Strategic Flood Risk Assessment Update

London Borough of Havering

Annex A - Growth Areas Review

B08600D2-L-03 | 03

21 November 2016

-

Document history and status

Revision	Date	Description	By	Review	Approved
01	26/08/16	For client review	M Aspin & M Leung	M Symons & M White	R Collins
02	07/11/16	For client review	M Aspin & M Leung	M Symons & M White	R Collins
03	21/11/16	Addresses client comments	M Aspin & M Leung	M Symons & M White	R Collins

Strategic Flood Risk Assessment Update

Project No:	B08600D2
Document Title:	Annex A - Growth Areas Review
Document No.:	B08600D2-L-03
Revision:	03
Date:	21 November 2016
Client Name:	London Borough of Havering
Client No:	-
Project Manager:	Richard Collins
Author:	Meryl Leung, Matt Aspin
File Name:	\\CROFIL01\MSData\Projects\Water\Clients\LB Havering\B08600D2-L Local Plan Support\900 Deliverables\904 SFRA Annex\v02\LBH L1 SFRA 2016 Update Annex A v03.docx

Jacobs U.K. Limited

Simpson House
6 Cherry Orchard Road
Croydon CR9 6BE
United Kingdom
T +44 (0)20 8686 8212
F +44 (0)20 8681 2499
www.jacobs.com

Contents

Supporting Figures

London Riverside	
A01	Flood Zones
A02	Fluvial Flood Depth
A03a-d	Tidal Flood Hazard, Depth, Level and Velocity
A04	Flood Warning / Onset of Flooding
A05	Flood Defences
A06	Surface Water Flood Risk
A07	Other Sources of Flood Risk
A08a	Climate Change (River Thames Sea Level Rise)
A08b	Climate Change (10% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A08c	Climate Change (15% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A08d	Climate Change (25% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A08e	Climate Change (35% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A08f	Climate Change (70% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
Romford Town Centre	
A09	Flood Zones
A10	Flood Depth
A11	Flood Warning / Onset of Flooding
A12	Flood Defences
A13	Surface Water Flood Risk
A14	Other Sources of Flood Risk
A15a	Climate Change (10% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A15b	Climate Change (15% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A15c	Climate Change (25% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A15d	Climate Change (35% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)
A15e	Climate Change (70% Uplift on Rivers Beam, Ingrebourne and Mardyke Model)

1. Introduction

1.1 Background

This annex accompanies the London Borough of Havering Updated Level 1 Strategic Flood Risk Assessment (SFRA) which incorporates new flood risk information and provides guidance on applying the updated guidance from the Environment Agency on the consideration of climate change for Flood Risk Assessments and SFRA's. The updated Level 1 SFRA provides the necessary information to apply the Sequential Test across Havering and support the Sustainability Appraisal when considering the allocation of development sites in the emerging Local Plan.

In line with the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG), the overall aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1, the allocation of land taking into account the flood risk vulnerability of the land use, development in Flood Zone 2 should be considered next, applying the Exception Test if required. Then, only if it can be demonstrated that there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test. The Exception Test is defined in the NPPF at paragraph 102 as:

