Birmingham City Council

Level 2 Strategic Flood Risk Assessment

April 2012

Birmingham City Council

ATKINS

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Glossary

Term	Meaning / Definition
Annual Exceedance Probability	The probability that there will be a *flood event* exceeding a particular severity in any given year
Aquifer	A source of groundwater compromising water-bearing rock, sand or gravel capable of yielding significant quantities of water
Brownfield site	Any land or site that has been previously developed
Catchment	An area of land that contributes flow to a particular point
Catchment Flood Management Plan	A strategic planning tool through which the *Environment Agency* seeks to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management
Climate Change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity (anthropogenic) such as greenhouse gas emissions
Core Strategy	Development plan document which sets the long-term spatial planning vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
Culvert	A structure which fully contains a watercourse as it passes through an embankment or below ground.
Department for Environment, Food and Rural Affairs	Government Agency responsible for policy and regulations on the environment, food and rural affairs
Development	The undertaking of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land
Development Plan	As set out in Section 38(6) of the Planning and Compulsory Purchase Act (2004), an authority's development plan consists of the relevant regional spatial strategy (or the spatial development strategy in London) and the development plan documents contained within its local development framework.
Discharge	Rate of flow of water
Environment Agency	Government Agency responsible for flooding issues from main river, and strategic overview of flooding
Exception Test	A requirement within *NPPF* that requires justification for a development application within *Flood Zones 2 & 3*
Flood event	A flooding incident usually in response to severe weather or a combination of flood generating characteristics
Flood Probability	The estimated probability of a flood of given magnitude occurring or being exceeded in any specified time period expressed as a *return period* or *Annual Exceedance Probability (AEP)*
Flood Risk	The combination of the *flood probability* and the magnitude of the potential consequences of the *flood event*
Flood Risk Assessment	An appraisal of the *flood risks* that may affect *development* or increase *flood risk* elsewhere

Term	Meaning / Definition
Flood Risk Vulnerability	The vulnerability classification used to assess which land use is appropriate in each *Flood Zone*. For further information, refer to *Table 2 in NPPF*
Flood Zones	Flood Zones provide a general indication of flood risk, mainly used for spatial planning
Floodplain	An area of land that would naturally flood from a watercourse, an estuary or the sea
Floods and Water Management Act	The Floods and Management Water Act clarifies the legislative framework for managing surface water flood risk in England
Floodwater	Excess *runoff* that cannot be stored or conveyed safely
Fluvial Flooding	Flooding caused by a river
Functional Floodplain	Land where water has to flow or be stored in times of flood. It includes the land which would flood with an annual exceedance probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the *Local Planning Authority* and the *Environment Agency*.
Greenfield	Undeveloped land
Greenfield Runoff Rate	The rate of runoff which would occur from a site that was undeveloped and undisturbed
Groundwater	Water that exists beneath the ground in underground aquifers and streams
Groundwater Flooding	Flooding caused by groundwater rising and escaping due to sustained periods of higher than average rainfall (years) or a reduction in abstraction for water supply
Informal Flood Defence	A structure that provides a flood defence function, but has not been built or maintained for this specific purpose (e.g. boundary wall)
Local Authority	An administrative unit of local government
Local Development Documents	Documents that set out the spatial strategy for local planning authorities which comprise development plan documents
Local Development Framework	Framework which forms part of the statutory development plan and supplementary planning documents which expand policies in a development plan document or provide additional detail
Local Flood Risk Management Strategy	Strategy outlining the Local Authorities approach to local flood risk management as well as recording how this approach has been developed and agreed.
Local Planning Authority	Body responsible for planning and controlling development, through the planning system.
Main River	A watercourse designated on a statutory map of Main rivers, maintained by Department for Environment, Food and Rural Affairs (*Defra*).
Mitigation measure	A generic term used in this guide to refer to an element of *development* design which may be used to manage *flood risk* to the *development*, or to avoid an increase in *flood risk* elsewhere.

Term	Meaning / Definition
Model	A representation of the environment. This is often undertaken using a computer software package that performs hydraulic calculations, but can also be undertaken by constructing a physical representation of an environment.
National Planning Policy Framework	Framework setting out the Government's planning policies for England and how these are expected to be applied. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.
Overland Flow	Flooding caused by surface water runoff when rainfall intensity exceeds the infiltration capacity of the ground, or when the soil is so saturated that it cannot accept any more water.
Planning Policy Statements	The Government's updated planning advice contained within Planning Policy Guidance (PPGs)
Pluvial Flooding	'Pluvial' flooding (or surface runoff flooding) is caused by rainfall and is that flooding which occurs due to water ponding on or flowing over the surface before it reaches a drain or watercourse.
Redevelopment	The construction of new *development* on land which is, or has been, developed (*brownfield*)
Regional Spatial Strategy	The regions policies in relation to the development and use of land forming part of the development plan for local planning authorities
Residual Risk	The risk that remains after all avoidance, reduction, and *mitigation measures* have been implemented
Return Period	A term used to express *flood probability*. It refers to the estimated average time between the occurrences of a hydrological event (*flood event*) of a given magnitude.
Runoff	*Overland flow* as well as rainfall that flows over an impermeable surface
Sequential Test	The risk based approach prescribed within *NPPF* that aims to steer new *development* or redevelopment to areas at the lowest probability of flooding (*Flood Zone* 1).
Sewer Flooding	Flooding caused by the blockage or overflowing of sewers from urban drainage systems
Source Protection Zone	Defined areas showing the risk of contamination to selected *groundwater* sources used for public drinking water supply
Standard of Protection	It is the estimated probability of a *flood event* occurring which is more severe than that which an area is protected by *flood defences*
Strategic Flood Risk Assessment	A study to examine *flood risk* issues on a sub-regional scale, typically for a river *catchment* or *local authority* area during the preparation of a development plan.
Surface Water Flooding	Flooding caused by the combination of pluvial flooding, sewer flooding, flooding from open channels and culverted urban watercourses and overland flows from groundwater springs
Surface Water Management Plan	A study undertaken in consultation with key local partners to understand the causes and effects of surface water flooding and agree the most cost effective way of managing surface water flood risk for the long term.

Term	Meaning / Definition
Sustainability Appraisal	Tool for appraising policies to ensure they reflect sustainable development objectives (i.e. social, environmental and economic factors) and required in the act to be undertaken for all local development documents. It incorporates strategic environmental assessment.
Sustainable Development	*Development* that meets the needs of the present without compromising the ability of future generations to meet their own needs (The World Commission on Environment and Development, 1987)
Sustainable Drainage Systems	A sequence of management practices and control structures that are designed to drain surface water in a more sustainable manner.
Watercourse	Any natural or artificial channel that conveys surface water
Windfall Site	A site which comes forward and receives planning permission in a location which was not anticipated or allocated in the Local Plan for that purpose.

Abbreviations

Term	Meaning / Definition
AAP	Area Action Plan
AEP	Annual Exceedance Probability
BCC	Birmingham City Council
BGS	British Geological Society
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
EA	Environment Agency
FRA	Flood Risk Assessment
LDD	Local Development Documents
LDF	Local Development Framework
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PPS	Planning Policy Statement
SFRA	Strategic Flood Risk Assessment
SMURF	Sustainable Management of Urban Rivers and Floodplains
SUDS	Sustainable Drainage Systems

Executive Summary

Birmingham City Council in partnership with Atkins has produced this Level 2 Strategic Flood Risk Assessment (SFRA) in accordance with the National Planning Policy Framework (NPPF). The purpose of the Level 2 SFRA is to facilitate application of the Sequential and Exception Tests.

The purpose of the Sequential Test is to screen the proposed development sites against the Flood Zones and then assess the sites in Flood Zone 2, 3a and 3b to determine whether there are any alternative sites at a lower risk of flooding which could facilitate this type of development. This has been undertaken for the sites allocated by Birmingham City Council and results are outlined in this report.

Following the application of the Sequential Test, the Exception Test should be applied where it is not possible or consistent with wider sustainability objectives to locate all development in zones of lower flooding probability. In accordance with NPPF, for the Exception Test to be passed:

a) 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;

b) 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.

The Exception Test has been applied to 29 sites allocated by Birmingham City Council and the results are outlined in this report.

1. Background

1.1 Introduction

A Level 1 Strategic Flood Risk Assessment (SFRA) was prepared by Birmingham City Council and Atkins in January 2010 for the City Council. The Level 1 SFRA was updated in April 2012 due to a review of the Strategic Housing Land Availability Assessment (SHLAA) to inform the Core Strategy and other Local Development Documents in accordance with the requirements of NPPF[1 2]

As part of the Level 1 SFRA all proposed development sites were assessed against the Flood Zones in terms of their vulnerability in accordance with the NPPF. The Level 1 SFRA showed that following the application of the first stage of the Sequential Test there are number of development sites which depending on their proposed use should be located in zones of lower flooding probability or will need to be subject to the Exception Test if it is not possible or consistent with wider sustainability objectives to relocate this development.

It is intended that the Level 2 SFRA will consider SHLAA, Commercial Sites and those identified in the Aston, Lozells and Newtown AAP. Core Employment Zones will not be considered as these are large areas and not site specific allocations.

The SFRA should be considered to be a living document, subject to regular review in response to changing policy requirements, and improved understanding of flood risk that the planning authority should continually draw upon.

1.2 Purpose of the Level 2 SFRA

The NPPF identifies that the scope of a Level 1 SFRA should be widened to facilitate application Exception Test. More detailed information is required where there is deemed to be development pressure in areas that are at medium or high flood risk and there are no other suitable alternative areas for development after applying the Sequential Test. This more detailed study should consider the detailed nature of the flood hazard, taking account of the presence of flood risk management measures such as flood defences. This will allow a sequential approach to site allocation to be adopted within a Flood Zone. It will also allow the policies and practices required to ensure that development in such areas satisfies the requirements of the Exception Test, to be identified for insertion into the LDD.

In general, the SFRA should aim to provide clear guidance on appropriate risk management measures for adoption on potential sites within Flood Zones 2 and 3, which are protected from flooding by existing defences, to reduce the extent to which individual developers need to undertake separate studies of the same problem and to provide guidance as to what issues/aspects would need to be looked at in more detail as part of a site specific FRA.

The SFRA should provide information on the variation of risk within Flood Zones which are protected by flood defence infrastructure, draw appropriate conclusions and make recommendations for each potential development site.

1.3 Scope of the Level 2 SFRA

Following the completion of the Birmingham Level 1 SFRA update, the following scope for the Level 2 assessment was developed in conjunction with the Environment Agency:

[1] Department for Communities and Local Government (2012) – National Planning Policy Framework
[2] Department for Communities and Local Government (2009) – Technical Guidance to the National Planning Policy Framework

- an investigation of the condition of flood defences, the flood risk benefit that these provide, as well as the residual flood risk of the structures;
- an appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure with an appropriate allowance for climate change;
- definition and mapping of the functional floodplain in locations where this has not been undertaken (it was not necessary to undertake this as it has already been undertaken for all watercourses where recent modelling is available);
- guidance on appropriate policies for sites which satisfy parts of the Exception Test, and requirements to consider at the planning application stage to pass part b) of the Exception Test; and
- meaningful recommendations to inform policy, development control and technical issues.

1.4 Deliverables of the Level 2 SFRA

The deliverables of the Level 2 SFRA are:

- Project Report;
- Individual report for each development site which passes parts a) of the Exception Test;
- Drawings for each site which pass parts a) of the Exception Test showing:
  - Flood zones across the site;
  - Surface water flood risk;
  - Groundwater flood risk: and
  - Flood hazard mapping.

