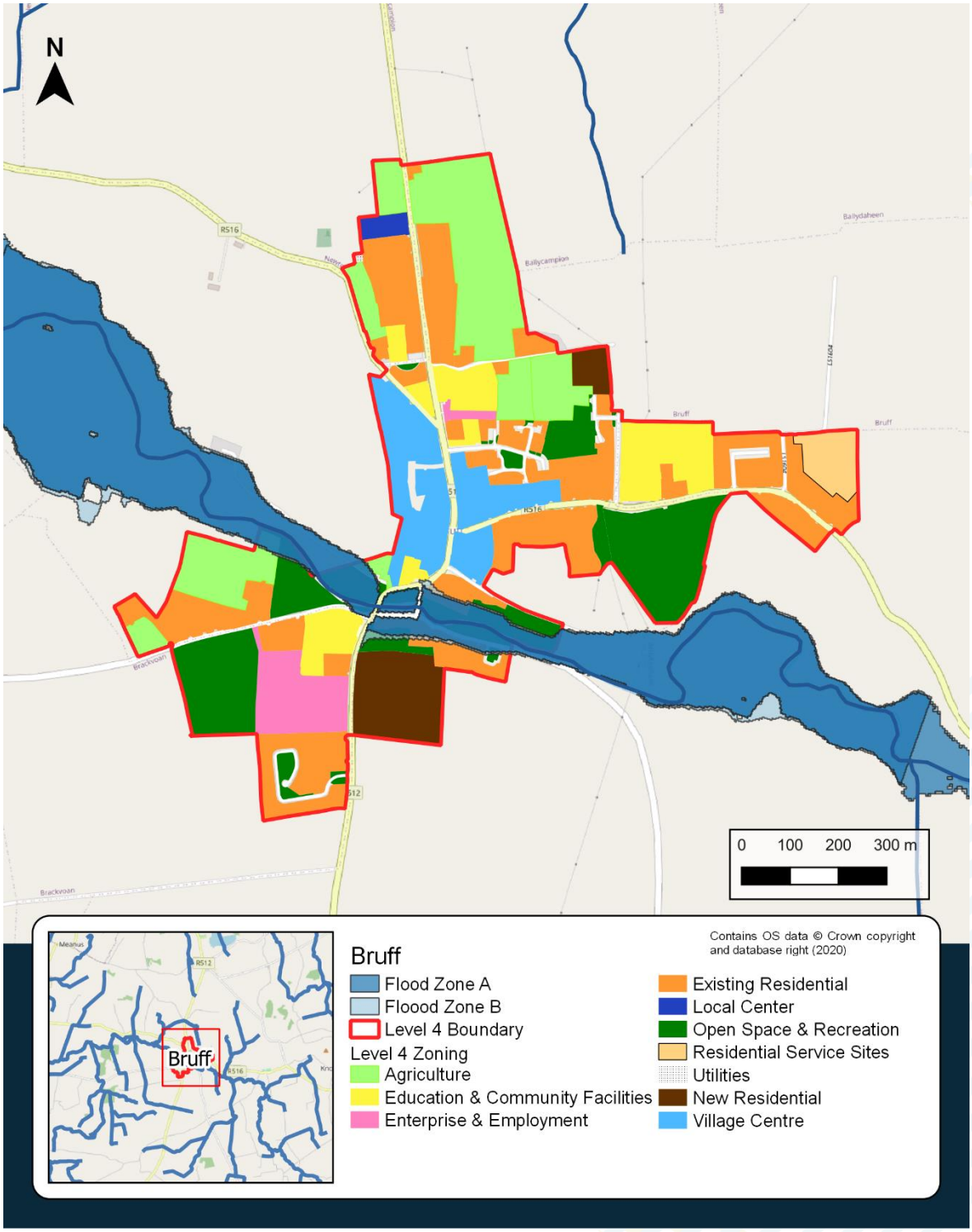


Figure 8-2 Bruff

8.3.3 Bruree

The Maigue River runs through Bruree from east to west, with a tributary joining the Vartry in the centre of town. The majority of the land within Flood Zone A and B is zoned for open space which is appropriate and should be maintained. A small area of Existing Residential zoning is within Flood Zone A and B, therefore future development here should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

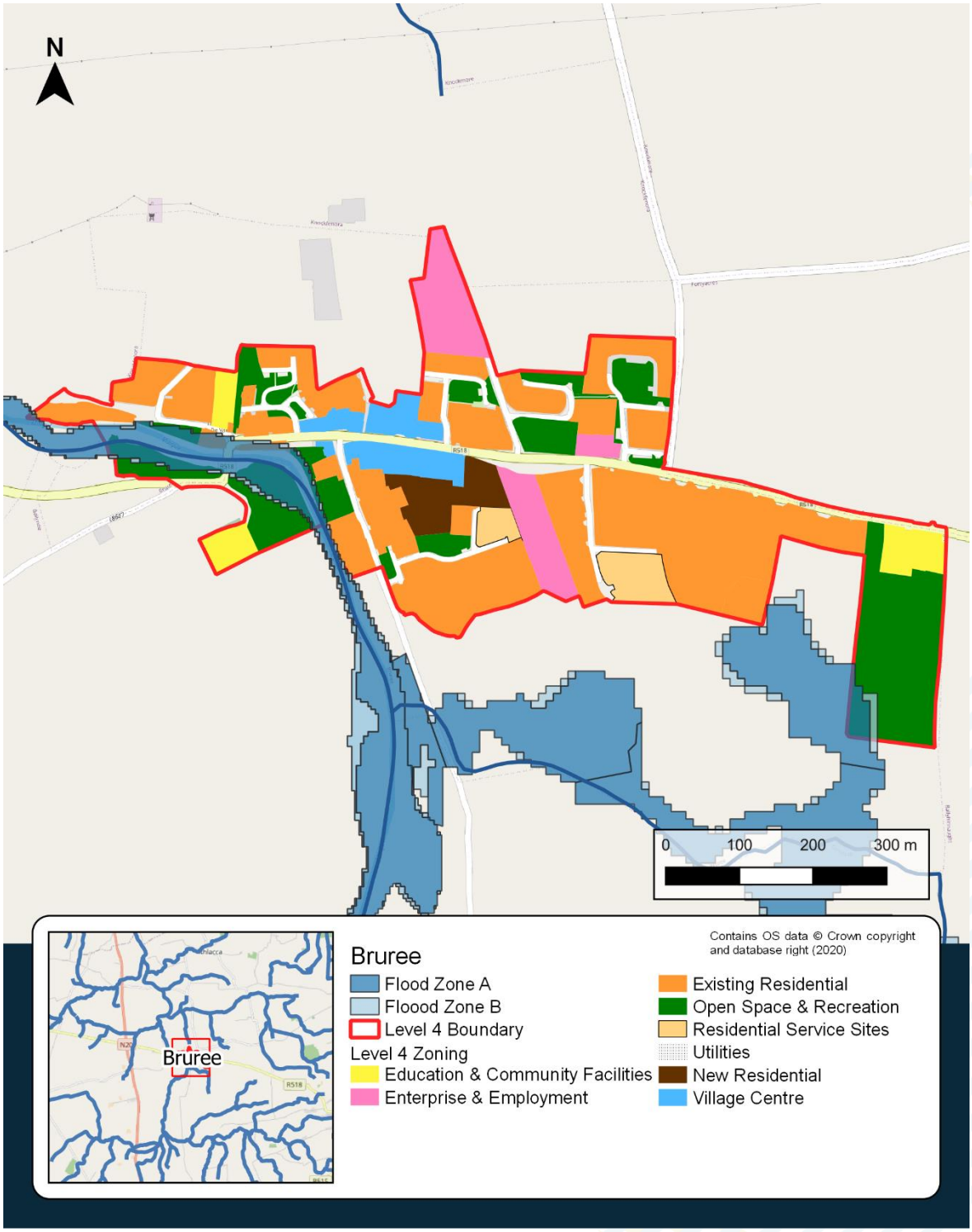


Figure 8-3 Bruree

8.3.4 Cappamore

The primary watercourse in Cappamore is the Dooglasha River, this flows to the town in a southerly direction before turning southeast through the town. The River Bilboa confluences with the Dooglasha at the eastern end of the settlement. In the 1990s, the OPW constructed a diversion channel which reduced the risk of flooding to the town. The benefit of this bypass channel was included in the CFRAM modelling on which these Flood Zones are based.

