



## Appendix D – Cumulative Impact Assessment

*This appendix provides a summary of the catchments where the level of flood risk and development pressures mean they could potentially be affected by cumulative impacts and identifies recommendations for local planning policy for Maldon district, so the impacts are addressed.*

### 1 Background

#### 1.1 Introduction

The cumulative impact of development should be considered at both the local plan making, planning application and development design stages. Where necessary appropriate mitigation measures should be implemented so flood risk is not exacerbated, and where possible the development should be used to reduce existing flood risk issues.

To understand the cumulative impact of future development on flood risk in Maldon, catchments have been identified where development may have the greatest potential effect on flood risk, and where further assessment would be required within a Level 2 Strategic Flood Risk Assessment (SFRA) or site-specific Flood Risk Assessment (FRA). The potential change in developed area within each catchment and communities' sensitivity to combined fluvial and pluvial flood risk, alongside the coverage of historic flooding events were considered to identify catchments at greatest susceptibility to increased flood risk as a result of development. Where catchments have been identified as sensitive to the cumulative impact of development, the assessment concludes with strategic planning policy recommendations to manage the risk.

#### 1.2 Strategic flood risk policy

The Maldon District Local Development Plan (approved in 2017) is currently under review. The current plan establishes the strategy for the route to future development and growth between the plan period 2014 to 2029, aiming to produce sustainable development throughout the district through the improvement of infrastructure, social aspects of society and maintaining the natural environment to limit the contribution to and the effects of climate change, in turn reducing overall flood risk in Maldon in future years.

The North Essex and South Essex Catchment Flood Management Plans (CFMPs) have established methodologies for directing flood risk management throughout the study areas by dividing the regions into catchment areas, categorising them based on levels of flood risk and types of flood risk, before applying a policy to the region based on these characteristics.

Within the regions covering the study area, the general actions suggested for consideration include the exclusive construction of appropriate developments in areas of flood risk, to minimise flood risk for residents in the region.

Further specific suggestions for developments include:

- Developing improved emergency response plans for future essential infrastructure.
- Maintain a consistently high standard of maintenance at water storage facilities (reservoirs) throughout the region.
- Develop improved flood risk studies to determine level of risk for select areas in North Essex.



- Improve flood forecasting systems to give greater foresight and preparation time against flood events.
- Identify areas where bank and channel maintenance can be reduced, to improve the river flow and increase water storage on nearby floodplains.

The Environment Agency (EA) use CFMPs as a method of guiding future investment decisions, in addition to conducting projects and actions.

### **1.3 Assessment of Cross-Boundary Issues**

The topography of Maldon is predominantly dominated by lowland characteristics and is primarily comprised of the catchments of the Rivers Blackwater, Crouch and Chelmer. The topography directs the flow in most of the watercourses from the west of Maldon district to the east, from the higher topography of Danbury at approximately 105m AOD to the Blackwater and Crouch estuaries.

The River Blackwater enters Maldon district from the north of the region at Kelvedon, approximately 9km north of Heybridge. The Blackwater flows around the northwest extent before passing through Heybridge and joining the River Chelmer as the Blackwater Estuary, flowing into the North Sea to the east.

The River Chelmer enters Maldon from the west, 3km east of Langford and flows east through Maldon, to merge with the River Blackwater 8km downstream at Heybridge Basin.

The River Crouch enters the region at the southwestern extent, flowing east directly south of North Fambridge and Burnham-on-Crouch, before discharging into the North Sea in the east.

There are additional watercourses which join the Blackwater estuary, with the most prominent Lawling Creek originating in the area surrounding Maylandsea, in the centre of the Maldon district, extending 3.5km northeast to merge with the Blackwater downstream. A map of the watercourses within the district is provided as Figure 1-2 of the main SFRA report.