2. The Sequential Test

2.1 Introduction

As part of the Level 1 SFRA four land allocation datasets were identified by Birmingham City Council these were:

- Residential sites from the Strategic Housing Land Availability Assessment (2010);
- Commercial Sites (2011);
- Core Employment Areas identified through the Employment Land Review (2010); and
- Aston, Lozells and Newtown Area Action Plan (AAP) (2011).

The screening element of the Sequential Test was undertaken using the land allocations as identified by Birmingham City Council. The Sequential analysis was undertaken in three stages:

1. The first stage was a preliminary analysis of flood risk across the City to identify the different Flood Zones and to identify the constraints that are imposed upon development within these zones.
2. The second stage of the analysis included a more detailed assessment of the potential housing and employment areas that have been identified by Birmingham City Council against these flood risk zones. Sites were assessed for their proposed uses appropriateness against level of flood risk.
3. An assessment of the flood risk from all other sources to identify sites that are outside of the Flood Zones but may still require a FRA as they are at risk of flooding from other sources.

In total there were 1468 residential sites, 418 commercial sites, 66 core employment areas and 50 AAP sites, current and proposed identified in the Level 1 SFRA. The initial, Level 1 screening of the sites identified the undefended Flood Zone that sites are located in as detailed in Table 2.1

Development Type	Flood Zone 1 Low Probability	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Flood Zone 3b Functional Floodplain
Residential	1358	22	57	31
Commercial	340	20	34	24
Employment	27	5	5	29
Aston, Lozells and Newtown AAP	35	2	6	7

Table 2.1– Number of Land Allocations in Flood Zones

In order to complete the Sequential Test, as outlined in the NPPF, the sites in Flood Zone 2, 3a and 3b must be assessed to determine whether there are any alternative sites at a lower risk of flooding which could facilitate this type of development. This section summarises the application and results of the Sequential Test.

2.2 Screening of Sites

Prior to undertaking the Sequential Test the sites identified in the Level 1 SFRA have been screened.

Firstly it was determined that the Core Employment Zones should not be considered as these are large areas of the City where the Core Strategy identifies that employment use should be retained and hence are not site specific allocations.

Secondly the remaining residential, commercial and AAP sites have been screened to identify any sites which have already been developed or have planning permission. These sites can be removed from this assessment as the flood risk will have already been considered as part of the site specific Flood Risk Assessment (FRA). This was necessary as the Sequential Test was applied to sites allocated by the Planning Authority in 2010, some of which may have already been developed.

In addition to this, consultation was undertaken with Birmingham City Council Area Planners to determine sites that could be removed, as alternative sites exist or the flood risk was considered too high to allow development to take place.

2.2.1 Hockley Brook Modelling

Further to the Level 1 SFRA an integrated modelling study has been undertaken of the Hockley Brook by Birmingham City Council and updated flood outlines have been produced for the 1 in 100 year and 1 in 1000 year chance of flooding.

The updated outline shows that for the 1 in 100 year (greater that 1%) chance of flooding the flow stays within the Hockley Brook channel/culvert. The updated 1 in 1000 year (greater than 0.1) chance of flooding outline is much reduced from that shown on the existing Flood Zone maps, as shown in Figures A.1 and A.2 in Appendix A.

Discussions are underway with the Environment Agency and the updated flood outlines will ultimately be adopted by the Environment Agency for use in their Flood Zone maps. Therefore, as a result of this work sites that are no longer in the Flood Zones due to revised Hockley Brook modelling have been removed, many of these sites are with the Aston, Lozells and Newtown AAP area. The initial results of this modelling are included in Appendix A together with the updated screening of sites which was undertaken as part of baseline study for the Aston, Lozells and Newtown AAP.

2.2.2 Results of Screening

The tables in Appendix B list all the sites that were removed and the reasons for the removal.

Table 2.2 identifies the number of sites following this screening within each Flood Zone that need to pass the Sequential Test if development is to proceed.

Development Type	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Flood Zone 3b Functional Floodplain
Residential	19	12	13
Commercial	5	3	0
Aston, Lozells and Newtown AAP	4	1	6

Table 2.2 – Number of Land Allocations in Flood Zones requiring a Sequential Test

The specific sites from the table above are listed in the tables below; these tables also identify the watercourse that poses the flood risk and whether the site is partially or fully within each Flood Zone.

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2
CC81	Residential	Land btw Allison St / Coventry St / Meridan St	River Rea	Partially

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2
CC93	Residential	Hurst St / Sherlock St / Skinner La / Pershore Rd	River Rea	Partially
CC95	Residential	Btw Lower Exxes St / Kent St / Sherlock St / Hurst St	River Rea	Partially
CC102	Residential	Adj Magnolia House, Highgate St	River Rea	Partially
CC111	Residential	Btw Sherlock St / Hurst St / Bishop St	River Rea	Fully
CC191	Residential	Site of Barford House, Lawford Grove, Gooch Street	River Rea	Partially
CC198	Residential	10 St. Lukes Road	River Rea	Partially
CC207	Residential	Land bounded by Bradford Street and Birchall Street and Green Street	River Rea	Partially
CC227	Residential	Adj. River Rea and Montague Street	River Rea	Partially
E58	Residential	Albert Road/Station Road	River Cole	Partially
E98	Residential	Garages adj Thistle House	River Tame	Partially
E408	Residential	27 to 41, Embleton Grove	River Cole	Partially
N9	Residential	Wellington Road, Aston	River Tame	Partially
N476	Residential	83 to 89, Water Orton Lane	River Tame	Partially
S23	Residential	186 Harborne Road	Chad Brook	Partially
S38	Residential	Allenscroft Road	River Rea	Partially
S98	Residential	694-704 Pershore Road	River Rea	Partially
S107	Residential	California Pentecostal Church adjoining 176 Stonehouse Lane	Stonehouse Brook	Partially
S141	Residential	308-330 Pershore Road	River Rea	Partially
079010900	Commercial	Aston Lane	River Tame	Partially
098912300	Commercial	Land Adjacent BOC, Plume Street	Hockley Brook	Partially
118920500	Commercial	Bromford Road/Fort Parkway	River Tame	Fully
118930102	Commercial	Heartlands Central between Wolseley Drive and Drews Lane	River Tame	Partially
139040600	Commercial	Former Stagecoach PH Berrandale Road	River Tame	Partially
ED1	AAP - Education	Birmingham City University	River Tame	Partially
LC3	AAP -Mixed Use	Witton Road	River Tame	Partially
IRA	AAP - Industrial Regeneration	Newtown Row	Hockley Brook	Partially

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2
H6	AAP -Housing Regeneration	Newtown & Lozells	Hockley Brook	Partially

Table 2.3 –Sites within Flood Zone 2

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2	Partially or Fully within Flood Zone 3a
CC90	Residential	Btw High St Deritent / Mill La / Bradford St	River Rea	Partially	Partially
CC91	Residential	Wholesale markets , Barford St	River Rea	Partially	Partially
CC199	Residential	Barrow Walk, St. Lukes Road	River Rea	Fully	Partially
E59	Residential	B&Q Site Station Road Stechford	River Cole	Partially	Partially
E158	Residential	Btw Pershore Rd & Alexandra Rd	River Rea	Partially	Partially
N140	Residential	Site including 3 - 7 & 15, 17 Perry Common Road & 2 - 6 Turfpit Lane	Hawthorn Brook	Partially	Partially
S11	Residential	Cadnam Close	Bourn Brook	Partially	Partially
S24	Residential	184 Harborne Road	Chad Brook	Partially	Partially
S67	Residential	Prestwood Road (rear 29)	Wood Brook	Partially	Partially
S109	Residential	Land fronting 17-35 Stonebrook Way	Stonehouse Brook	Partially	Partially
S128	Residential	Druids Lane site, Druids Heath	Chinn Brook	Partially	Partially
S129	Residential	2-100 Leasow Drive & land to the rear of.	Bourn Brook	Partially	Partially
079120114	Commercial	Holford Park Thameside Side Holford Way	River Tame	Partially	Partially
088811102	Commercial	Land between Cheston Road and Birmingham to Fazeley Canal	Hockley Brook	Fully	Partially
088811600	Commercial	Corner of Rocky Lane and Chester Street	Hockley Brook	Fully	Fully
LC3	AAP - Local Centre	Witton Road	River Tame	Partially	Partially

Table 2.4 –Sites in Flood Zone 3a

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2	Partially or Fully within Flood Zone 3a	Partially or Fully within Flood Zone 3b
CC196	Residential	Site of Princethorpe Tower, Conybere Street	River Rea	Fully	Partially	Partially
E51	Residential	Plough and Harrow, Coventry Road	River Cole	Fully	Partially	Partially
E89	Residential	Land off Roma Rd	River Cole	Partially	Partially	Partially
E95	Residential	Jcn of Bromford Dr & Reynoldstown Rd	River Tame	Fully	Fully	Fully
E106	Residential	Btw 17 Hyperion Rd & 7 Papyrus Way	River Tame	Fully	Fully	Fully
E107	Residential	Adj 17 Papyrus Way	River Tame	Fully	Fully	Fully
E108	Residential	Jcn of Tipperary Cl & Trigo Croft	River Tame	Fully	Fully	Fully
E109	Residential	Adj 7 - 17 Hyperion Rd	River Tame	Fully	Fully	Fully
E110	Residential	Land Adj 25 Trigo Croft	River Tame	Fully	Fully	Fully
E111	Residential	Rear of 19 - 25 Trigo Croft	River Tame	Fully	Fully	Fully
E165	Residential	Percy Rd / Evelyn Rd	River Cole	Partially	Partially	Partially
E410	Residential	Land off, Lancaster Drive and Farnborough Road	Tame & Plants Brook	Partially	Partially	Partially
S347	Residential	1125 to 1157 Pershore Road	River Rea	Partially	Partially	Partially
LC1	AAP - Local Centre	Perry Barr/Birchfield	River Tame	Partially	Partially	Partially
11	AAP - Housing Site	Tame Road	River Tame	Fully	Partially	Partially
MU4	AAP - Mixed Use	Westwood Road / Dulverton Road	River Tame	Fully	Partially	Partially
IRB	AAP - Industrial Regeneration	Brookvale Road	River Tame	Partially	Partially	Partially
IRB	AAP - Industrial Regeneration	Tame Road	River Tame	Fully	Partially	Partially
R1-R6	AAP -Regional Investment Site	Aston Hall Road/Priory Road/Queens Road	River Tame	Partially	Partially	Partially

Table 2.5 –Sites in Flood Zone 3b

2.3 Application of the Sequential Test

In accordance with the requirements of the NPPF, and in order to complete the Sequential Test the remaining sites are those where it is considered that alternative sites are not available to accommodate this type of development. The justification for taking these sites forward is detailed below.

It is important to consider that although there is a range of Housing sites available within the Authority area, these are not sufficient to meet Housing requirements. Therefore use of land within Flood Zones is necessary to avoid the allocation of Greenbelt land.

2.3.1 Residential Sites

Flood Zone 2

The 19 sites in Table 2.6 are located to some degree within Flood Zone 2. Although the NPPF does not restrict the use of these sites for residential developments it is noted that if and where possible, sites of a lower flood risk, i.e. Flood Zone 1, should be utilised first in accordance with the Sequential Test. The results of the Sequential Test are presented in the table.