Flood risk in Cappamore is mostly contained on the northeast side of the town and does not greatly extend past the banks of the watercourses, being contained within the two channels. In this area, small parts of Town Centre, Existing Residential, Utilities and Education and Community Facilities and Agricultural zonings all lie within Flood Zone A and B.

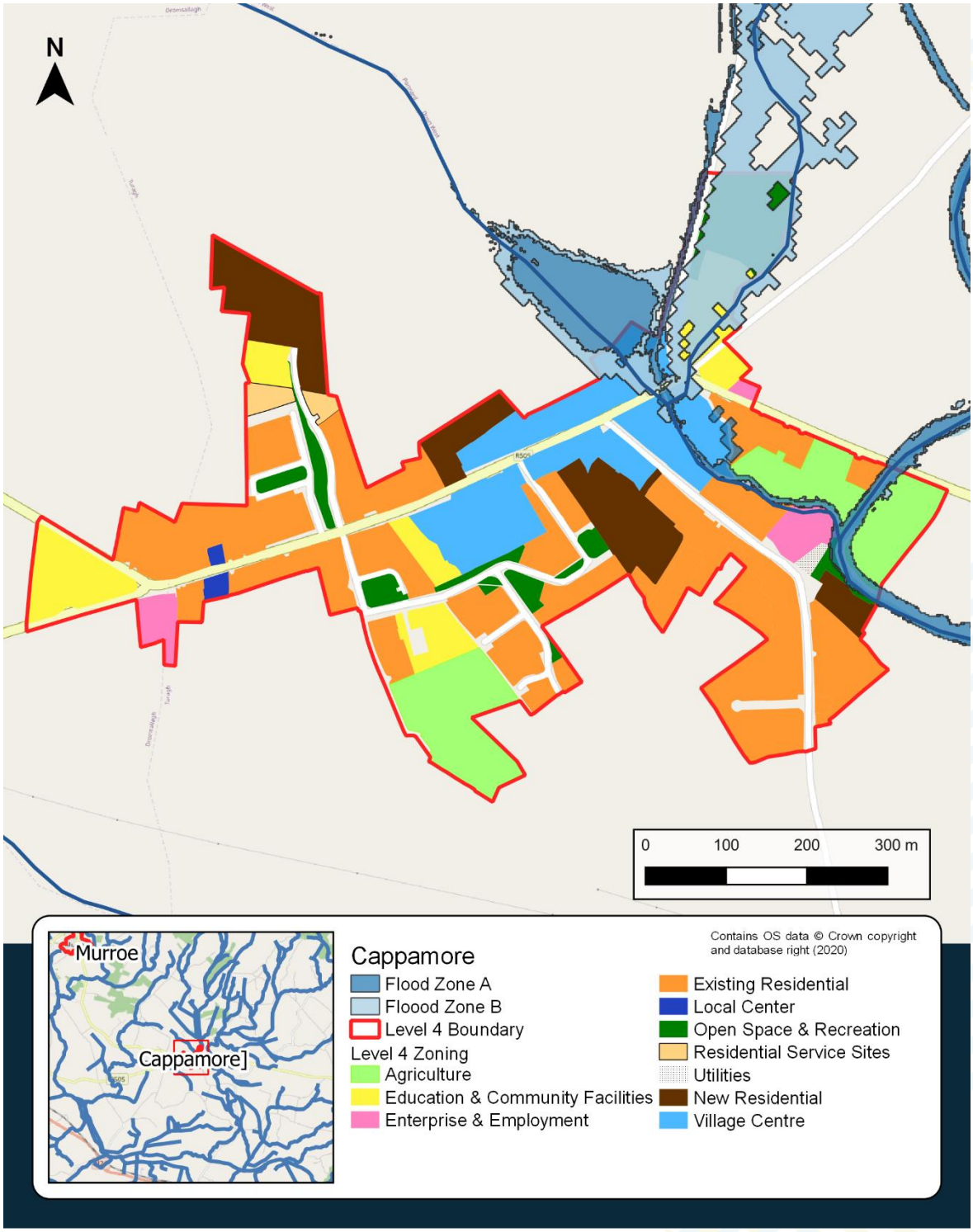


Figure 8-4 Cappamore

The extent of Flood Zone A/B across the Town Centre zoning is very limited and risks can be managed by following the sequential approach, guided by an appropriately detailed FRA.

Where there is Existing Residential development within Flood Zones A/B future development should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

The Agricultural zoning is water compatible and should be retained in Flood Zones A and B.

The zoning objective for Education and Community Facilities has been retained to reflect the current use of the site, but future development in this area must be limited to minor development (Section 5.28 of the Planning Guidelines), provided there is no intensification of use and consequent increase in flood risk.

8.3.5 Doon

Three river courses run through Doon. The Bottle Hill river is located on the west of the settlement, the river Doon runs through the centre of the town, and a tributary of the Doon River flows to the east of the town. All watercourses flow in a southerly direction. The two outer watercourses do not have Flood Zone mapping associated with them, but this does not mean that there is no flood risk arising. The Justification Test has not been applied and any future development adjacent to these unmapped watercourses should follow the sequential approach. The main watercourse through Doon has Flood Zones depicted based on broadscale modelling and refined using topographic data and site visit observations.

Flood Zone A and B intersects the Town Centre at the borders and covers small areas of Education and Community to the west and a large area to the north of Doon. The extent of Flood Zone A/B across the Town Centre zoning is very limited and risks can be managed by following the sequential approach, guided by an appropriately detailed FRA. Flood risk in the area of Education and Community needs careful assessment prior to future development being permitted. As such, the Justification Test for these sites have not been passed and development must be limited to minor developments (Section 5.28). A site specific flood risk assessment of the stream is likely to result in a reduction in flood extent, after which the Sequential Approach should be applied to locate development in Flood Zone C.

There are also areas of Existing Residential at the north of the settlement which is in Flood Zone A. Guided by a site specific flood risk assessment, development within Flood Zones A and B should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within Flood Zones A and B. Other areas within Flood Zone A and B are zoned as Open Space and Recreation or Agriculture and should be retained as they are water compatible and therefore appropriate.