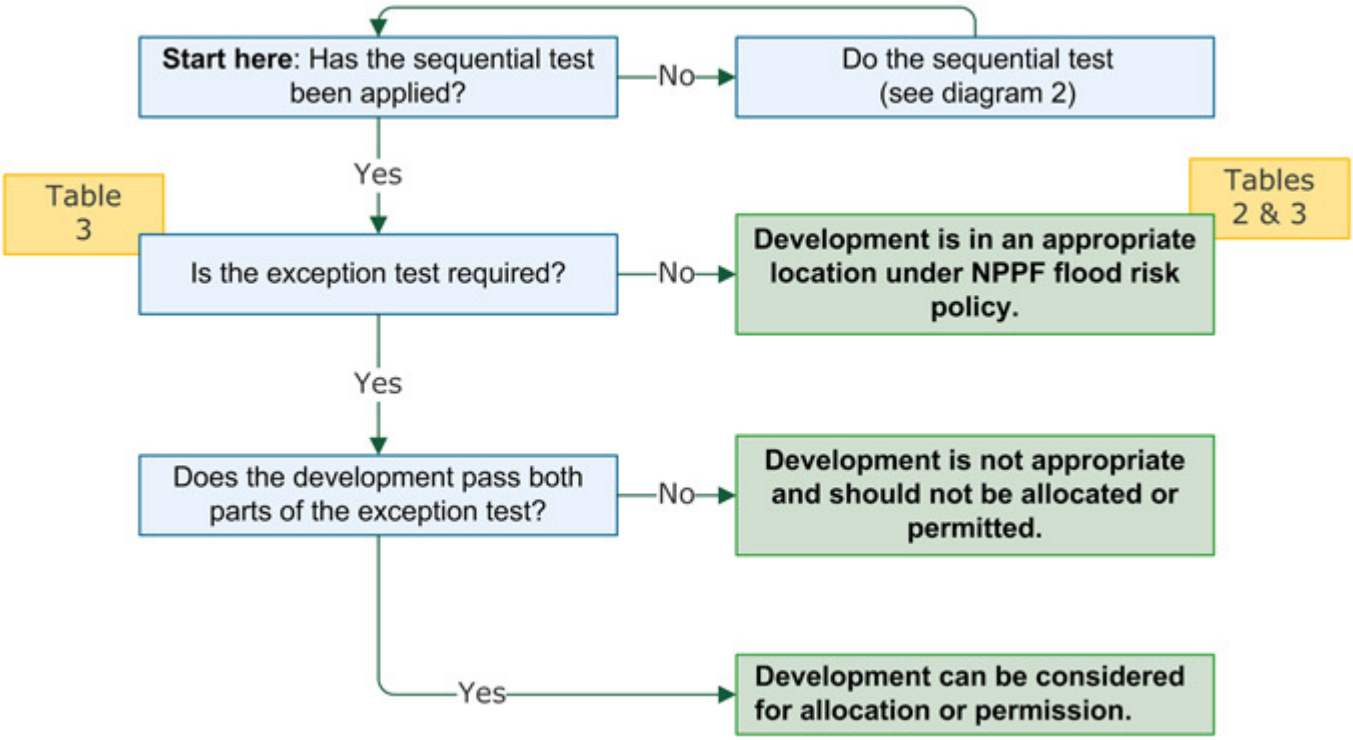
If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*

- *a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the test will have to be passed for development to be allocated or permitted.

The flow diagram below is taken from the NPPG and demonstrates how the Sequential Test is applied in Local Plan making and explains the circumstances where the Exception Test would need to be passed.



It is likely that the Exception Test will need to be passed as part of the emerging Local Plan. In lieu of the Level 2 SFRA which will be required at a later stage once the emerging Local Plan includes site allocations, the Environment Agency has confirmed that an acceptable way forward for this document is to provide a Level 1 SFRA Annex to deal with flood risk relating to the Strategic Development Areas in the emerging Local Plan, including the assessment of residual risk based on the hypothetical failure of a flood defence. The residual flood risk, (i.e. the flood risk that would result should the defences be removed or fail) should be considered in determining the viability of land for future allocation. Therefore, this Annex provides more detail than is normally presented in a Level 1 SFRA but is not a Level 2 SFRA which would still need to be completed where the Exception Test needs to be passed.

The specific objective of the SFRA Update Annex A is to form an important part of the flood risk evidence base for the emerging Local Plan through considering the potential flood risk implications of two strategic Strategic Development Areas proposed as part of the emerging Local Plan:

- Rainham and Beam Park; and
- Romford Town Centre.

This evidence base will partially fulfil the requirements in a Level 2 SFRA in respect of high level information to support strategic Strategic Development Areas in the Local Plan, but not to the same level of detail as would be required for site allocations with defined boundaries.

Strategically, Rainham and Beam Park has been identified as one the Greater London Authorities new housing zones and would be a major area of new development encompassing:[1]

- 3,250 homes, of which 1,000 are houses;
- 3,500 – 4,000 sqm new town centre uses in Beam Park including 2,000 sqm of retail floor space and a new railway station;

[1] Rainham and Beam Park Planning Framework, Final Report, January 2015: https://www.havering.gov.uk/Documents/Planning/Rainham-Beam-Park-Planning-Framework.pdf

- A new 2-Form Entry Primary School;
- Health and community facilities at Beam Park Centre; and
- Expansion of Havering College.

On 15 June 2016, Cabinet Members of London Borough of Havering entered into an overarching agreement with the Greater London Authority (GLA) for funds to become allocated to the Romford Housing Zone. London Borough of Havering is 1 of only 8 Boroughs to be awarded a second Housing Zone. Romford is designated one of the 13 metropolitan centres in the London Plan. The aim of the Housing Zone status to boost housing supply, stimulate building and produce the new low cost homes London needs to meet its growing population. The investment from GLA will support the delivery of:[2]

- 3,304 homes;
- An East-West pedestrian and cycle route;
- New public square; and
- New community related infrastructure.