Site Ref	Address	Results of Sequential Test	Exception Test Required
CC81	Land between Allison St / Coventry St / Meridan St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC93	Hurst St / Sherlock St / Skinner La / Pershore Rd	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC95	Between Lower Exxes St / Kent St / Sherlock St / Hurst St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC102	Adjacent Magnolia House, Highgate St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC111	Between Sherlock St / Hurst St / Bishop St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	No

Site Ref	Address	Results of Sequential Test	Exception Test Required
CC191	Site of Barford House, Lawford Grove, Gooch Street	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC198	10 St.Lukes Road	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	No
CC207	Land bounded by Bradford Street and Birchall Street and Green Street	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment. This site is on the periphery of the Flood Zone and the risk of flooding can be ameliorated through design measures and the arrangement of development within the site.	No
CC227	Adj. River Rea and Montague Street	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	No
E58	Albert Road/Station Road	There are no similar sites in the vicinity. Part of Stechford Sustainable Urban Neighbourhood proposed in Core Strategy (draft policy E9).	No
E98	Garages adjacent Thistle House	There are no similar sites in the vicinity. The majority of this site is not in an area of flood risk.	No
E408	27 to 41, Embleton Grove	The majority of this site is not in an area of flood risk. There is a need to replace existing substandard housing.	No
N9	Wellington Road, Aston	This site is suitable for residential use through the redevelopment of industrial premises.	No
N476	83 to 89, Water Orton Lane	There are alternative sites elsewhere but this site is a logical infill development site in the middle of existing residential properties. There are no suitable alternative uses.	No
S23	186 Harborne Road	This is a small redevelopment site. Only a small area at the edge of this site is at risk from flooding, and the site could be developed around this.	No
S38	Allenscroft Road	There are no similar sites in the vicinity. The majority of this site is not in an area of flood risk.	No
S98	694-704 Pershore Road	There are no similar sites in the vicinity. The majority of this site is not in an area of flood risk.	No

Site Ref	Address	Results of Sequential Test	Exception Test Required
S107	California Pentecostal Church adjoining 176 Stonehouse Lane	Only a small area at the edge of this site is at risk from flooding, and the site could be developed around this.	No
S141	308-330 Pershore Road	This is part of a major redevelopment at Edgbaston Cricket Ground involving residential on upper floors.	No

Table 2.6 –Sequential Testing of Residential Sites in Flood Zone 2

Flood Zone 3a

The 12 sites in Table 2.7 are located to some degree within Flood Zone 3a. As identified in the NPPF, these sites require an Exception Test if it is to be demonstrated that they are appropriate, considering all non-flood risk related sustainability issues, for residential development. These sites will be considered further in Section 3.

Site Ref	Address	Results of Sequential Test	Exception Test Required
CC90	Between High St Deritend / Mill La / Bradford St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	Yes
CC91	Wholesale markets , Bradford St	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	Yes
CC199	Barrow Walk, St.Lukes Road	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	Yes
E59	B&Q Site Station Road Stechford	Part of Stechford Sustainable Urban Neighbourhood proposed in Core Strategy (draft policy E9).	Yes
E158	Between Pershore Rd & Alexandra Rd	This site is a current housing estate redevelopment.	Yes
N140	Site including 3 - 7 & 15, 17 Perry Common Road & 2 - 6 Turfpit Lane	The Core Strategy identifies the need for 11,000 new homes in NW Birmingham and this site would contribute to that figure. The site is only marginally affected by flooding	Yes
S11	Cadnam Close	Only a small area at the edge of this site is at risk from flooding, and the site could be developed around this.	Yes
S24	184 Harborne Road	This is a small redevelopment site. Only a small area at the edge of this site is at risk from flooding, and the site could be developed around this.	Yes

Site Ref	Address	Results of Sequential Test	Exception Test Required
S67	Prestwood Road (rear 29)	No similar sites in the vicinity. S283 nearby is not in a flood risk area, and has planning permission for 14 dwellings. This site is elevated above the surrounding roads, and may be less likely to flood than the maps suggest.	Yes
S109	Land fronting 17-35 Stonebrook Way	No. Adjacent site S106 removed from 2011 SHLAA due to flood risk. Only a small edge of this site is at risk, and the site could be developed around this.	Yes
S128	Druids Lane site, Druids Heath	The vast majority of this large site is not in an area of flood risk. There is a need to replace existing substandard housing in the medium term.	Yes
S129	2-100 Leasow Drive & land to the rear of.	The majority of this site is not in an area of flood risk. There is a need to replace existing substandard housing in the medium term.	Yes

Table 2.7 – Sequential Testing of Residential Sites in Flood Zone 3a

Flood Zone 3b (Functional Floodplain)

The 13 sites in Table 2.8 are to some degree located with Flood Zone 3b, Functional Floodplain. The NPPF considers that residential development within this zone is not acceptable and should not be permitted; these sites will need to be assessed in more detail to determine the extent of the flood risk and whether with appropriate policies the sites can pass the Exception Test and be developed safely.

Site Ref	Address	Results of Sequential Test	Exception Test Required
CC196	Site of Princethorpe Tower, Conybere Street	The existing industrial use of this site is of little long term regeneration value and the Core Strategy does not identify it as valuable industrial land. One of the objectives of the Core Strategy is to promote more residential development within the City Centre in order to deliver regeneration benefits to the wider area. The site is Brownfield and as such is a priority for redevelopment.	Yes
E51	Plough and Harrow, Coventry Road	Vacant former public house – residential proposal would be for conversion / refurbishment of existing vacant building. Worst affected part of site is amenity area to rear which would be retained as amenity space.	Yes
E89	Land off Roma Rd	Longstanding residential proposal. Adjust boundary of site to remove area affected.	Yes
E95	Junction of Bromford Drive & Reynoldstown Road	There are no real alternative sites in area. Will be brought forward as part of longer term strategy for area – including impact of HS2. Current HS2 proposals include diverting River Tame in this area – will require this to be done so that it resolves / reduces flood risk issues affecting estate.	Yes
E106	Between 17 Hyperion Rd & 7 Papyrus Way	There are no real alternative sites in area. Will be brought forward as part of longer term strategy for area – including impact of HS2. Current HS2 proposals include diverting River Tame in this area – will require this to be done so that it resolves / reduces flood risk issues affecting estate.	Yes

Site Ref	Address	Results of Sequential Test	Exception Test Required
E107	Adjacent 17 Papyrus Way	A number of former garage and amenity sites on the Bromford Estate. Falls within flood plain of River Tame. No real alternative sites in area – to be put in long term category of SHLAA.	Yes
E108	Junction of Tipperary Close & Trigo Croft	A number of former garage and amenity sites on the Bromford Estate. Falls within flood plain of River Tame. No real alternative sites in area – to be put in long term category of SHLAA.	Yes
E109	Adjacent 7 - 17 Hyperion Road	A number of former garage and amenity sites on the Bromford Estate. Falls within flood plain of River Tame. No real alternative sites in area – to be put in long term category of SHLAA.	Yes
E110	Land Adjacent 25 Trigo Croft	A number of former garage and amenity sites on the Bromford Estate. Falls within flood plain of River Tame. No real alternative sites in area – to be put in long term category of SHLAA.	Yes
E111	Rear of 19 - 25 Trigo Croft	A number of former garage and amenity sites on the Bromford Estate. Falls within flood plain of River Tame. No real alternative sites in area – to be put in long term category of SHLAA.	Yes
E165	Percy Road / Evelyn Road	Site is only partially affected (Percy Road frontage)	Yes
E410	Land off, Lancaster Drive and Farnborough Road	There are no real alternatives in area.	Yes
S347	1125 to 1157 Pershore Road	There are no real alternatives in area.	Yes

Table 2.8 – Sequential Testing of Residential Sites in Flood Zone 3b

2.3.2 Commercial Sites

Flood Zone 2

The 5 sites in Table 2.9 are located to some degree within Flood Zone 2, 'Medium Probability'. The NPPF considers that this Flood Zone is appropriate for commercial uses. However it is noted that if and where possible sites of lower flood risk, i.e. Flood Zone 1. The results of the Sequential Test are presented in the table.

Site Ref	Address	Results of Sequential Test	Exception Test Required
079010900	Aston Lane	The site is behind commercial and industrial uses fronting Aston Lane. It's redevelopment would make a key contribution to the growth of Perry Barr/Birchfield.	No
098912300	Land Adjacent BOC, Plume Street	Site is located within an established industrial area. Its redevelopment would help to consolidate this area for employment use in accordance with Policy CEA of the Core Strategy	No
118920500	Bromford Road/Fort Parkway	The site is an existing industrial site within the Bromford Industrial Regeneration Area and as such forms part of a larger area which is one of the city's key industrial locations. The draft Core Strategy also identifies the site as a core employment site that will be retained in industrial use.	No

Site Ref	Address	Results of Sequential Test	Exception Test Required
118930102	Heartlands Central between Wolseley Drive and Drews Lane	Important Core Employment Area within Core Strategy – part of Heartlands Central proposal (E14). No alternative sites of similar size.	No
139040600	Former Stagecoach PH Berrandale Road	Important Core Employment Area within Core Strategy – part of Heartlands Central proposal (E14). No alternative sites of similar size..	No

Table 2.9 – Sequential Testing of Commercial Sites in Flood Zone 2

Flood Zone 3a

The 3 sites in Table 2.1 are identified to be located within Flood Zone 3a. For these sites commercial uses are generally considered appropriate. However it is noted that if and where possible sites of lower flood risk should be utilised first. The results of the Sequential Test are presented in the table.

Site Ref	Address	Results of Sequential Test	Exception Test Required
079120114	Holford Park Thameside Side Holford Way	Site is within a large, established industrial park. No alternative use suitable for this site. River Tame Strategy would bring site out of flood risk	No
088811102	Land between Cheston Road and Birmingham to Fazeley Canal	Site is located within established industrial area. Alternative sites exist for industrial uses	No
088811600	Corner of Rocky Lane and Chester Street	Site is located within established industrial area. Alternative sites exist for industrial uses	No

Table 2.10 – Sequential Testing of Commercial Sites in Flood Zone 3a

2.3.3 Aston Lozells and Newtown AAP Sites

Flood Zone 2

The 4 sites in Table 2.11 are located to some degree within Flood Zone 2. Although the NPPF does not restrict the use of these sites unless highly vulnerable development is proposed it is noted that if and where possible, sites of a lower flood risk, i.e. Flood Zone 1, should be utilised first. The results of the Sequential Test are presented in the table.