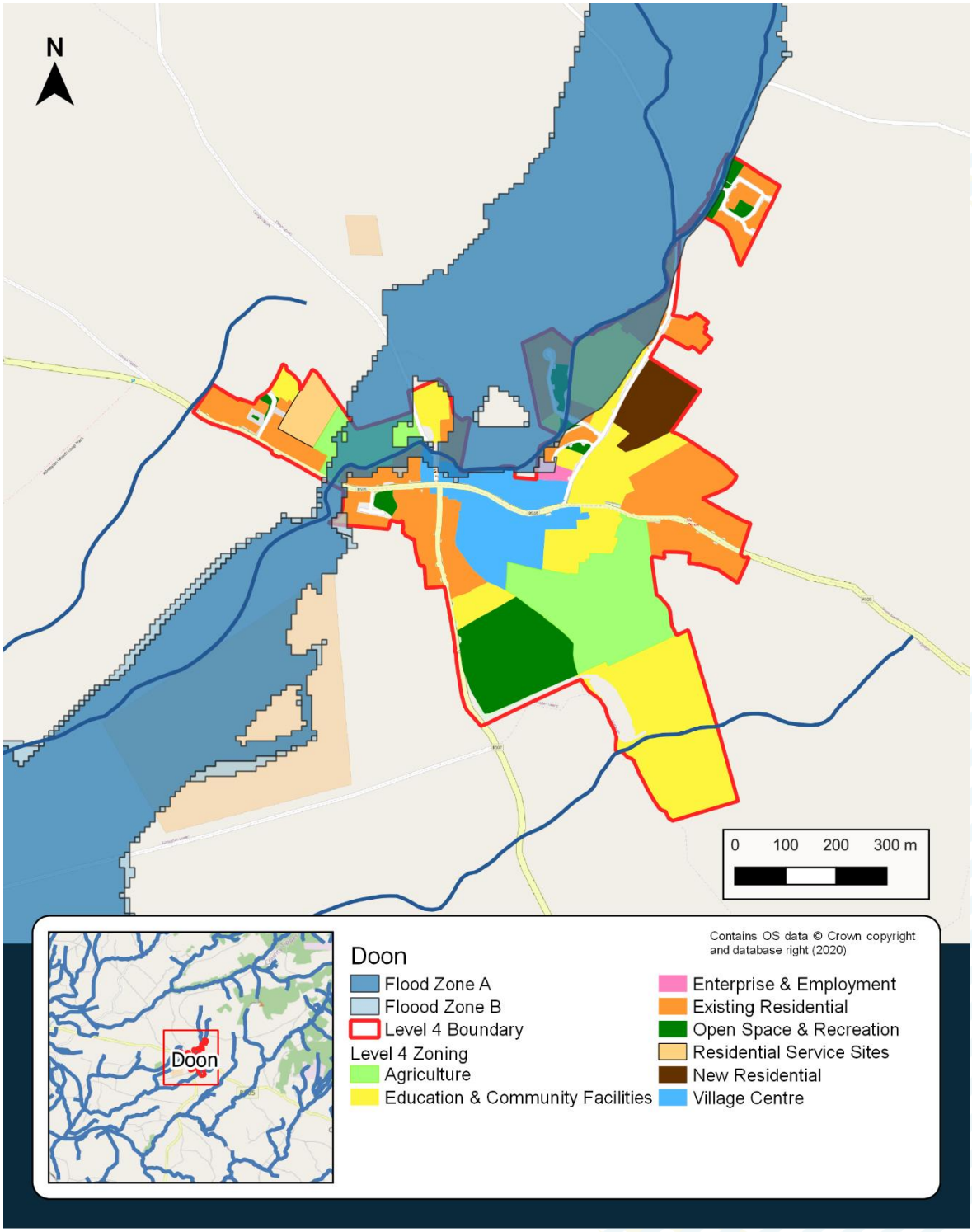


Figure 8-5 Doon

8.3.6 Dromcolliher

The Alhavarraga stream runs through Dromcolliher in a south to north direction. The extents of Flood Zone A and B are very narrow. Where they pass through water compatible Open Space and Recreation, with some parts zoned for Agriculture, they are appropriate and should be maintained. However, Flood Zone A and B also borders parts of the Town Centre to the west. Small areas of Utilities, Enterprise and Employment, and Education and Community

Facilities also intersect with Flood Zones A and B. The extent of Flood Zone A/B across the Town Centre zoning is very limited and risks can be managed by following the sequential approach, guided by an appropriately detailed FRA.

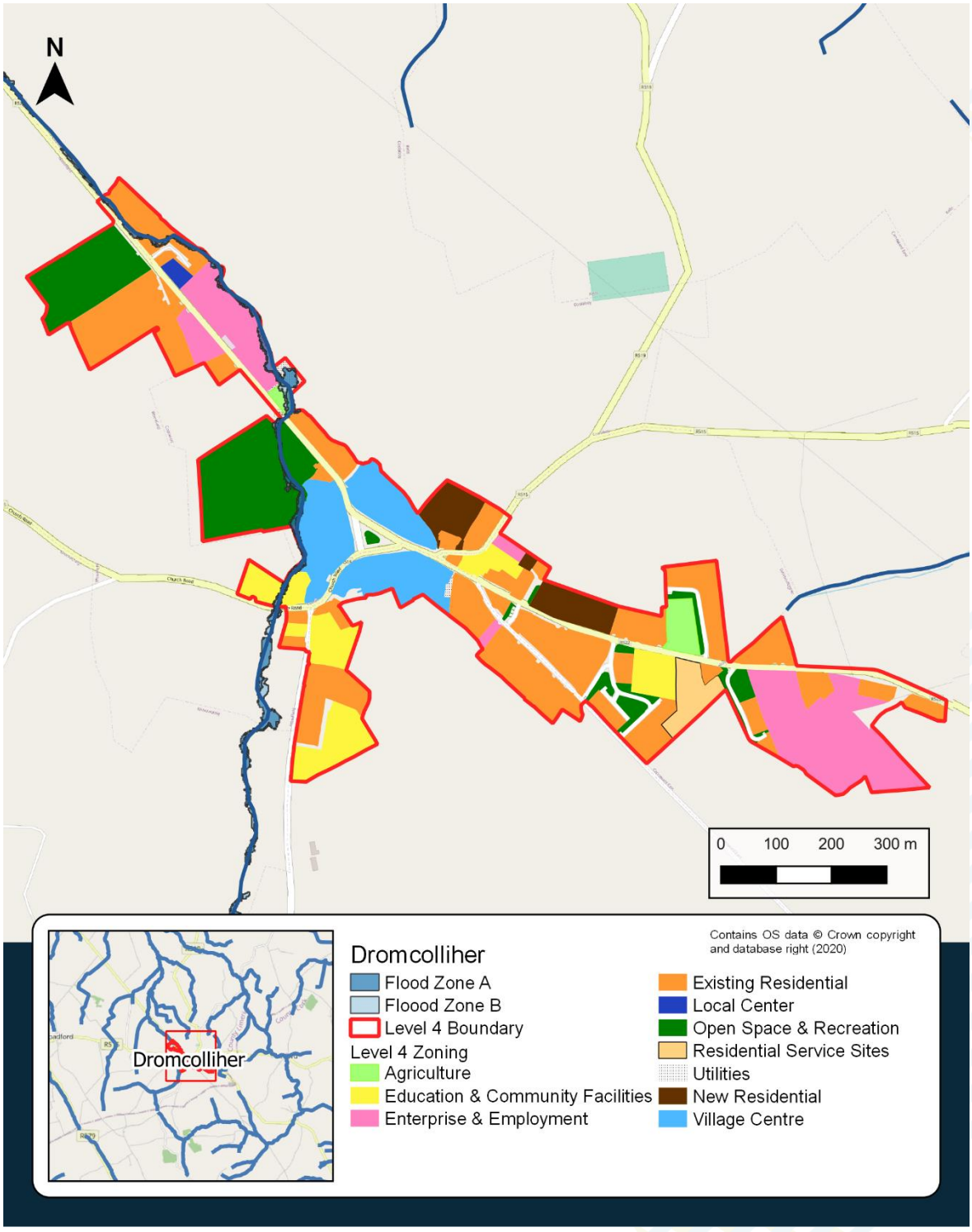


Figure 8-6 Dromcolliher

8.3.7 Foynes

Foynes lies on the banks of the Shannon estuary. The north and south Ballinacragga Rivers flow through Foynes into the estuary. Although a flood relief scheme has been completed, this only aims to manage tidal risk and is focused

around the Port and immediately adjacent residential properties. A scheme was identified under the CFRAM programme of works which will address fluvial risks, but there is currently no programme for this to commence.