New development in the two Housing Zones is consistent with the Borough's adopted planning and regeneration strategies.

1.2 Methodology

Inputs from the London Borough of Havering on the quantum and defined boundaries of housing and employment growth for each Strategic Development Area will be considered and assessed against the detailed nature of the flood characteristics of the flood zones relevant to the Strategic Development Areas including:

- Flood probability;
- Flood depth;
- Flood hazard;
- Rate of onset of flooding; and
- Duration of flood.

[2] Romford Housing Zone Decision Details regarding Overarching Borough Agreement with the GLA to support the reinvigoration of Romford town centre. Available at: http://democracy.havering.gov.uk/ieDecisionDetails.aspx?ID=2053

2. Rainham and Beam Park Strategic Development Area

Strategic Development Area Name	Rainham and Beam Park Strategic Development Area			
Location	Rainham			
River Catchment	River Thames, River Beam, River Ingrebourne			
Flood Risk Zone (% Total Area)	**3b**	**3a**	**2**	**1**
	5	15	5	75
Surface Water Flood Risk Zone (% Total Area)	**High (Greater than 3.3% annual chance)**	**Medium (Between 3.3% and 1% annual chance)**	**Low (Between 0.1% and 1% annual chance)**	**Very Low (Less than 0.1% annual chance)**
	1	4	20	75

2.1 Description

The Rainham and Beam Park Strategic Development Area (RBPSDARBPSDA) located just north of the Rainham Marshes is bounded by the River Beam, the railway line that services Rainham station, Brookway and Lambs Lane South and slightly north of the A1306.

2.1.1 Flood Defence Assets

Please refer to Figure A05

The RBPSDA is at risk of fluvial flooding from the Rivers: Thames, Beam and Ingrebourne. Of these the most significant is the Thames. The RBPSDA is primarily at risk of flooding should the Thames Tidal Defences (TTD) fail. The TTD provide a minimum standard of protection of the 0.1% 1 in 1,000 annual chance event. The TTD defence (crest) level varies along the frontage of the London Borough of Havering (LBH): the western half defence level is 7.1m AOD which changes to 7.0m AOD approximately halfway along. The boundary between the two levels is approximately at the Rainham Main Sewer which outfalls into the River Thames from the Rainham Marshes adjacent to the Tilda Rice factory (NGR: TQ 5152 8019). At the far eastern end of the Borough boundary there is a relatively short (approximately 140m) length of defence with defence level of 6.9m AOD.

Based on the Environment Agency's AIMS database fluvial flood defences on the River Ingrebourne extend from the Thames to the A1306 and are classified as either high ground or embankments. Defences on the River Beam extend from the Thames to Beam Country Park.

Washlands Flood Storage Area (FSA) is located on the River Beam to the north of the RBPSDA. Dovers Corner Flood Storage Area is adjacent to the River Ingrebourne to the north of the RBPSDA. These Flood Storage Areas are designed to attenuate flood flows on both watercourses during storm events. This reduction in flow would mitigate flood risk along both watercourses in the RBPSDA.

Through liaison with the Environment Agency it is understood that the Washlands FSA is likely to require an increase in storage capacity to continue to provide its current Standard of Protection (SoP) when the impact of climate change is taken into account.

2.2 Flood Risk Summary

2.2.1 Flood Zones

Please refer to Figure A01

Fluvial flood zones from the Rivers Beam, Ingrebourne and Thames encroach upon the Strategic Development Area, the predominant risk is from the River Thames although this is residual risk should the TTD fail.

The River Beam and River Thames define the borders of the Borough in the west and south respectively. The River Ingrebourne flows south-west through the RBPSDA from the east to the River Thames in the south. The Rainham Main Sewer runs from the River Ingrebourne, just south of the A1306 and discharges into Rainham Marshes. The River Beam flood zones indicate the majority of the land along the western boundary of the RBPSDA is designated as Flood Zone 3b – Functional Floodplain. Towards the south of the RBPSDA the land immediately east of the River Beam is designated as Flood Zone 3a. The southern edge of the RBPSDA is land designated as Flood Zones 3a and 2. These extents include both fluvial and tidal modelling from the River Thames, to the south of the RBPSDA. Flood Zones 3a and 2 cover much of the western end of the RBPSDA the land adjacent to the River Ingrebourne is designated predominantly as Flood Zone 3a.