Site Ref	Development Type	Address	Results of Sequential Test	Exception Test Required
ED1	Education	Birmingham City University	Only alternative site is at Eastside, this is now not feasible due to HS2	No

Site Ref	Development Type	Address	Results of Sequential Test	Exception Test Required
LC3	Mixed Use	Witton Road	Alternative sites may be available; however this building is included within the Council's Historic Environment Record as a building of local historical importance being former steam tram sheds and offices. Inclusion within the Historic Environment Record means that a site is recognised as a heritage asset- a site whose significance (value to this and future generations) merits consideration in the planning process. This is as defined in Planning Policy Statement 5, Planning for the Historic Environment, which states that in considering proposals for development affecting heritage assets, local planning authorities should take into account the significance of the heritage asset and the value it holds for this and future generations. Inclusion in the Historic Environment Record means that any proposed development would need to retain and enhance the significance of the heritage asset. Accordingly the protection of the historic building through its reuse would provide a wider benefit to the community.	No
IRA	Industrial Regeneration	Newtown Row	No alternative sites of this size exist within the area. The Core Strategy policy identifies this as a core employment area which will be retained in employment use. Most of the area is already developed and Royal Mail are already in place, any development within this area will be within small pockets. It is predominantly the northern edge of this area that falls within the Flood Zones, it is anticipated that the current Hockley Brook modelling will take the majority of this area out of Flood Zone 3a, however as the culvert passes through the area an easement would be required for any future redevelopment. De-culverting would not be considered a requirement due to the depth of the brook in this location.	No
H6	Housing Regeneration	Newtown	This is an existing housing area, the intention is to relocate people within the same area, and therefore an alternative site is not appropriate.	No

Table 2.11 – Sequential Testing of AAP Sites in Flood Zone 2

Flood Zone 3a

The site in Table 2.12 is located to some degree within Flood Zone 3a. As identified in the NPPF, 'water compatible' and 'less vulnerable' uses are appropriate, for all other uses an Exception Test is required. Prior to promoting these sites, investigations should be undertaken to determine whether sites of lower flood risk, Flood Zone 1 or 2 sites, could be used as alternative sites. The results of the Sequential Test are presented in Table 2.12.

Site Ref	Development Type	Address	Results of Sequential Test	Exception Test Required
LC3	Local Centres	Witton Road	Existing local centre. It is not feasible to relocate this area as historically it has been at the centre of and served the local community. The intention is to support and encourage its continued use as a local centre not to redevelop. Flood Zone 3 only affects a small number of properties in Witton Road and the car park at the junction of Witton Road and Manor Road, there is no development proposed on this car park.	No as redevelopment of this area is not planned. The intention is to retain this area as a Local Centre

Table 2.12 – Sequential Testing of AAP Sites in Flood Zone 3a

Flood Zone 3b (Functional Floodplain)

The 6 sites in Table 2.13 are to some degree located with Flood Zone 3b, Functional Floodplain. The NPPF considers that only 'water compatible' development is appropriate within this zone. These sites will need to be assessed in more detail to determine the extent of the flood risk and whether with appropriate policies the sites can pass the Exception Test. The results of the Sequential Test are presented in the table.

Site Ref	Development Type	Address	Results of Sequential Test	Exception Test Required
LC1	Local Centres	Perry Barr/Birchfield	This is a well established existing shopping centre serving the north-west of Birmingham, there is not an alternative site could accommodate a development of this size.	Yes
11	Housing Site	Tame Road	There are alternative sites which could accommodate residential uses however this site forms a natural extension to the Siemen's site which has planning permission for residential development. Opportunities for new residential development are scarce in this part of the plan area (Witton), which is characterised by a predominance of small terraced properties. These properties do not meet the growing need for larger family homes in the area particularly for ethnic minority families. The site would not be brought forward for development until the Environment Agency's River Tame Strategy has been implemented.	Yes
MU4	Mixed Use	Westwood Road /Dulverton Road	There are alternative sites which could accommodate residential uses, however a mixed use development incorporating residential uses is considered appropriate here. New residential sites are scarce in this part of the plan area (Witton), which is charactised by a predominance of small terraced properties. These properties do not meet the growing need for larger family homes in the area particularly for ethnic minority families. The site would not be brought forward for development until the Environment Agency's River Tame Strategy has been implemented.	Yes

Site Ref	Development Type	Address	Results of Sequential Test	Exception Test Required
IRB	Industrial Regeneration	Brookvale Road	This is an existing industrial area; no alternative sites of this size exist within the area. The Core Strategy policy identifies this as a core employment area which will be retained in employment use. The intention is to support and encourage its continued use as an industrial area not to redevelop. If the Tame Strategy proceeds this area will be benefit from the defences.	No
IRB	Industrial Regeneration	Tame Road	This is an existing industrial area; no alternative sites of this size exist within the area. The Core Strategy policy identifies this as a core employment area which will be retained in employment use. The intention is to support and encourage its continued use as an industrial area not to redevelop. If the Tame Strategy proceeds this area will be benefit from the defences.	No
R1-R6	Regional Investment Site	Aston Hall Road/Priory Road/Queens Road	There is not an alternative site of this size in the north of the city which would meet the criteria for a Regional Investment Site, the criteria being: • over 20 hectares • brownfield • well served by public transport • good access to the motorway network	Yes

Table 2.13 – Sequential Testing of AAP Sites in Flood Zone 3b

2.4 The Need for Application of the Exception Test

The results of the Sequential Test have highlighted that there are a number of sites that will require an Exception Test if they are to be developed.

3. The Exception Test

3.1 Introduction

The Exception Test should be applied where it is not possible or consistent with wider sustainability objectives to locate all development in zones of lower flooding probability. In accordance with the NPPF, for the Exception Test to be passed:

a) 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

b) 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.

3.2 Exception Test

Following the application of the Sequential Test there are 25 residential sites and 4 AAP sites that need to pass the Exception Test if development is to proceed.

These are listed in Table 3.1 below together with the evidence for part a) of the Exception Test.

Site Ref	Dev. Type	Address	Part a) Sustainability benefits to the community
CC90	Residential	Between High St Deritend / Mill Lane / Bradford St	This site forms a part of a wider area of redevelopment linked with the Wholesale Markets. The site is previously developed brownfield land. The site is a highly sustainable location in close proximity to the City Core and regeneration of this area will deliver significant sustainability benefits. This site is on the periphery of Flood Zone 3 and the vulnerability of any new development to flooding can be ameliorated through design measures and the arrangement of buildings within the site.
CC91	Residential	Wholesale markets , Bradford St	The Wholesale Markets site is a strategic regeneration site which will deliver a substantial regeneration benefit to the City Centre incorporating sustainability benefits including new green space, sustainable travel facilities and low carbon development. The site is previously developed brownfield land. Flood Zone 3 only affects a minority of the site, and the flood risk can therefore be addressed through good design and the distribution of uses. In addition, given the scale of the site it likely that it will be feasible to incorporate flood mitigation measures within the site.
CC196	Residential	Site of Princethorpe Tower, Conybere Street	This site forms a part of a wider area of redevelopment linked with the Wholesale Markets. The site is previously developed brownfield land. The site is a highly sustainable location in close proximity to the City Core and regeneration of this area will deliver significant sustainability benefits. This site is on the periphery of Flood Zone 3 and the vulnerability of any new development to flooding can be ameliorated through design measures and the arrangement of buildings within the site.

Site Ref	Dev. Type	Address	Part a) Sustainability benefits to the community
CC199	Residential	Barrow Walk, St. Lukes Road	This site forms a part of a wider area of redevelopment linked with the Wholesale Markets. The site is previously developed brownfield land. The site is a highly sustainable location in close proximity to the City Core and regeneration of this area will deliver significant sustainability benefits. This site is on the periphery of Flood Zone 3 and the vulnerability of any new development to flooding can be ameliorated through design measures and the arrangement of buildings within the site.
E51	Residential	Plough and Harrow, Coventry Road	Sustainable location on major public transport corridor and adjacent to Hay Mills Local Centre. Development could be designed to avoid area of greatest flood risk.
E59	Residential	B&Q Site Station Road Stechford	Sustainable location on major public transport route. Close to rail station and shopping and community facilities at Stechford Local Centre.
E89	Residential	Land off Roma Rd	Longstanding residential proposal in a sustainable location. Close to Tyseley Rail Station and major bus routes along Warwick Road.
E95	Residential	Junction of Bromford Drive & Reynoldstown Road	Childrens Home within residential estate. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E106	Residential	Between 17 Hyperion Road & 7 Papyrus Way	Redevelopment of amenity site within residential estate. Development would bring a site into housing use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E107	Residential	Adjacent 17 Papyrus Way	Redevelopment of amenity site within residential estate. Development would bring a site into housing use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E108	Residential	Junction of Tipperary Close & Trigo Croft	Redevelopment of cleared former garage site within residential estate. Development would bring a vacant site into use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E109	Residential	Adjacent 7 - 17 Hyperion Rd	Redevelopment of cleared former garage site within residential estate. Development would bring a vacant site into use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E110	Residential	Land Adjacent 25 Trigo Croft	Redevelopment of amenity site within residential estate. Development would bring a site into housing use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.
E111	Residential	Rear of 19 - 25 Trigo Croft	Redevelopment of amenity site within residential estate. Development would bring a site into housing use within an established residential area. Will be brought forward as part of the wider strategy to address flood risk issues in the area.

Site Ref	Dev. Type	Address	Part a) Sustainability benefits to the community
E158	Residential	Between Pershore Rd & Alexandra Rd	Existing housing site in sustainable location close to community facilities including Calthorpe Park. Pershore Road a major public transport corridor is nearby.
E165	Residential	Percy Road / Evelyn Road	Site is currently developed for industrial uses and is in a sustainable location close to shops and community facilities, including Strateford Road which is a major public transport route. The site is only partly affected on the Percy road frontage and can re-designed to address the flood risk issue.
E410	Residential	Land off, Lancaster Drive and Farnborough Road	Sustainable site close to shopping and community facilities on Castle Vale estate. Adjust boundary and design to address flood risk issue.
N140	Residential	Site including 3 - 7 & 15, 17 Perry Common Road & 2 - 6 Turfpit Lane	The site is currently occupied by a derelict garage. Its redevelopment for housing would form a natural extension to residential properties nos. 3-7 Perry Common Road in a predominantly residential area.
S11	Residential	Cadnam Close	Redevelopment of residential care home site, potentially for cater for students or healthcare professionals. Close to University and QE Hospital. Brownfield site which can be developed without building on the small area of flood risk.
S24	Residential	184 Harborne Road	Small site with expired planning permission for housing redevelopment. Sustainably located site close to Harborne Centre, only suitable for residential use. Can be developed without building on the small area of flood risk.
S67	Residential	Prestwood Road (rear 29)	Garage court surrounded by residential development, some of which is in Zone 3a. Sustainable location in a residential area, close to local shops, schools and public transport.
S109	Residential	Land fronting 17-35 Stonebrook Way	Sustainably located site, close to local shops, public transport and imminent new food store. Can be developed without building on the area of flood risk.
S128	Residential	Druids Lane site, Druids Heath	Large scale redevelopment of existing substandard housing to provide new housing, shops, employment land, community facilities and infrastructure. This can be designed around flood risk.
S129	Residential	2-100 Leasow Drive & land to the rear of.	Redevelopment of existing substandard housing. Sustainable location close to the centre of Selly Oak.
S347	Residential	1125 to 1157 Pershore Road	Development of the site would remove a scrap yard from a mainly residential area.
LC1	Local Centres	Perry Barr/ Birchfield	This is a well established existing shopping centre serving the north-west of Birmingham. The Core Strategy Draft Policy SP18 identifies Perry Barr/Birchfield Centre as one of three district centres in the city for growth and development.
11	Housing Site	Tame Road	Core Strategy Draft Policy SP24 identifies the need for 11,000 new homes in the North of Birmingham. This site is adjacent to the former Siemens Site which already has planning permission for approximately 130 homes.

Site Ref	Dev. Type	Address	Part a) Sustainability benefits to the community
MU4	Mixed Use	Westwood Road /Dulverton Road	The site is located within a mixed area of residential and industrial use and comprises large vacant industrial premises. Redevelopment of this site for mixed use will help reconcile the currently awkward relationship of the site to existing housing.
R1-R6	Regional Investment Site	Aston Hall Road/ Priory Road/ Queens Road	The Aston RIS is supported in the Core Strategy Consultation Draft and will be a high quality development attractive to international, national and regional investors. It will contribute to the portfolio of employment opportunities in the City and the Region to support the diversification of the regional and local economies. It plays an essential part in delivering the strategic vision for the area by helping create new jobs and a more flexible and competitive economy.