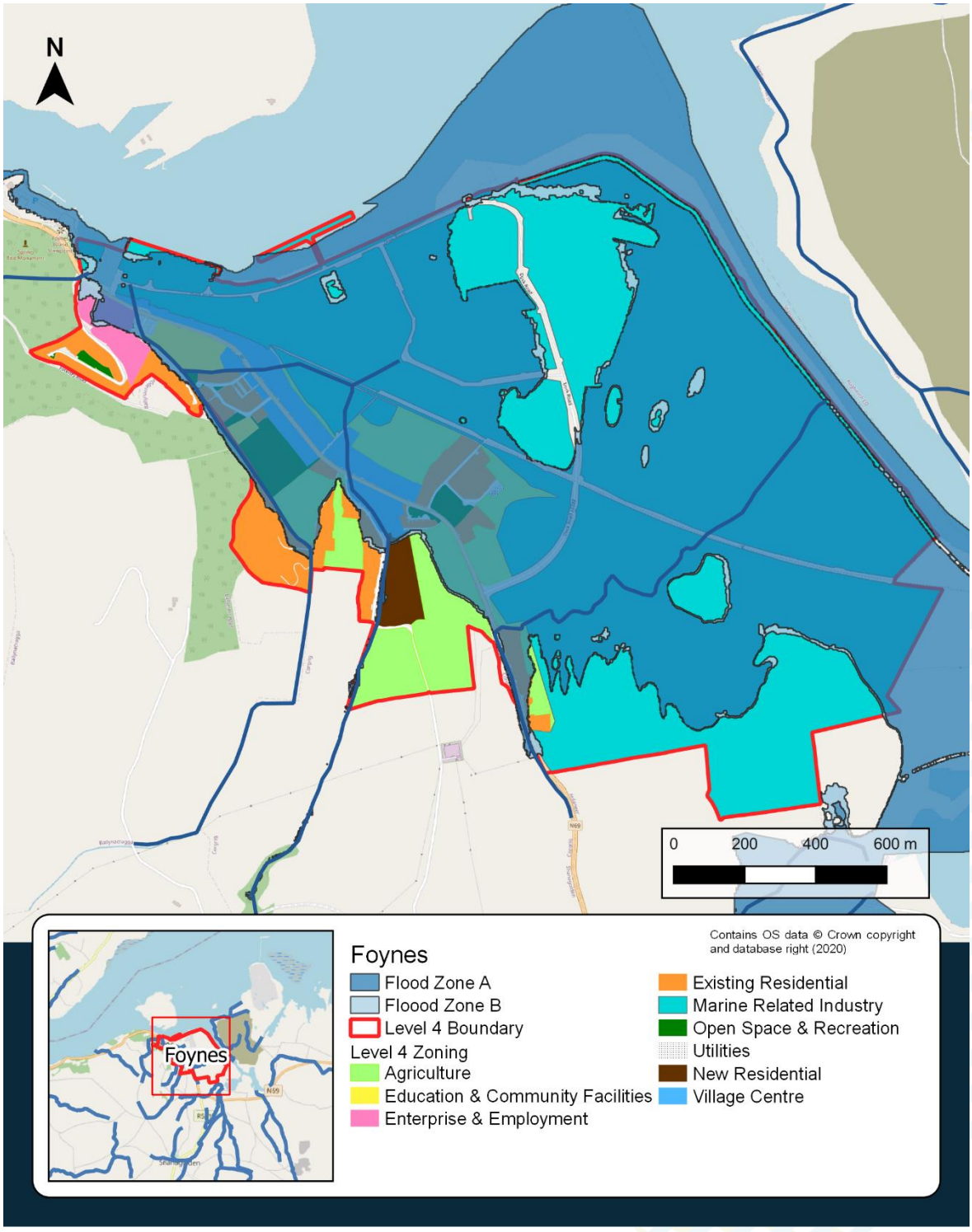


Figure 8-7 Foynes

A large part of Flood Zone A and B is currently zoned as marine industry, which is a water compatible use. Any new development within this area, and associated with any existing developments here, would need a site specific FRA to be carried out but the Justification Test is not required.

The entirety of the Town Centre lies within Flood Zones A and B. Until such time as the fluvial flood relief scheme has been completed major development in Foynes is considered premature and new development should be limited to minor development (Section 5.28 of the Planning Guidelines) as it does not pass the Justification Test.

Existing Residential areas within Flood Zone A and B should limit future development to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. Once the flood relief scheme has been completed this may be reappraised in light of the residual risks associated with the scheme.

8.3.8 Glin

Glin is situated on the banks of the Shannon estuary where the Glencorbry River flows through it from east to west and into the estuary. There are several areas of Existing Residential development that are shown to be within Flood Zones A/B. Future development here should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. There is also a small area of Enterprise and Employment within Flood Zones A/B and risks in this zoning can be managed by following the sequential approach, guided by an appropriately detailed FRA.

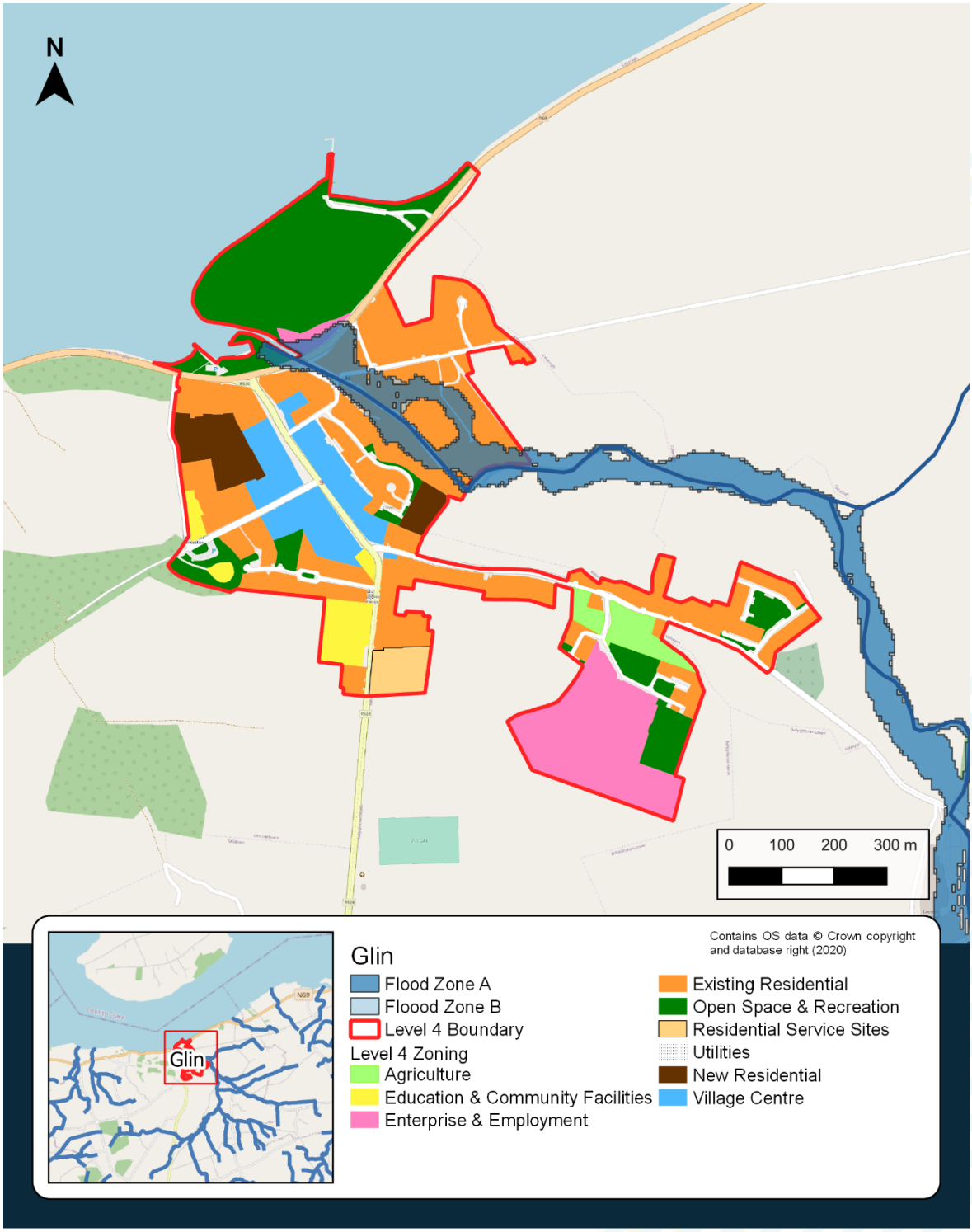


Figure 8-8 Glin

8.3.9 Hospital

The Mahore River flows through the north of Hospital. There is very little flood risk here with very small areas of Existing Residential, Utilities, Open Space and Recreation and Agriculture intersecting with Flood Zones A and B. Existing Residential areas within Flood Zone A and B should limit future development to minor development (Section

5.28 of the Planning Guidelines) with no new, major development permitted within this area. Agriculture and Open Space and Recreation are water compatible uses, are appropriate and should be retained.