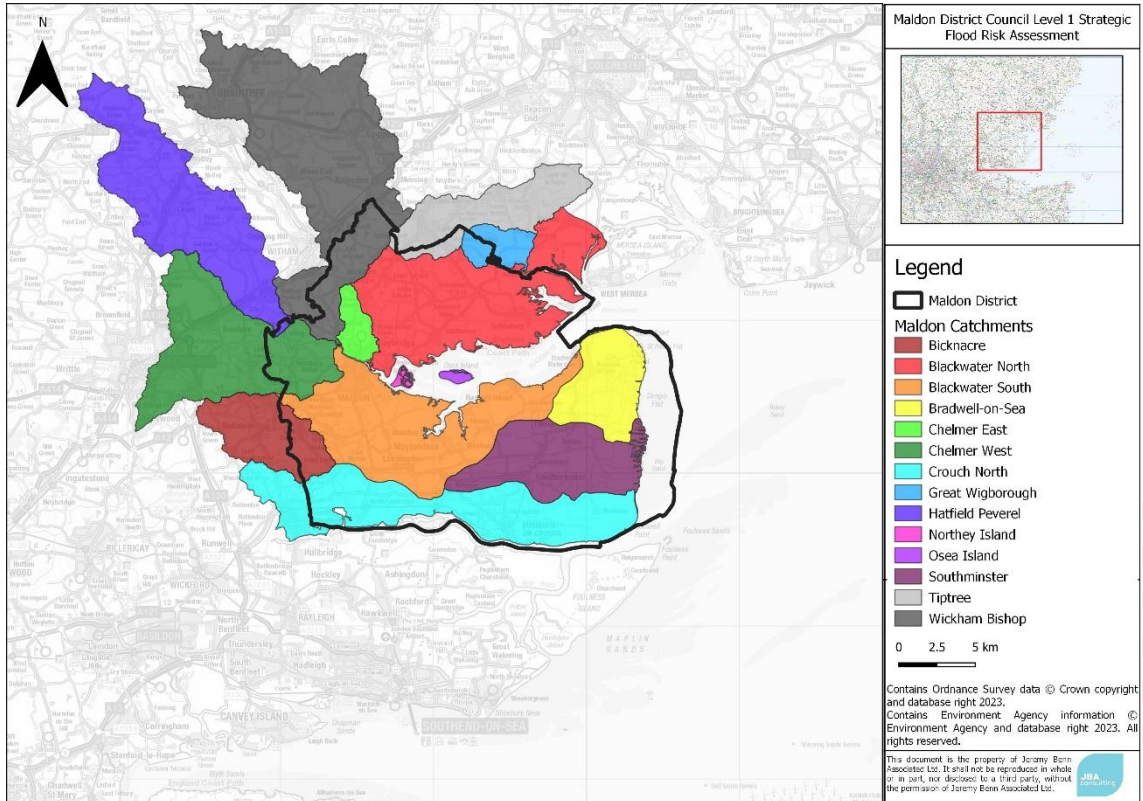
Due to the network of existing watercourses, future development both within and outside of Maldon district has the potential to affect flood risk to existing development and surrounding areas.

Development control should ensure that the impact on receiving watercourses from development in the immediate vicinity has been considered appropriately during the planning stage and appropriate development management decisions are made so there is no adverse impact on flood risk or water quality. All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, provided the developments near watercourses in neighbouring authorities comply with the latest guidance and legislation relating to flood risk and sustainable drainage, the effects of development should result in no increase in flood risk within the area. In preparing the SFRA the neighbouring authorities were contacted for information on their site allocations, to understand where development in neighbouring authorities may contribute to flood risk in Maldon.

The following Local Plans have been adopted by neighbouring local authorities and include policies relevant to flood risk and drainage:

- Braintree District Local Plan 2033
- Colchester Local Plan 2017-2033
- Chelmsford Local Plan 2013-2036

The Water Framework Directive (WFD) river catchments defined in the River Basin Management Plans in combination with LIDAR data were used to divide Maldon into manageable areas on which to base the cumulative impact assessment. These catchments are illustrated in Figure D-1.



**Figure D-1: Catchments within Maldon district**



## 2 Cumulative Impact Assessment

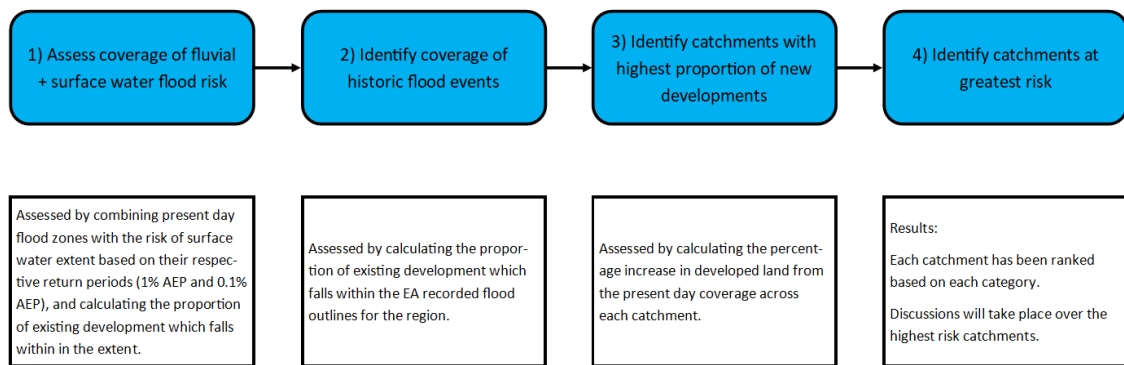
### 2.1 Cumulative Impact Assessment Methodology