Table 3.1 – Evidence for Exception Test Parts a) and b)

4. Assessment of Proposed Development Sites

4.1 Introduction

The following section describes the methodology applied in assessing whether the sites outlined in Section 3 are likely to pass part b) of the Exception Test:

> '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.'

In order to make this assessment the flood risk for each proposed development sites has been assessed and a site summary report is included in Appendix C for each site.

4.2 Methodology for Assessing Flood Risk

4.2.1 Flood Risk

Flood risk for each of the proposed development sites has been assessed using existing datasets as described below.

Fluvial

Fluvial flood risk has been assessed based on the Environment Agency Flood Zones; these zones are based on 1D and 2D modelling of the Main Rivers such as the River Rea, River Tame and Plants Brook. Where more detailed modelling is available this information has been used to supplement the Environment Agency Flood Zones.

Surface Water

Surface water flood risk has been assessed based on the Flood Map for Surface Water (FMfSW), using the 0.5% Annual Exceedance Probability (AEP) event, identifying shallow (<0.1m) and deep (>0.3m) surface water flooding extents. The 0.3m threshold was chosen as it represents a typical value for the onset of significant property damages when property flooding may start (above doorstep level) and because it is at around this depth that moving through floodwater (driving or walking) may become more difficult; both of which may lead users to consider the need to close roads or evacuate areas.

The FMfSW better represents the mechanisms that cause surface water flooding than the current 2009 Areas Susceptible to Surface Water Flooding (AStSWF) map in the following ways:

- improved ground and surface data in many areas;
- sewer flow now represented;
- infiltration now represented;
- storm duration more representative;
- buildings now included;
- two storm likelihoods (3.3% AEP and 0.5% AEP event) now mapped; and,
- different roughness figures for urban and rural now included.

Where more detailed modelling is available this information has been used to supplement the FMfSW.

Groundwater

Flood risk to the site from groundwater flooding has been assessed based on the British Geological Society (BGS) Susceptibility to Groundwater Flooding Map. This is the first national hazard data set for groundwater flooding, and is based on geological and hydrogeological information, and can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

Areas are ranked as having Very Low, Low, Moderate, High and Very High susceptibility to groundwater flooding. The scale of detail is 1:50,000, and should therefore only be used as a broad scale indication of potential areas of groundwater flood risk. Where sites are identified as being susceptible to groundwater flooding the site specific Flood Risk Assessment should address this potential issue.

4.2.2 Integrated Modelling

The Level 2 SFRA has made use of two integrated InfoWorks models for 3 of the proposed development sites which take into account fluvial, pluvial and sewer flooding, to allow a better understanding of flood risk for these sites. These models are the River Cole Integrated Model and the Wood Brook Integrated Model.

River Cole Integrated Model

The River Cole Integrated model was developed by Atkins in March / April 2011 using InfoWorks CS 2D (Version 12). The model has been verified. The critical storm duration for the proposed development sites was a 480-minute storm profile. Both summer and winter profiles were run and the worst-case scenario applied to the site. Model outputs were generated using the 2D results triangles, but removing areas containing a depth of less than 0.1m.

The InfoWorks model shows a greater level of flood risk than that indicated by the Environment Agency Flood Zones, as fluvial, pluvial and sewer flooding is taken into account rather than only fluvial sources.

Wood Brook Integrated Model

The Wood Brook Integrated model was built by Atkins in January 2009 using InfoWorks CS 2D (Version 12). The model has been verified. The critical storm duration for the proposed development site was a 60-minute summer storm profile, and the model geometry file applied was without buildings. Model outputs were generated using the 2D results triangles, with no depth threshold set.

This more detailed modelling shows a greater level of flood risk than that indicated by the Environment Agency Flood Zones, as fluvial, pluvial and sewer flooding is taken into account rather than only fluvial sources.

4.2.3 Flood Hazard Assessment

When considering the safety of the development in terms of part b) of the Exception Test, specific local circumstances need to be taken into account including the characteristics of a possible flood event in terms of the frequency, speed of onset of flooding, depths and velocity of the flood water.

Flood hazard describes the physical risk that floodwater presents to people (and to vehicles and property). It is a function of water depth (D), velocity (v) and a debris factor (DF). The flood hazard classification is summarised in Table 4.1 and is based on Defra guidance FD2321[3].

[3] Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006

Flood Hazard Rating (D x (v + 0.5) + DF	Degree of Flood Hazard	Description
<0.75	Low	Caution – Flood Zone with shallow flowing water or deep standing water
0.75-1.25	Moderate	Dangerous for Some (i.e. children, elderly and infirm) – Danger: Flood Zone with deep or fast flowing water
1.25-2.5	Significant	Dangerous for most people (i.e. general public) – Danger: Flood Zone with deep fast flowing water
>2.5	Extreme	Dangerous for all (i.e. emergency services) – Extreme danger: Flood Zone with very deep fast flowing water

Table 4.1 - Flood Hazard Classification (risks to people)

For the sites identified in Table 4.2, where flood risk has been identified as requiring more detailed consideration, an assessment of flood hazard for the development site has been undertaken. The approach adopted for these assessments is summarised within the Site Summary Reports in Appendix C.

Site Ref	Development Type	Address	River Catchment
CC90	Residential	Between High Street Deritend / Mill Lane / Bradford Street	River Rea
CC91	Residential	Wholesale markets , Bradford Street	River Rea
S67	Residential	Prestwood Road (rear 29)	Wood Brook
CC196	Residential	Site of Princethorpe Tower, Conybere Street	River Rea
E165	Residential	Percy Road / Evelyn Road	River Cole
E410	Residential	Land off, Lancaster Drive and Farnborough Road	Plants Brook and the River Tame
E51	Residential	Plough and Harrow, Coventry Road	River Cole
S128	Residential	Druids Lane site, Druids Heath	Chinn Brook
S347	Residential	1125 to 1157 Pershore Road	River Rea

Table 4.2 – Sites Requiring more Detailed Assessment

4.3 Breach Analysis

Owing to the location of the proposed development sites in relation to the watercourses it was not necessary to undertake any breach assessments as part of the Level 2 SFRA.

4.4 Results of Assessment of Sites

In total 25 residential sites and 4 Aston, Lozells and Newtown AAP sites have been assessed. The Site Summary Reports show the developer if an FRA is likely to be able to show that the sites can pass part b) of the Exception Test. Of these there are 9 sites which will ultimately benefit from the flood alleviation works proposed in the River Tame Strategy, these sites will not be brought forward for development until the Tame Strategy works are implemented.

5. Summary and Recommendations

5.1 Introduction

This section summarises the findings of the Level 2 SFRA and outlines further recommendations.

5.2 Summary

This SFRA Report provides an overview of the application of the Sequential and Exception Test to sites allocated by Birmingham City Council, including residential sites identified in the SHLAA, Commercial Sites and those identified in the Aston, Lozells and Newtown AAP.

The Level 1 SFRA identified 203 sites would need to pass the Sequential Test in order for development to proceed. Further screening was undertaken on these sites to remove any that already had planning permission, any that were removed from the Flood Zones as a result of the latest Hockley Brook modelling and any where the flood risk was considered too great. Following this screening 44 residential sites, 8 commercial sites and 12 AAP sites were identified as requiring a Sequential Test. Evidence is provided in the report to outline how all of these sites pass the Sequential Test.

Following the application of the Sequential Test 25 residential sites (12 in Flood Zone 3a and 13 in Flood Zone 3b), and 4 AAP sites were identified that would also need to pass the Exception Test if development is to proceed due to their land use classification. Evidence has been presented as to how these sites can pass part a) of the Exception Test and Site Summary Reports have been produced to demonstrate if the developers site specific FRA is likely to be able to show that the sites can pass part b) of the Exception Test.

There are 9 sites which will ultimately benefit from the flood alleviation works proposed in the River Tame Strategy, these sites will not be brought forward for development until the Tame Strategy works are implemented.

5.3 Recommendations

5.3.1 Level 1 SFRA Recommendations and Policies

This Level 2 SFRA should be read in conjunction with the Level 1 SFRA, there are a number of policies outlined in the Level 1 SFRA that need to be applied to all developments, of particular relevance are the following.

Requirements for a Flood Risk Assessment

In accordance with the NPPF, site specific FRAs are required for all sites over 1 hectare in size, for all sites located with fluvial Flood Zones 2, 3a and 3b. In addition, as stated in the Level 1 SFRA, FRAs should be prepared for all sites considered to be at risk from other sources of flooding; therefore a site specific FRA will be required where:

- Sites are over 1 hectare;
- Sites are located within Flood Zones 2, 3a and 3b;
- Sites are at risk of surface water flooding (as defined by the ‘locally agreed surface water information’);
- Sites are within 250m of an historic flooding location; and
- Sites are within a ‘local flood risk area’ defined by the Surface Water Management Plan when published.

Surface Water Drainage Assessment

As part of their FRA developers should demonstrate that the disposal of surface water from the site will not exacerbate existing flooding.

Greenfield Sites

For Greenfield sites the surface water run-off should be restricted to the greenfield run-off rate for the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) including an allowance for climate change.

Brownfield Sites

As a minimum, for the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) event (including an appropriate allowance for climate change), the developed rate of run-off into a watercourse, or other receiving water body should show a minimum of a 20% reduction in peak flows between the existing and developed scenarios. Developers are, however, strongly encouraged to further reduce runoff rates from previously-developed sites as much as is reasonably practicable.

Brownfield Sites at Flood Risk

Where the site specific FRA has identified that the site:

- is at risk of surface water flooding (as defined by the 'locally agreed surface water information'); or
- has flooded historically; or
- is within a 'local flood risk area' defined by the Surface Water Management Plan when published

The surface water run-off should be restricted to the greenfield run-off rate for the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) including an allowance for climate change.

Brownfield Sites where the Runoff Impacts on a Community at Flood Risk

Where the site specific FRA has identified the run-off from the site impacts on a downstream community that is in an area that:

- is at risk of surface water flooding (as defined by the 'locally agreed surface water information');
- has flooded historically; or
- is within a 'local flood risk area' defined by the Surface Water Management Plan when published

The surface water run-off should be restricted to the greenfield run-off rate for the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) including an allowance for climate change.

Surface Water Drainage Assessment Requirements

A surface water drainage assessment should be undertaken to demonstrate that surface water runoff from the proposed development can be effectively managed without increasing flood risk elsewhere. A surface water drainage assessment should include the following:

- Assessment of whether the development will increase the overall discharge from the site by calculating the change in area covered by roofs and hard-standing.
- Details of how overland flow from the new development can be intercepted to prevent flooding of adjacent land.

- Details of how additional onsite surface water attenuation can be provided to mitigate against known flooding problems or as a result of incapacity on the drainage systems.
- Demonstration that overland flows will not increase flood risk to both existing development and receiving watercourses.
- Agreement that the rates of discharge from the development are acceptable to the Environment Agency and sewerage authorities.

Sustainable Urban Drainage Systems

Large increases in impermeable areas for a site could contribute to a significant increase in surface water runoff peak flows and volumes. In turn this could contribute to an increase in flood risk elsewhere unless adequate SUDS techniques are implemented as part of a development. Reductions in the rate of surface water run-off are required for all developments. Volumes of run-off should also be reduced wherever possible using infiltration and attenuation techniques.