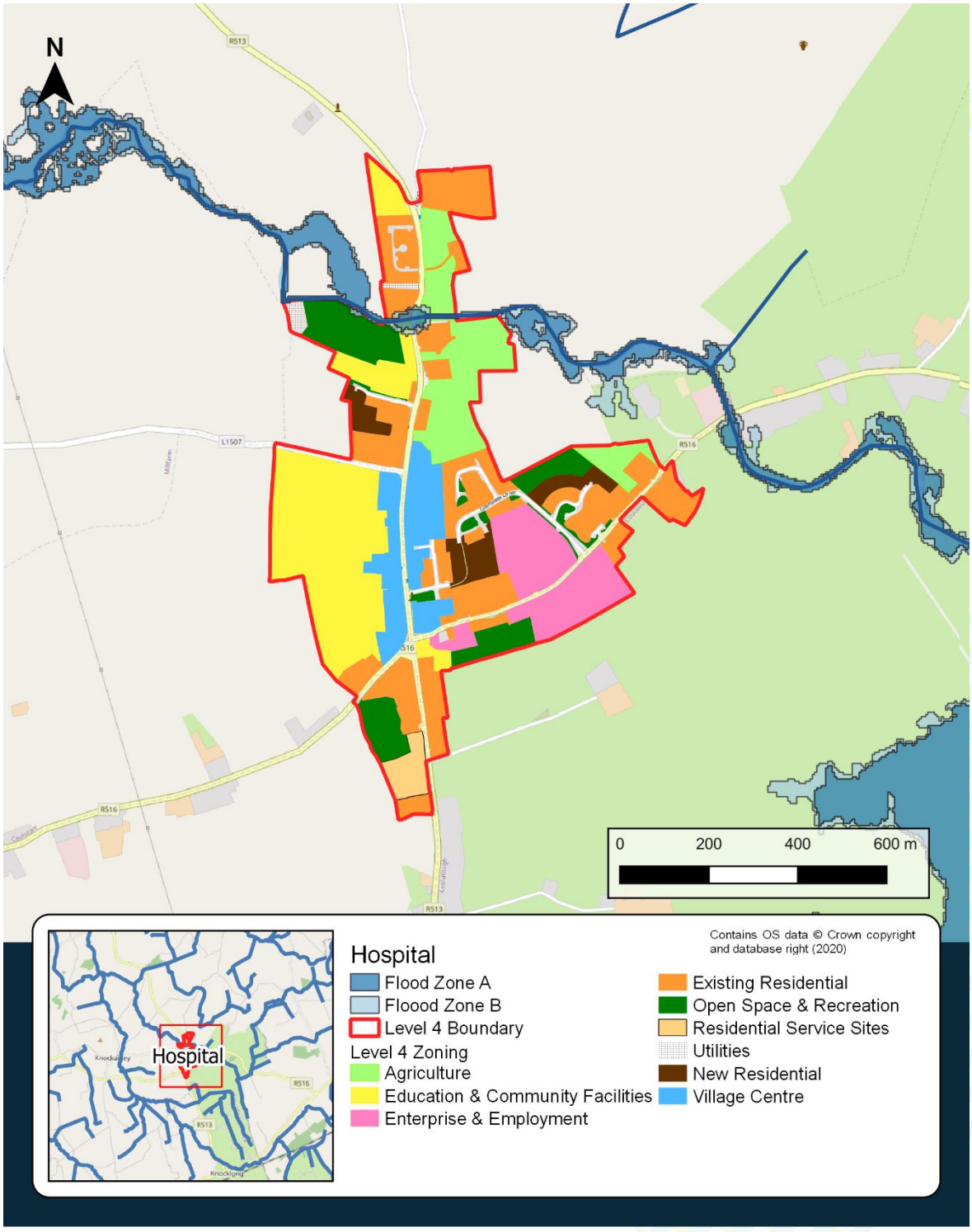


Figure 8-9 Hospital

8.3.10 Kilfinane

The main watercourse flowing through the settlement is the Ballyroe which flows in a north-westerly direction. Existing Residential, Open Space and Recreation and Agricultural areas lie within Flood Zones A and B at the south of the settlement.

Existing Residential areas within Flood Zone A and B should limit future development to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. Open Space and Recreation and Agriculture areas are water compatible and should be maintained.

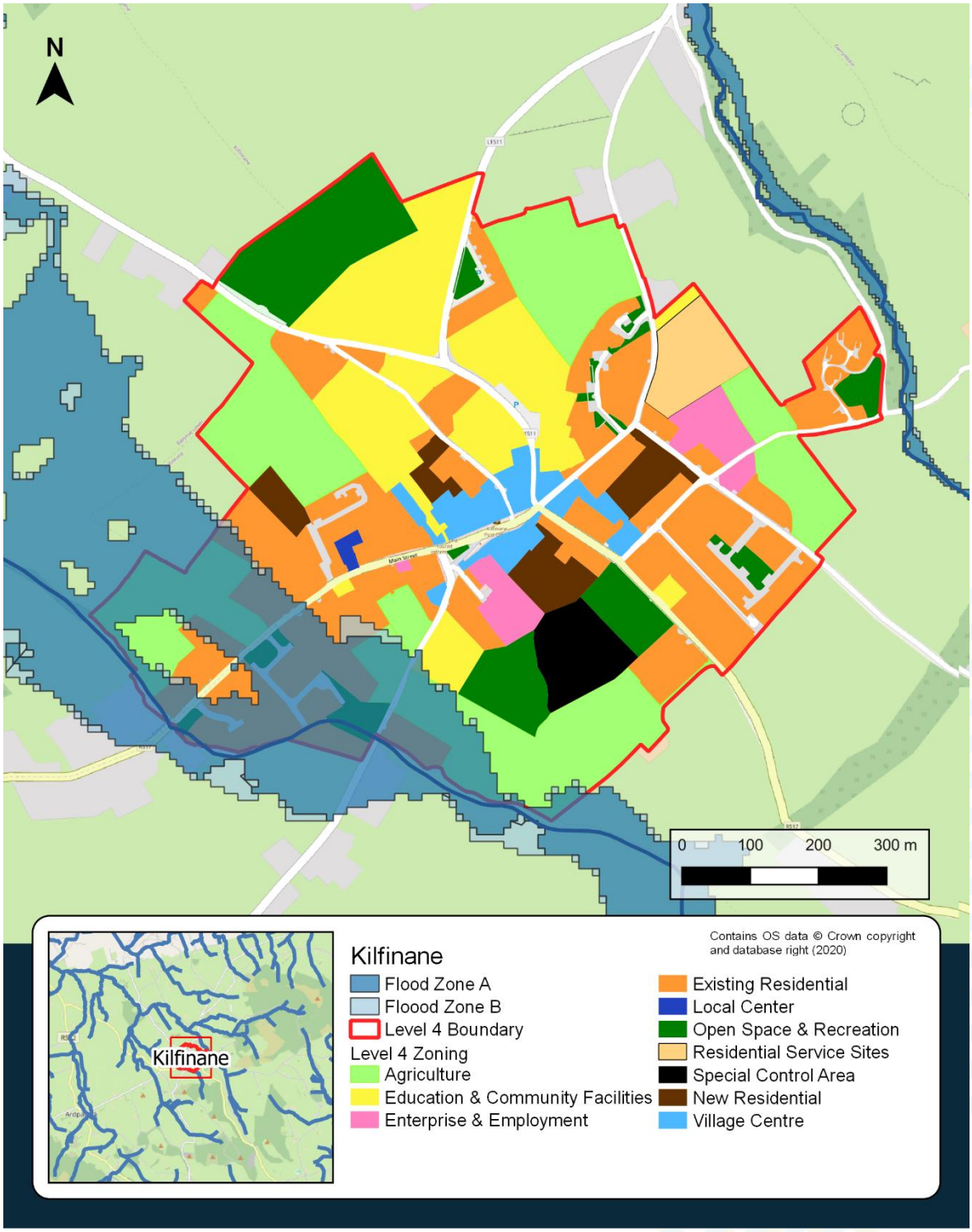


Figure 8-10 Kilfinane

8.3.11 Pallasgreen

There are two watercourses flowing through Pallasgreen. The Sunville stream flows from south to north on the west of the settlement, while the Dromlara River flows in a westerly direction at the north of the settlement.

