Limerick City and County Council

Croom Local Area Plan Review

Strategic Environmental Assessment Screening, Habitats Directive Assessment Screening Report and Flood Risk Assessment Stage 1

Forward/Stratgeic Planning
Economic Development Directoate
Limerick City and County Council
Merchants Quay
Limerick

August 2019

Contents:

1.1 Introduction

Croom is designated a Tier 3 population centre in the Limerick County Development Plan 2010 - 2016 (as extended), which is identified as a centre on a transport corridor. It is located 22km to the south west of Limerick City and is on the N20 Cork to Limerick National Primary Route. In the 2016 Census, Croom LAP boundary area had a population of 1,157. Having regard to the local population, the proposed review falls below the mandatory population threshold for Strategic Environmental Assessment, which is currently 5,000 people. The zoned area of Croom in the current draft is 150.94 ha, which is below the mandatory area threshold for SEA which is 50km^2. This is a reduction from the 160.45ha of the existing plan.

Figure 1: Location of Croom, relative to other towns in Limerick.

Review of the Local Area Plan

The review of the local area plan is to update the statutory content of the LAP, the plan has been extended for a period of five years, but this period is now drawing to a close, which makes it necessary to update the plan and its policy content. Policy content has also changed since the preparation of the previous plan with the publication of the National Planning Framework. The policy content of the plan will require updating to take new planning guidance and policies into account.

1.2 Screening Statement

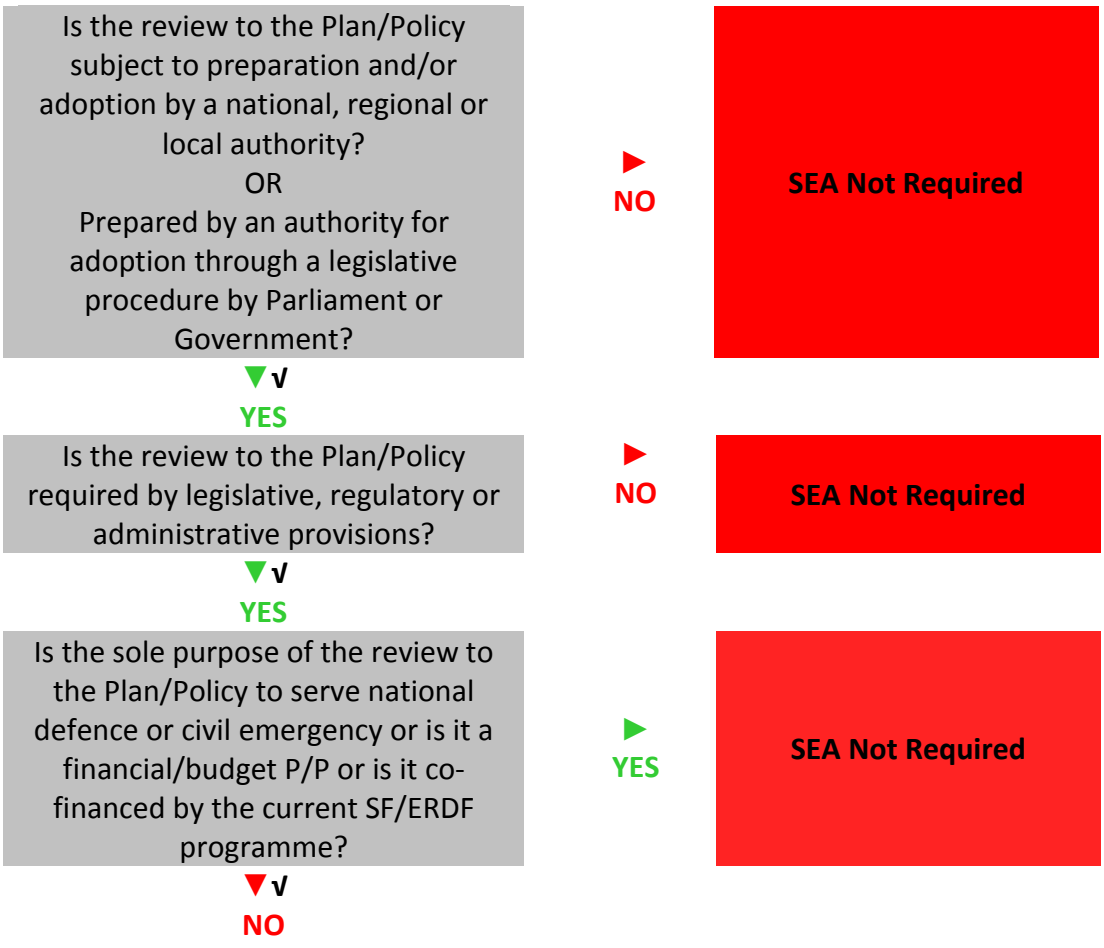
The Planning and Development (Strategic Environmental Assessment) Regulations 2004-2011 (S.I. No. 436 of 2004, SI 201 of 2011) require case by case screening of individual plans and programmes, based on the criteria in Schedule 2A to the Planning and Development Regulations (Amended). These criteria must be taken into account in determining whether or not significant effects on the environment would be likely to arise.

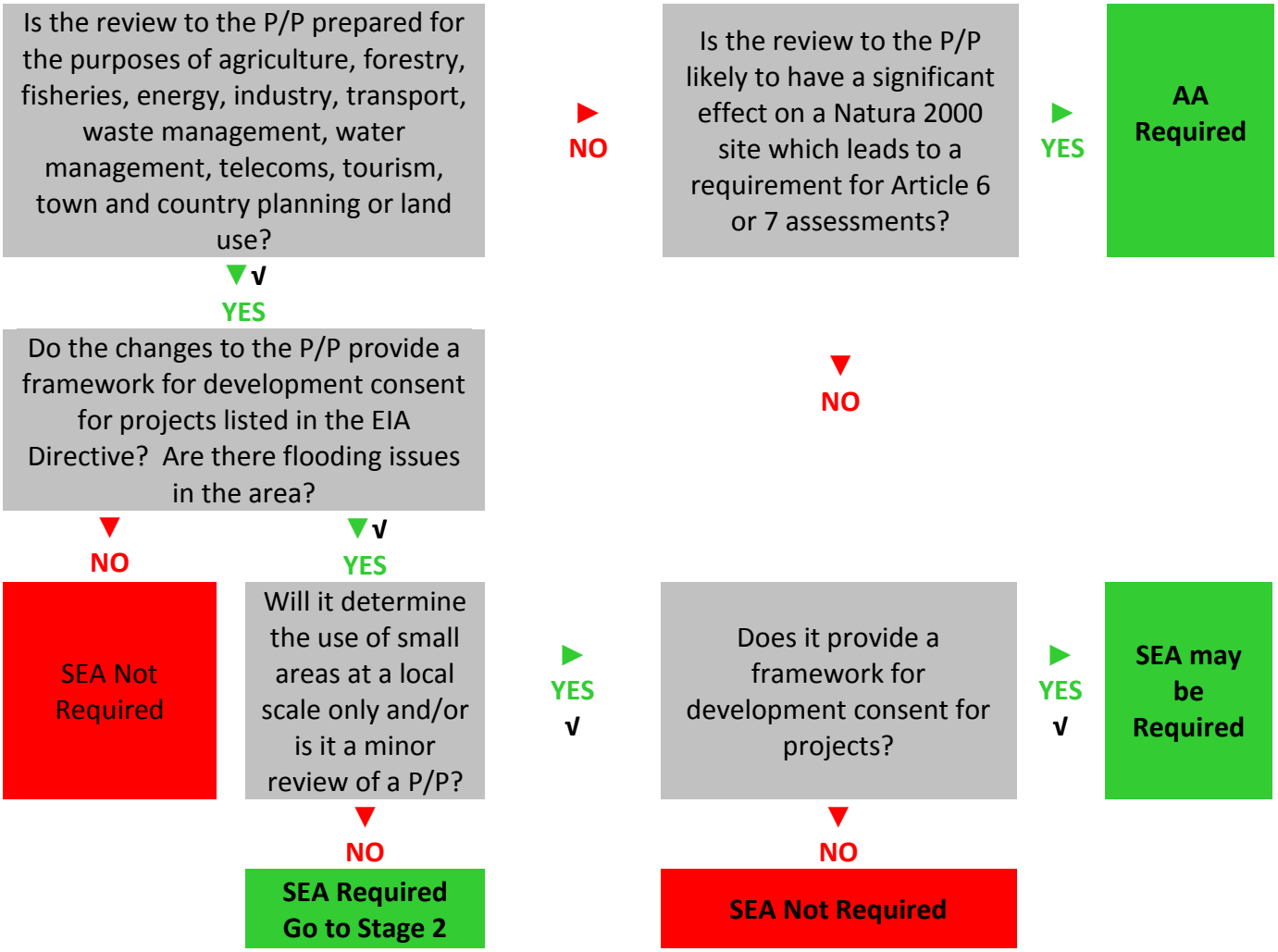
As outlined above, the review of the Croom Local Area Plan falls below the threshold for which SEA is mandatory.

Stage One - Pre-Screening

The first step in determining whether the review of the Croom Local Area Plan would require an SEA involves a pre-screening check. The pre-screening check places the proposed review in context with consideration of how the reviews fits in with larger policy issues. Stage 2 assesses the environmental significance of the review by examining how it fits in with policy guidance documents and its possible environmental effects.

Figure 1 Pre-Screening Decision Tree





Stage Two - (A) Environmental Significance Screening

The application of environmental significance criteria is important in determining whether an SEA is required for small plans/policies or modifications to Plans/Policies. Annex II (2) of Directive 2001/42/EC sets out the "statutory" criteria which should be addressed when undertaking a screening assessment.

Criteria for Determining the Likely Significance of Environmental Effects

Characteristics of the Plan/Programme

i. *The degree to which the plan or programme sets a framework for projects and other activities, either with regard to the location, nature, size and operating conditions or by allocating resources;*

The review seeks to examine and update the zoning and policy content of the current Croom Local Area Plan. This will set the policy objectives to which any project that is subject to the planning process will have to adhere to within the boundaries of the LAP.

ii. The degree to which the plan or programme influences other plans and programmes including those in a hierarchy;

- **National Planning Framework**

The National Planning Framework is the Government's high level strategic plan for shaping the future growth and development of the country to 2040. All subsequent planning documents should comply with this document.

- **The Mid West Regional Planning Guidelines 2010 - 2022:**

While these are still current, the Regional Economic and Spatial Strategy (RSES) for the Southern Region, which is currently in draft form will shortly replace this.

- **Draft Regional Economic and Spatial Strategy for the Southern Region:**

The draft Regional Economic and Spatial Strategy for the Southern Region is currently being prepared. When adopted this will be the regional guidance for the Southern Region and its contents will be taken into account in the plan.

iii The relevance of the plan or programme for the integration of environmental considerations in particular with a view to promoting sustainable development;

The review of the Croom LAP is being prepared under the Planning and Development Act 2000 (amended) and takes into account relevant environmental and planning considerations, in particular those put forward in the National Planning Framework. This allocates population targets for Limerick, which will replace those of the Core Strategy, which was part of the Limerick County Development Plan 2010-2016 (as extended), however, Limerick City and County Coucnil have taken into account the population targets set out in the National Planning Framework and the Implementation Roadmap for the National Planning Framework, in preparation of the projected population growth for croom, as set oyt in the draft plan.

(iv) Environmental problems relevant to the plan or programme;

The underlying environmental issues of the Croom LAP relate to the following:

- Sequential development of the town of Croom.
- Avoidance of pollution to the nearby Lisnakiltagh Stream from development that may take place within the expanded boundary and avoidance of pollution to the River Maigue.
- Rationalization of the zoning pattern to take into account population figures for the city and county as set out in the National Planning Framework and the Circular from the Department of Housing, Planning and Local Government outlining the Implementation Road Map of the National Planning Framework.
- Potential flooding issues within the Local Area Plan boundaries.

(v) The relevance of the plan or programme for the implementation of Community legislation on the environment (e.g. plans and programmes linked to waste-management or water protection).

The existing waste water treatment plant serving croom has some spare capacity existing in the plant of approximately 500 population equivalent (approximately 25% spare capacity). The plant has a current capacity of 2,000 population equivalent. It is likely that the residential zoning lands will be rationalised in the review. In the current draft plan, for instance, residential serviced sites have been reduced from 12.8ha in total to 3.03, while Resdential Development Area zonings have been reduced to 11.66ha from 18.8ha. These reductions in residentially zoned land, will ease potential pressure on the WWTP.

There is an issue in terms of potable water sources in Croom. There are currently three sources of water supply, a borehole with reasonable capacity adjacent to the By-Pass, a spring with limited capacity at Skagh and a borehole with limited capacity that was constructed as part of Cois Sruthain housing development. There is also limited reservoir storage. Demand is close to supply limits and there can be pressure and/or outage issues on the periphery, if significant leaks occur.

Irish Water have commenced a borehole programme in Croom and have drilled two exploratory boreholes. One is adjacent to the main source at the By-Pass and one is adjacent to the water tower. The exploratory borehole adjacent to the main source had reasonable yield and the one at the water tower had very low yield. Irish Water (IW) are currently reviewing the position. Any applications for development in Croom should consult with Irish Water prior to advancing.

Characteristics of the Effects and of the Area Likely to be affected

i. The probability, duration, frequency and reversibility of the effects

The effects are likely to be long term, but the encouragement of development in a serviced location through the Local Area Plan is a sustainable alternative to scattered development in the wider countryside.

ii. The cumulative nature of the effects

Cumulative negative environmental effects are likely to be localised within the expanded plan boundaries and limited in nature.

iii. The trans-boundary nature of the effects

There are no trans-boundary effects.

iv. The risks to human health or the environment (e.g. due to accidents)

None, the town is not close to a Seveso or heavy industrial site. There is sufficient capacity in the Waste Water Treatment Plant for potential development uses. There are no heavy industry or industrial plants in the town that might cause accidents.

v. *The magnitude and spatial extent of the affects (geographical area and size of the population likely to be affected)*

The area that will be directly affected is that within the development boundaries of Croom. This currently is 150.94ha. The population of the area within the Croom LAP boundary is 1,157 in the 2016 Census period.

vi. *The value and vulnerability of the area likely to be affected due to*

- *Special natural characteristics or cultural heritage;*

Croom has a large variety of remains dating from pre-history, through to the remains of a Norman Castle and fortifications to more modern buildings such as the mill and railway infrastructure, which indicate more modern industrial heritage. The town has been designated as an historic town, which highlights its historical importance. The area of the town centre is itself a Recorded Monument.

Figure 3: This shows protected structures in Croom. Many are located in the settlement core, which is an Architectural Conservation Area (ACA)

Figure 4: Railway goods sheds in Croom (Source NIAH website).

The review of the plan will continue to take into account the historic nature of the town and continue with the Architectural Conservation Area designation, in addition to its individual protected buildings.

- *Exceeded environmental quality standards or limit values;*

As outlined above, there has been a reduction in residential zoning in the draft plan which eases potential pressures on the Waste Water Treatment System. In addition, the protection of the ACA designations and the Special Control Area near Croom Castle has served to protect, these sensitive areas of the town (see Figure 6 below).

Figure 5: Croom Castle that is located on the old Cork road. (Source: UCG landed estates database).

- *Intensive land-use;*

Development in Croom has been limited over the past decade. It is considered that the continuation of current protective measures such as the Special Control Area and the Architectural Conservation Area, will ensure that Croom would be adequately protected from insensitive development.

vii. The effects on areas or landscapes which have a recognised national, community or international protection status.

There are no landscapes that have a community or international protection status in Croom. The measures outlined above (i.e. Special Control Area and Architectural Conservation Areas) are considered to afford sufficient protection for national and regional level monuments and their structures and settings.

1.3 Stage 2 – Summary, Conclusion and Recommendation:

At this stage in the plan process, no strategically significant environmental problems can be identified in relation to the above issues. There is an issue with potable water supply, however, it is anticapted that with Irish Water interventions a address this issue. However, it must be said that there will be changes to the zoning and policy content of the plan during the review process and these will require subsequent screenings, as the process proceeds.

Following the screening process, whereby the specific context of the review to the Croom LAP has been assessed against the environmental significance criteria as contained in Annex II (2) of the SEA Directive**, it is concluded that a Strategic Environmental Assessment is not required for the review of the Croom LAP at this stage in the plan process.**

2.1 Appropriate Assessment Screening:

Introduction

This is an Appropriate Assessment Screening of the proposed review to the Croom LAP, in accordance with the requirements of Article 6(3) of the EU Habitats Directive (92/43/EEC).

The existing Croom LAP was originally prepared in 2009. This review needs to be screened for 'Appropriate Assessment'. Based on the *Methodological guidance on the provision of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*, a 'Screening Matrix' and a 'Finding of No Significant Effects Matrix' have been completed. The conclusions are that the revision of the LAP **does not require** an Appropriate Assessment.

The principal consideration for an Appropriate Assessment, would be if the LAP were likely to have significant effects on a Natura 2000 site – Special Areas of Conservation and Special Protection Areas (SAC's and SPA's) are Natura 2000 sites. The Tory Hill SAC site and Lower River Shannon SAC and the River Shannon and Fergus SPA are closest to the plan area.

The main ecological threat to the Lower River Shannon SAC site is from potential run off from within the LAP boundary during development works or overloading of the Waste Water Treatment Plant for the town.

There is no risk to the Tory Hill Special Area of Conservation site, from potential development within the Local Area Plan Boundary. Though the closest Natura 2000 site, there is no link, hydrological or otherwise with the site.

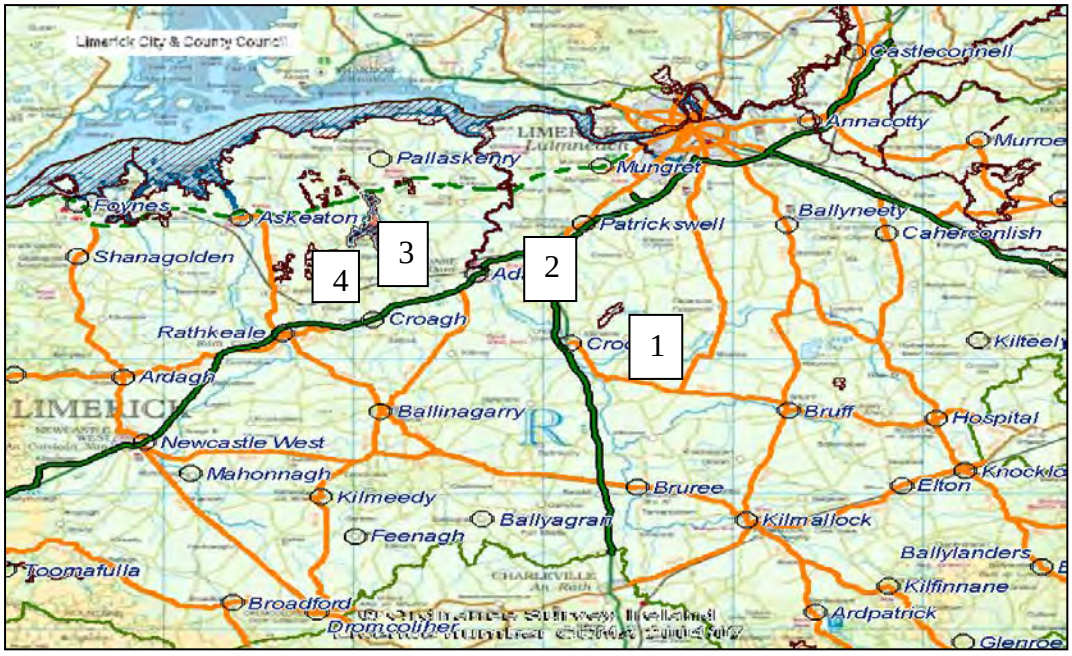


Figure 1: Showing the Tory Hill SAC No.1 site to the east of the town and the Lower River Shannon SAC No.2 to the north- west. The other SAC sites listed below within a radius of 22 km are also shown No. 3 Curraghchase Woodlands and No.4 Askeaton Fen Complex.