2.2.2 Flood Depth

Please refer to Figure A02

A 1% (1 in 100) AEP event, modelled in 2004 by the Environment Agency, has been used to assess potential flood depths within the RBPSDA. There are localised depressions within the RBPSDA that are potentially at risk of ponding up to depths of 1 metre. Ponding is also indicated against the A1306 embankments immediately to the west of the location where the River Ingrebourne is crossed. Flooding follows the courses of the River Beam and the River Ingrebourne throughout the RBPSDA, however not exceeding 1m in depth, other than the locations previously summarised. Additional localised ponding occurs immediately south of the RBPSDA boundary.

2.2.3 Flood Hazard

Please refer to Figure A03

Flood hazard has been calculated by the methodology contained within the Defra Guidance: Flood Risk Assessment Guidance for New Development; FD2320/TR2. The degree of flood hazard provides a guide to the risk to people from a combination of predicted flood depth and velocity. A ‘Debris Factor’ is added to the calculation to account for the additional hazard posed by floating debris. A summary of the flood hazard classifications and their description is included in Table 1.

Table 1: Flood Hazard Classification

Classification	Degree of hazard	Description
Low	Caution	Flood Zone with shallow flowing or deep standing water
Moderate	Dangerous for some (i.e. children)	Danger: flood zone with deep or fast flowing water
Significant	Dangerous for most	Danger: flood zone with deep fast flowing water
Extreme	Dangerous for all	Extreme danger: flood zone with deep fast flowing water

Based on FD2321/TR2 Table 4.2

Flood hazard modelling has been completed for a hypothetical breach in the TTD. The flood hazard is designated as low for the majority of the Strategic Development Area. The south-eastern corner has a very small area designated as having an Extreme flood hazard rating.

2.2.4 Flood Warning / Onset of Flooding

Please refer to Figure A04

The response time of the River Beam and the River Ingrebourne should be sufficient for Flood Warnings to be issued by the Environment Agency. In the event of a Thames Tidal Breach, it may not be possible to provide flood warnings if the breach results in rapid inundation. In this particular Strategic Development Area, the Flood Alert and Flood Warning areas are extremely similar and resemble the extents of Flood Zone 2.

The Environment Agency aims to issue a 'Flood Alert' two hours prior to the onset of any flooding within the area. They also aim to provide a 'Flood Warning' two hours prior to the onset of property flooding. The warnings are only possible for flooding from fluvial sources as information regarding the possible onset of flooding is collected using telemetry gauges on river levels.

There are currently no formal warning systems in place to raise the alarm in response to anticipated groundwater flooding incidents.

2.2.5 Surface Water Flood Risk

Please refer to Figure A06

Surface water flood risk across the RBPSDA is relatively low with only one substantial surface water flow route. Other locations within the RBPSDA have been identified as being susceptible to localised ponding in natural depressions. The main flow route enters the RBPSDA as it flows south from the Beam Valley Country Park. It is essential that potential surface water flood risk before and after development is assessed at the earliest opportunity of the design process. Please refer to Section 4.8 of the main SFRA report.

2.2.6 Other Sources of Flood Risk

Please refer to Figure A07

Approximately half of the RBPSDA is indicated as having between 50% and 75% of its area susceptible to groundwater flooding. The other half of the RBPSDA is designated as having greater than 75% of its area susceptible to groundwater flooding.

There are currently no internal or external flood records to properties within the RBPSDA.

2.2.7 Impact of Climate Change

Please refer to Figures A08a-e

Figure A08a indicates the predicted Flood Zone 3a climate change extents for flooding from the River Thames, based upon predicted sea level rise. The increase in extents predicts additional inundation against the existing situation along the A1306. The 'undefended; versions of the BIM and Mardyke models have been adopted for this assessment and consequently provide an indication of what Flood Zone 3 could become subject to influence of climate change.

Figures A08b-f indicates climate change extents from detailed modelling of the Rivers Beam, Ingrebourne and Mardyke for a range of uplift factors specified in the updated Environment Agency guidance[3]. The 10% uplift scenario indicates a negligible increase in extents within the Strategic Development Area. The 15%, 25% and 35% uplift scenarios indicate a small increase in extents around the A1306 roundabout just north of Rainham Police Station. The 70% uplift scenario indicates an increase in extents at the aforementioned roundabout as well as in the Rainham Village Primary School grounds; they also show an increase in Flood Zone 3a to as far east as Stirling Close.