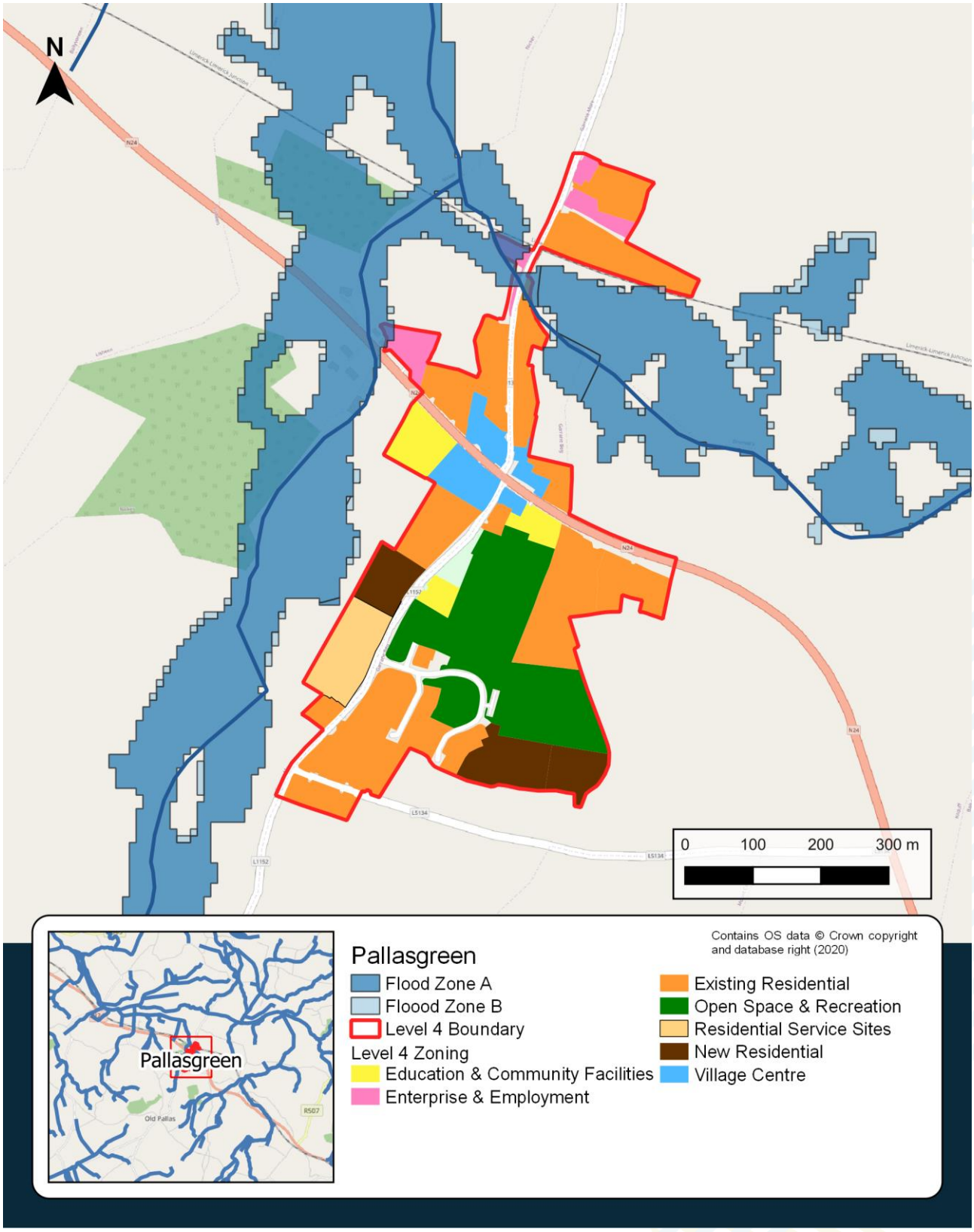


Figure 8-11 Pallasgreen

There is a very small area of Existing Residential development that is shown to be within Flood Zones A/B. Future development here should be limited to minor development (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area. There is also a small area of Enterprise and Employment within Flood

Zones A/B at the north of the settlement and risks in this zoning can be managed by following the sequential approach, guided by an appropriately detailed FRA.

8.3.12 Pallaskenry

There is a large wetlands area to the east of the town within the settlement. The areas falling with Flood Zone A and B are largely designated for Open Space and Recreation which is appropriate and should be maintained.

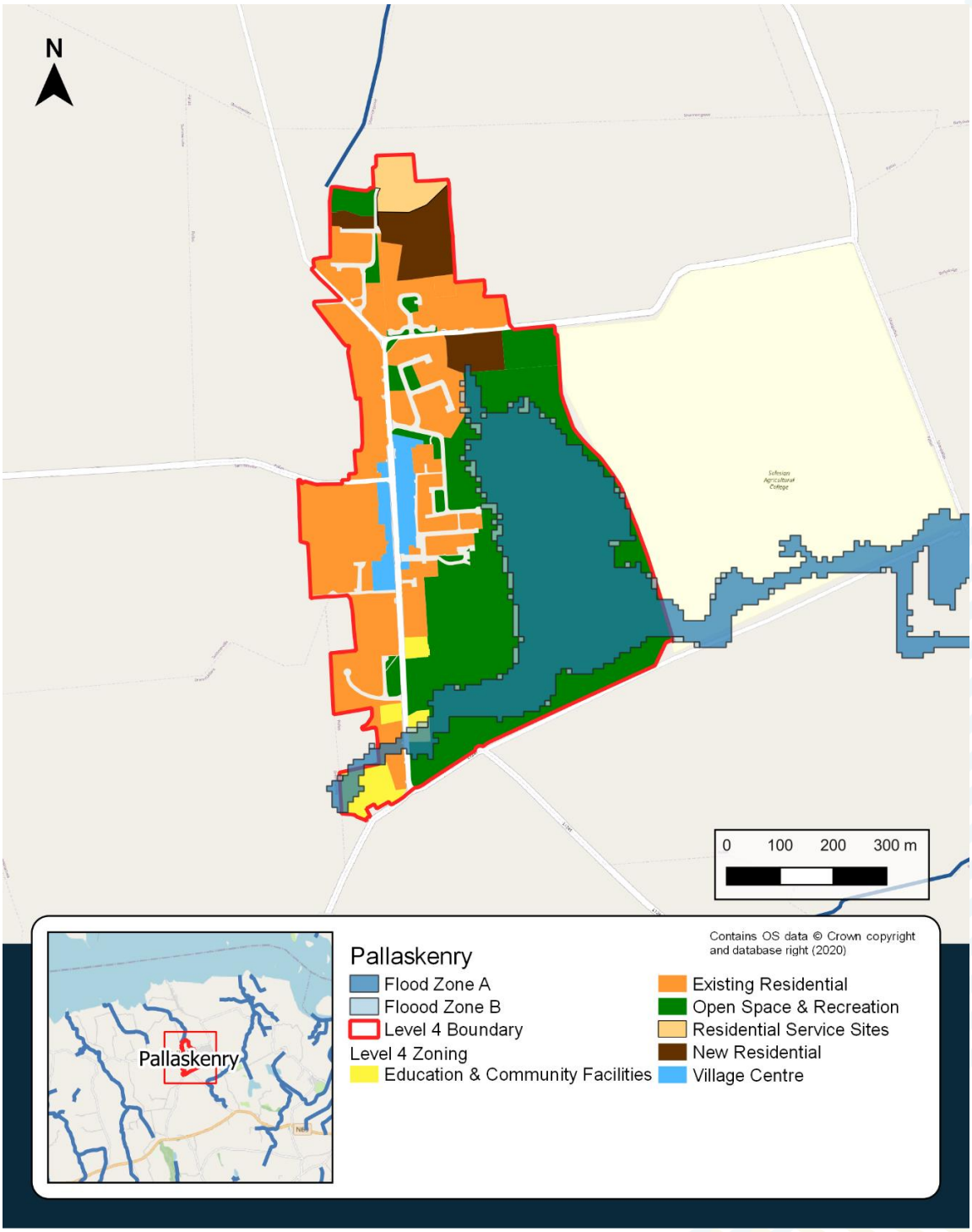


Figure 8-12 Pallaskenry

The extents of Flood Zone A and B cover a very small part of the settlement designated for Existing Residential and Education and Community Facilities. The flood extents covering these areas are limited and flood risk can be managed

by following the sequential approach, guided by an appropriately detailed FRA. Where there is existing residential zoning within Flood Zone A or B, new development should be limited to minor development only (Section 5.28 of the Planning Guidelines) with no new, major development permitted within this area.

8.3.13 Level 5 and 6 Settlements

As part of the screening assessment, fluvial and/or tidal risk has been identified in a number of Level 5 and 6 small villages and rural clusters, as listed below:

- Anglesboro,
- Ardpatrick,
- Ashford,
- Athlacca,
- Ballybrown,
- Ballyhahill,
- Ballyorgan,
- Ballysteen,
- Broadford,
- Carrigkerry,
- Croagh,
- Dromkeen,
- Elton,
- Feenagh,
- Feohanagh,
- Galbally,
- Glenbrohane,
- Granagh,
- Kilbeheny,
- Kilcolman,
- Kildimo,
- Kilmeedy,
- Knockainy,
- Loghill,
- Meanus,
- Monagea,
- Montpelier,
- Mountcollins
- Strand,
- Templeglantine,
- Tournafulla.