As indicated above, the only site that might be affected by the works would be the downstream Lower River Shannon SAC site that may be affected by run off generated by preparing the lands for development works.

Figure 2: Special Protection Area sites within 26km of Croom. They are numbered from No.1 Slieve Felim Hills SPA, No. 2 River Shannon and Fergus Estuary SPA to No.3 Mullagharierks and West Limerick Hills SPA.

2.2 Screening Matrix

Brief description of the review to the project or plan:
This is the review of the Croom Local Area Plan carried out in accordance with the provisions of the Planning and Development Act 2000 (Amended).
Brief description of the Natura 2000 sites:
The River Shannon and Fergus SPA (004077) is located downstream of Croom, where the River Maigue is designated - See Figure 2, No. 2. The Lower River Shannon SAC (002165 - see Figure 1 No. 2) site is approximately 5km upstream of the Plan area and to the northwest of the Croom. The SAC site has been selected, because of a range of riparian habitats and species such as wet woodlands, tidal mudflats, estuaries and for species such as otter, salmon and lamprey.

Maintenance of high water quality is an important factor in ensuring the preservation of these habitats.

The River Shannon and River Fergus SPA site has been selected, because of its importance for wintering and migratory wildfowl. The site comprises the entire estuarine habitat west from Limerick City and it is the mud flats with its invertebrate community, which is of particular importance as a feeding area for migratory wildfowl.

Askeaton Fen Complex SAC site (002279- See Figure 1 No. 4) contains Calcareous fens and Alkaline fens 15km to the north west of Croom.

Curraghchase woodlands SAC site (0000174-See Fig 1 No. 3) a woodland site designated for the Lesser Horseshoe bat, is 12km to the north west.

Tory Hill SAC (000439- See Figure 1, No.1) is an isolated wooded limestone hill, situated about 2 km North East of Croom, Co. Limerick. Lough Nagirra is located within the Tory Hill SAC and has a thick fringe of Common Reed (*Phragmites australis*) and, in association with it, areas of alkaline fen and calcareous fen vegetation referable to the Caricion davallianae alliance with Saw Sedge (*Cladium mariscus*). Both of these fen types are listed on Annex I of the E.U. Habitats Directive, the latter with priority status. Tory Hill is also designated for areas of orchid-rich calcareous grassland, a habitat that is listed with priority status on Annex I of the E.U. Habitats Directive; it is found on the eastern side of the hill and on its summit. This is the closest site to Croom.

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161-see Figure 2 No.3) is a very large site centred on the borders between the counties of Cork, Kerry and Limerick.
The site consists of a variety of upland habitats, though almost half is afforested. The coniferous forests include first and second rotation plantations, with both pre-thicket and post-thicket stands present. Substantial areas of clear-fell are also present at any one time. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the Hen Harrier.

The Slieve Felim Hills SPA (004165) is an upland site with forestry, upland grassland and fragmented peat-land habitats (shown as No. 1 in Figure 2). This is within 26km of Croom and lies to the north east and is designated for the Hen Harrier.

Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site:

The main way in which ex-situ impacts could be created is through pollution that would affect water quality in the Lower River Shannon SAC site. Since the River Maigue flows into the River Shannon system should pollution occur elements of this might eventually end up in the Shannon itself that is also an SPA.

It is not considered that there is the possibility of effects on the other Natura 2000 sites mentioned above in that the effects will be localised in the plan area and involve the development of appropriately zoned land.

Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of:

- **Size and scale;**

There are no direct aspects of the review to the plan that would have an effect on the Natura 2000 site. It is the secondary impacts of the review i.e. the eventual development within the LAP boundary and resulting run off that could have an effect on downstream water quality in the River Maigue and the River Shannon Systems. As has been indicated in the SEA Screening document above, there has been an overall reduction of 9.5ha in the amount of zoned land in the current draft, which reduces potential development pressure and hence potential runoff or increased loadings on the Waste Water Treatment Plant.

- **Land-take;**

There is no land take from Natura 2000 sites.

- **Distance from Natura 2000 site or key features of the site;**

The River Shannon and Fergus SPA site and the River Shannon SAC are located 7km and 10km respectively northwest of the town. The Askeaton Fen complex is 15km to the north west. Curraghchase woodlands are 12km to the north west and Tory Hill is 2km to the east. The West Limerick Hills SPA is 25km to the west, while the Slieve Felim SPA is 26km to the northeast.

- **Resource requirements (water abstraction etc.);**

No policies within the review indicate the need for abstraction of water from any designated site.

- **Emission (disposal to land, water or air);**

There is the risk of runoff from development activity to the Lisnakiltagh Stream to the River Maigue which in turn is designated when it reaches Adare 7km to the north west. This risk is regarded as small. A site visit in February 2019 showed that measures were in place at a nearby development site that prevented run off to the river, while construction was underway, adequate measures shall be put in place to prevent this type of run – off in subsequent developments.

- **Excavation requirements;**

Any excavation, which may be permitted under the scope of the plan, will take place within the LAP boundaries and with the exception of the possible generation of sediment for site, excavations in the lands in the northeastern part of the town are not expected to have any effects on Natura 2000 sites.

- **Transportation requirements;**

It is not considered that any of the transport policies proposed in the plan or traffic flows resulting from the review will have any effect on any designated sites.

- **Duration of construction, operation, decommissioning, etc.;**

No construction projects within the plan area will encroach upon designated sites due to the distance from them. The lifespan of the plan, following review, will be six years.

- **Other**

None

Describe any likely changes to the site arising as a result of:

- **Reduction of habitat area:**

None - all of the sites are at a distance from the lands, which will be the subject of the review.

- **Disturbance to key species;**

None- all of the sites are at a distance from the lands, which will be the subject of the review.

- **Habitat or species fragmentation;**

None- all of the sites are at a distance from the lands, which will be the subject of the review.

- **Reduction in species density;**

None- all of the sites are at a distance from the lands, which will be the subject of the review.

- **Changes in key indicators of conservation value**

No projects giving rise to significant adverse changes, in key indicators of conservation value for Natura 2000 sites are likely given that policies are in place to control possible ex-situ effects and the distance from the Natura 2000 sites.

- **Climate change:**

The concentration of development within an area such as Croom, which can be easily serviced, is better from a resource and climate change perspective than more dispersed development in the wider countryside.

Describe any likely impacts on the Natura 2000 site as a whole in terms of:

- **Interference with the key relationships that define the structure of the site;**

None

- **Interference with key relationships that define the function of the site;**

None

Provide indicators of significance as a result of the identification of effects set out above in terms of:

- **Loss;**

Not applicable

- **Fragmentation;**

Not applicable

- **Disruption;**

Not applicable

- **Disturbance;**

Not applicable

- **Change to key elements of the site (e.g. water quality etc.);**

Not applicable

Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts are not known. Not applicable

2.3 Finding of No Significant Effects Matrix

Name of Project or Plan:	Croom LAP 2009-2015 (As extended) review
Name and location of Natura 2000 sites:	- River Shannon and Fergus SPA site (004077) to the 14km from northern boundary of the LAP - Lower River Shannon SAC (Site Code 002165) to the 7km north of the town - Askeaton Fen Complex SAC site (002279) 15 km to the west and north west. - Curraghchase woodlands SAC site (0000174) a woodland site designated for the Lesser Horseshoe bat, 12km to the north west - Tory Hill (00439) 2 km to the east. - The West Limerick Hills SPA is 25km to the west, while the Slieve Felim SPA is 26km to the northeast.
Description of the Project or Plan	As given in Screening Matrix above.
Is the Project or Plan directly connected with or necessary to the management of the site (provide details)?	No, the review of the LAP is intended to provide for updating the policy contents of the current plan as it nears the end of its statutory period.
Are there other projects or plans that together with the project of plan being assessed could affect the site (provide details)?	None
The Assessment of Significance of Effects	
Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 sites:	Effects are most likely to result from potential development of the school site, to the north east of the town centre, which lies 7km upstream from the Lower River Shannon SAC site. There is the small possibility of runoff finding its way downstream to this site. This risk is not regarded as significant. A site visit in February 2019 showed that measures were in place to prevent run off reaching the stream, all developments shall include

	appropriate conditions to be attached to the grant of planning permission to ensure there are no impact from runoff.
Explain why these effects are not considered significant:	No Natura 2000 sites are within the LAP boundaries. The nearest water dependent site is 7km distant.
List of Agencies Consulted: Provide contact name and telephone or email address:	SEA/AA Screening Reports are being sent to: • SEA Section, Environmental Protection Agency • Planning System and Spatial Policy Section, Department of Housing, Planning and Local Government • Department of Agriculture, Food and the Marine • Department of Communications, Climate Action and Environment • Development Applications Unit, Department of Culture, Heritage and the Gaeltacht,
Summary of Responses received for previous draft	Not applicable

Data Collected to Carry out the Assessment

Who carried out the Assessment?	**Sources of Data**	**Level of assessment Completed**	**Where can the full results of the assessment be accessed and viewed**
Heritage Officer, Forward/Strategic Planning Section, Economic Development Directorate, Limerick City and County Council	Existing NPWS Site Synopses. Site visits during plan preparation process.	Desktop study, site visits	With plan documentation on request.

Comhairle Cathrach
& Contae **Luimnigh**

Limerick City
& County Council

Forbairt Gheilleagrach,
Ceanncheathrú Chorparáideach,
Cé na gCeannaithe,
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Appropriate Assessment (AA) Screening Determination

Planning and Development Act 2000 (Amended) Planning and Development Regulations 2001 (Amended)

Pursuant to the requirements of the above, Limerick City and County Council has prepared a Draft Local Area Plan for Croom 2019 - 2025.

Having regard to Article 6(3) of the Habitats Directive and Part XAB of the Planning and Development Act 2000 (Amended), the guidance contained in the Department of Housing, Planning, Community and Local Governments "Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities" (2010) following an examination, analysis and evaluation of the objective information provided in the "Draft Croom Local Area Plan Appropriate Assessment Screening Report" prepared by Tom O'Neill, Heritage Officer, Limerick City and County Council, dated 12th August 2019. Limerick City and County Council, as the Competent Authority determines that the Draft Local Area Plan, individually and in combination with other plans and projects, does not require an Appropriate Assessment as it has been concluded that it is possible to rule out likely significant effects on all European sites.

Following analysis of all draft objectives set out in the plan, none would be expected to give rise to any threats to any of the conservation objectives in terms of their attributes and targets for any of the European sites.

Therefore, a Stage 2 Appropriate Assessment will not be required.

Dr. Pat Daly

Deputy Chief Executive

FLOOD RISK ASSESSMENT

3.1 Introduction: Flood risk in Croom

This is the Stage 1 flood risk identification for the review of the 2009 – 2015 (as extended) Local Area Plan for Croom. The review is for updating the policy contents of the plan as it is nearing the end of its duration.

3.2 Stage 1: Flood Risk Identification

The Technical Appendices of the *Planning and Flood Risk Management Guidelines (November 2009 p.9)* identify the following sources of information:

- OPW Preliminary flood risk assessment indicative fluvial flood maps,
- National Coastal Protection strategy study flood and coastal erosion risk maps,
- Predictive and historic flood maps and benefiting land maps,
- Predictive flood maps produced under CFRAM studies,
- River Basin Management Plan and reports,
- Indicative assessment of existing flood risk under Preliminary Flood Risk Assessment,
- Previous flood risk assessments**,**
- Advice from Office of Public Works,
- Internal consultation with Local Authority personnel, in particular water services engineers,
- Topographical maps - in particular LIDAR,
- Information on flood defence condition and performance,
- Alluvial deposition maps,
- Liable to flood markings on old 6 inch maps. In addition these maps particularly the first edition, contain information on landscape features and infrastructure such as mills and weirs that can indicate hydrological features,
- Local Libraries and newspaper reports,
- Local consultation e.g. local groups,
- Walkover surveys to assess potential sources of flooding and likely routes of flood waters and flood defences,
- National, regional and local spatial plans and previous planning applications.

OPW Preliminary Flood Risk Assessment (PFRA) indicative fluvial flood maps
The above maps were consulted. It indicated that the town centre was subject to medium risk, while the hospital, the nearest risk location to the proposed school site shown as 1 below was indicated as low risk (OPW/Jacobs Jun 27th 2011, p.3).

National Coastal Protection Strategy Study flood and coastal maps
Maps for this study would not be of any assistance in dealing with specific flooding issues in Croom.

Predictive and historic flood maps and benefiting land maps (flood maps.ie)

These maps were consulted. These show benefiting lands in the north of the plan area in the area shown in red in Figure 1 below. This takes in the lands that are the had been the subject of a previous amendment which are located immediately to the north west of the hospital. These are shown as 1 below.

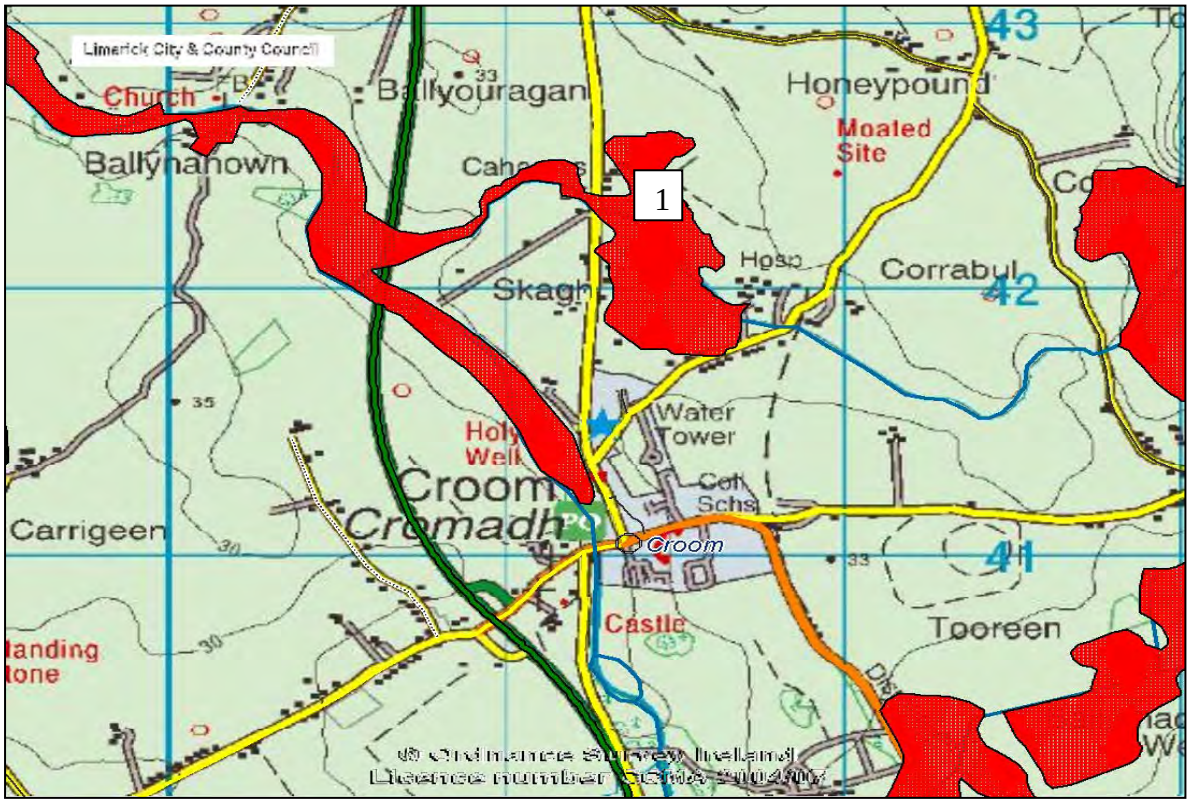

Figure 1: The red areas show the locations of flood benefiting lands. Flood benefiting lands indicate lands, which would benefit from flood relief measures for use for agricultural purposes.

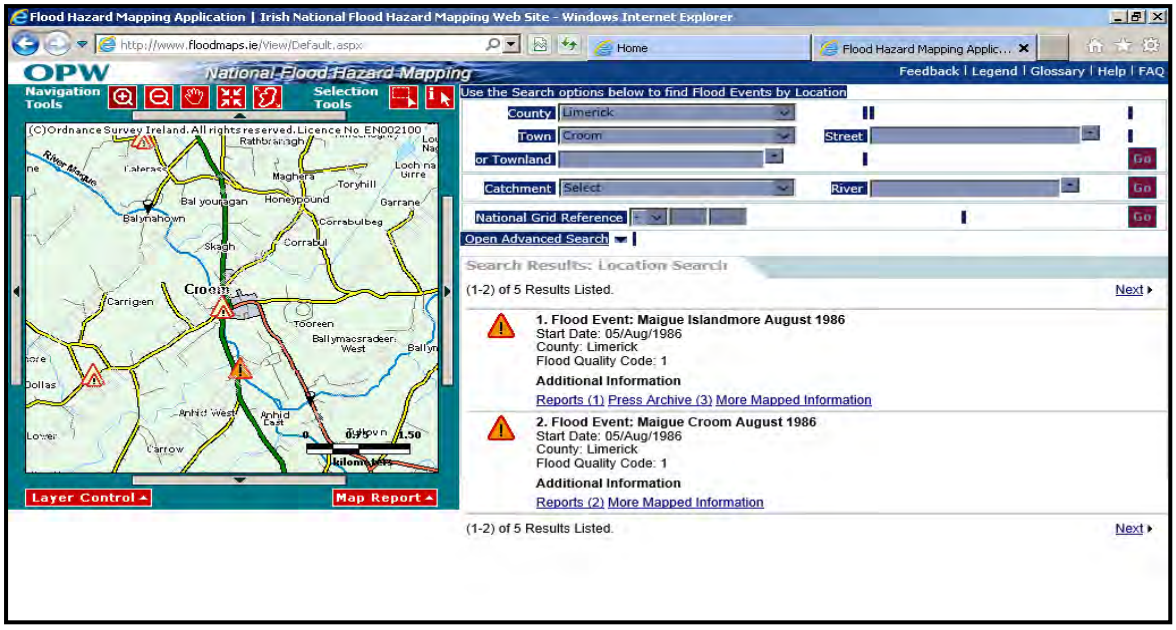

Figure 2: This is taken from Flood maps.ie showing flood events in town centre and to the south and south west of the town.

The Preliminary Flood Risk Assessment Maps from July 2011 based on the 1:50,000 scale show Croom as being subject to a 1:100-year flood risk. This includes both the main settlement core and the lands in the north east of the plan area.