Table 2: Peak River Flow Climate Change Factors to be Adopted by development Vulnerability Classification

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
2	HC + UE	HC + UE	HC + UE	Central	None
3a	UE	Should not be permitted	HC + UE	HC + UE	Central
3b	UE	Should not be permitted			Central

UE= Upper End, HC = Higher Central

The allowance to be made for the predicted impact of climate change on peak river flows throughout the UK is subject to the location (river basin district[3]), timescale (design-life) to be considered and the vulnerability classification (see Paragraph 66 of the NPPG) of the proposed development. For Havering the uplift factors to be applied are summarised in Table 3.

Table 3: Recommended Climate Change allowances for Peak River Flow

Allowance	2015 to 2039	2040-2069	2070-2115
Upper End	25%	35%	70%
Higher Central	15%	25%	35%
Central	10%	15%	25%

[3] https://www.gov.uk/government/publications/flood-risk-assessments-river-basin-district-maps

2.3 Development Acceptability

As set out in Section 3.1 of the main SFRA report flood zones have been delineated across the Borough for LBH to apply the Sequential Test. The purpose is to steer development away from areas susceptible to flooding. However, it is accepted in Table 3 of the Planning Practice Guidance[4] it is not always compatible with wider sustainability objectives for the development to be located in zones of low flood risk. In such circumstances the Exception Test can be applied (see Section 1.1).

Based on the Rainham and Beam Park Planning Framework[5] the RBPSDA is proposed to consist of mixed use development, predominantly residential but also including a primary school, college and library and other mixed use development centred on the proposed district centre. Based on these proposed uses the majority of the development would be classified as 'More Vulnerable' in accordance with *Table 2: Flood Risk Vulnerability Classification* of the Planning Practice Guidance[4]. If the new development includes basements then it would change to 'Highly Vulnerable'.

Table 4: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Appropriate				
2	Appropriate	Exception Test required	Appropriate		
3a	Exception Test required	Should not be permitted	Exception Test required	Appropriate	
3b	Exception Test required	Should not be permitted			Appropriate

This table is based on Table 3, Paragraph 067 of the Planning Practice Guidance

With reference to Table 3 assuming the development is classified as 'More Vulnerable' the Exception Test would need to be applied to meet the criteria outlined above for the development to progress. Such development would not be acceptable in areas of Flood Zone 3b. There are small areas of Flood Zone 3b within the GA but these are restricted to the watercourse channel and therefore are unlikely to impinge on the development proposals. The majority of the GA is within flood zone 3 of the River Thames which it would be anticipated would protect the development to at least a 0.1% (1in 1,000) annual chance standard of protection as outlined in Section 2.1.1 and that based on the Thames Estuary 2100 project it is anticipated will be maintained by the Environment Agency.

When considering the impact of climate change on fluvial flood risk based on an assumed 'More Vulnerable' development vulnerability classification, with reference to Table 2 and Table 3 the 70% and 35% uplift factors should be applied to determine the future extent of Flood Zone 3a for an assumed development lifetime of 100 years.

[4] Planning Practice Guidance, DCLG, March 2014: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-3-flood-risk-vulnerability-and-flood-zone-compatibility/
[5] Rainham and Beam Park Planning Framework, London Borough of Havering, January 2016

2.4 Planning Considerations

Overall the Strategic Development Area encompasses up to 144 ha of land, much of which is already developed. The Rainham and Beam Park and Planning Framework was adopted by Council's Members in February 2016 as a non-statutory planning policy document that would be a material planning consideration when the Council is considering development proposals in the Rainham and Beam Park area. This document considers the existing infrastructure of the area and identifies design principles for future development. It identifies constraints which need to be overcome and development opportunities. In terms of flood risk and water management the document states:

Opportunities

Natural environment – the site has good access to open spaces and the natural environment along the Beam River and River Ingrebourne, to Rainham Marshes, Rainham Wildspace, Thames Chase Community Forest and the All London Green Grid.

Challenges

Flood Risk – some sites are on low-lying land and are vulnerable to fluvial and tidal flooding.

Section 2.2 of this Annex outlines the flood risk constraints noting that a number of potential development sites fall within the fluvial flood risk 1 in 100 year event including climate change. The document suggests potential mitigation including opening up culverts, upgrading and improving existing flood mitigation measures and where flood risk represents a significant risk allocating this land as Green Space. LBH should encourage future riverside development to enhance and help regenerate the River Beam and River Ingrebourne corridors.

The funding of new infrastructure will also be required and the planning framework identifies SuDS as a vital part of the new infrastructure required to facilitate new development.