Developers are advised to consult with Birmingham City Council, Environment Agency and Severn Trent Water Limited early in the site planning process about their SUDS proposals to ensure that they are adopting the most appropriate methods.

5.3.2 Policy Recommendations

Linkages with other Flood Risk Management Strategies

The City Council should ensure that in developing and taking forward the findings of the SFRA it has regard to other developing strategies that consider flood risk management in the Birmingham area. Of particular relevance is the Trent Catchment Flood Management Plan (CFMP), the Tame Strategy, Sustainable Management of Urban Rivers and Floodplains (SMURF) and the emerging Surface Water Management Plan and Local Flood Risk Management Strategy.

SUDS Strategy

Following commencement of the relevant provisions of the Flood and Water Management Act a SUDS policy should be developed as supplementary planning guidance for Birmingham.

5.3.3 Development Control Recommendations

Guidance on the application of the Sequential and Exception Tests

The Birmingham Level 1 SFRA has identified that considerable areas of Birmingham have a relatively high risk of flooding. As a result, and in accordance with the NPPF, the Sequential Test and Exception Tests will need to be applied to many proposed development schemes.

Developers should approach the City Council, the Environment Agency, Severn Trent Water and other key organisations at an early stage to discuss flood risk issues, including the scope of site-specific FRAs, in particular design, flood risk and attenuation issues, along with guidance on the application of the Sequential and Exception Tests.

Any new allocations proposed by Birmingham City Council should also be assessed to determine whether the Sequential and Exception Tests can be passed.

Sites Affected by the River Tame Strategy

Sites likely to benefit from the Tame Strategy will not be promoted in the short term. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Windfall sites

As previously outlined in the Level 1 SFRA, proposed development for “windfall sites” will by definition not derive from any potential development sites that have been sequentially tested as

part of this SFRA. The Sequential Test will need to be carried out for windfall sites and, if necessary, the Exception Test at the planning application stage.

Site Specific Flood Risk Assessments

This Level 2 SFRA does not replace the need for site specific FRAs. A greater level of detail should be provided by these assessments with respect to flood risk and any protection afforded to the site, including from informal flood defences. Consideration should be given to the proportion of the site located within specific Flood Zones and the implications of this upon the development layout of the site. This process will allow planning of sites to place higher vulnerability uses within lower risk areas. Where required, the site specific FRA will address part b) of the Exception Test.

5.3.4 Technical Recommendations

SFRA Review

The SFRA has been produced based on current understanding of flood risk and existing and available flood risk information. In time, as Environment Agency studies are completed, the Surface Water Management Plan and Local Flood Risk Management Strategy are developed and further flood risk understanding is developed the information within this document will become outdated. Therefore, it is important that the SFRA is reviewed and updated at regular intervals to incorporate this information.

Appendix A – Hockley Brook Modelling and Aston Lozells and Newtown AAP Baseline

Hockley Brook Modelling

Work has been undertaken by Birmingham City Council to model Hockley Brook and updated flood outlines have been produced for the 1 in 100 year and 1 in 1000 year chance of flooding. The existing and updated Flood Zone 3 outline is shown in figure A-1, the updated outline shows that for the 1 in 100 year (greater that 1%) chance of flooding the flow stays within the Hockley Brook channel/culvert. The existing and updated Flood Zone 2 outline is shown in figure A-2, the updated outline is much reduced from that shown on the existing Flood Zone maps. The updated flood outlines will ultimately be adopted by the Environment Agency for use in their Flood Zone maps.

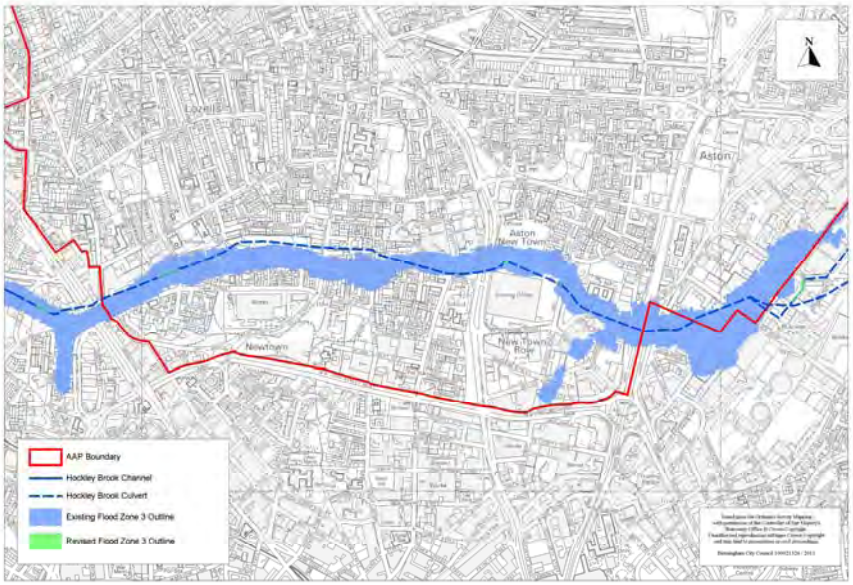


Figure A.1: Hockley Brook Existing and Revised Flood Zone 3 Outline

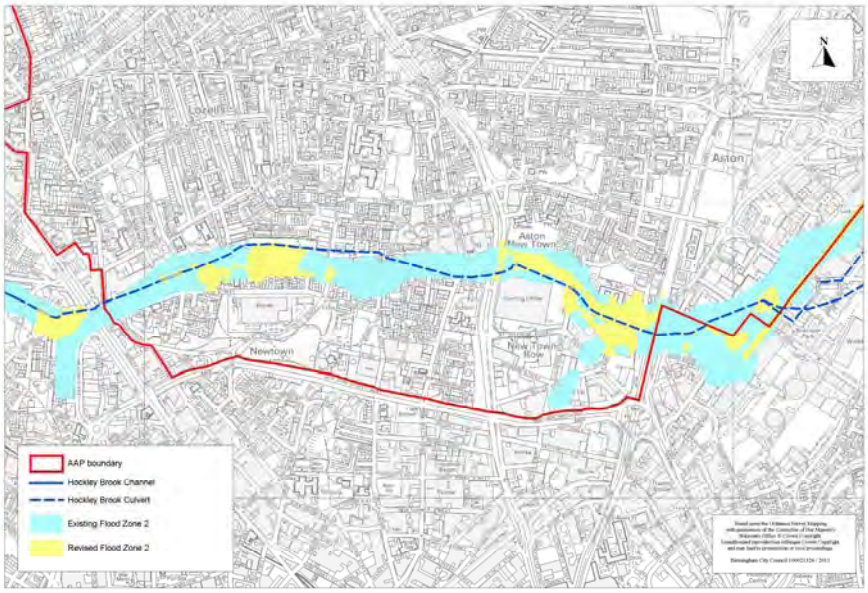


Figure A.2: Hockley Brook Existing and Revised Flood Zone 2 Outline

The Effect of Hockley Brook Modelling on Aston Lozells and Newtown AAP Sites

The results of the Hockley Brook modelling study have been applied to the 35 sites identified in the AAP; the affect of this is that there are now 4 sites located to some degree within Flood Zone 2, 1 site located to some degree within Flood Zone 3a, and 7 sites located to some degree within Flood Zone 3b. There are 3 sites which were previously identified in the Level 1 SFRA as being within Flood Zone 3 that are no longer with any Flood Zone.

The specific sites are listed in the tables below.

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 2
ED1	Education	Birmingham City University	River Tame	Partially
LC3	Mixed Use	Witton Road	River Tame	Partially
IRA	Industrial Regeneration	Newtown Row	Hockley Brook	Partially
H6 & H7	Housing Regeneration	Newtown & Lozells	Hockley Brook	Partially

Figure A.3 - Aston Lozells and Newtown Sites located within Flood Zone 2

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 3a	Partially or Fully within Flood Zone 2
LC3	Local Centres	Witton Road	River Tame	Partially	Partially

Figure A.4 - Aston Lozells and Newtown Sites located within Flood Zone 3a

Site Ref	Development Type	Address	Watercourse	Partially or Fully within Flood Zone 3b	Partially or Fully within Flood Zone 3a	Partially or Fully within Flood Zone 2
LC1	Local Centres	Perry Barr/Birchfield	River Tame	Partially	Partially	Partially
11	Housing Site	Tame Road	River Tame	Partially	Partially	Fully
3	Housing Site	Former Siemens Site	River Tame	Partially	Partially	Partially
MU4	Mixed Use	Westwood Road / Dulverton Road	River Tame	Partially	Partially	Fully
IRB	Industrial Regeneration	Brookvale Road	River Tame	Partially	Partially	Partially
IRB	Industrial Regeneration	Tame Road	River Tame	Partially	Partially	Fully
R1-R6	Regional Investment Site	Aston Hall Road/Priory Road/Queens Road	River Tame	Partially	Partially	Partially

Figure A.5 - Aston Lozells and Newtown Sites located within Flood Zone 3b

Site Ref	Development Type	Address
LC4A	Local Centres	Newtown Shopping Centre
LC5	Local Centres	Wheeler Street
MU1B	Mixed Use	New John Street West

Figure A.6 - Aston Lozells and Newtown Sites outside of Flood Zones following Hockley Brook study.

Appendix B – Site Screening

Site Ref	Development Type	Address	Reason for Removal
CC242	Residential	111-112 Digbeth	Detailed planning permission
E328	Residential	Rear of Bromford Inn PH, Bromford Lane	Detailed planning
E352	Residential	1044 Coventry Road	Removed from SHLAA by Planning Strategy
N443	Residential	22 South Parade	Under Construction
S351	Residential	Rear of 768 to 772 Pershore Road	Detailed planning permission
027820400	Commercial	Site of the Mill PH, Abbeydale Road	Detailed planning permission
048330201	Commercial	Birmingham Battery Site, Harborne Lane	Outline planning permission
068440701	Commercial	308 to 330 Pershore Road	Outline planning permission
068440702	Commercial	Land adjacent cricket ground and rear of Pershore Road	Outline planning permission
069130400	Commercial	Regina Drive, Walsall Road	Detailed planning permission
078422300	Commercial	Land at Haden Way and Belgrave Middleway	Detailed planning permission
078622700	Commercial	89 and 90 Meriden Street	Detailed planning permission
079020603	Commercial	Former IMI Works, Witton Road	Outline planning permission
079020607	Commercial	Former IMI Works, Witton Road	Detailed planning permission
079130800	Commercial	Holford Drive Playing Fields, Holford Drive	Detailed planning permission
088632900	Commercial	11 Bromley Street	Detailed planning permission
098321900	Commercial	Greet Primary School, Paercy Road	Detailed planning permission
098442900	Commercial	Former Fisher Foundries Ltd, Albion Road	Detailed planning permission
098711300	Commercial	30 Inkerman Street	Detailed planning permission
108930600	Commercial	Former Alstom Site, Common Lane	Outline planning permission