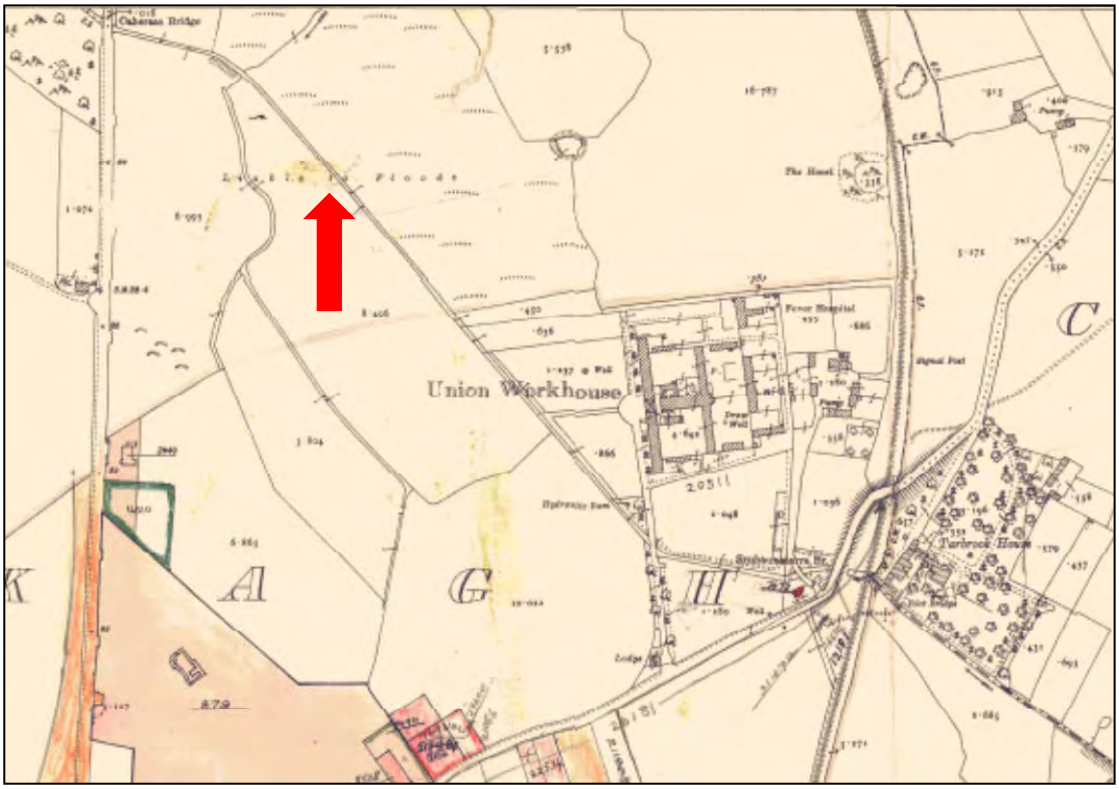

Figure 3: Second edition six-inch map series showing part of the subject area as being liable to flooding.

The older six-inch map series showed the portions of land close to the Lisnakiltagh Stream as being subject to flooding. A number of Flood Risk Assessment (FRA) have been carried out in the vicinity of the stream.

Predictive flood maps produced under CFRAM studies

The draft predictive flood maps show only the area to the south of the lands in question at risk of flooding with only a narrow strip north of the Lisnakiltagh Stream shown as being subject to a 1:10 year risk of flooding. The CFRAMs map is shown below with the educationally zoned site hatched in red.

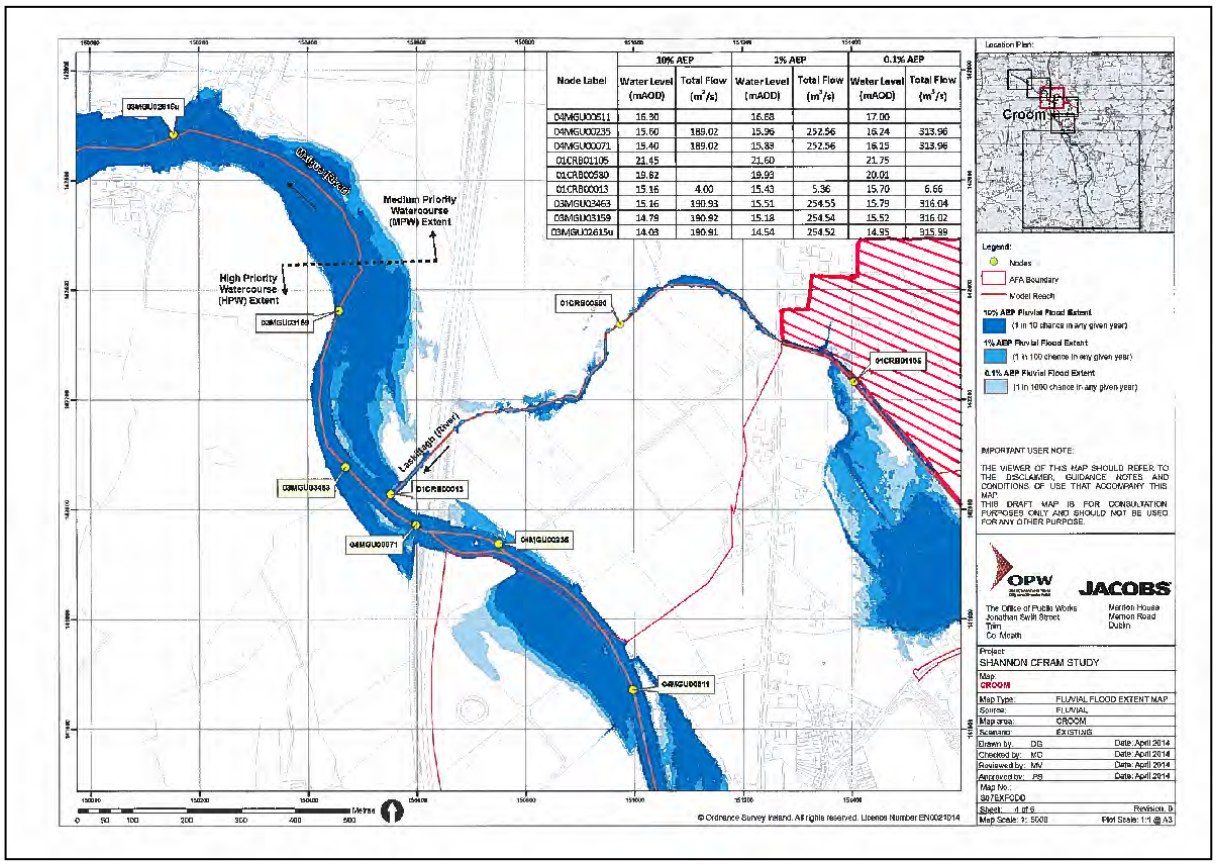

Figure 4: Draft CFRAMS map showing educationally zoned area hatched in red.

This educationally zoned area with the exception of a narrow strip- less than 10m at the edge of the water course- is shown as free of flood risk. This is also true of the area immediately upstream which is not shown on this map. The dark blue areas indicate a 1:10 risk of flooding, the light blue indicates a 1:100 risk, while the lightest shade indicates a 1:1000 risk.

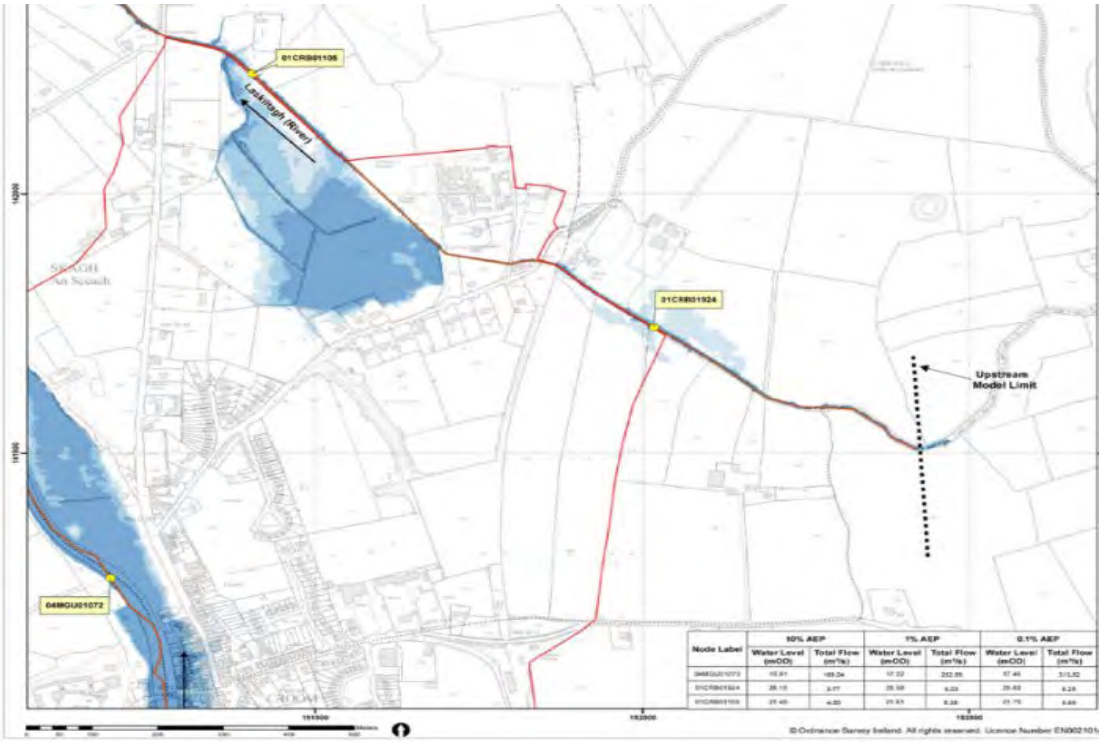

Figure 5: Up to date CFRAM map, which indicates flood risk to the town centre and to the northeast of the Plan area

River Basin Management Plan and reports
Insufficient detail available to inform responses at LAP level.

Indicative assessment of existing flood risk under Preliminary Flood Risk assessment
In these maps, Croom town centre is shown as being subject to 1:100-year flood risk and as being a probable area for further assessment.

Previous flood risk assessments
Flood maps.ie consulted, see Fig. 3 above. See below for assessments submitted with previous applications.

OPW advice
Ongoing consultation with the OPW in realtion to flooding in Croom.

Internal consultations with Council personnel
Discussions regarding drainage and flooding issues took place with council engineers, which supported the views shown in above.

Information on flood defences and condition
While there are no flood defences present in the plan area, there are some issues that arise in relation to infrastructure. Walk over surveys and local sources indicate that the bridge arch in Caherass Bridge, just downstream of the site, indicated below, can prove to be a constraint to water flow during high flow conditions. It would be necessary to ensure that development which would result in discharges of surface water to the stream, shall incorporate measures

that reduce run off to suitable rates in order to avoid additional overloading on the capacity of the river channel and the constriction posed by the bridge arch.

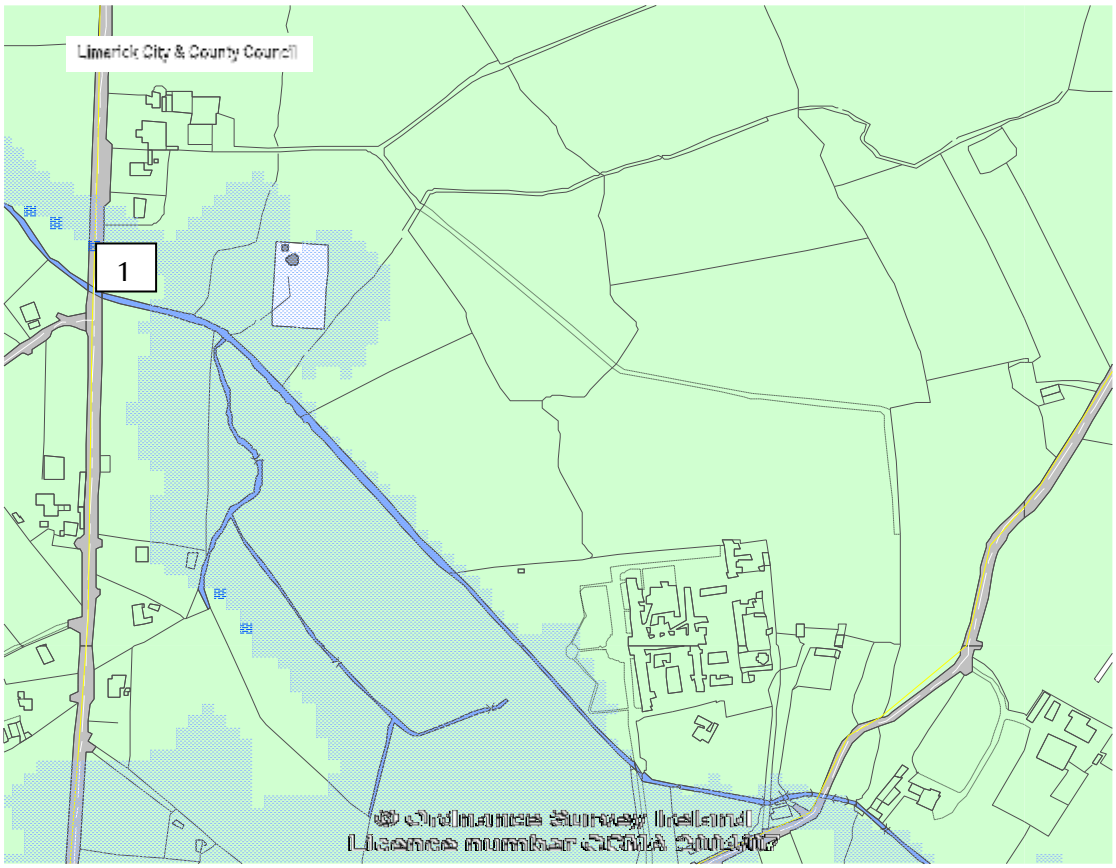

Figure 5: Location of Caherass Bridge at one, which has a constricted arch.

LIDAR maps:
The Council has purchased LIDAR mapping, which has been used to provide more accurate information in relation to flood risk. This has been used with the JBA maps, a screen grab for which is shown below. Please note that the contents of the CFRAM maps supersede these maps as a source of flooding information.

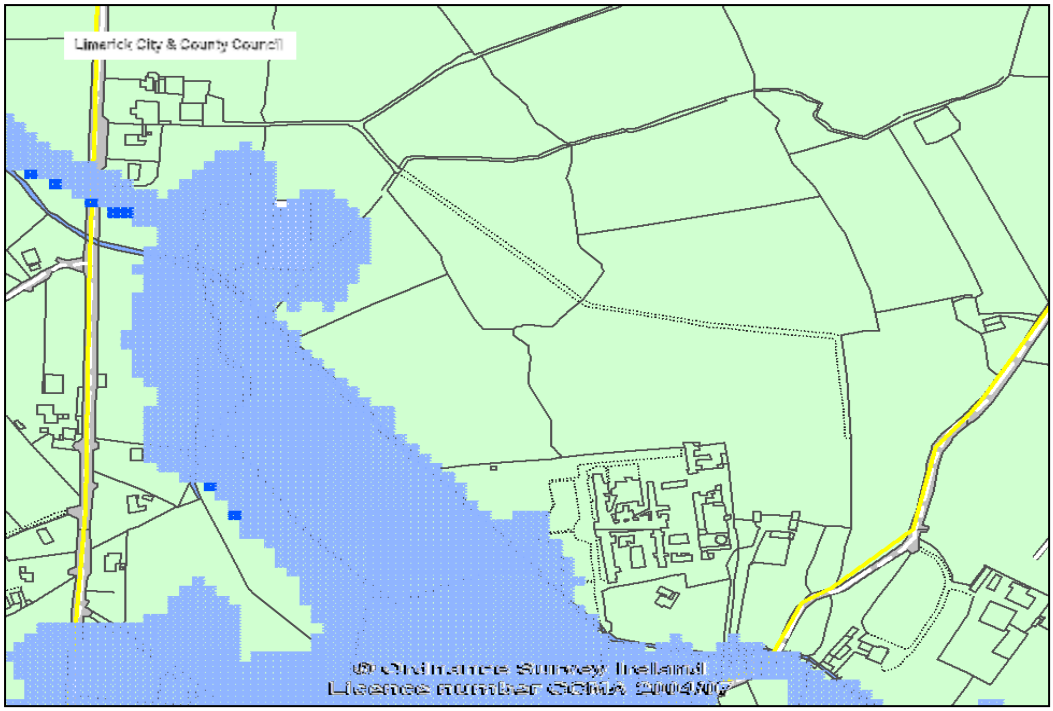

Figure 6: JBA flood maps. The light blue is Flood Zone A, the darker blue is flood Zone B. These zones are explained below.

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding);

Alluvial deposition maps

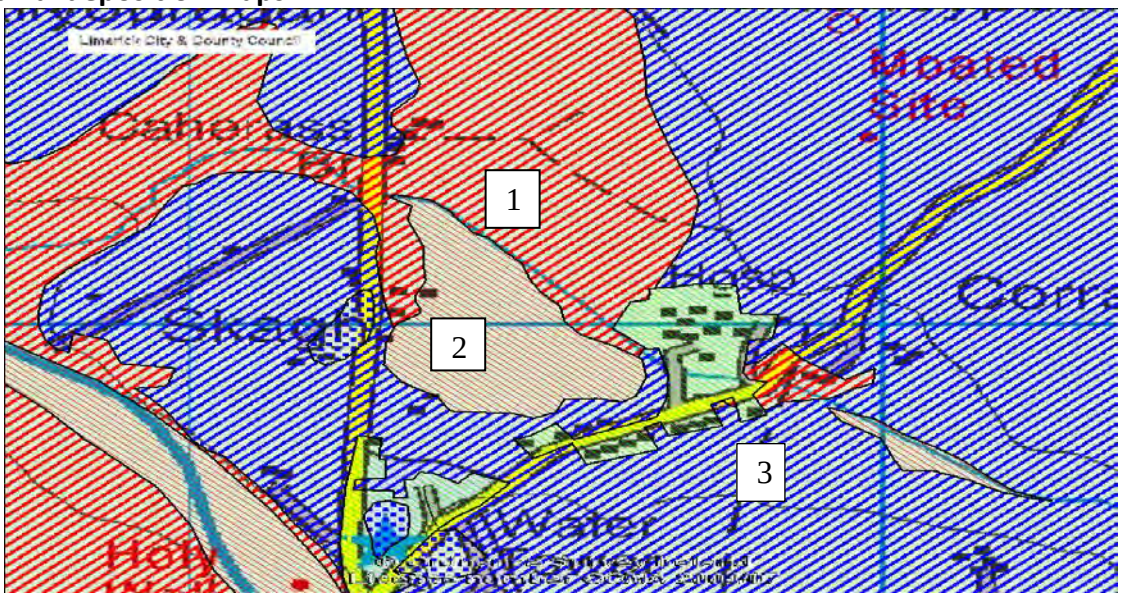

Figure 7: The soils shown on the map, above, show area No.1 as mineral soils, area No.2 as alluvial and area No.3 as deep well drained mineral.

The alluvial soils on the map correspond with the liable to flood lands, which are shown on the six-inch map series and are consistent with the lower ground levels in the northern part of the plan area.

Liable to flood markings on old 6 inch maps

Areas liable to flood were shown on the 6 inch maps dating from 1920 (surveyed in 1841-revised 1920). The screen grab from the OSI website shows areas liable to flood in the north east of the plan area.