This broadscale assessment determines where the potential cumulative impact of development may have the greatest effect on flood risk across the study area. Catchments within the study area were ranked using the following metrics:

- Sensitivity to increased risk of surface water and fluvial flooding
- Prevalence of recorded flooding incidences
- Area of new development proposed within the catchment

Analysis of this data facilitated the identification of catchments at the greatest potential risk of cumulative impacts.

Figure D-2 illustrates the methodology used in this assessment.



**Figure D-2: Overview of the methodology used in the Cumulative Impact Assessment**

To identify which catchments are more sensitive to cumulative impacts, each catchment was given a ranking for each of the three metrics. The results for each assessment were then ranked into three categories: High, Medium, and Low, as shown in Table D-1.

The ranking results were combined from all three assessments to give an overall High, Medium and Low ranking for each catchment within the district. Ranking delineations were given at natural breaks in the results.

**Table D-1: Ranking assessment criteria**

Risk ranking	% of properties at risk due to an increase in flood risk over time	Coverage of historic flood extents	% Area of Catchment covered by new development
Low risk	≤25%	≤5%	≤5%
Medium risk	25-50%	5-15%	5-15%
High risk	>50%	>15%	>15%



### 2.1.1 Susceptibility to combined risk of surface water and fluvial flooding

Predicted flood risk was assessed using following:

- The area of the OS Zoomstack District building layer (building coverage supplied by Ordnance Survey at the district scale) within the merged 1% AEP surface water flooding extent and Flood Zone 3a for each catchment.
- The area of the OS Zoomstack District building layer within the merged 0.1% AEP surface water flooding extent and Flood Zone 2 for each catchment.

The difference in the area at risk in these two datasets has then been used as an indicator to identify which catchments are more sensitive to increases in flooding.

### 2.1.2 Historic flood risk

A historic flood risk score was derived for each catchment within the study area using the total area of the OS Zoomstack District building layer within the Environment Agency's Recorded Flood Outlines in each catchment.

### 2.1.3 Increase in developed area

Development within Maldon itself does not have the potential to directly affect flood risk in neighbouring authorities, as the Rivers Blackwater, Crouch and Chelmer drain from the area into the North Sea, although may still increase risk downstream within Maldon.

Proposed development areas in the surrounding districts of Braintree, Colchester, Chelmsford and Rochford were supplied by the respective Councils.

Tendring District Council were also approached with requests for this information, however did not provide a response. Therefore, proposed developed areas in the district of Tendring have been derived from their Strategic Housing Land Availability Assessment (SHLAA)<sup>1</sup>, October 2022. Data from Appendix 7 of the document does not indicate the presence of proposed development sites within the catchments identified as part of this assessment.

This information has been used to calculate the overall increase in development from the existing scenario to identify catchments likely to be under the greatest pressure for development. The context for this being that in circumstances where the proportion of proposed new development is greater, then it is more likely to give rise to cumulative effects.

It should be noted that it was assumed that all sites and the entirety of the site footprint would be developed.

### 2.1.4 Sources of information

A summary of the datasets used to inform the CIA is provided in Table D-2.

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<sup>1</sup> [https://www.tendringdc.gov.uk/sites/default/files/documents/planning/Planning\\_Policy/SHLAA%20October%202022.pdf](https://www.tendringdc.gov.uk/sites/default/files/documents/planning/Planning_Policy/SHLAA%20October%202022.pdf)