These settlements have no specific zoning objectives, just a settlement boundary or node. In these settlements new, highly and less vulnerable development is not considered to have passed the Justification Test and should be located in Flood Zone C. In Flood Zones A and B, in general only minor development (Section 5.28 of the Planning Guidelines) and water compatible uses will be permitted.

Some of the settlements listed above had a mapped Flood Zone, but in some cases a watercourse has been identified but due to the size of the catchment, the Flood Zone has not been delineated. In these cases, it is the responsibility of the applicant to undertake an appropriately detailed FRA and to then apply the sequential approach as the Plan Making Justification Test has not been satisfied in these settlements.

It should also be noted that there may be unmapped watercourses in the other Level 5 and 6 settlements which may present a localised level of risk, which is likely to be manageable as part of the drainage and surface water management strategy, but should be considered in line with the guidance set out in Section 5.

8.3.14 Open Countryside

All areas outside of the settlements listed in the hierarchy have been classed as open countryside in the settlement hierarchy of the Development Plan.

The Development Plan itself generally does not provide for land use zonings and the Plan Making Justification Test has not been applied, or passed. Therefore, in line with the Flood Risk Guidelines, the sequential approach should be applied. In these areas new, highly and less vulnerable development should be located in Flood Zone C. In Flood Zones A and B, only minor development (Section 5.28 as amended) and water compatible uses will be permitted.

To support the assessment of site specific risk and the application of the sequential approach, a Flood Zone map for the rural area has been prepared, covering all watercourses with a catchment area of greater than 5km^2. Where there are local watercourses present, but not included in the Flood Zone map, a site specific flood risk assessment should be carried out with a view to defining the Flood Zones and then applying the sequential approach.

9 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 Table 9-1 below.

Outputs from future studies and datasets 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.

Table 9-1: SFRA Review Triggers

Trigger	Source	Possible Timescale
Catchment Flood Risk Assessment and Management (CFRAM) Flood Hazard Mapping - future cycles	OPW under the Floods Directive	6-year cycle under EU Floods Directive
Shannon River Basin Catchment Flood Risk Assessment and Management (SCFRAM) Plan	OPW	6 yearly reviews
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
Construction / completion of flood relief schemes	OPW / LCCC	Unknown

Appendices: Justification Tests

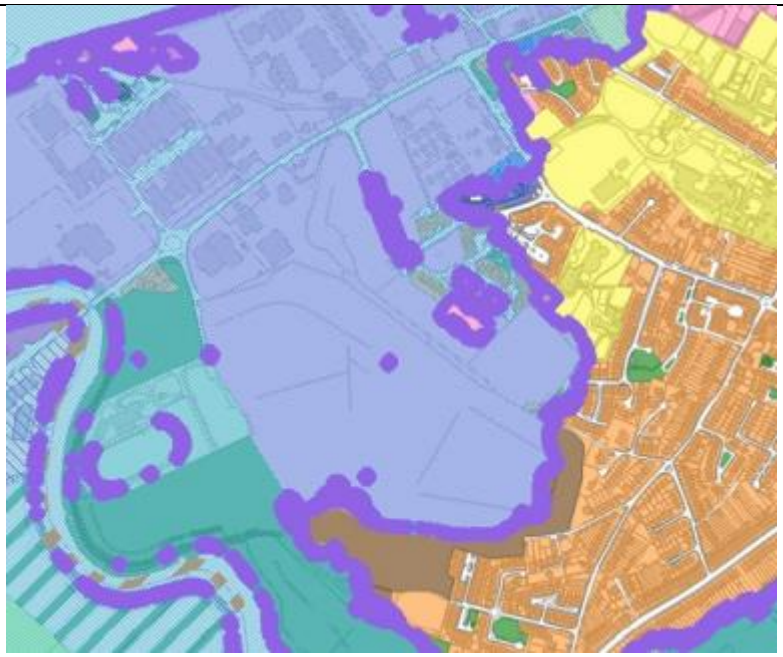
A.1 City Suburbs

A.1.1 Industry and Enterprise and Employment lands at the Dock Road

The urban settlement is targeted for growth under the National Planning Framework regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework (NPF) and Regional Spatial and Economic Strategy (RSES) for the Southern Region. The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.
The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the town and in particular:	
(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	Limerick's Dock Road has been identified as a key employment and enterprise location under the MASP, which acknowledges the significant potential of this area of the City for economic development. The lands at the Dock Road subject of Flood Zone A & B are essential to the expansion of marine related industries associated with Limerick Port and Docks. The lands are also essential for the provision of lands for employment uses which cannot be accommodated in the City Centre (warehousing, logistics etc.). Within the Metropolitan Area, the area zoned as Limerick's "City Centre" would correspond with the centre of the settlement. The undeveloped area of the Dock Road consolidates the existing built up area contiguous to the City Centre. These greenfield and brownfield lands are therefore essential to facilitate expansion and compact

	growth of Limerick City.
(ii) Comprises significant previously developed and/or under-utilised lands	These are undeveloped greenfield and brownfield lands which would consolidate the existing built up area contiguous to the City Centre.
(iii) Is within or adjoining the core of an established or designated urban settlement	The Dock Road is a designated key employment location adjoining the core of the Limerick Shannon Metropolitan Area.
(iv) Will be essential in achieving compact or sustainable urban growth	The delivery of development on these lands is essential to allow consolidation of the existing built up area of the Dock Road, achieve compact growth and enable Limerick to fulfil its economic development role in the Mid-West Region.
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement	Suitable alternative lands are not available for development within and adjoining the core of the City and working port/ docks to facilitate marine related industry and uses, nor enterprise and employment uses which cannot be accommodated in the City Centre.
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.	The scale of risk within this area is dependent on a number of factors, including the specific location with the wider zoning objective and the proposed use. Any development proposals will have to address and manage flood risk with the site plans. As risk here is predominantly tidal, for most sites this can be achieved through appropriate setting of finished floor levels, ground raising and use of the sequential approach within the development to ensure more vulnerable elements of the design are at a higher level. Emergency plans are likely also to form part of the flood management response. Where it is not possible to manage risks within the development, or such proposals cause an increase in flood risks to third part lands, the development will be deemed premature until the flood relief scheme has been completed.

A.1.2 Enterprise and Employment lands at Greenpark



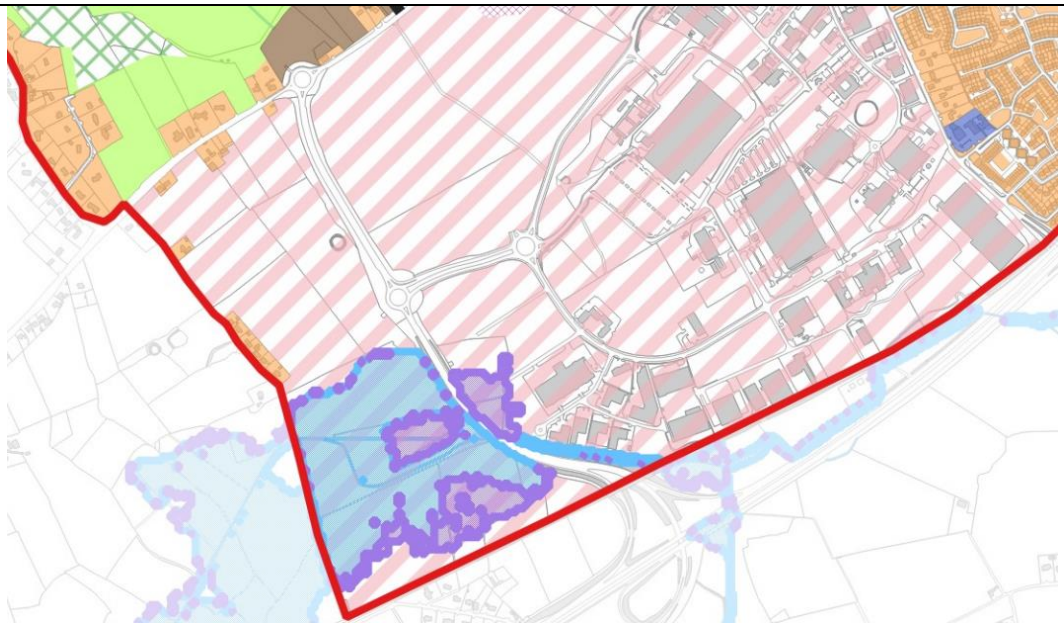
The urban settlement is targeted for growth under the National Planning	The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework