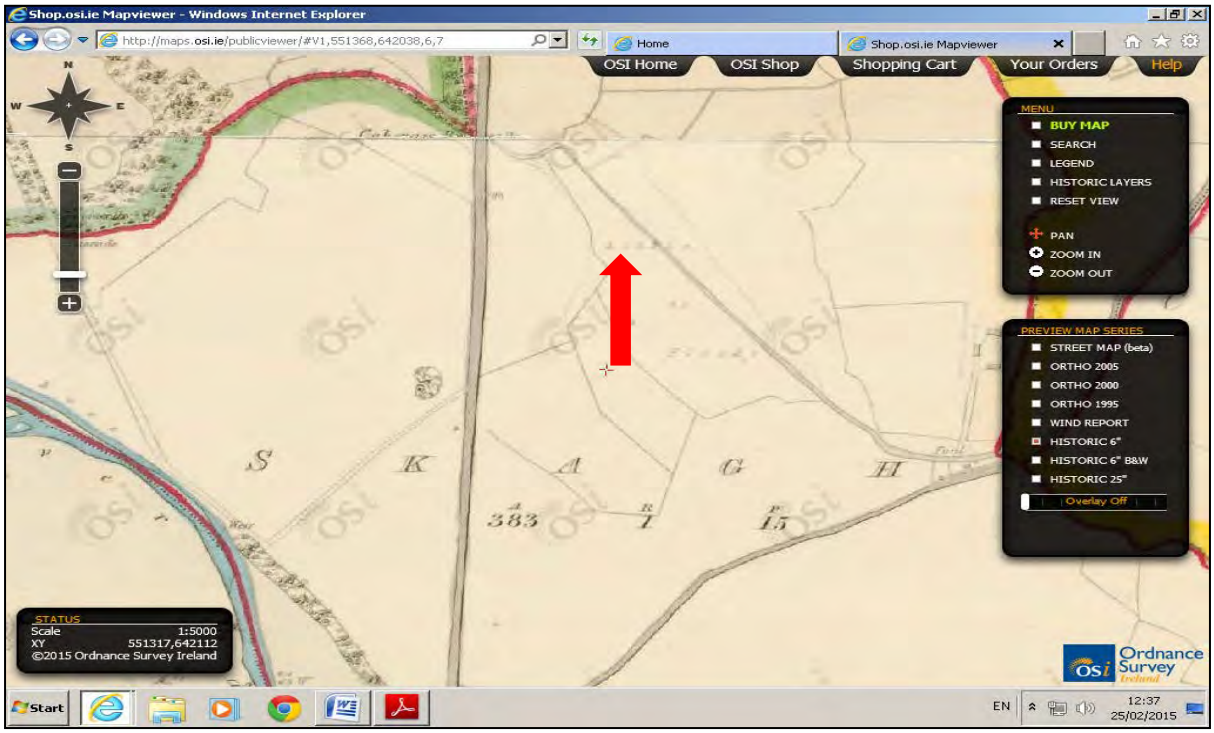

Figure 8: The liable to flooding maps are shown mid picture.

These lands are in the north east of the plan area. Local sources also indicated that this area was subject to flooding. The lands have been re-seeded, however, these lands showed signs of ponding as the water levels in the river did not permit the field drains to fully discharge to the river channel. This was on the 22nd of February 2019.

Local libraries and reports

OPW reports were consulted. These date from 1986 and relate to flood events in the town centre.

Local consultations

A public meeting was held and haven spoken with one of the adjacent householders, they confirmed that the lands shown as liable to flood in Figure 8 are still subject to temporary flooding events and ponding.

Walkover surveys

See above

17. National, regional and local spatial plans

Insufficient detail was present in other plans or strategies in order to inform the current survey.

18. Previous planning applications

A number of planning applications have been submitted in the vicinity of the Lisnakiltagh Stream over the past number of years, which have included a number of flood risk assessment as part of the application process. Details are listed and summarized below.

13/680: Permission sought by Board of Management Colaiste Chiarain for construction of a two storey post primary school to be used for educational purposes, which will accommodate circa 1,000 no. students. The development will comprise 57 no teaching spaces and all ancillary areas along with the provision of 3 no playing areas, car parking spaces, bus and car-set down areas, provision of a new vehicular/pedestrian access from the L-1478-1, entrance associated works and the creation of a new pedestrian link to the existing footpath as well as all landscaping, site boundary treatment works and ancillary site development works. A flood Risk Assessment was submitted by Hydro Environmental Ltd. Permission was refused on the site on the basis that the application did not pass the Justification Test for the location of vulnerable development on lands that were not zoned i.e. "that the urban settlement is targeted for growth under the National Spatial Strategy..." (Planning System and Flood Risk Management 2009, p. 37).

16/50: Permission granted for the construction of (i) a two storey, post primary school, to be used for educational purposes, (ii) 3 no. playing pitches, (iii) internal vehicular & pedestrian infrastructure including roads, footpaths, car parking spaces and bus & car set-down areas, (iv) a vehicular and pedestrian access off the New Distributor Road identified in the Croom Local Area Plan which is to be constructed by the local authority, (v) the provision of a temporary construction access from the L-1478-1, (vi) an on-site foul pumping station, (vii) an underground tank to facilitate rainwater harvesting and a Class 1 interceptor and (viii)all ancillary site development works. Flood assessment was carried out by Hydro Environmental Ltd. which deemed the site suitable for development.

17/1150: Permission granted to Nivon Healthcare t/a Zest Healthcare for the provision of a primary care centre over two floors, measuring 1,280msq gross floor area, consisting of (a) a general medical practise clinic; consultation rooms, offices & treatment areas, (b) a public healthcare facility; procedure rooms, treatment rooms, office & administration suites, (c) a single storey annexe containing a pharmacy & external waste disposal enclosure, (d) 60 surface car-parking spaces at grade, (e) the provision of an entrance to the site from the existing roadway immediately to the south of the site and amendments to the existing boundary wall, (f) the provision of an outlying electrical supply substation single storey building (g) a storm water drainage outfall to the Lisnakiltagh river & all associated site works Flood assessment carried out by Punch Consulting engineers submitted November 2017.

17/8011: Part 8 application for Croom Distributor Road - provision for a scheme to advance the unbuilt section of the distributor road to complete the link to High Street R516 at its southern extent and a distributor road between Crecora Road and Limerick Road to the north. In addition, a new road will be constructed to the north of the proposed distributor road

crossing the Laskiltagh River to accommodate access to a proposed post-primary school which will be located north of the river. Flood assessment carried out by Mott McDonald Consultating Engineers on behalf of Limerick City & County Council and deteremined to be accepatable.

18/38: Outline Permission granted to Toomey Construction Ltd for two number two storey dwelling houses on land zoned as services sites, new front boundary wall, storm water soak pits, public water and foul connection for each dwelling house. Two new entrances are required, one entrance for each house. A Stage 3 flood risk assessment was carried out by AECOM, deemed the sites suitable for development.

Above is the outline of a number of planning applications, which have been granted in the lands within the northern area of the zoned lands in Croom. During the assessments of the above planning applications an issue arose in terms of differing estimates of annual flow in the Lisnakiltagh Stream (Qbar value/annual maximum flow rate). There have been ongoing discussions with the Office of Public Works in this regard. Another flood study was commissioned by LCCC to consider the lands in the north east of the plan area. Mott MacDonald were commissioned by Limerick City and County Council to carry out a Flood Risk Assessment (FRA) for the lands between the Crecora Road and Old Limerick Road. The report, dated 14th August 2019, is the most up to date flood assessment available and relates to the north east of the plan area. This is shown in Figure 9 below. Th report is also available in an appendix to the plan.

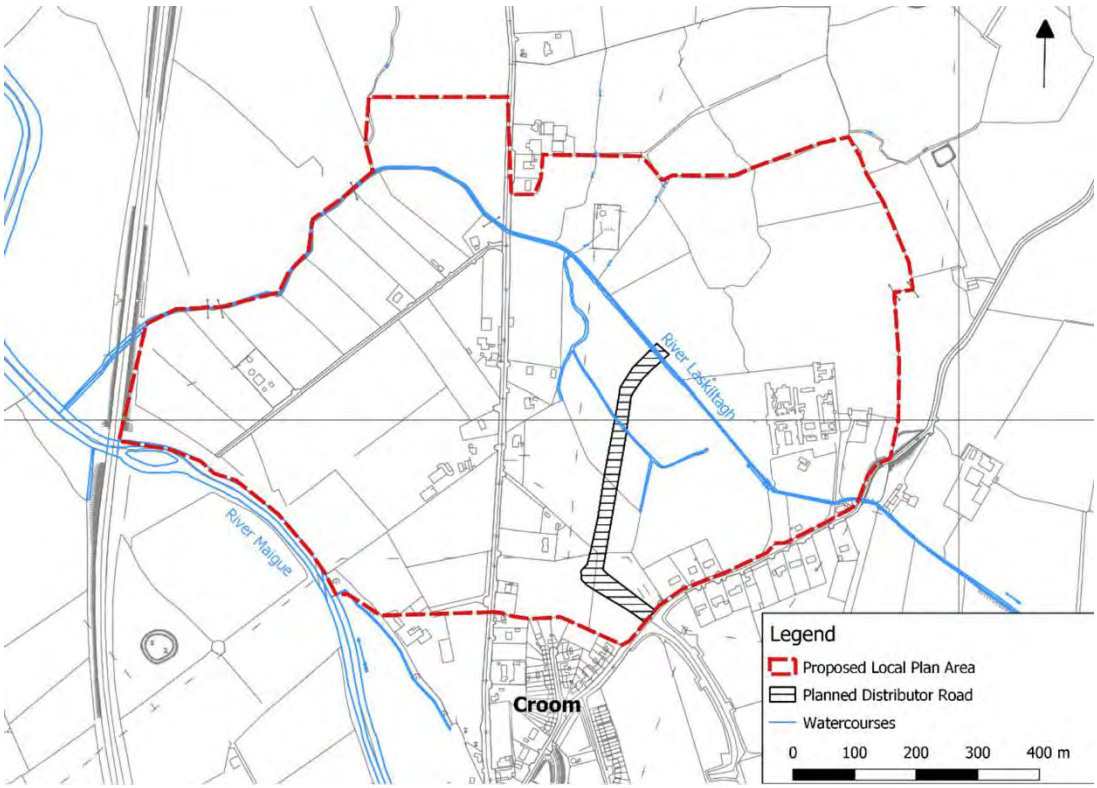

Figure 9: This map, taken from the Mott MacDonald report shows the area that was the subject of the Flood Risk Assessment. This was taken from page 2 of the 14th August report.

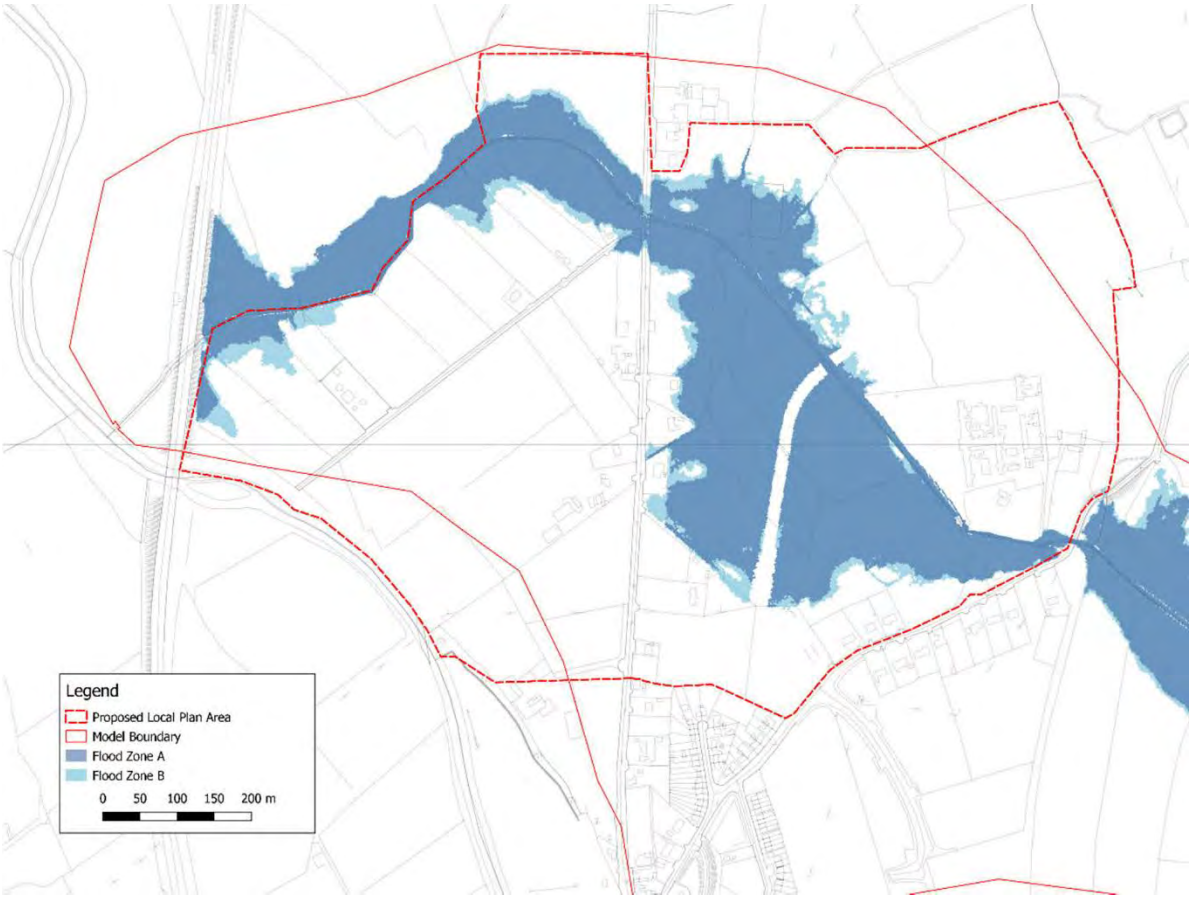

Figure 10: Showing flood extents in the area in question with 95% confidence.
Source: Mott MacDonald, 14th August 2019 p. 17.

The new study considered the area shown Figure 9 and took into account increased flow figures and a 50% blockage in Caherass bridge which has been identified as a risk factor in previous studies. It also took into account revised bridge design for the crossing of the Lisnakiltagh Stream, where the distributor road connects to the secondary school site. The revised bridge design has 14.5m span which could have an effect on flood extents. It shows an increased areas subject to flood risk, which demonstrates a larger flood extent, occurring in the updated hydraulic model results.

Conclusion:
The northeastern part of the plan area has flat topography and slopes very gradually from the southeast to the northwest. The northern part of the lands is historically prone to flooding as indicated on the historic six-inch maps (Fig. 8), soil map (Fig. 7) and also the flood benefitting maps (Fig. 1).The historic drainage pattern also indicates that this was the case. Figure 5 (up to date CFRAMs) also indicates that these lands are subject to flood risk. The Caherass bridge may also pose a constriction risk for the passage of flood waters. Having regard to the above and the issues highlighted in relation to the annual maximum flow rate, the Local Authority commissioned a further flood study which was completed in August 2019. This showed a greater flood extent over previous models.

The zoning in the existing plan, shows a mixture of Residential, Residential Serviced Sites, Industrial and Education and Community and Open space usage in the area shown in Figure 9. In terms of vulnerability residential is regarded as the most vulnerable (Flood Risk Guidelines 2009, p.25), while educational and community uses would be unsuitable as they would encourage gatherings of people in vulnerable areas. This would also mean that such facilities would be unusable during flooding periods and immediately afterwards.

This area would not pass the Justification Test for Development Plans (DOEHLG, 2009 pp. 26-27 and p. 37) as the area is not a "well established" city and urban core area and has not been targeted for growth under the former National Spatial Strategy and following national level plans and strategies. As noted in the SEA screening document above (p.2) Croom is designated as a Tier 3 population centre in the Limerick County Development Plan 2010 - 2016 (as extended), which is identified as a centre on a transport corridor. This is below the City in the settlement hierarchy and because of this lies outside the settlement types where the justification test might justify development in flood prone areas. The lands in question are not necessary "to facilitate regeneration or expansion of the centre of the urban settlement" (DEHLG 2009, p.37)

The 2009 guidance places an emphasis on risk avoidance (p.9) stating that "development should preferentially be located in areas with little or no flood hazard thereby **avoiding** or minimising the risk". Bearing in mind the increase in flood extents identified in the assessment it is considered best to re-zone the land, that is subject to flood risk for agricultural use or open space which are compatible uses with flood risk areas.

Appendix

MOTT MACDONALD civil

Croom Local Area Plan

Flood Risk Assessment

14 August 2019

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Croom Local Area Plan

Flood Risk Assessment

14 August 2019

Limerick City and County Council

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	27/06/19	Z Carroll D Wilkie	L Cload	P Whitefoot	First Draft
B	14/8/19	L Cload	D Wilkie	M Nekula	Update with new 14.5m bridge and OPW comments

Document reference: 405974 | 002 | B

Information class: Standard

Contents

1 Introduction

1.1 Scope and purpose of study

Mott MacDonald has been commissioned by Limerick City and County Council to carry out a Flood Risk Assessment (FRA) for the lands between the Crecora Road and Old Limerick Road. This FRA will be used to inform the Croom Local Area Plan.

To support this FRA, hydraulic modelling has been undertaken developing a flood model previously prepared by Mott MacDonald that examined the impact of a new distributer road across the area. (the Mott MacDonald Croom Distributor Road 2017 1d-2d Flood Modeller-TUFLOW model). The model has been converted into an ESTRY-TUFLOW model and includes the proposed Distributor Road and the 2d domain has been extended to cover the full 1d extent. The modelling results for flood extents and depth will be used to identify which lands are suitable for development types based on flood zoning.

The design of the distributer road is ongoing at the time of writing. A revised bridge design was produced in May 2019 by DBFL and provided to MM in August 2019 and used to update the model.

The information and recommendations presented within this assessment are dependent on the accuracy and reliability of the information, correspondence and data available to Mott MacDonald at the time of assessment.

Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, Mott MacDonald takes no liability for, and gives no warranty against, actual flooding of any property (client's or third party). The FRA has been prepared for the purpose of supporting the Croom Local Area Plan.