**Table D-2 Summary of datasets used within the Maldon Cumulative Impact Assessment**

Dataset	Coverage	Source of Data	Use of Data
Catchment Boundaries	Maldon district + surrounding districts	Water Framework Directive Catchments amended to reflect LiDAR	Identifying extent of catchments areas surrounding the Maldon district
Risk of Flooding from Surface Water	Maldon district + surrounding districts	Environment Agency RoSFW mapping	Assessing coverage of surface water flood extents at existing buildings in each catchment area
Fluvial Flood Zones 2 and 3	Maldon district + surrounding districts	Environment Agency Flood Zone mapping	Assessing coverage of flood zones at existing buildings in each catchment area
EA Recorded Flood Outlines	Maldon district + surrounding districts	Environment Agency Recorded Flood Outlines dataset	Assessing coverage of historic flood events at existing buildings in each catchment area
OS Zoomstack District Buildings	Maldon district + surrounding districts	Defra	Identifying existing buildings in each catchment
Identified coded sites	Maldon district	Maldon District Council	Identifying proposed development sites in Maldon
Allocated sites in neighbouring authorities	Surrounding districts	Braintree District Council, Colchester City Council, Chelmsford City Council and Rochford Council	Identifying proposed development sites in surrounding authorities

**2.1.5 Assumptions**

The assumptions made when conducting the cumulative impact assessment are shown in Table D-3.

**Table D-3: Assumptions**

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water and fluvial/tidal flood risk	Total area of properties flooded	Assumption that all properties have been included in the OS Zoomstack District Buildings dataset. It may not include all new build properties.	Most up to date and best data available.
Surface water and fluvial/tidal flood risk	Total number of properties flooded	Assumption made that all buildings included within the OS Zoomstack District buildings dataset are susceptible to flooding	Considered a conservative approach to assessment given the level of detail required.



		(i.e. not water compatible, etc.).	
Sites of proposed development	Total area of proposed development in each catchment area	Assumption that data supplied comprises the most recent version of proposed sites dataset.	Most up to date and best available data.
Sites of proposed development	Total area of proposed development in each catchment area	Sites in Tendring have been based on the SHLAA in the absence of any response from Tendring District Council.	Most up to date and best available data.
Level of growth	All proposed development will go forwards	All proposed development considered to be progressed for the purposes on the CIA.	Most up to date and best available data. Conservative approach to assessment.
Level of growth	All proposed development sites will be	All proposed development sites have been assumed to be developed totally (100% impermeable) for the purpose of the CIA	Most up to date and best available data. Conservative approach to assessment.
Island catchments	-	Island catchments included within assessment but perhaps are not as susceptible to cumulative risks due to their size. Areas of flood risk are also predominantly tidal in these locations.	Important to include all catchments within the assessment. However, when analysing the CIA scores and rankings, island catchments should be considered with their size and the source of flood risk in mind.

## 2.2 Cumulative Impact Assessment

### 2.2.1 Sensitivity to increase in fluvial and pluvial flood risk

The difference in area of existing development within the combined Flood Zone 3a and RoFSW 1% AEP extent and the combined Flood Zone 2 and RoFSW 0.1% AEP extent was calculated as a percentage to provide the percentage of development area at risk of flooding due to an increase in flood risk over time. Percentage increases of <25% indicate low risk, percentage values from 25-50% indicate medium risk and percentages of >50% indicate areas of high risk.

**Table D-4 Percentage of existing buildings at risk of flooding due to an increase in flood risk over time**

Catchment	Percentage of properties at risk	Rank	Category
Chelmer West	71%	14	High
Chelmer East	13%	2	Low
Northey Island	0%	1	Low
Osea Island	57%	9	High
Blackwater North	28%	7	Med
Blackwater South	24%	4	Low
Southminster	36%	8	Med
Bradwell-on-Sea	26%	6	Med
Crouch North	25%	5	Low
Bicknacre	60%	10	High
Great Wigborough	17%	3	Low
Wickham Bishop	67%	11	High
Hatfield Peverel	71%	13	High
Tiptree	70%	12	High

### 2.2.2 Coverage of historic flooding

The proportion of each catchment covered by recorded historic flood extents was calculated to provide a broadscale understanding of historic flood risk. Percentage coverages from <5% indicate low risk, percentage values from 5-15% indicate medium risk and percentages of >15% indicate areas of high risk.

**Table D-5 Percentage of existing buildings within historic flood extents by catchment**

Catchment	Percentage coverage	Rank	Category
Chelmer West	1%	5	Low
Chelmer East	23%	13	High
Northey Island	100%	14	High
Osea Island	2%	9	Low
Blackwater North	3%	10	Low
Blackwater South	1%	8	Low
Southminster	0%	4	Low
Bradwell-on-Sea	8%	12	Med
Crouch North	4%	11	Low
Bicknacre	0%	1	Low
Great Wigborough	1%	7	Low
Wickham Bishop	1%	6	Low
Hatfield Peverel	0%	1	Low



Catchment	Percentage coverage	Rank	Category
Tiptree	0%	1	Low

### 2.2.3 Increase in developed area

Maldon District Council and neighbouring authorities provided a list of likely new development sites. Using this information, the total area of new development in each catchment was measured as a percentage of its catchment area. A percentage increase of 0-50% indicates low risk, 51-100% indicates medium risk, and an increase of >100% indicates high risk.