The Rainham and Beam Park and Planning Framework will support the emerging London Borough of Havering Local Plan through providing supporting evidence to demonstrate how the area can be developed. In particular it contains information and guidance relating to six specific character areas. The planning recommendations for development in various flood zones (section 7.11 of the main document) of the Updated Level 1 SFRA will need to be considered as part of the overall evidence base for determining allocations in the emerging Local Plan.

2.5 Conclusions

The southern section of the Rainham and Beam Park Strategic Development Area is located within fluvial Flood Zones 3a and 2 with areas designated as Flood Zone 3b adjacent to the River Beam and Ingrebourne. Flood depths, modelled for a 1% (1 in 100) AEP event, indicate localised ponding in several locations across the Strategic Development Area with maximum depths exceeding 1m. Flood depths of up to 0.75m, for the same event, are indicated as more widespread across the Strategic Development Area adjacent to the main watercourses. Consequently, the risk to life within the area is considered to be moderate.

3. Romford Town Centre Strategic Development Area

Strategic Development Area Name	Romford Town Centre			
Location	Romford			
River Catchment	River Rom, Blacks Brook			
Flood Risk Zone (% Total Area)	**3b**	**3a**	**2**	**1**
	2	1	20	77
Surface Water Flood Risk Zone (% Total Area)	**High (Greater than 3.3% annual chance)**	**Medium (Between 3.3% and 1% annual chance)**	**Low (Between 0.1% and 1% annual chance)**	**Very Low (Less than 0.1% annual chance)**
	2	5	20	73

3.1 Description

The boundary for the Romford Town Centre Strategic Development Area includes the area inside the A125 and A1251 ring road around the town centre; it also includes the River Rom corridor to the A12 and areas to the north east and south west of the town centre. Seven sites have been earmarked for development and labelled as 'Key Opportunity Sites' in the Romford Town Centre Development Framework (June 2015)[6]. In addition to these seven sites, three key sites have been identified as part of Romford Housing Zone. The nine sites are:

- 1 Como Street
- 2 Angel Way
- 3 The Brewery
- 4 Station Quarter North
- 5 Atlanta Boulevard + 108-116 South Street
- 6 Bridge Close
- 7 Homebase Site
- 8 Waterloo Road Estate
- 9 Romford Gas Works

It should be noted that for the purposes of this Annex, the boundary is based on potential flood risk and the key sites and therefore does not completely align with the Strategic Development Area.

[6] Available from: http://democracy.havering.gov.uk/documents/s15499/Item%201b%20-%20RDF%20Brochure%20-%20not%20on%20agenda.pdf

3.1.1 Flood Defence Assets

Please refer to Figure A12

The area is alleviated from flooding from the River Rom and Blacks Brook by formal flood defences. In this area, these defences are in the form of raised ground along the lengths of the watercourses. No formal Flood Storage Areas have been constructed within the Strategic Development Area. The Strategic Development Area is situated too far north to be affected by a breach of defences along the River Thames. No formal defences exist along the length of the River Rom through Romford town centre. There are no areas indicated as Benefitting from Defences within the Strategic Development Area.

3.2 Flood Risk Summary

3.2.1 Flood Zones

Please refer to Figure A09

The River Rom and one of its tributaries, Blacks Brook, run through the Strategic Development Area. A narrow corridor of land adjacent to the River Rom is designated as Flood Zone 2 with very small areas designated as Flood Zone 3b. Where Blacks Brook enters the Strategic Development Area, the land adjacent is designated as Flood Zone 3a and 3b. The land adjacent to the confluence between the two watercourses, north of Blacks Brook, is also indicated as Flood Zone 3b.

Opportunity site 7 is located solely in Flood Zone 1. Opportunity Sites 1, 2, 4, 5 and 6 all slightly encroach upon Flood Zone 2. The south-eastern corner of Opportunity site 3 is located within Flood Zone 3b.

3.2.2 Flood Depth

Please refer to Figure A10

Modelling by the Environment Agency in 2004 for a 1% (1 in 100) AEP event indicate the flood depths to exceed 1m in four locations within the Strategic Development Area. Three of these locations are adjacent to the River Rom (roundabout between St Edwards Way and the A125, roundabout between the A125 and the A1251 and to the east of Queen's Hospital). The largest area of ponding however is located west of the River Rom, near Cottons Park. Flood depths of up to 0.75m are indicated along the length of the two watercourses within the Strategic Development Area.

Opportunity sites 4 and 5 have some areas identified as having flood depths of up to 0.50m for the modelled 1% (1 in 100) annual chance event. Depths for Opportunity sites 1, 2, 3, 6 and 7 could reach up to 1.00m for the same event.