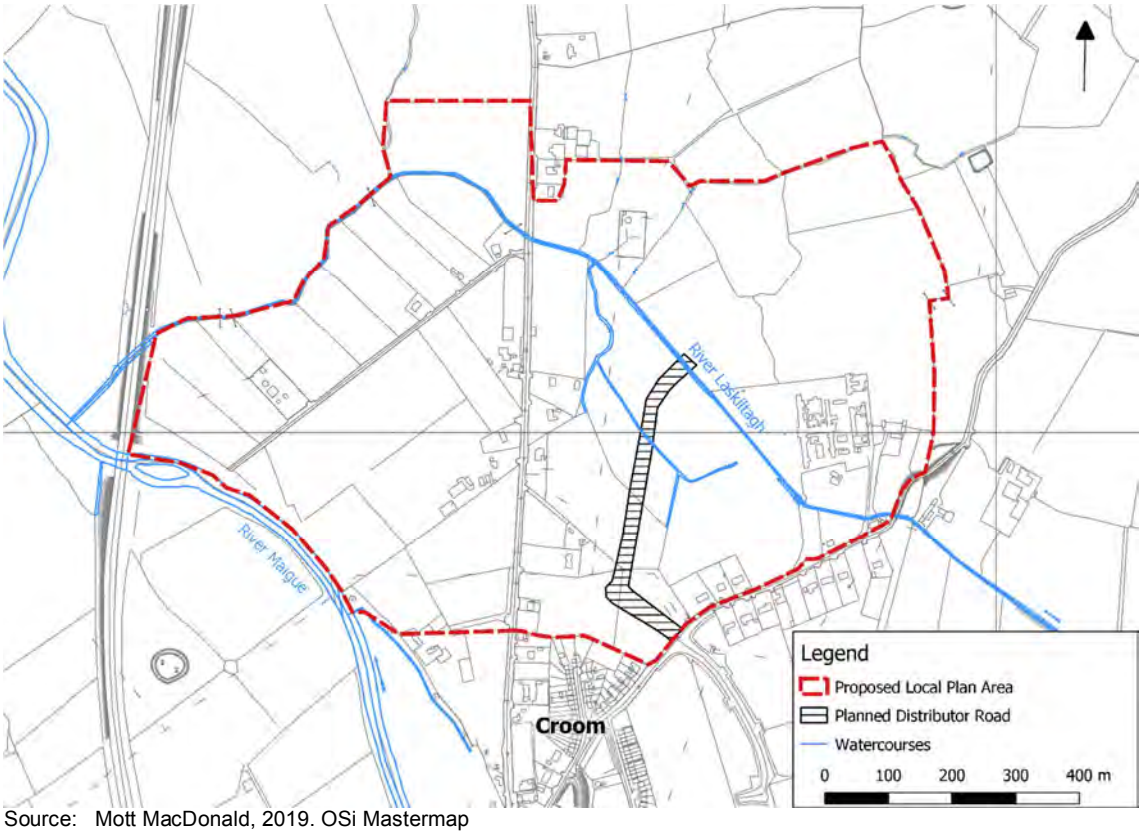
1.2 Site location and description

Limerick City and County Council provided Mott MacDonald with a shapefile of planning application zoning for Croom in March 2019. This shapefile has been used to create a new proposed outline for the Croom Local Area Plan (Figure 1). This area is the Proposed Area for this study.

The Proposed Area lies directly north of Croom village in County Limerick and lies between the Crecora Road and Old Limerick Road, where the proposed Croom Distributor Road is planned. Various planning application flood studies have been submitted for this area as two watercourses border the Proposed Area: The River Maigue to the west and River Laskiltagh to the north. The main flood risk concern for the Proposed Area is from the River Laskiltagh, which is the main focus of this study.

This Proposed Area is approximately 0.75km^2 and is largely made up of agricultural land, with a mixture of residential and industrial areas to the south of the site.

Figure 1: Location of proposed Local Area Plan site

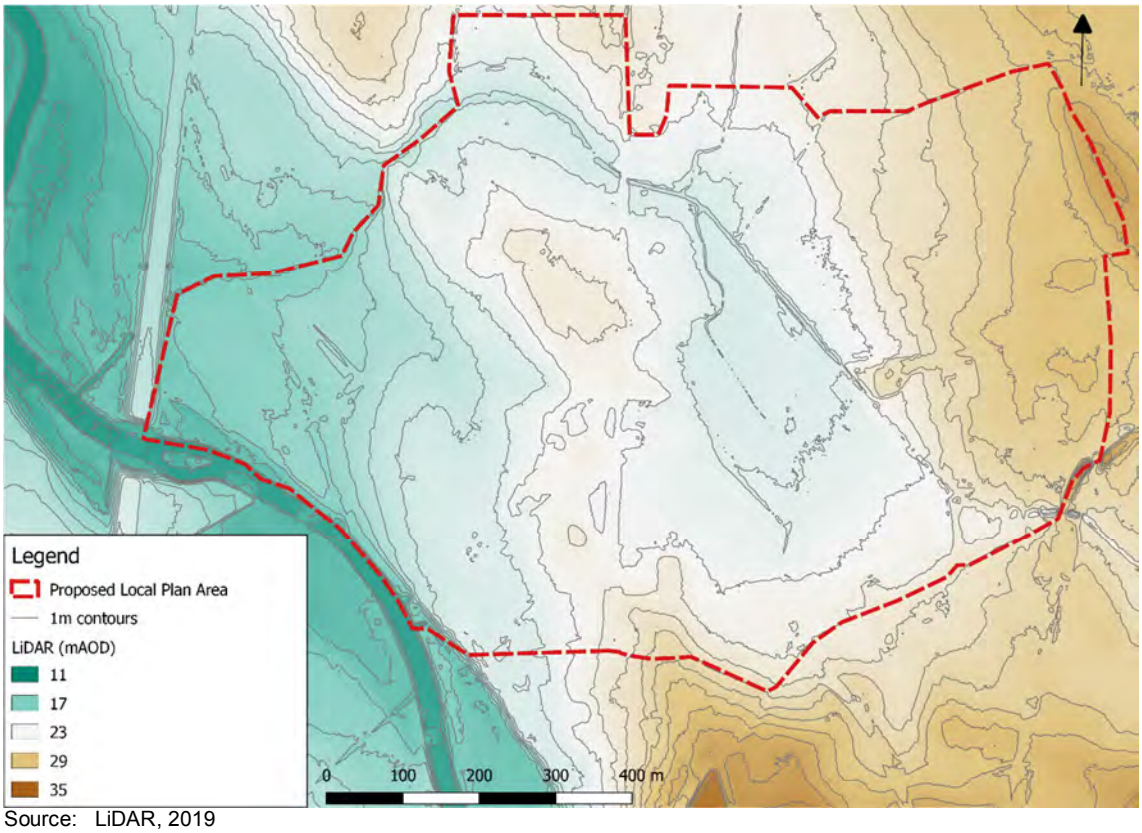


Source: Mott MacDonald, 2019. OSi Mastermap

1.2.1 Topography

The topography of the Proposed Area is steep at the eastern boundary (29.7mAOD) and gradually declines in elevation (15.5mAOD) to the western boundary where the River Laskiltagh confluences with the River Maigue (LiDAR, 2019). The average elevation of the Proposed Area is 23mAOD.

Figure 2: Topography of Proposed Area



Source: LiDAR, 2019

2 The Planning System and Flood Risk Management Guidelines

2.1 The Planning System and Flood Risk Management, Guidelines for Planning Authorities

Flooding is a natural process that can happen at any time in a variety of locations, and which affects people indiscriminately. Flooding from rivers and sea is probably the best-known source of flooding, however flooding can also occur from prolonged, intense, and localised rainfall leading to flooding from sewers, overland flow and groundwater flooding.

The frequency, pattern and severity of flooding are expected to increase as a result of climate change. Development can also exacerbate the problems of flooding by removing floodplain storage, altering watercourses, and accelerating and increasing surface water runoff.

In November 2009 The Office of Public Works (OPW) published "The Planning System and Flood Risk Management, Guidelines for Planning Authorities"[1] (The Planning Guidelines). The guidelines aim to integrate flood risk management into the planning process to assist the delivery of sustainable development. It aims to encourage a transparent and consistent consideration of flood risk in the planning process.

The objectives of the guidelines are given as (Paragraph 1.6):

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water runoff;
- 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.

2.2 Flood Risk Assessment Methodology

The recommended stages of flood risk assessment within the guidelines are:

- Flood risk identification – A desk-based study to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation;
- Initial flood risk assessment (FRA) – A qualitative or semi-quantitative study to confirm the sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.
- Detailed flood risk assessment – A methodology to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of flood hazard to a proposed or existing

[1] The Office of Public Works, *The Planning System and Flood Risk Management, Guidelines for Planning Authorities* (November 2009).

development, of its potential impact on flood elsewhere and of the effectiveness of any proposed measures.

2.3 Decision making planning process

Management of flood hazard and potential risks in the planning system should be based on an interpretation of issues of both planning and flood risk set out within the guidelines and primarily, but not solely, based around the use of:

1. **Sequential Approach** through the use of identified flood zones (see Table 1 for definition of Flood Zones);
2. **Justification Test** for development that needs to be in flood risk areas for reasons of proper planning and sustainable development.

The Planning Guidelines categorise the likelihood of flooding in the form of three flood zones. These flood zones each relate to geographical areas at high, moderate or low risk of flooding, depending on if they are Zone A, B or C respectively. Table 1 below provides a definition of each flood zone.

The likelihood of flooding is defined as a percentage risk of occurring in any year. For example, a flood event may be described as having an Annual Exceedance Probability (AEP) of 1%. A flood event of 1% AEP is therefore commonly referred to as a 1 in 100-year flood event.

Table 1: Definition of Flood Zones

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

Source: The Office of Public Works, *The Planning System and Flood Risk Management, Guidelines for Planning Authorities* (November 2009).

The determination of the extent of the flood zones should be based on current extreme water levels without any allowance for climate change. Aspects of climate change should be addressed as part of any flood risk assessment, including residual risks.

Furthermore, it is important to note that the flood zones shown in Table 1 are indicative of fluvial (river) and coastal flooding only, and do not include other information on the risk of flooding from sources such as pluvial, groundwater or artificial drainage systems.

The modelling undertaken in this report categorises the 3 flood zones for Croom.

3 Hydrological Analysis

The hydrological analysis for the River Laskiltagh has been carried out using the FSU Web Portal. After consultations with the OPW, additional data sources have also been utilised to provide the most up-to-date flood flow estimates. The additional sources of data included:

- Previous hydraulic model of the River Laskiltagh by Mott MacDonald in 2017[2]
- OPW, Hydro-Data website (www.waterlevel.ie)[3]
- Shannon Catchmnet-based Flood Risk Assessment and Management (CFRAM) study, Hydrology Report Unit of Management 24, by Jacobs, 2016[4]

Consultation with the OPW also highlighted that given the inherent uncertainty when examining an ungauged catchment, it is advisable to adopt the highest confidence level (i.e. 95% CL) flows when considering flood risk for residential areas.

The design flood flows have been calculated for the River Laskiltagh, upstream of the confluence with the River Maigue, Irish Grid Reference 150556,141993.

The index flood, QMED, has been estimated using the 24008 Castleroberts pivotal site. The Annual Maxima (AM) series on the FSU Web Portal has been extended using the Hydro-Data website from 2005 – 2017. The new rating for the Castleroberts station, as presented in the CFRAM Stud, has been applied and the AM series from 1990-2017 have been updated to reflect the changes in the river channel. Following these updates, the new QMED estimates of 3.103 m^3/s and 6.082m^3/s have been adopted.

The growth curve at the subject site has been derived using a pooling group analysis with a GEV distribution, as per FSU guidance.

Design flows are summarised in Table 2, with full details of methodology given in Appendix A.

Table 2: River Laskiltagh design flows

Design Flood	Flow (m^3/s)
1% AEP (1 in 100 year)	6.889
0.1% AEP (1 in 1000 year)	8.875
1% AEP (1 in 100 year), 95% Confidence Interval	13.503
0.1% AEP (1 in 1000 year), 95% Confidence Interval	17.395

The IOH 124 method has been used as an additional hydrological method for a comparison. However, the results have not been used, as the method has been considered less reliable when compared to the latest Flood Studies Update (FSU). The main reasons for this are:

- The IOH method uses a general model to estimate the Index Flood (QBAR) and general growth factors, which is applied to all catchment across Ireland. In our case, we applied the FSU Method with a detailed review for both, i.e. the Index Flood and growth factor estimates. The Index Flood was based on the review of the selected pivotal site nearby the subject

[2] 356664SA_01C Croom Distributor Road, Flood Risk Modelling, by Mott Macdonald, 26 Sep 2017

[3] http://waterlevel.ie/hydro-data/stations/24008/station.html?1558515354

[4] https://s3-eu-west-1.amazonaws.com/docs.floodinfo.opw/floodinfo_docs/Shannon_CFRAM/UOM24/01_Hydrology/TD_HYDO_0372_Final_V2_0_JAC_HydrologyRpt_UoM24_160705_MainReport.pdf

catchment and its Annual Maxima (AM) series from the FSU Web portal data and CFRAM study. The growth factor was based on the selected pooling group of suitable, hydrologically similar catchments.

- The IOH 124 method is also best suited for the rural catchment of size between 0.5km^2 to 25km^2. The subject catchment is of 25.677km^2, therefore just on the top end of the suitability.

Overall, the confidence in the FSU Method has been assessed as higher and therefore, the peaks from this method have been used in the hydraulic model. Moreover, following the discussion with OPW, we have used the 95% Confidence Interval to reflect the OPW requirements for the subject site.

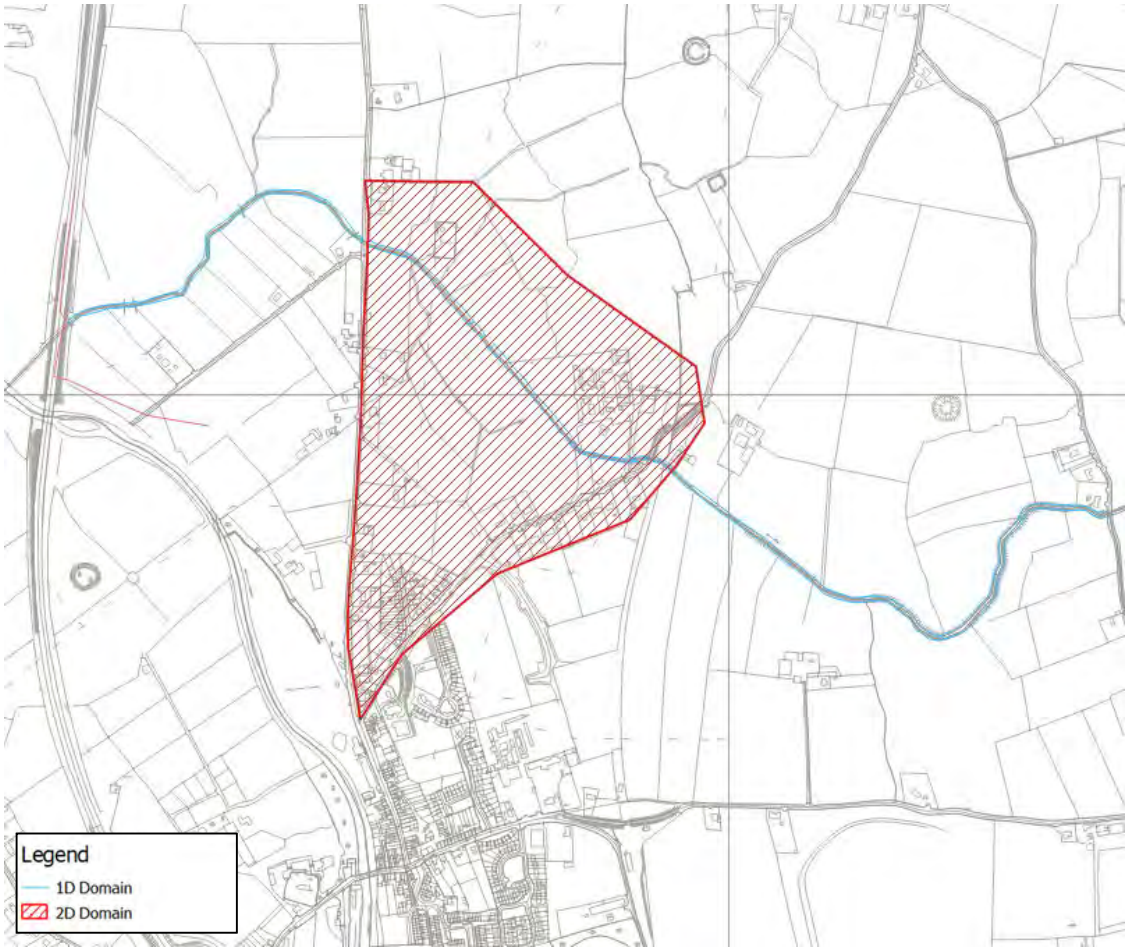
The outcomes of this method are presented in Appendix A.

4 Hydraulic Modelling

Hydraulic modelling is based on previous modelling[5] conducted by Mott MacDonald in 2017.

The previous hydraulic model and flood risk assessment assessed the impact of the proposed distributor road. The figure below shows the extent of the previous hydraulic model's 1D and 2D domains.

Figure 3: Overview of 2d domain in previous hydraulic modelling



Source: Mott MacDonald, 2019. OSi Mastermap.

4.1 Software used

ESTRY-TUFLOW has been used to model the 1D and 2D model domains. The use of a 1D-2D linked modelling approached is preferred to capture overland flow paths. The model has been run using the latest version of TUFLOW available at the time of the study (2018-03-AD).

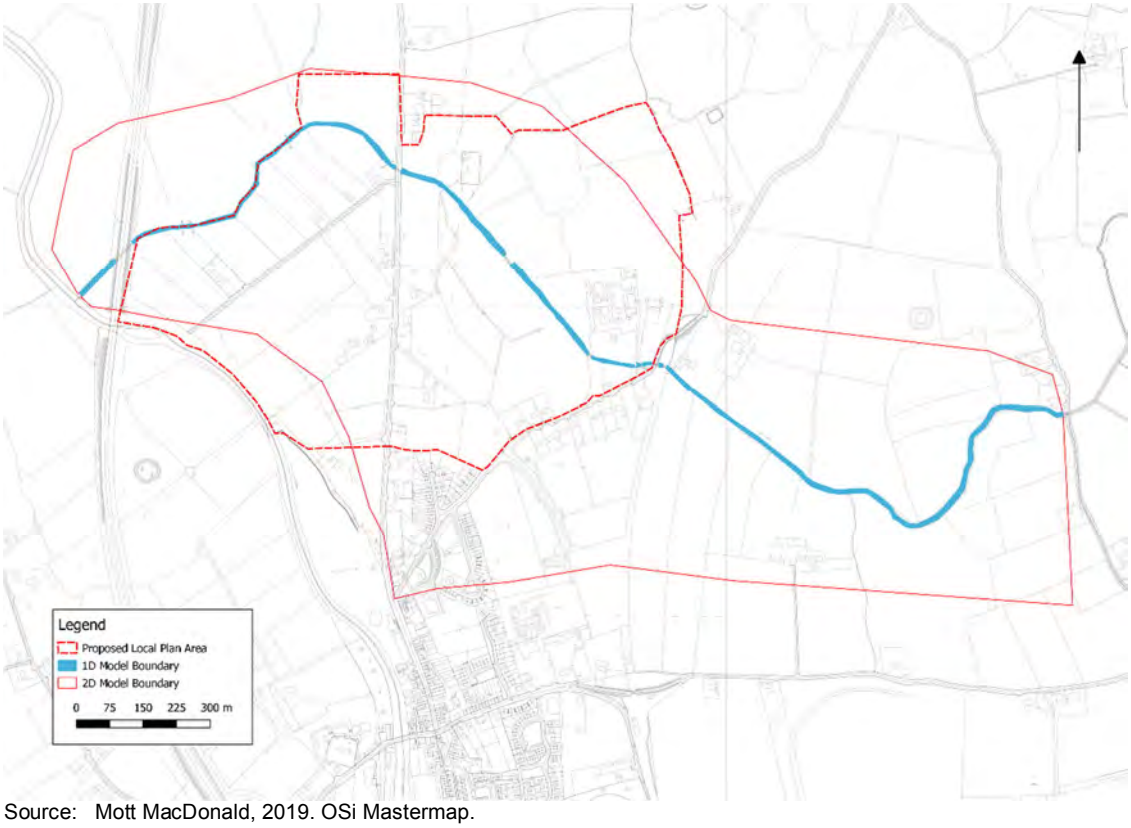
[5] Mott MacDonald (2017) Croom Distributor Road: Flood Risk Modelling. Rev C.