**Table D-6 Changes in areal extent of developed areas by catchment**

Catchment	Percentage increase in development area	Rank	Category
Chelmer West	97%	9	Med
Chelmer East	85%	8	Med
Northey Island	0%	1	Low
Osea Island	0%	1	Low
Blackwater North	130%	12	High
Blackwater South	131%	13	High
Southminster	116%	11	High
Bradwell-on-Sea	0%	1	Low
Crouch North	229%	14	High
Bicknacre	12%	5	Low
Great Wigborough	20%	6	Low
Wickham Bishop	99%	10	Med
Hatfield Peverel	72%	7	Med
Tiptree	5%	4	Low

### 2.3 Overall rankings

As can be seen from the above tables, there are catchments that are potentially at high risk in multiple categories. Rankings from each assessment have been combined to give an overall ranking. A Red-Amber-Green (RAG) rating was then applied to the catchments, with red areas representing areas of higher risk, amber representing medium risk and green representing low risk. The results of the RAG assessment can be observed in Figure F-3. Scores of <20 represent areas of low risk, whilst scores of 20-25 indicate medium risk, and scores in excess of 25 represent areas of high flood risk.

**Table D-7: Overall catchment scores**

Catchment	Total score	Overall Rank	Category
Chelmer West	28	12	High
Chelmer East	23	8	Med
Northey Island	16	1	Low



Catchment	Total score	Overall Rank	Category
Osea Island	19	5	Low
Blackwater North	29	13	High
Blackwater South	25	10	High
Southminster	23	8	Med
Bradwell-on-Sea	19	5	Low
Crouch North	30	14	High
Bicknacre	16	1	Low
Great Wigborough	16	1	Low
Wickham Bishop	27	11	High
Hatfield Peverel	21	7	Med
Tiptree	17	4	Low