3.2.3 Flood Hazard

Flood Hazard has not been considered in this Strategic Development Area because there are no Areas Benefitting from Defences or raised embankment defences according to the Environment Agency's AiMS database. The Strategic Development Area is also outside of the reach of a Thames Tidal Breach. Therefore the flood hazard for the Romford Town Centre Strategic Development Area is classified as very low.

3.2.4 Flood Warning / Onset of Flooding

Please refer to Figure A11

The response time of the River Rom should be sufficient enough for Flood Warnings to be issued by the Environment Agency. In this particular Strategic Development Area, the Flood Alert area for Blacks Brook does not cover a substantial area adjacent to the watercourse. No Flood Warnings are available for flooding from Blacks Brook. The Flood Alert and Flood Warning areas for the River Rom are extremely similar and resemble the extents of Flood Zone 2 with Romford town centre omitted.

The Environment Agency aims to issue a 'Flood Alert' two hours prior to the onset of any flooding within the area. They also aim to provide a 'Flood Warning' two hours prior to the onset of property flooding. The warnings are only possible for flooding from fluvial sources as information regarding the possible onset of flooding is collected using telemetry gauges on river levels.

Flood Alerts are available for Opportunity Sites 4 and 5. Flood Warnings are available for Opportunity Sites 1, 2 and 6.

There are currently no formal warning systems in place to raise the alarm in response to anticipated groundwater flooding incidents.

3.2.5 Surface Water Flood Risk

Please refer to Figure A13

There are two major flow paths through the Strategic Development Area. Other locations across the Strategic Development Area are indicated as being susceptible to localised ponding; however no additional major flow routes are identifiable. The first follows the course of the River Rom (North Romford and South Romford Critical Drainage Areas) from the north west of the Strategic Development Area, to the south. The second enters the Strategic Development Area from the east, following the course of Blacks Brook, before joining with the first and flowing south. It is essential that potential surface water flood risk before and after development is assessed during the outline design process of any project.

As the Opportunity Sites are located along the banks of the River Rom and Blacks Brook, all are associated with some degree of surface water flood risk. Each Opportunity Site has areas likely to be affected from surface water flooding during 3.33% (1 in 30), 1% (1 in 100) and 0.1% (1 in 1,000) annual chance events.

3.2.6 Other Sources of Flood Risk

Please refer to Figure A14

Groundwater flooding is identified across the Strategic Development Area as being caused by Superficial Deposits. Approximately 80% of the Strategic Development Area is indicated as having greater than 75% of its area susceptible to groundwater flooding. The remaining area is designated as having between 25% and 50% of its area susceptible to groundwater flooding. One report of groundwater flooding has been identified as from September 2007 in the area just south of the town centre, designated as Opportunity Site 5.

Records indicating both the internal and external flooding of properties are available within the Strategic Development Area. Within the RM7 postcode boundary, there are 25 internal and 33 external reports of flooding to property. Within the RM1 postcode boundary, there are 93 internal and 229 external reports of flooding to property. As the collection of postcode boundaries has a greater area than the Strategic Development Area, these numbers are likely to be smaller within the Strategic Development Area itself.

3.2.7 Impact of Climate Change

Please refer to Figures A15a-e

The 10%, 15% and 25% uplift scenarios indicate small scale extent increases on the River Rom north-west of Romford Town Centre; small increases are also visible in Romford Town Centre on Blacks Brook. The 35% uplift scenario includes increases in similar areas to those described above; however the extents on Blacks Brook are predicted to increase to as far as the Romford railway station. The 70% uplift scenario includes small increases to extents on the River Rom as well as slightly more significant increases in extents on Blacks Brook in Romford Town Centre.

Opportunity Site 1 is predicted to be affected by the increase in extents on the River Rom. Opportunity Sites 4 and 5 are likely to be affected by the increase in extents on Blacks Brook in the town centre.

3.3 Planning Considerations

The Romford Area Action Plan was adopted in 2008 setting out specific policies and allocations to deliver growth and stimulate regeneration of Romford Town Centre. The Romford Area Action Plan will be superseded and replaced by the new Local Plan and the Site Specific Allocations Local Plan.

As part of the evidence base for the emerging Local Plan, the London Borough of Havering commissioned the Romford Town Centre Development Framework which provides '*both a strategic vision and practical delivery plan that sets out a course for town centre improvements over the next 20 years, maximising in particular the opportunities presented by Crossrail's arrival in 2018*'. This framework was agreed by Council Members in August 2015 and is now in place as a vehicle to shape development and promote development opportunities in the Romford area.