4.2 Modelling schematic

A model schematic showing both the 1D and 2D model extents is shown in Figure 4 below. The model consists of a single 2D domain covering the entire study area.

Circa 2.5km of the River Laskiltagh watercourse have been included in the hydraulic model, as shown below in an overview of the modelled area.

Figure 4: Hydraulic modelled area overview, including propose development area



Source: Mott MacDonald, 2019. OSi Mastermap.

4.3 1D model build

4.3.1 1D boundaries

The 1D boundary was created following updates to the 1D network and revision of hydrology (1D_bc_Croom _002.shp). A fluvial inflow (flow-time; QT boundary) is located at the upstream end of the 1D section of the model. A fluvial outflow (head-time; HT boundary) is located at the downstream boundary (2d_bc_downstream_002_L.shp).

4.3.2 1D roughness

Topographical survey, photographs and OSi Mastermap have been used to inform the 1D roughness values. Bridges have a universal roughness 0.040 applied. The culverts roughness ranges from of 0.011 to 0.015. The sections of open channel have roughness values applied to

each cross section, through the csv files linked through the 1D_xs_Croom_002.shp, ranging between 0.044 and 0.060.

4.3.3 1D Structure

Bridges and culverts have been modelled in Estry. A summary of the structures is given in Table 3.

Table 3: Summary of culvert attribute table

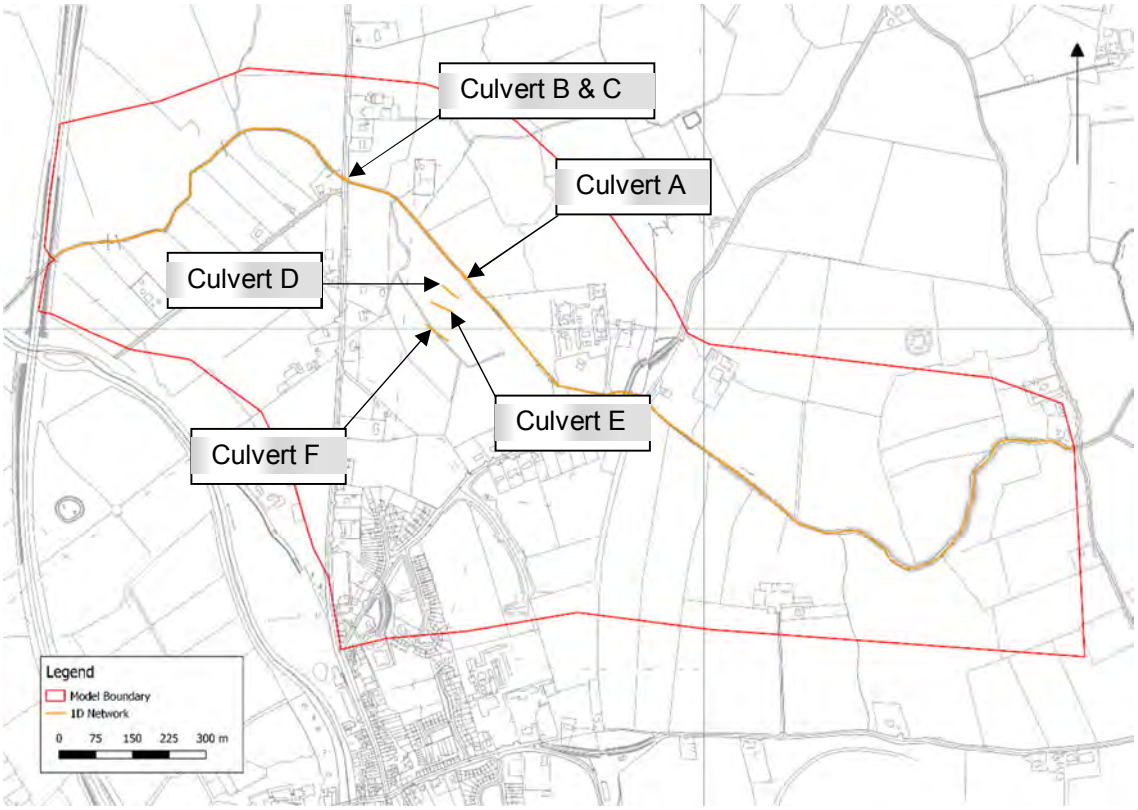
	Culvert A (NBR_D)	Culvert B (92C1L)	Culvert C (92C2R)	Culvert D (Channel_1)	Culvert E (Channel_2)	Culvert F (Ditch)
Culvert Type	Rectangular	Circular	Circular	Rectangular	Rectangular	Rectangular
Length (m)	-	-	-	24.96	26.33	37.1
Diameter (m)	-	2	2	-	-	-
Width (m)	14.5	-	-	-	-	-
Height (m)	2	-	-	-	-	-
Upstream Invert (mAOD)	20.54	19.74	19.91	21.51	21.76	21.98
Downstream Invert (mAOD)	20.44	19.54	19.71	21.47	21.6	21.58
Roughness Coefficient	0.011	0.011	0.011	0.015	0.015	0.015
Blockage Percentage (%)	0	0	0	0	0	0

Source: Mott MacDonald, 2019. Refer to Figure 5 for culvert locations/

The design of Culvert A was taken from drawing 122032-5510 rev D – May 2019, by DBFL Consulting Engineers.

Additional culverts were added to represent culverts in the new road embankment as discussed in Section 4.5.

Figure 5: Culvert Location overview



Source: Mott MacDonald, 2019. OSi MasterMap.

4.3.4 Weirs

Weirs have been added to represents the deck level/ground level above each culvert and bridge structure, to allow flood water to overtop the bridge in the 1D domain of the model if the structure becomes surcharged. The weir dimensions are specified through the linked XZ table, with the invert level applied in the network layer.

4.4 2D model build

This section gives details to what modifications were made to the 2D domain of the hydraulic model.

4.4.1 2D domain

Using LiDAR (April 2019) a digital terrain model (DTM) was created in the 2D domain to represent the floodplain from the Monks' Ditch watercourse. A grid size of 2m was selected to represent the detail of the area.

The DTM was adjusted to include a representation of the proposed distributor road based on drawings of the proposals.

4.4.2 2D roughness

Within the 2D domain, Manning's n has been defined using OSi MasterMap. By using OSi MasterMap, the 2D floodplain can be spilt into different roughness classes based on the 'feature code attribute', and each feature code attribute assigned a Manning's n coefficient value. The Manning's n values used in the model on the 2D domain are provided in Table 7.

The building footprints have also been informed by the OSi MasterMap data. These use a higher Manning's 'n' of 0.3 to represent impact of walls and storage whilst still permitting flooding in the building footprint for storage[6].

It is noted that the OSi MasterMap provided for this study excluded areas in the north west of the model. Therefore, in these locations, roughness was determined through the use of photographs.

Table 4: Manning's roughness coefficient assigned to 2D elements

Material	Manning's 'n' roughness coefficient
Global Floodplain Area	0.060
Buildings	0.300
Roads	0.020
Water	0.044

Source: Mott MacDonald, 2019.

4.5 1D–2D linking

HX lines representing the channel banks were created to allow for flood water to spill out of bank and flow onto the 2D floodplain (2d_bc_hx_Croom_004_L.shp). This was applied along 1D network channel.

Culverts are planned to be constructed through the proposed distributor road embankment to minimise impact on flood risk. These have been modelled as 1D culverts connected to the 2D domain using an SX connector (2d_bc_SX_CN_Croom_PostS_002_P.shp), which allows for overland flow to enter and leave the culvert as necessary. Details on these culverts are specified in Table 3.

4.6 Fluvial flooding events

The hydraulic model was run for the following fluvial flood events:

- 1% AEP (1 in 100 year return period).
- 0.1% AEP (1 in 1000 year return period).

4.7 Sensitivity

No calibration data was available at the time of the study and therefore this model is not calibrated or verified.

The following sensitivity tests were undertaken to understand whether the hydraulic model build is sensitive to small changes in the following items.

- Blockage sensitivity at Caherass Bridge, 50% blockage applied for both return periods.
- Increased fluvial inflow to the model by 95% for both return periods.

[6] Syme, W, J. (2008). Flooding in Urban Areas- 2D modelling Approaches for Buildings and Fences. Proceedings of 9th National Conference on Hydraulics in Water Engineering.

5 Results Assessment

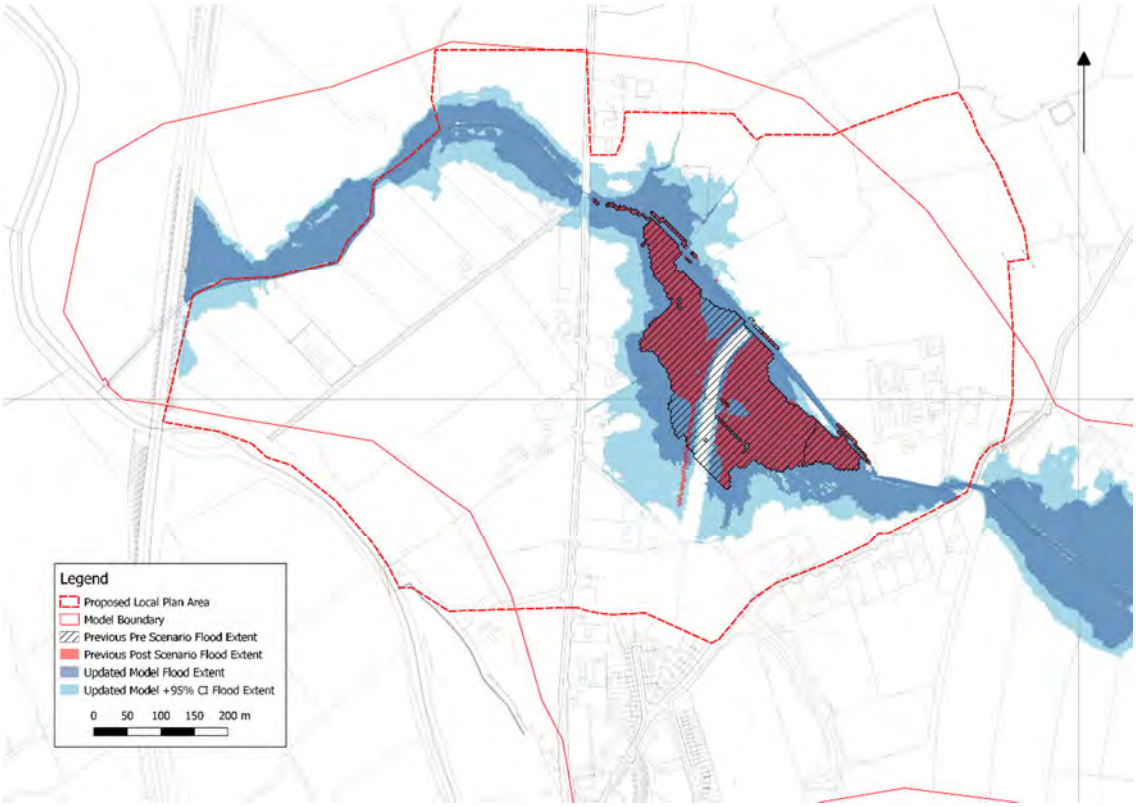
5.1 Comparison to Previous Modelling

The previous hydraulic model had a smaller 2d domain, as the focus of the model was the impact the proposed road would have to the flood risk on the surrounding area, and therefore represented no out of bank flow occurring in the 2d domain upstream of the proposed development area.

The updated hydraulic modelled, with larger modelled area, updated hydrograph and updated lidar data has been compared to the previous modelled flood events. All updated modelling includes the proposed distributor road from the previous model.

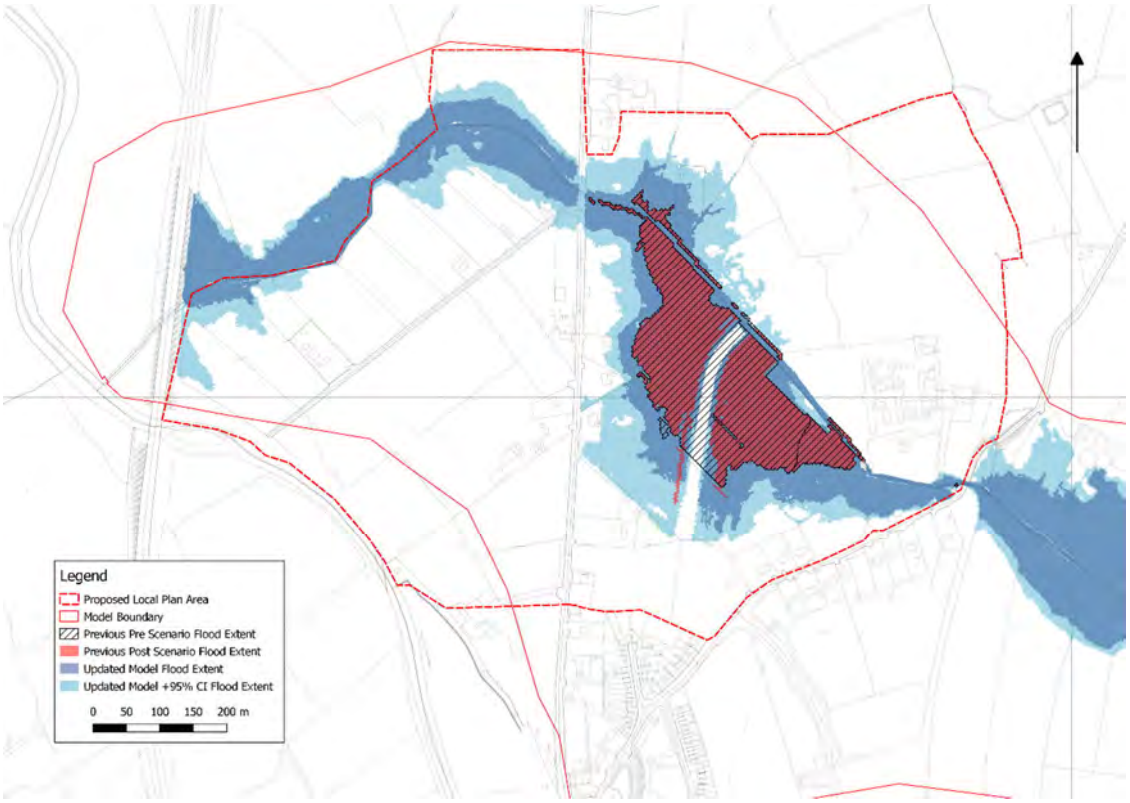
Figure 6 and Figure 7 shows a comparison of the previously modelled flood extents against the updated model flood extents. It shows a larger flood extent occurring in the updated hydraulic model results.

Figure 6: 1 in 100 year flood extent comparison to previously modelled results



Source: Mott MacDonald, 2019. OSi MasterMap. Confidence Interval (CI)

Figure 7: 1 in 1000 year flood extent comparison to previously modelled results



Source: Mott MacDonald, 2019. OSi MasterMap

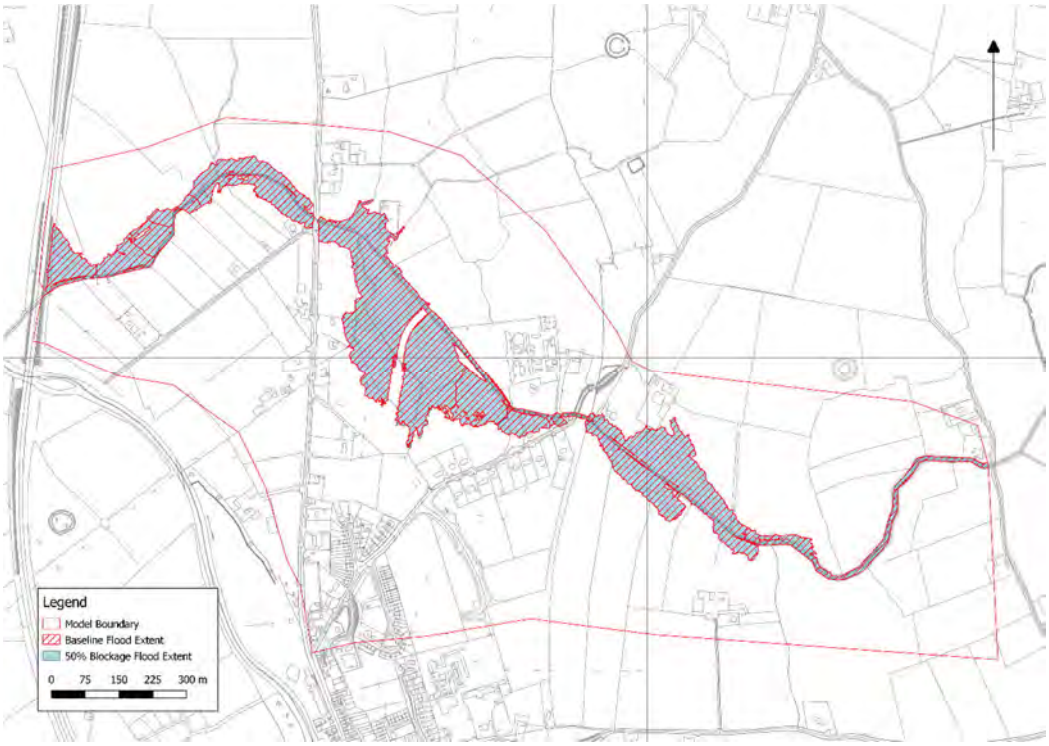
5.2 Sensitivity Analysis

5.2.1 Blockage

Below in Figure 8 and Figure 9 is the comparison between the standard model run flood extents, overlaid with the flood extents from the model runs with an additional 50% blockage applied to the Caherass Bridge structure.

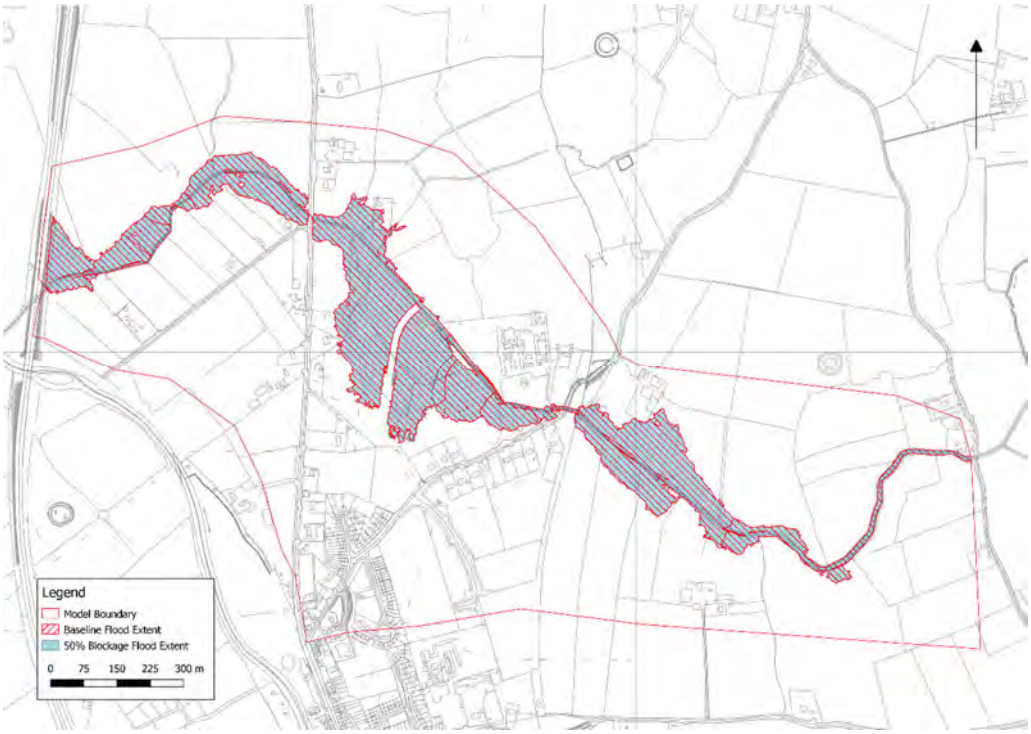
The flood extents for both runs for the 100 year and the 1000 year return periods show a minor increase in the block scenario flood extent.