Framework regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	(NPF) and Regional Spatial and Economic Strategy (RSES) for the Southern Region. The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.
The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the town and in particular:	
(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	Limerick's Dock Road has been identified as a key employment and enterprise location under the MASP, which acknowledges the significant potential of this area of the City for economic development. The lands at Greenpark off the Dock Road subject of Flood Zone A & B are essential for the provision of lands for employment uses which cannot be accommodated in the City Centre (warehousing, logistics etc.). Within the Metropolitan Area, the area zoned as Limerick's "City Centre" would correspond with the centre of the settlement. The undeveloped area at Greenpark consolidates the existing built up area between the City Centre and the natural boundary presented by the Ballinacurra Creek and N18. These greenfield and brownfield lands are therefore essential to facilitate expansion and compact growth of Limerick City.
(ii) Comprises significant previously developed and/or under-utilised lands	These are undeveloped greenfield and brownfield lands at an edge of centre location.
(iii) Is within or adjoining the core of an established or designated urban settlement	The lands are located off of the Dock Road, a designated key employment location, adjoining the core of the Limerick Shannon Metropolitan Area.
(iv) Will be essential in achieving compact or sustainable urban growth	The delivery of development on these lands is essential to allow consolidation of the existing built up area of this employment area, achieve compact growth and enable Limerick to fulfil its economic development role in the Mid-West Region.
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement	Suitable alternative lands are not available for development within and adjoining the core of the City for enterprise and employment uses which cannot be accommodated in the City Centre.
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.	The site (and proposed development area) is not within the existing area of risk (although is largely within Flood Zone A) so risk is from residual risk of breach rather than direct inundation. The defences are part of the OPW arterial drainage scheme and are of unknown condition and standard of protection, although the defence height (as modelled by CFRAM and RPS) provides protection to the site in the 0.5% and 0.1% tidal events. Any development proposals will have to address and manage flood risk with the site plans, typically through appropriate setting of finished floor levels, ground raising and use of the sequential approach within the development to ensure more vulnerable elements of the design are at a higher level. As breach is likely to happen rapidly, with little time for issue of a warning,

	consideration should be given to emergency access during a breach event and the means of ensuring the safety of all site users. Where it is not possible to manage risks within the development, or such proposals cause an increase in flood risks to third party lands, the development will be deemed premature until the flood relief scheme has been completed.

A.2 Southern Environs

A.2.1 High Tech/ Manufacturing zoned lands within Raheen Business Park



The urban settlement is targeted for growth under the National Planning Framework regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework (NPF) and Regional Spatial and Economic Strategy (RSES) for the Southern Region. The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.
The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the town and in particular:	
(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	These lands are not essential to facilitate regeneration or compact growth. However, they are essential to the operation of the existing Business Park, identified as a strategic employment location under the MASP.
(ii) Comprises significant previously developed and/or under-utilised lands	These lands have been developed for attenuation purposes ancillary to the operation of the Business Park.
(iii) Is within or adjoining the core of an established or designated urban settlement	The lands are not within or adjoining the City Centre. However, the lands are located within an existing Business Park identified as a strategic employment

	location under the MASP. The Business Park is an employer of regional significance with multi-national employers present. It is one of the largest employment hubs in the region.
(iv) Will be essential in achieving compact or sustainable urban growth	The lands are essential to enable the continued sustainable growth of the Business Park.
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement	There are no suitable alternative lands to provide attenuation for the Business Park. The lands are ideally located to serve this function and to enable future development of the Business Park.
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.	As an attenuation area, this use is water compatible and is appropriate but change to accommodate highly or less vulnerable development would not be considered to have passed the Plan Making Justification Test. Under this SFRA the capacity of the attenuation area has not been assessed and the further ability of the area to store water is unknown. This would need to be assessed under a detailed surface/storm water study for the area, either in conjunction with or in advance of further development of the Business Park.

A.2.2 Enterprise and Employment zoned lands to the northwest of the M20/M7/N18 Junction

The urban settlement is targeted for growth under the National Planning Framework regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework (NPF) and Regional Spatial and Economic Strategy (RSES) for the Southern Region. The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's

	ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.
The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the town and in particular:	
(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	These greenfield lands will facilitate the regeneration of Southill and contribute to the expansion of the City Centre.
(ii) Comprises significant previously developed and/or under-utilised lands	These are undeveloped greenfield lands.
(iii) Is within or adjoining the core of an established or designated urban settlement	The lands are within or adjoining the core of an established or designated urban settlement.
(iv) Will be essential in achieving compact or sustainable urban growth	The delivery of development on these lands will contribute to compact urban growth. However, the area is limited in size and will be ancillary to the development of the larger landholding.
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement	Suitable alternative lands are available for development in closer proximity to the City Centre.
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Pan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.	Part of these lands are subject to flooding as indicated in the map above. However, this portion of the site will be used for water compatible uses, ancillary to the overall development of the area. As such, the Plan Making Justification Test for these lands within Flood Zone A and B has not been passed and development on site must follow the sequential approach, locating water compatible uses within these parts of the development area.

A.2.3 Enterprise and Employment zoned lands at Dock Road

The urban settlement is targeted for growth under the National Planning Framework regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework and Regional Spatial and Economic Strategy for the Southern Region. The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.
The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the town and in particular:	
(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	Limerick's Dock Road has been identified as a key employment and enterprise location under the MASP, which acknowledges the significant potential of this area of the City for economic development. The lands at the Dock Road subject of Flood Zone A & B were identified as essential to support the expansion of marine related industries, associated with Limerick Port and Docks. Having regard to their location next to the Docks, these lands are also considered essential for the provision of lands for employment uses which cannot be accommodated in the City Centre (warehousing, logistics etc.). Within the Metropolitan Area, the area zoned as Limerick's "City Centre" would correspond with the centre of the settlement. The undeveloped area of the Dock Road consolidates the existing built up area contiguous to the City Centre. These greenfield and brownfield lands are therefore essential to facilitate expansion and compact growth of Limerick City.
(ii) Comprises significant previously developed and/or under-utilised lands	The Dock Road area has had a long history of development and as such has particular importance in both employment and service provision. These are undeveloped greenfield lands

	which would consolidate the existing built up area contiguous to the City Centre.
(iii) Is within or adjoining the core of an established or designated urban settlement	The Dock Road is a designated key employment location adjoining the core of the Limerick Shannon Metropolitan Area, as identified in the RSES.
(iv) Will be essential in achieving compact or sustainable urban growth	The delivery of development on these lands is essential to allow consolidation of the existing built up area of the Dock Road, achieve compact growth and enable Limerick to fulfil its economic development role in the Mid-West Region.
(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement	Suitable alternative lands are not available for development within and adjoining the core of the City, on which enterprise and employment uses which cannot be accommodated in the City Centre can be facilitated.
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.	The flood zones show the site within Flood Zone A and B extents. Any future development should be subject to a Site Specific Flood Risk Assessment, which should address the following and an objective included in this regard: - Apply sequential approach should be applied through site planning and should avoid encroachment onto, or loss of, the flood plain, - Highly Vulnerable Development shall not be permitted in Flood Zone A or B, - Should address climate change scenarios in relation to FFLs and potential mitigation measures, - Finished floor levels should be above the 0.1% or 1% AEP level where appropriate, - Proposals should not impede existing flow paths or cause flood risk impacts to the surrounding areas, and Emergency evacuation plan and defined access/egress routes should be developed for extreme flood events. Any Site Specific Flood Risk Assessment should be cognisant of the identified proposed flood defences adjacent to the site. Any development shall also be required to be built in accordance with SuDS principles and in compliance with the surface water and drainage policies as set out in the Draft Development Plan.