Table B.1 – Flood Zone 2 Sites Removed

Site Ref	Development Type	Address	Reason for Removal
CC106	Residential	Between Fazeley Street / River Rea / Canal	Remove from SHLAA due to being in Enterprise Zone
CC107	Residential	Junction of Fazeley Street / Pickford Street	Remove from SHLAA due to being in Enterprise Zone
CC110	Residential	Btw Barford Street / Rea Street South / Moseley Street	Removed from SHLAA, awaiting results of River Rea Modelling
CC112	Residential	Btw Sherlock Street / Bishop Street / Barford Street	Removed from SHLAA due to flood risk
CC197	Residential	28 to 58 Berrington Walk	Removed from SHLAA, awaiting results of River Rea Modelling
CC200	Residential	Berrington Walk, St. Lukes Road	Removed from SHLAA, awaiting results of River Rea Modelling
CC203	Residential	Typhoo Wharf, Bordesley Street	Detailed planning permission
CC208	Residential	Land corner of Bradford Street and Rea Street	Detailed planning permission
CC209	Residential	Land fronting Bradford Street	Detailed planning permission
CC210	Residential	Land corner of High Street Deritend and Stone Yard	Detailed planning permission
CC211	Residential	Land corner of Chapel House Street and Bradford Street	Detailed planning permission
CC212	Residential	Land corner of High Street Deritend and Chapel House Street	Detailed planning permission
CC214	Residential	Land bounded by Bradford Street and Birchall Street and Cheapside	Removed from SHLAA, awaiting results of River Rea Modelling
CC215	Residential	Former Harrison Drape Building, Bradford Street	Detailed planning permission
CC216	Residential	Bull Ring Trading Estate, High Street Deritend	Outline planning permission
CC218	Residential	46 to 48 Bradford Street	Detailed planning permission
CC256	Residential	44 Bradford Street	Detailed planning permission
CC80	Residential	Land btw Meridan Street / Oxford Street / Coventry Street / Railway	Remove from SHLAA due to being in Enterprise Zone
CC87	Residential	Moseley Street / Rea Street / Cheapside / Charles Henry Street	Removed from SHLAA, awaiting results of River Rea Modelling
CC88	Residential	Rea Street / Land bounded by Moseley Street / Bradford Street / Barford Street	Removed from SHLAA, awaiting results of River Rea Modelling
CC89	Residential	St Eugines Court Rea ST	Removed from SHLAA, awaiting results of River Rea Modelling

Site Ref	Development Type	Address	Reason for Removal
E157	Residential	Junction of Edward Road & Harbury Road	Removed from SHLAA due to flood risk
E184	Residential	Site of Public Baths Farnborough Road	Removed from SHLAA due to flood risk
E216	Residential	Land adjacent 52 Orchard Way	Outline planning permission
E247	Residential	Former MEB depot, George Road	Under Construction
E34	Residential	Little Bromwich Road (50 - 64)	Removed From SHLAA as difficult to develop
E409	Residential	Adjacent 32 Cadbury Drive	Detailed planning permission
E415	Residential	Site of Ternhill House, Halfpenny Field Walk	Detailed planning permission
N101	Residential	New Triumphant Pentecostal Church, Farm Street	New Hockley Brook modelling now takes this site out of flood zone 3a and 2
N111	Residential	330 Hospital Street	New Hockley Brook modelling now takes this site out of flood zone 3a and 2
N139	Residential	Site adjacent to 59 Perry Common Road	Removed from SHLAA due to flood risk
N189	Residential	5-7 Crescent Avenue	Removed from SHLAA not appropriate for residential uses.
N249	Residential	Site and garages rear of 14 Severn Court, Garrard Gardens	Removed from SHLAA due to flood risk
N362	Residential	Land Bounded by Alma Street and Mews Walk and Porchester Street	Under Construction
N382	Residential	Land between Dovedale Road and Hurstwood Road	Removed from SHLAA by Planning Strategy
N385	Residential	39 to 149 Dovedale Road	FRA already approved for this site by Environment Agency
N65	Residential	North Newtown Area 2 site 4	New Hockley Brook modelling now takes this site out of flood zone 3a and 2
S102	Residential	21 Merritts Brook Lane	Environment Agency re-ran model over latest LiDAR, this now removes this site from the flood zones.
S116	Residential	1-7 Swinford Road	Removed from SHLAA due to flood risk
S203	Residential	Land to the rear of 2-87 Station Road	Removed from SHLAA by Planning Strategy
S223	Residential	Birmingham Battery Site off Harborne Lane	Outline planning permission
S275	Residential	Land adjacent 44 Station Road	Outline planning permission

Site Ref	Development Type	Address	Reason for Removal
S346	Residential	Land fronting Pershore Road	Removed from SHLAA due to flood risk
S353	Residential	Rear of 34a to 40 Oakfield Road	Detailed planning permission
S452	Residential	1159 to 1171 Pershore Road	Detailed planning permission
028320100	Commercial	Land adjacent to 100 to 146 Ferncliffe Road	Detailed planning permission
048330202	Commercial	Birmingham Battery adjacent to railway off Harborne Lane	Outline planning permission
058141300	Commercial	Land at Hazelwell Lane and Pershore Road	Outline planning permission
058811900	Commercial	Land corner of Soho Pool Way and Park Road	Detailed planning permission
068440501	Commercial	Edgbaston Mill, Edgbaston Road	Detailed planning permission
068440504	Commercial	Edgbaston Mill, Edgbaston Road	Complete
069220400	Commercial	Alexander Stadium, Walsall Road	Detailed planning permission
069220500	Commercial	Central Motorway Police Centre, Thornbridge Avenue	Detailed planning permission
078622200	Commercial	Land bounded by Digbeth and Coventry Street and Oxford Street and Meriden Street	Detailed planning permission
078622300	Commercial	Typhoo Wharf, Bordesley Street	Detailed planning permission
078643101	Commercial	Land corner of Bradford Street and Rea Street	Detailed planning permission
078643102	Commercial	Land corner of High Street Digbeth and Rea Street	Detailed planning permission
078643103	Commercial	Land fronting Bradford Street	Detailed planning permission
078643104	Commercial	Land corner of High Street Deritend and Stone Yard	Detailed planning permission
078643105	Commercial	Land corner Chapel House Street and Bradford Street	Detailed planning permission
078643106	Commercial	Land corner of High Street Deritend and Chapel House Street	Detailed planning permission
078643300	Commercial	Land bounded by Bradford Street and Birchall Street and Cheapside	Site is identified in SHLAA
078643400	Commercial	Former Harrison Drape Building, Bradford Street	Outline planning permission
078643600	Commercial	Bull Ring Trading Estate, High Street Deritend	Outline planning permission

Site Ref	Development Type	Address	Reason for Removal
078822100	Commercial	Aston Manor School, Phillips Street	Detailed planning permission
079020604	Commercial	Former IMI Works, Witton Works	Outline planning permission
079020606	Commercial	Former IMI Works, Witton Works	Outline planning permission
079020608	Commercial	Former IMI Works, Witton Works	Detailed planning permission
079020609	Commercial	Former IMI Works, Witton Works	Outline planning permission
098912800	Commercial	Cuckoo Wharf Business Park, Lichfield Road	Detailed planning permission
099030400	Commercial	Salford Metals, Lichfield Road	Detailed planning permission
099240300	Commercial	162 to164 Streetly Road	Detailed planning permission
118940601	Commercial	Rear of Bromford Inn PH, Bromford Lane	Detailed planning permission
139140500	Commercial	Above Unit 3 and 4 Chester Road	Detailed planning permission
149020500	Commercial	Former Skylark PH, Farnborough Road	Detailed planning permission
158310500	Commercial	2259 to 2297 Coventry Road	Outline planning permission

Table B.2 – Flood Zone 3a Sites Removed

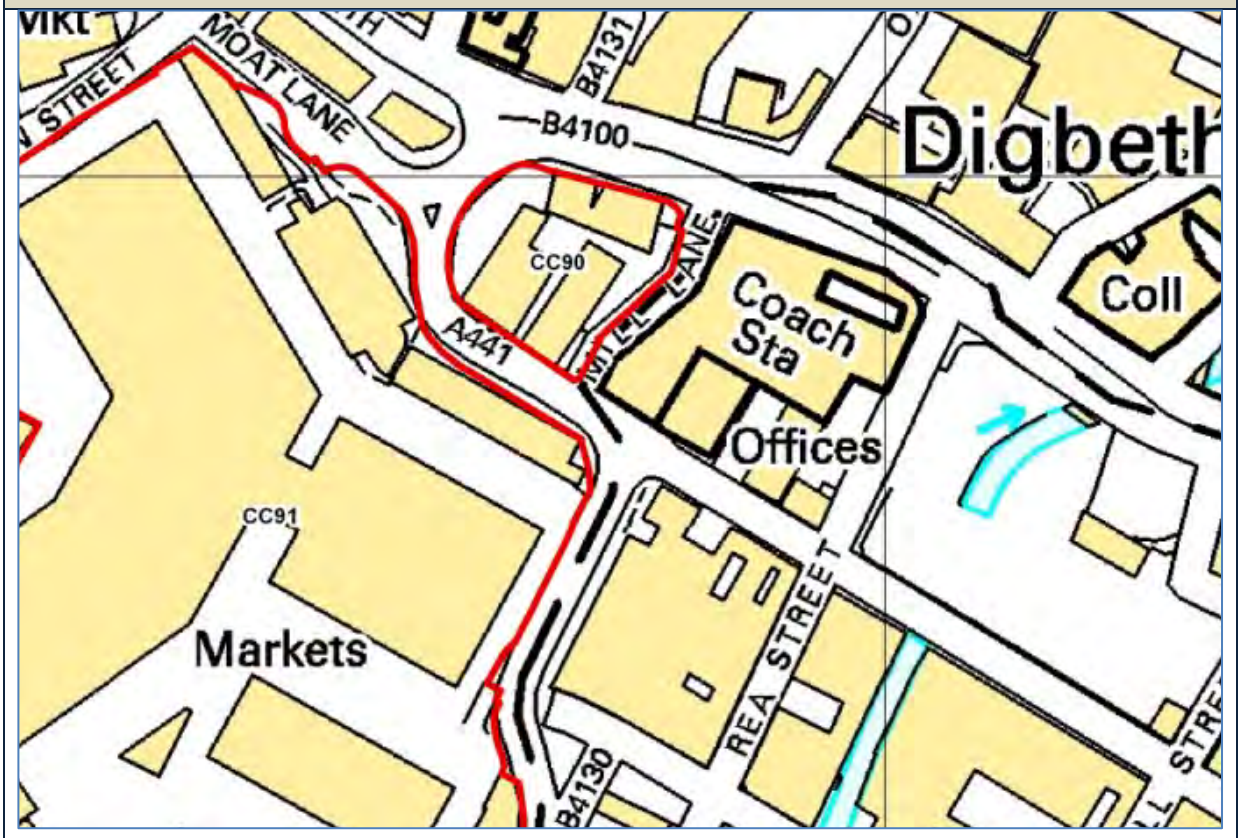
Site Ref	Development Type	Address	Reason for Removal
CC113	Residential	Rea Street South	Remove from SHLAA due to Rea
CC12	Residential	St Lukes Site F	Remove from SHLAA duplicate site
E375	Residential	Adjacent 1 Wincanton Croft	Under Construction
N177	Residential	Site rear of 110-153 Tame Road	Duplicate of AAP Site 11
N374	Residential	Land off Witton Road and Tame Road	Outline planning permission
N379	Residential	Corner, Long Acre and Crompton Road	Detailed planning permission
S106	Residential	Land to the rear of 50-138 Brinklow Road	Removed from SHLAA
S108	Residential	Land to the rear of 132-176 Stonehouse Lane	Removed from SHLAA
S224	Residential	Former MG Rover Works, Bristol Road South	Environment Agency agreed that site should be removed as developer is considering final solution for this site.
S254	Residential	North Works, Longbridge Lane	Environment Agency agreed that site should be removed as developer is considering final solution for this site.
S255	Residential	North Works, Bristol Road South	Environment Agency agreed that site should be removed as developer is considering final solution for this site.
S262	Residential	Mill Lane	Under Construction
S304	Residential	245 to 247 Harborne Lane	Detailed
S348	Residential	Land at Bewdley Road	Outline planning permission
S418	Residential	146 to 156 Sarehole Road	Outline planning permission
S99	Residential	582-588 Pershore Road	Removed from SHLAA
007720400	Commercial	1547 to 1563 Bristol Road South	Detailed planning permission
017710101	Commercial	North Works, Longbridge Lane	Detailed planning permission
017710102	Commercial	North Works, Longbridge Lane	Environment Agency agreed that site should be removed as developer is considering final solution for this site.
017710103	Commercial	North Works, Bristol Road South	Environment Agency agreed that site should be removed as developer is considering final solution for this site.
017710202	Commercial	North Works Car Park, Longbridge Lane and Devon Way	Environment Agency agreed that site should be removed as developer is considering final solution for this site.