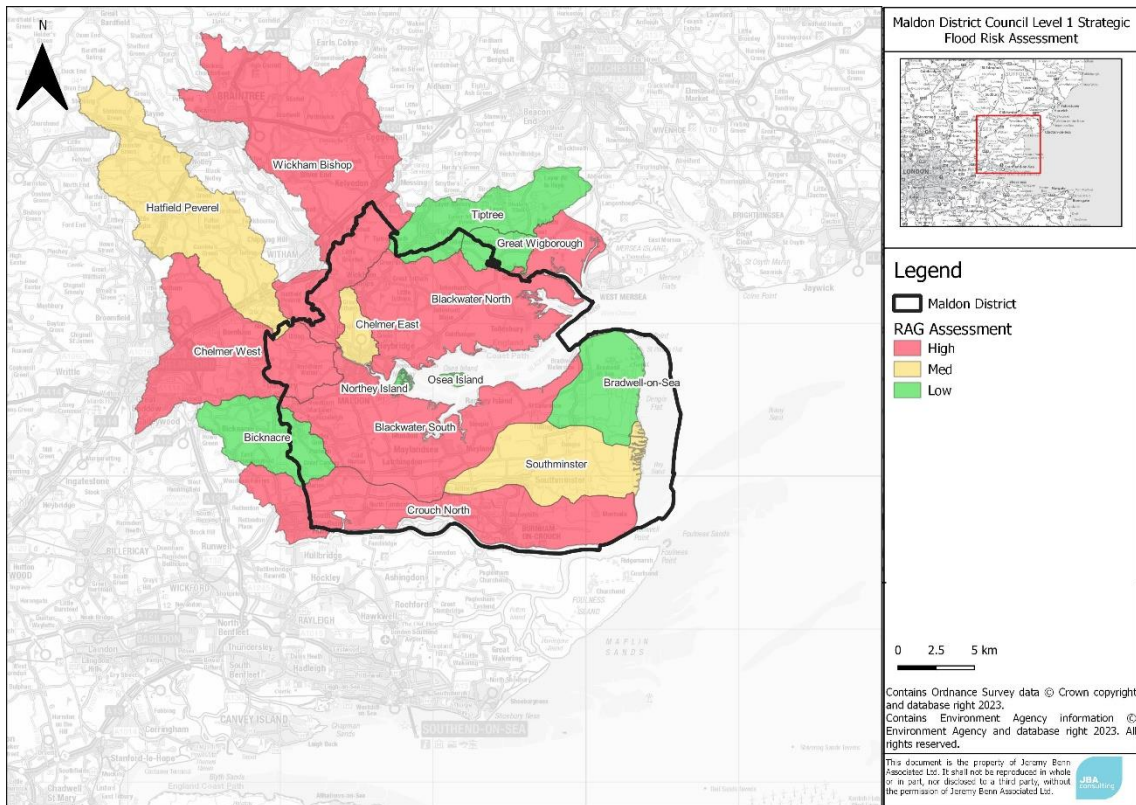


Figure D-3: Overall catchment scores



### 3 Policy Recommendations

#### 3.1 Broadscale Recommendations

The cumulative impact assessment for Maldon has identified that proposed developments within the catchment areas will potentially have a varied level of cumulative impact on flood risk. Catchments have been identified as high, medium, or low risk based on the number of historic flood events, sensitivity of existing development to increased flood risk, in addition to the percentage increase of proposed developments from the existing property coverage.

The following policy recommendations apply to all catchments within the study area:

- Maldon District Council should work closely with neighbouring local authorities to develop Local Planning Policies for catchments that drain into Maldon. This should be done to a) ensure that development in neighbouring authorities does not impact Maldon adversely, and b) identify upstream measures to help mitigate risk in Maldon.
- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance, and management on all major development sites. Details will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure where practicable. Developers should refer to the relevant LLFA guidance for the requirements for SuDS in Maldon district, including the Essex SuDS Design Guide. Further guidance on SuDS can be found in Section 10 of the main SFRA report.
- Essex County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major developments. These should consider all sources of flooding so future developments are resilient to flood risk and will not increase flood risk elsewhere.
- Where appropriate, the opportunity for Natural Flood Management in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should be opposed, and day-lighting existing culverts promoted through new developments.
- Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites) for all sites unless it can be demonstrated that this is not practicable. If it is demonstrated that greenfield rates are not practicable then the runoff rates should be restricted to the closest rate that is practicable. Developers should refer to the relevant LLFA guidance for the requirements for SuDS in Maldon.
- Development proposals in areas of flood risk or where the site area exceeds 1 ha should undertake a site-specific Flood Risk Assessment. Site-specific FRAs should explore opportunities to provide wider community flood risk benefit through new developments. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may be either by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors, and/ or by providing a Partnership Funding contribution towards flood alleviation schemes.



- Maldon District Council should consider requiring developers to contribute to community flood defences outside of their red line boundary to provide wider benefit and help offset the cumulative impact of development.

Section 8.3 of the main report details the local requirements for mitigation measures.

### 3.2 Development within Medium Risk Catchments

Catchments within Maldon which have scored an overall risk ranking of medium (Chelmer East, Southminster and Hatfield Peverel), where development proposals are present should also consider the following recommendations:

- Maldon District Council should work closely with the EA and Essex County Council to identify any areas of land that should be safeguarded for any future flood alleviation schemes and natural flood management features.
- There is the potential for development in these catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.

### 3.3 Development within High Risk Catchments

Catchments within Maldon that have scored an overall risk ranking of high include Chelmer West, Blackwater North, Blackwater South, Crouch North and Wickham Bishop. In addition to the recommendations for medium catchments, the following recommendations also apply to high risk catchments:

- Developers should include a "Construction" surface water management plan to support the Construction Drainage Phasing Plan. This should provide information to the EA, the LLFA and the LPA regarding the proposed management approach during the construction phase to address surface water management during storm events.
- The LLFA and LPA should consult with Local Non-For-Profit organisations such as wildlife trusts, rivers trusts and catchment partnerships to understand ongoing and upcoming projects where Natural Flood Management (NFM), flood storage and attenuation, and environmental betterment may be provided within the catchment in parallel with proposed development to contribute to reducing flood risk.
- Flood storage and betterment should be considered by developers as part of a site-specific assessment. In some cases more detailed modelling may be undertaken by the developer to ascertain the true storage needs and potential at each site at the planning application stage.
- Site-specific FRAs should include consideration of the potential cumulative effects of the proposed development on all sources of flood risk and how sensitive receptors may be affected. The sensitive receptors might be remote from proposed development sites and the assessments should consider the implications of all planned development with a catchment to understand the appropriate scale and scope of measures required and the contribution of the particular development proposals being considered.