Figure 8: 1 in 100 year flood extent comparison to blockage scenario



Source: Mott MacDonald, 2019. OSi MasterMap

Figure 9: 1 in 1000 period flood extent comparison to blockage scenario.



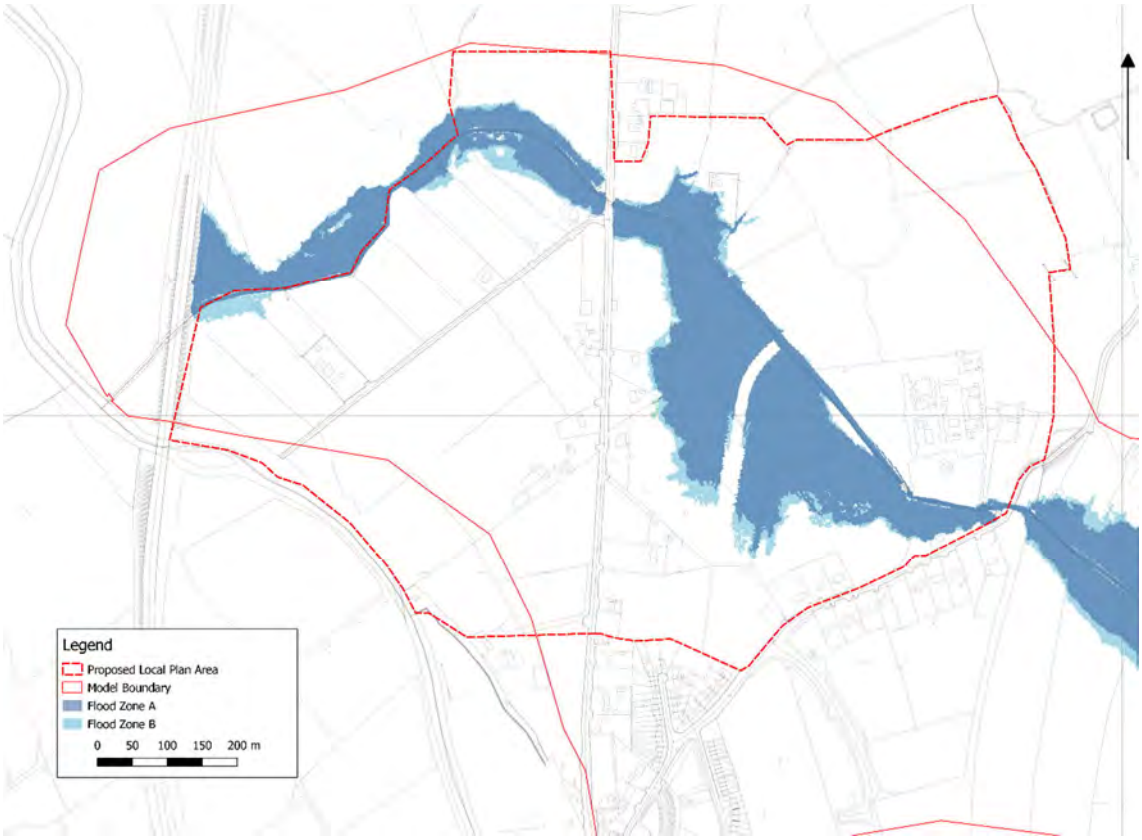
Source: Mott MacDonald, 2019. OSi MasterMap

6 Conclusion

A 1D/2D hydraulic model of the River Laskiltagh watercourse has been developed to highlight the flood zoning areas throughout a proposed development area, as shown in Figure 10 and Figure 11 below.

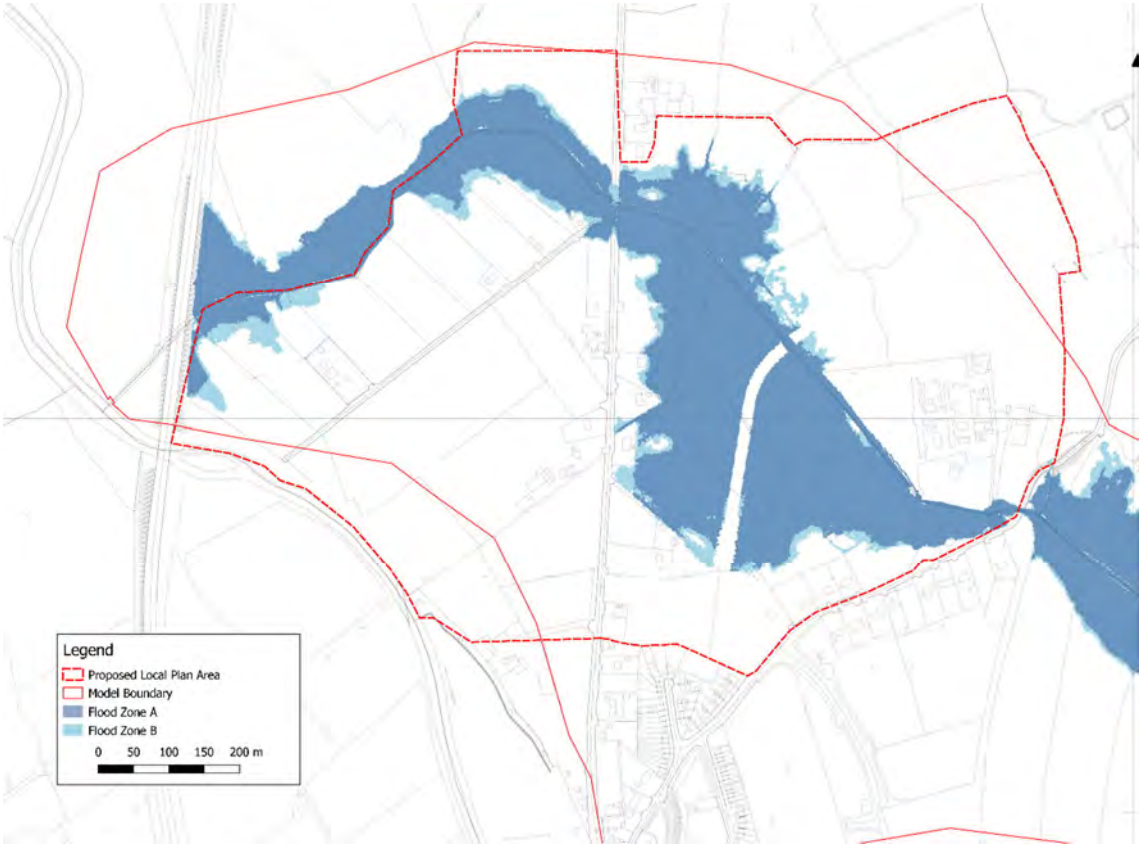
The comparison to previously modelled results shows the updated model has a larger flood extent. This is due to the changes made in the hydraulic model from the previously modelled scenario along with changes applied through updating the hydrology.

Figure 10: Flood Zoning in proposed development area



Source: Mott MacDonald, 2019. OSi MasterMap. The area within the Model Boundary not included in Flood Zone A or Flood Zone B will be classified as Flood Zone C.

Figure 11: Flood Zoning in proposed development area with plus 95% Confidence Interval



Source: Mott MacDonald, 2019. OSi MasterMap. The area within the Model Boundary not included in Flood Zone A or Flood Zone B will be classified as Flood Zone C.

Appendices

A. Hydrology analysis – details

The hydrological analysis for the River Laskiltagh has been carried out using the FSU Web Portal. The IOH 124 method has been used as an additional hydrological method for comparison. The details of the applied analyses are described in the following sections.

A.1 FSU Web Portal hydrological analysis

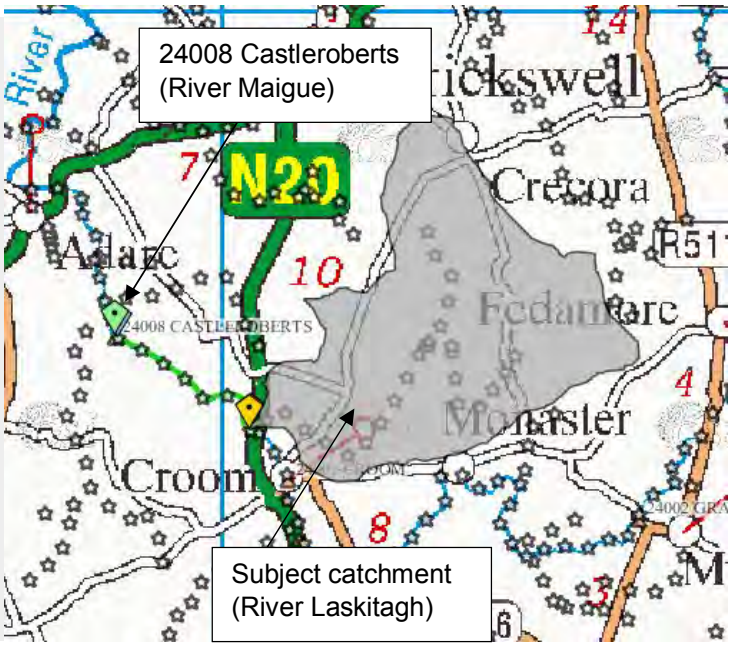
A.1.1 Subject catchment

The design flood flows have been calculated for the area of catchment of the River Laskiltagh, upstream of the confluence with the River Maigue (Irish Grid Reference 150557, 141994). This is deemed appropriate as the subject site is located close to the confluence with the River Maigue.

The extent of the subject catchment, as defined inside the FSU Web Portal, together with the Physical Catchment Descriptors (PCD) are displayed in Figure 12.

Figure 12: Catchment boundary of the River Laskiltagh

Location Number	24_1120_11
Contributing Catchment Area	25.677 km^2
BFISOIL	0.7163
SAAR	895.18 mm
FARL	0.966
DRAIND	0.582 km/km^2
S1085	2.6116 m/km
ARTDRAIN2	0.8094
URBEXT	0.0052
Centroid distance	369.5231 km
Coordinates	[150556.9984, 141993.9992]
QMED values	
PCD estimate	2.9558m^3/s
PCD urban estimate	2.9786m^3/s



Source: FSU Web Portal (

A.1.2 QMED

To estimate the QMED at the ungauged subject site, the 24008 Castleroberts pivotal site has been selected, which is geographically the closest and is located at the River Maigue downstream of the confluence with the River Laskiltagh. The location of the Castleroberts gauge is shown in Figure 12 above.

The pivotal site properties and QMED values as returned by the FSU Web Portal are shown Figure 13.

Figure 13: Pivotal site (24008 Castleroberts) – properties and QMED values from FSU

Pivotal site candidate properties	
Station Number	24008
Contributing Catchment Area	806.0444 km^2
BFISOIL	0.535
SAAR	939.47 mm
FARL	0.999
DRAIND	1.075 km/km^2
S1085	2.1395 m/km
ARTDRAIN2	0.52
URBEXT	0.0069
Centroid distance	21.6947 km
Hydrological similarity	3.0462
$QMED_{rural}$ values and confidence	
Pivotal gauged	119.125m^3/s
Pivotal PCD rural	124.085m^3/s
Pivotal PCD urban	125.356m^3/s
Subject PCD estimate	2.9558m^3/s
68% upper bound	4.0494m^3/s
68% lower bound	2.1575m^3/s
95% upper bound	5.5477m^3/s
95% lower bound	1.5748m^3/s
Status	

Source: FSU

The QMED estimation at the pivotal site has been further refined using additional data sources as agreed with the OPW. These included the following:

- The Annual Maxima (AM) series from the FSU Web portal has been extended using the Hydro-Data website[7] from 2005-2017, providing additional 13 years of data.
- The OPW confirmed that the channel bed and banks at the gauging station were re-graded in September 1990, therefore a revised rating has been applied to re-calculate the AMAX series from 1990. The new rating curves are presented in the CFRAM study[8] and revise the flow above 80m^3/s significantly. The new rating curves are presented in Figure 14.

The comparison of the FSU / revised AMAX series and QMED values are provided in Table 5 and Table 6.

[7] http://waterlevel.ie/hydro-data/stations/24008/station.html?1558515354

[8] https://s3-eu-west-1.amazonaws.com/docs.floodinfo.opw/floodinfo_docs/Shannon_CFRAM/UOM24/01_Hydrology/TD_HYDO_0372_Final_V2_0_JAC_HydrologyRpt_UoM24_160705_MainReport.pdf

Figure 14: 24008 – Maigue at Castleroberts – revised rating equations

Q = 49.61(W-0.5890)^1.677.	for the range: 0.700≤x<1.750m (above Gauge Zero)*
Q = 12.657(W+0)^2.8759	for the range: 1.750≤x<2.334m (above Gauge Zero)
Q = 5.8956(W+0)^3.7775	for the range: 2.334≤x<2.713m (above Gauge Zero)
Q = 2.2853(W+0)^4.7271	for the range: 2.713≤x<2.990m (above Gauge Zero)

Source: CFRAM Study

Table 5: FSU / Revised AMAX

Year	FSU AMAX	Revised AMAX	Year	FSU AMAX	Revised AMAX
1975	131.81	131.81	1997	118.5	133.73
1976	119.72	119.72	1998	165.5	230.75
1977	53.9	53.9	1999	109.2	120.62
1978	86.3	86.3	2000	156.1	208.47
1979	96.9	96.9	2001	112.7	125.43
1980	109.2	109.2	2002	96.9	104
1981	81.1	81.1	2003	92.1	97.66
1982	133.1	133.1	2004	130	152.29
1983	160.1	160.1	2005		119.04
1984	86.3	86.3	2006		115.93
1985	148.3	148.3	2007		174.02
1986	130.6	130.6	2008		162
1987	131.8	131.8	2009		139.22
1988	162.8	162.8	2010		132.04
1989	194.9	194.9	2011		127.88
1990	93.7	99.75	2012		115.00
1991	94.8	101.15	2013		218.77
1992	83.2	86.39	2014		107.20
1993	123.3	140.62	2015		173.49
1994	164.1	227.46	2016		129.21
1995	117.4	132.04	2017		104.15
1996	144.4	182.21			

Table 6: FSU / Revised QMED

Parameter	FSU Value	Revised value
Pivotal site		
QMED Pivotal gauged	**119.125**	**130.6**
QMED Pivotal PCD rural	124.085	124.085
QMED PCD urban	125.356	125.356
Pivotal adjfac	0.9503	1.0418
Subject site		
QMED Subject rural	2.9558	2.9558
QMED Subject urban	2.9786	2.9786
QMED Subject adjusted	2.8305	3.1032
QMED Subject adjusted (95% Confident Interval)	5.5477	6.0823

A.1.3 Growth curve

The growth curve at the subject site has been derived using a pooling group analysis inside the FSU Web Portal. The Euclidean scheme and GEV distribution have been applied, as per FSU guidance. The pooling group has been set up for the 100yr flood return period, using 500 year of pooled data. No further changes to the default selection of donors has been deemed necessary. The generated pooling group and growth curve are presented in Figure 15 and Figure 16.

The estimated growth factors for both, the 1% AEP (or 1 in 100yr) and 0.1% AEP (or 1 in 100yr) flood events, have been based on the above pooling group and are of 2.22 and 2.86 respectively.

The summary of the final peak flood is provided in Table 7.

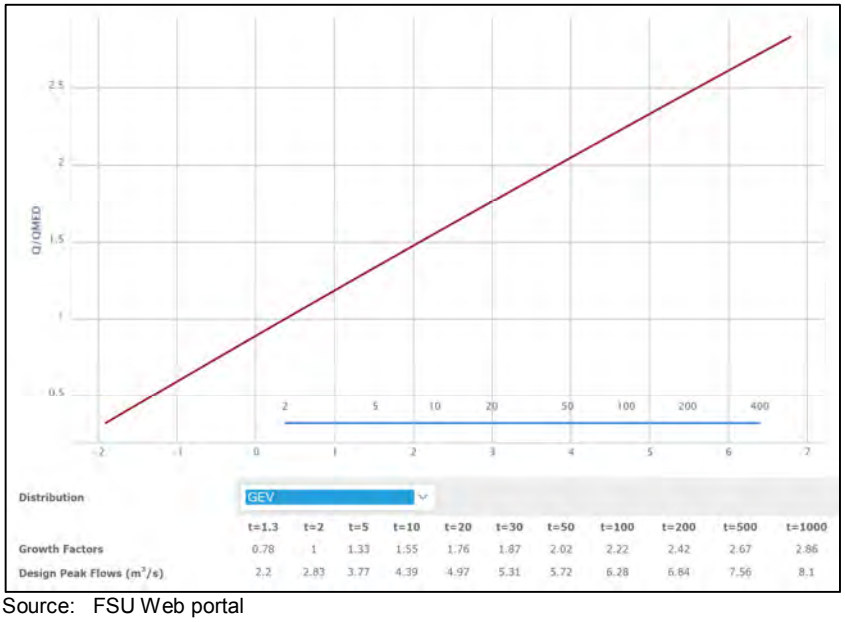
Figure 15: Pooled analysis

Station	Euclidean DIST(ij)	# years in FSU database	Cumulative # station-years
16051	0.347	13	13
25040	0.773	19	32
10021	0.801	24	56
09035	0.803	9	65
25034	0.866	26	91
26058	0.898	24	115
14009	0.943	25	140
09002	1.053	25	165
10022	1.092	17	182
08002	1.119	21	203
13002	1.141	19	222
26022	1.201	33	255
06031	1.24	18	273
25023	1.261	33	306
07001	1.411	18	324
14007	1.42	24	348
14013	1.423	49	397
24022	1.423	20	417
25025	1.456	31	448
06026	1.47	46	494
25027	1.496	42	536
26018	1.506	48	584
16001	1.525	33	617
09010	1.563	19	636
08012	1.572	19	655
25014	1.648	54	709

Legend: Pooled Auxiliary Selected

Source: FSU Web portal

Figure 16: Final growth curve



Source: FSU Web portal

The estimated final flood peak flows are presented in Table 7.