The study area of the Romford Town Centre Development Framework is the same as the boundary used for the Area Action Plan. The document defines nine character areas, each with a distinct character and focus, and sets out a design strategy for each. The Framework also identifies seven Key Opportunity Sites. Table 5 identifies nine key sites; seven of which are derived from the Key Opportunity Sites in the Romford Town Centre Development Framework and three additional key sites within Romford Housing Zone have been identified.

Table 5: Romford Town Centre Opportunity Sites

Opportunity Site Number	Site	Site Area (ha)
1	Como Street	0.5
2	Angel Way	2.51
3	The Brewery	2.65
4	Station Quarter North	0.58
5	Atlanta Boulevard + 108-116 South Street	1.9 and 0.25
6	Bridge Close	1.41
7	Homebase Site	1.56
8	Waterloo Road Estate	4.5
9	Romford Gas Works	6.2

In terms of flood risk it is stated that:

'The area is covered by a developing Strategic Flood Risk Assessment that identifies fluvial flooding to the Romford area largely as a result of the River Rom flowing approximately north to south and Black Brook flowing east to west that intersect near Exchange Street. Large parts of the network through Romford are culverted as a result of historical build-over and a requirement of the development plan will be to design for opening up of old culverts where appropriate and practical. They will be a key requirement from the Environment Agency in any future developments and will deliver biodiversity, cost and hydrological benefits. Costs for partial deculverting have been provided elsewhere'.

The Romford Town Centre Development Framework and Romford Housing Zone will be used to inform the policies and land allocations in the emerging Local Plan. The planning recommendations for development in various flood zones (section 7.11 of the main document) of the Updated Level 1 SFRA will help inform decisions on land use policies and site specific land allocations contained in the emerging Local Plan.

3.4 Development Acceptability

As set out in Section 3.1 of the main SFRA report flood zones have been delineated across the Borough for LBH to apply the Sequential Test. The purpose is to steer development away from areas susceptible to flooding.

However, it is accepted in Table 3 of the Planning Practice Guidance[7] it is not always compatible with wider sustainability objectives for the development to be located in zones of low flood risk. In such circumstances the Exception Test can be applied (see Section 1.1).

Romford Town Centre is proposed to consist of primarily mixed-use development including retail, offices and residential. Based on these proposed uses the majority of the development would be classified as 'More Vulnerable' (residential) or 'Less Vulnerable' (shops, offices) in accordance with *Table 2: Flood Risk Vulnerability Classification* of the Planning Practice Guidance[4]. If the new residential development includes basements then it would change to 'Highly Vulnerable'.

With reference to Table 3 assuming the development is classified as 'More Vulnerable' the Exception Test would need to be applied to meet the criteria outlined above for the development to progress if within Flood Zone 3a, it would be deemed acceptable if within Flood Zones 1 or 2. If classified as 'Less Vulnerable' the development would not require the application of the Exception Test unless located within Flood Zone 3b in which case it should not be permitted.

When considering the acceptability of a proposed development the predicted impact of climate change (allowing for the design life of the development) needs to be considered. Based on a classification of 'More Vulnerable' or Less Vulnerable' uplift factors would need to be applied to the 1% (1 in 100) annual chance event of +25%, +35% or +70% subject to which Flood Zone it is located within. Please refer to Tables 2 and 3.

3.5 Conclusions

The land immediately adjacent to the River Rom and Blacks Brook within the Romford Town Centre Strategic Development Area is predominantly located within fluvial Flood Zone 2 with small areas designated as Flood Zone 3b. Flood depths, modelled for a 1% (1 in 100) AEP event, indicate localised ponding in several locations across the Strategic Development Area with maximum depths exceeding 1m. Flood depths of up to 0.75m, for the same event, are indicated as more widespread across the Strategic Development Area adjacent to the main watercourses. Consequently, the risk to life within the area is considered to be low.

Based on an assumed mixed-use development, residential development would be classified as 'More Vulnerable' and would require uplift factors of +70% or +35% on the present-day Flood Zone 3 to account for the predicted impact of climate change. Offices and shops would be classified as 'Less Vulnerable' and would require the consideration of the +25% uplift factor if situated in Flood Zone 2 or +70% to +35% if within Flood Zone 3a.

If located within Flood Zone 2 then the Exception Test would not be required for the development, but if within Flood Zone 3a the Exception Test would need to be applied for residential development only.

[7] Planning Practice Guidance, DCLG, March 2014: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-3-flood-risk-vulnerability-and-flood-zone-compatibility/