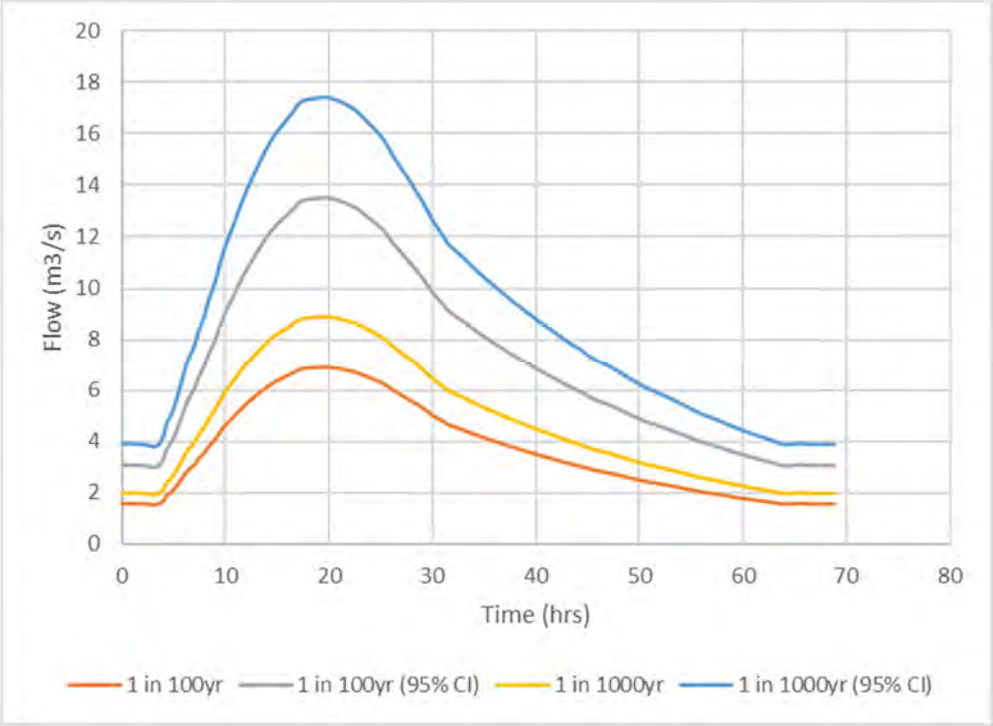
Table 7: Final flood flows summary

Design flood	QMED	Growth factor	Peal flood flow (m3/s)
1% AEP (1 in 100 year)	3.1032	2.22	6.889
0.1% AEP (1 in 1000 year)	3.1032	2.86	8.875
1% AEP (1 in 100 year), 95% Confidence Interval	6.0823	2.22	13.503
0.1% AEP (1 in 1000 year), 95% Confidence Interval	6.0823	2.86	17.395

A.1.4 Hydrograph width

The hydrograph shape from the previous 2017 hydraulic model[9] has been used. The hydrograph is in line with the CFRAM Study. The hydrograph has then been scaled up to match the latest flood peaks as shown in Figure 17, with a tabular summary in Table 8.

Figure 17: Flood hydrographs for River Laskiltagh



[9] 356664SA_01C Croom Distributor Road, Flood Risk Modelling, by Mott Macdonald, 26 Sep 2017

Table 8: Flood hydrographs for River Laskiltagh

Time	1 in 100yr flood	1 in 100yr (95% CI)	1 in 1000yr	1 in 1000yr (95% CI)
0	1.558226	3.05425	2.00744	3.934583
2.05	1.544558	3.027458	1.989831	3.900069
3.32	1.51722	2.973875	1.954613	3.831042
3.99	1.653907	3.241792	2.130704	4.176181
4.32	1.858937	3.643667	2.394841	4.693889
4.87	2.036629	3.991958	2.62376	5.142569
5.26	2.22799	4.367042	2.870288	5.625764
5.81	2.5287	4.956458	3.257688	6.385069
6.31	2.815742	5.519083	3.62748	7.109861
7.03	3.089115	6.054917	3.979663	7.800139
7.42	3.307813	6.483583	4.261409	8.352361
7.97	3.540181	6.939042	4.560764	8.939097
8.42	3.799885	7.448083	4.895337	9.594861
9.03	4.073258	7.983917	5.24752	10.28514
9.58	4.401306	8.626917	5.670139	11.11347
10.13	4.674679	9.16275	6.022321	11.80375
10.8	4.948052	9.698583	6.374504	12.49403
11.52	5.262431	10.31479	6.779514	13.28785
12.24	5.535804	10.85063	7.131696	13.97813
13.01	5.795508	11.35967	7.46627	14.63389
13.79	6.055212	11.86871	7.800843	15.28965
14.73	6.314917	12.37775	8.135417	15.94542
15.61	6.492609	12.72604	8.364335	16.3941
16.5	6.670302	13.07433	8.593254	16.84278
17.33	6.834325	13.39583	8.804563	17.25694
18.77	6.889	13.503	8.875	17.395
20.21	6.889	13.503	8.875	17.395
22.26	6.738645	13.20829	8.6813	17.01535
23.75	6.519946	12.77963	8.399554	16.46313
25.19	6.273911	12.29738	8.082589	15.84188
26.25	5.986869	11.73475	7.712798	15.11708
27.57	5.67249	11.11854	7.307788	14.32326
28.9	5.344442	10.47554	6.885169	13.49493
30.07	5.002726	9.80575	6.44494	12.63208
31.06	4.770359	9.350292	6.145585	12.04535
31.56	4.647341	9.109167	5.987103	11.73472
32.67	4.483317	8.787667	5.775794	11.32056
33.94	4.291956	8.412583	5.529266	10.83736
35.05	4.127933	8.091083	5.317956	10.42319
36.77	3.895565	7.635625	5.018601	9.836458

Time	1 in 100yr flood	1 in 100yr (95% CI)	1 in 1000yr	1 in 1000yr (95% CI)
38.15	3.717873	7.287333	4.789683	9.387778
39.48	3.553849	6.965833	4.578373	8.973611
40.64	3.417163	6.697917	4.402282	8.628472
41.86	3.280476	6.43	4.22619	8.283333
43.02	3.14379	6.162083	4.050099	7.938194
44.3	3.020772	5.920958	3.891617	7.627569
45.57	2.870417	5.62625	3.697917	7.247917
47.18	2.747399	5.385125	3.539435	6.937292
49	2.569706	5.036833	3.310516	6.488611
50.66	2.419351	4.742125	3.116815	6.108958
52.44	2.296333	4.501	2.958333	5.798333
54.04	2.173315	4.259875	2.799851	5.487708
55.87	2.02296	3.965167	2.606151	5.108056
57.48	1.92728	3.777625	2.482887	4.866458
59.25	1.804262	3.5365	2.324405	4.555833
60.91	1.708581	3.348958	2.201141	4.314236
62.68	1.612901	3.161417	2.077877	4.072639
63.95	1.544558	3.027458	1.989831	3.900069
65.34	1.558226	3.05425	2.00744	3.934583
67.11	1.544558	3.027458	1.989831	3.900069
68.83	1.544558	3.027458	1.989831	3.900069

A.2 IOH 124 Method

The Institute of Hydrology Report No. 124 provided a method for estimation of flood flows in the small rural catchments up to 25km^2. The method has been applied as a second independent method, however, it has been considered less reliable due to this method not providing an extension of the growth curve to the 1000 year return period and therefore, not used in the further analysis.

The input parameters are presented in Table 9, the FSR growth curve for Ireland has been applied

Table 9: Input parameters for IOH 124 Method

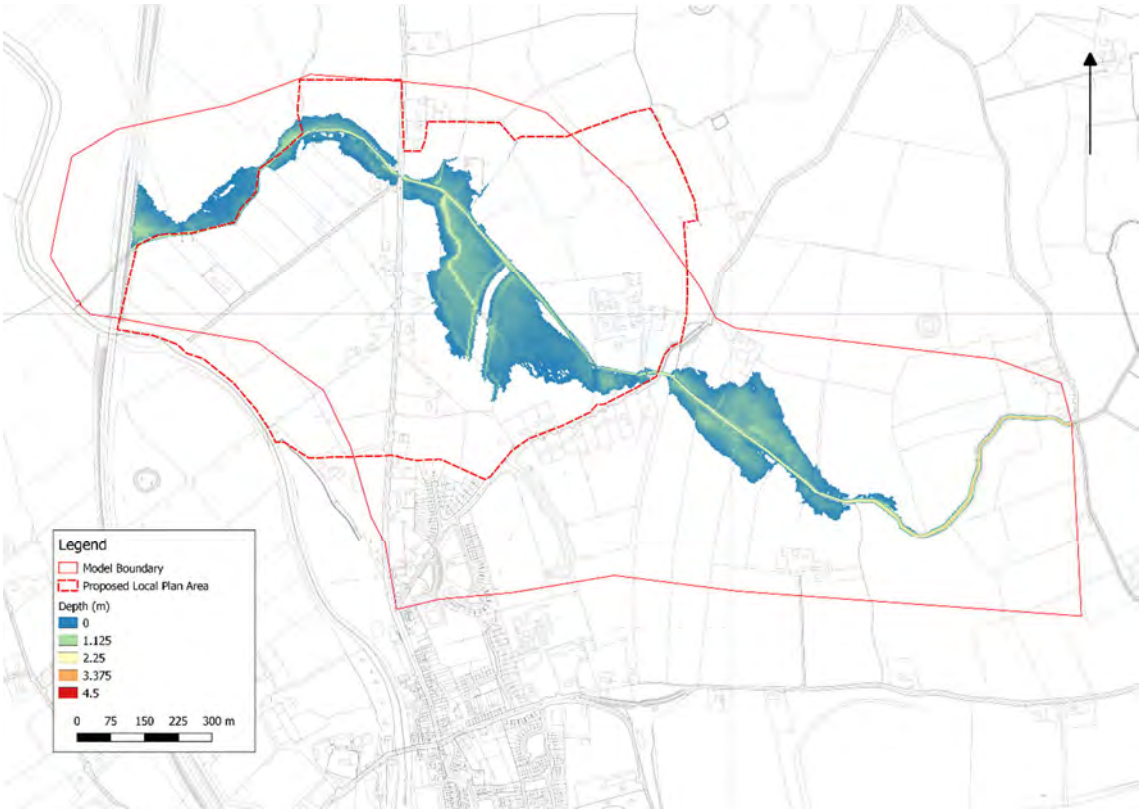
Parameter	Value
Catchment area (km2)	25.677
SAAR4170 (mm)	895
SOIL	0.45
WRAP class	1 in Class 4
URBAN	0.0052

The IOH 142 Method estimated the 1% AEP (or 1 in 100yr) flood event or 19.07m^3/s. The method does not provide an extension of the growth curve to the 0.1% AEP (or 1 in 1000yr) flood event.

B. Hydraulic Model

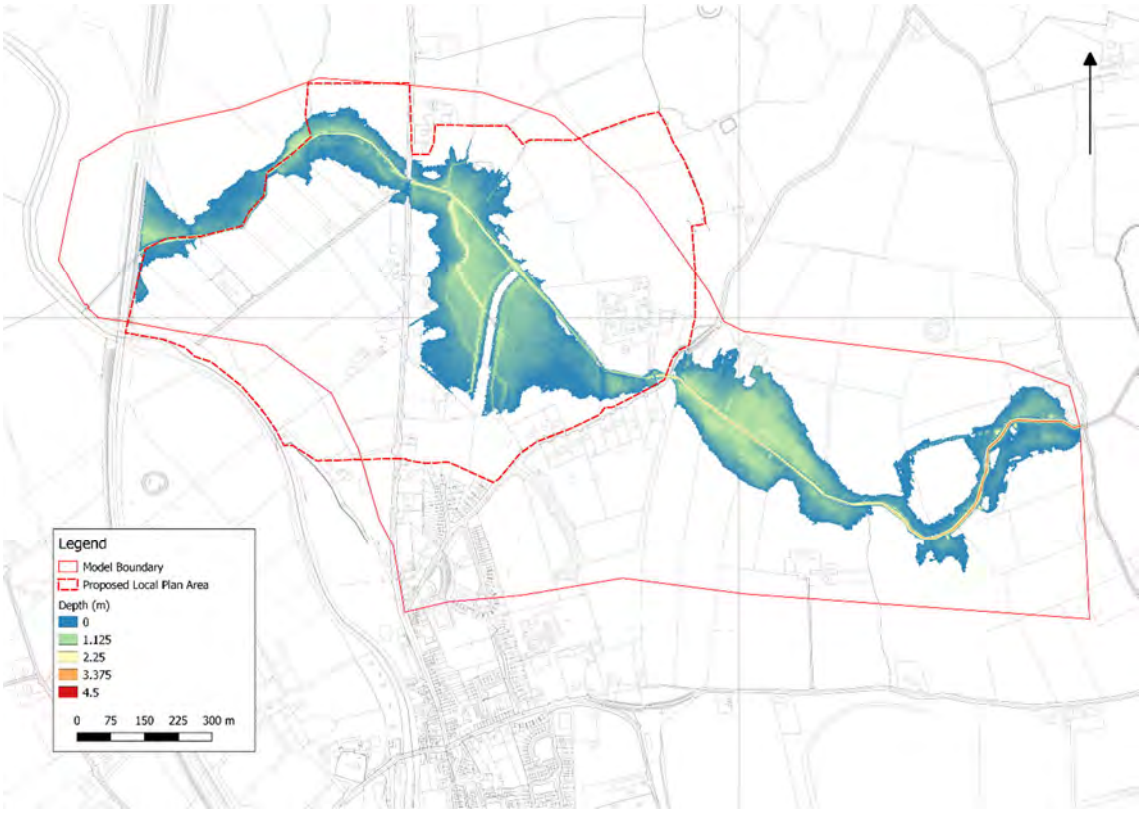
B.1 Depth Flood Maps

Figure 18: Depth 100 year return period



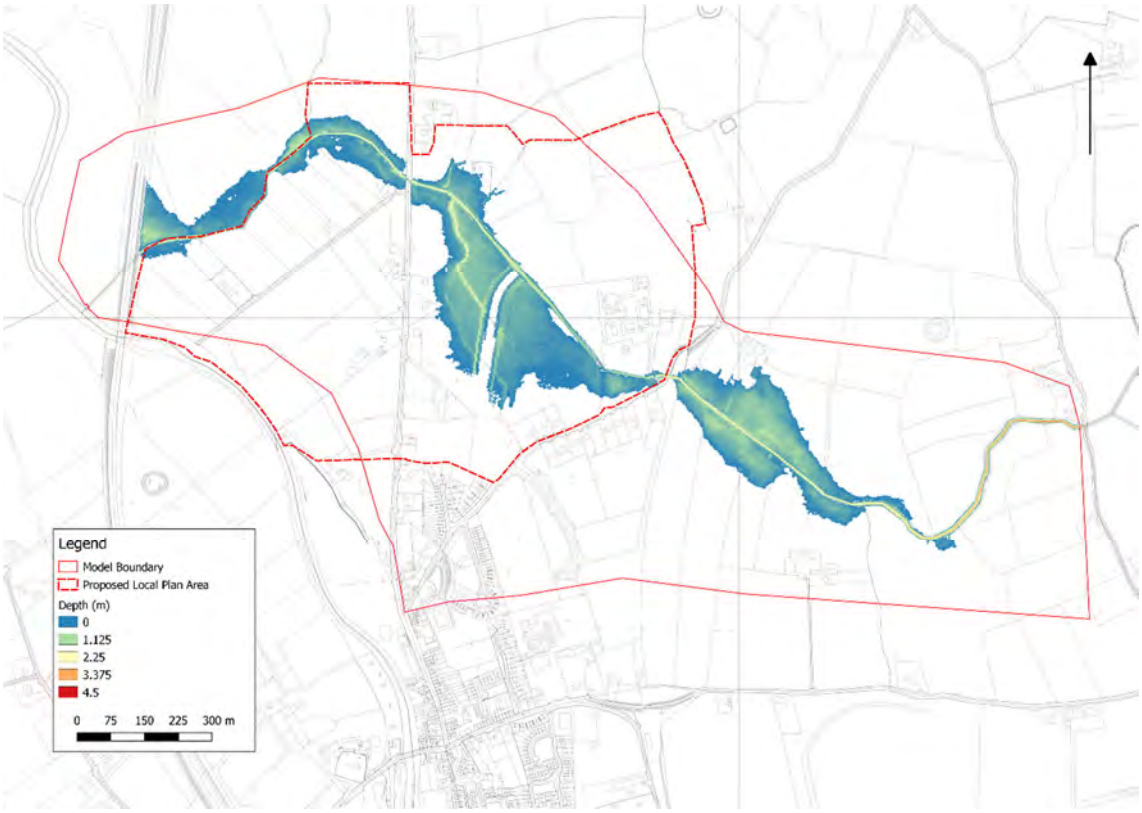
Source: Mott MacDonald, 2019. OSi Mastermap.

Figure 19: Depth 100 year return period plus 95% confidence Interval



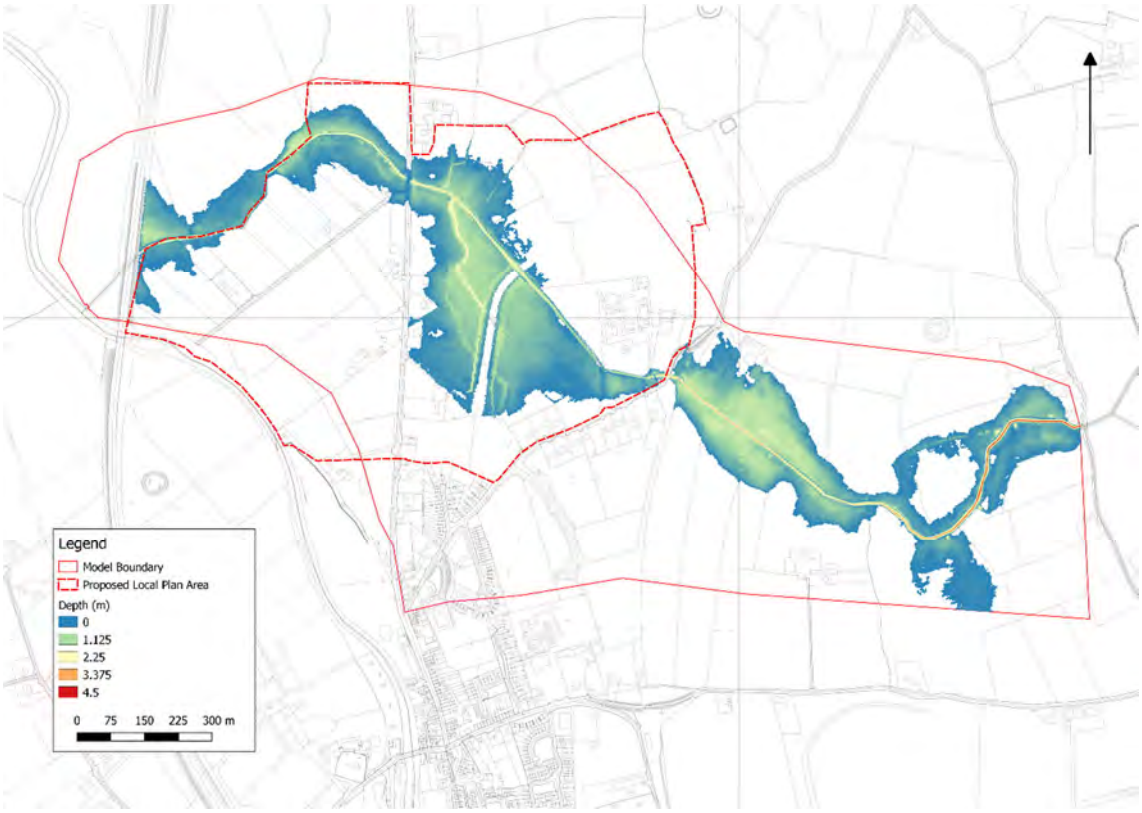
Source: Mott MacDonald, 2019. OSi Mastermap.

Figure 20: Depth 1000 year return period



Source: Mott MacDonald, 2019. OSi Mastermap.

Figure 21: Depth 1000 year return period plus 95% confidence Interval



Source: Mott MacDonald, 2019. OSi Mastermap.