Site Ref	Development Type	Address	Reason for Removal
017710203	Commercial	North Works Car Park Longbridge Lane and Devon Way	Detailed planning permission
018221200	Commercial	Land off Barnes Hill	Detailed planning permission
057920600	Commercial	24 Ebury Road	Detailed planning permission
058320101	Commercial	Former Pebble Mill Studios, Bristol Road and Pershore Road	Outline planning permission
058320103	Commercial	Bristol Road and Pershore Road	Outline planning permission
058320104	Commercial	Former Pebble Mill Studios, Bristol Road and Pershore Road	Outline planning permission
069120500	Commercial	205 Aldridge Road	Detailed planning permission
079120115	Commercial	Holford Park, Holford Way	Detailed planning permission
079240500	Commercial	Former P&O Container Depot, College Road	Detailed planning permission
088921400	Commercial	Land at Priory Road	Detailed planning permission
089130500	Commercial	Atlas Industrial Estate, Brookvale Road	Detailed planning permission
108310500	Commercial	Land corner of Manor Farm Road and Warwick Road	Detailed planning permission
108420700	Commercial	Land South of The Fordrough	Outline planning permission
139040303	Commercial	Land adjacent Fort Jester PH, Chester Road	Detailed planning permission
159010200	Commercial	Farnborough Road	Detailed planning permission
169110101	Commercial	Former Minworth Sewage Works, Water Orton Lane	Detailed planning permission
169110102	Commercial	Former Minworth Sewage Works, Water Orton Lane	Detailed planning permission
169110105	Commercial	Former Minworth Sewage Works, Water Orton Lane	Detailed planning permission
169110106	Commercial	Former Minworth Sewage Works, Water Orton Lane	Detailed planning permission
3	AAP - Housing Site	Former Siemens Site	Detailed planning permission

Table B.3 – Flood Zone 3b Sites Removed

Appendix C – Site Summary Reports

Site Summary Sheet: CC90 Deritend High Street, Mill Lane and Bradford Street



Site Name	CC90 – Light Industrial Units & The Dubliner Public House
Site Address	Between Deritent High Street, Mill Lane & Bradford Street, Digbeth
National Grid Reference	SP 07546 86394
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from the River Rea
Secondary Sources of Flood Risk	Surface water
Site Area (Ha)	0.58
Area within FZ1 (Ha)	0.31 (53%)
Area within FZ2 (Ha)	0.27 (47%)
Area within FZ3a (Ha)	0.04 (7%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Moderate. The flood hazard modelling suggests that the majority of the site (93%) is outside FZ3a. The eastern boundary of the site has a 'moderate' (0.75 – 1.25) hazard rating. Mill Lane has a 'significant' (1.25 – 2.5) hazard rating.
Is the site at risk from surface water flooding?	Yes. 0.01Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.05Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	A very small section of the site is considered to have a Very High susceptibility to groundwater flooding.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 93% of the site is located outside FZ3a with flood free access and egress routes up to an including the 0.1% AEP event. More vulnerable development is acceptable.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield land and is completely covered by paved areas, industrial units and a public house. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes. Dry access and egress routes are available via both Deritent High Street and Bradford Street. Both are flood free for the 0.1% AEP flood event from the River Rea.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	Yes. The eastern half of the site is covered by an EA Flood Warning service (River Rea at Highgate, Deritend and Digbeth).
Is compensatory flood storage required?	For development of the eastern half of the site compensatory storage would be required as the site lies partially within FZ3a. No compensatory storage would be required for the remainder of the site.
Can the loss of floodplain be compensated for within the site boundaries?	Yes. 93% of the site lies outside FZ3a and part of this area could be brought into the floodplain as compensatory storage. This could offset any storage losses due to redevelopment of the site.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and may therefore reduce flood risk elsewhere.
What is the Likelihood of the Exception Test being passed?	Good. 93% of the site is outside FZ3a. The western half of the site (53% of total) is in FZ1. The site is previously developed land.
Recommendations / Future Data Needs	Development of the site should be steered away from the eastern boundary along Mill Lane. If development of the eastern boundary of the site is pursued, approximately 175m^3 of compensatory storage would need to be provided for the 1% AEP event. Safe access and egress via Deritent High Street and Bradford Street would also need to be provided.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

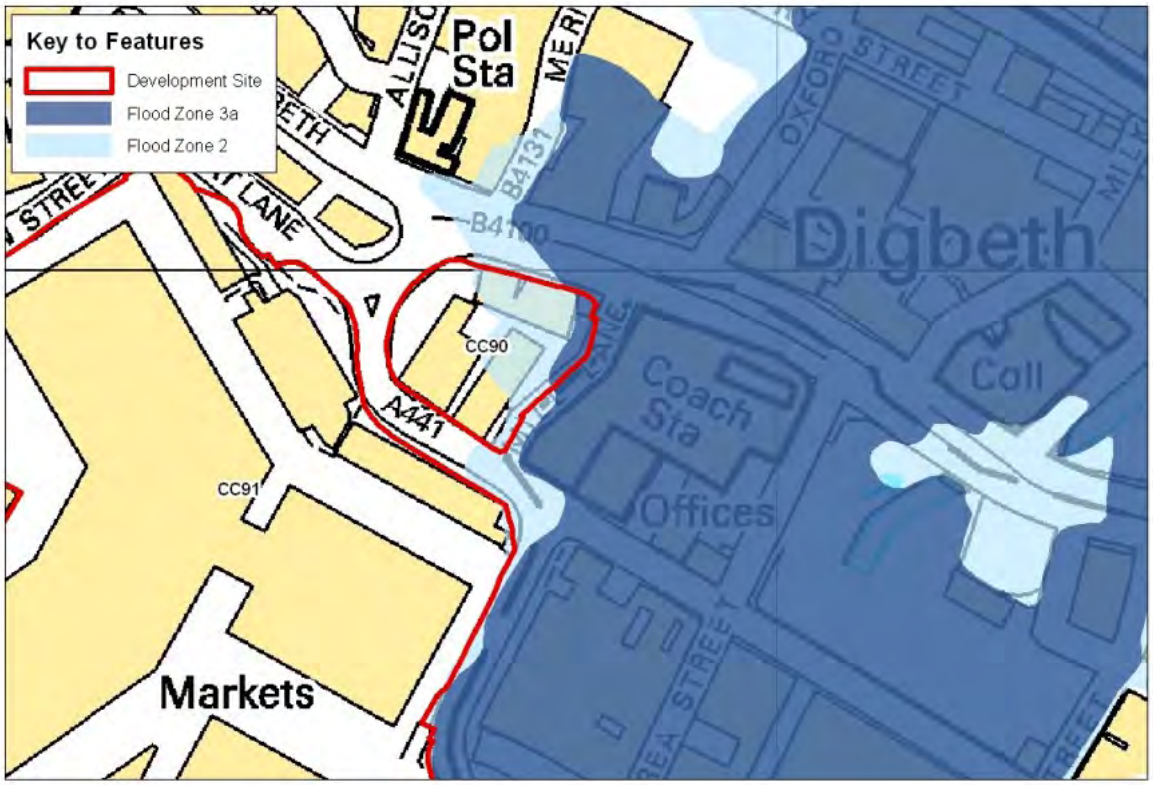
Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

Modelling Methodology Summary

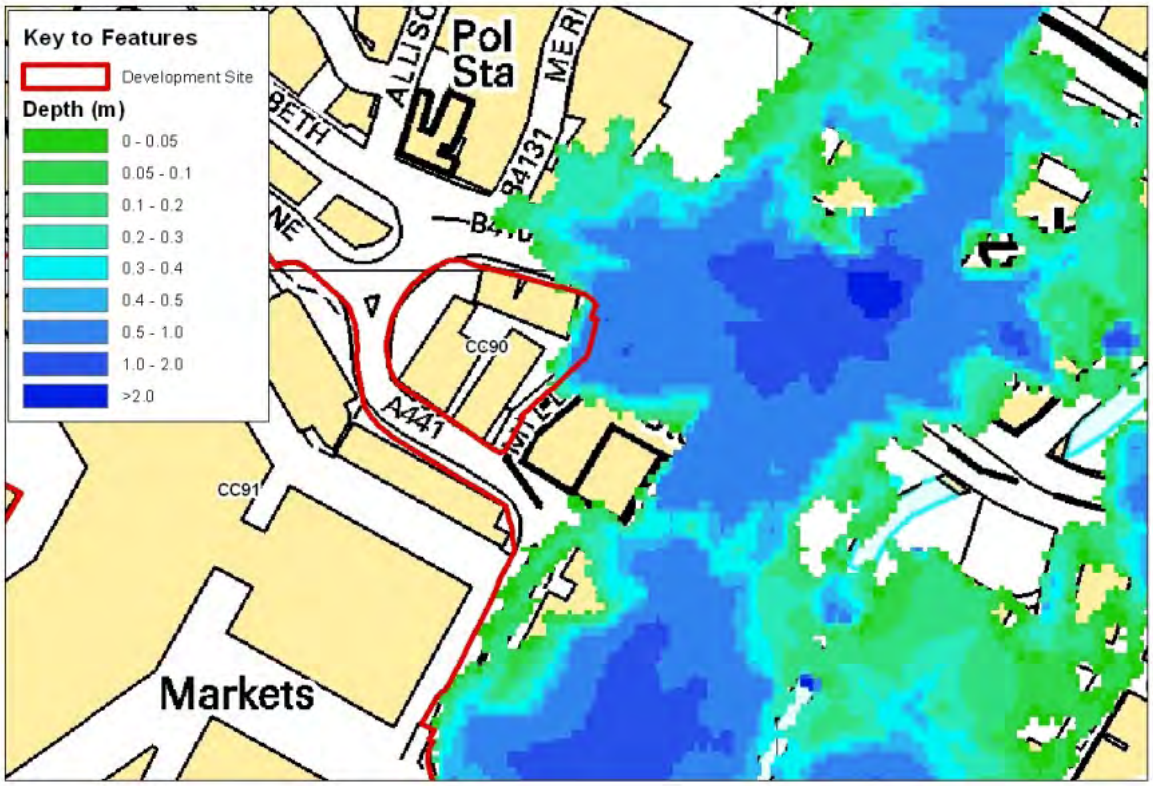
The flood risk, depth, hazard and velocity mapping outputs above were produced as part of the South Birmingham Flood Hazard Mapping project, completed in July 2010.

This was undertaken by Royal Haskoning using a linked ISIS-TUFLOW model. Version 3.3 of ISIS and version 2009-07-AD of TUFLOW were used.

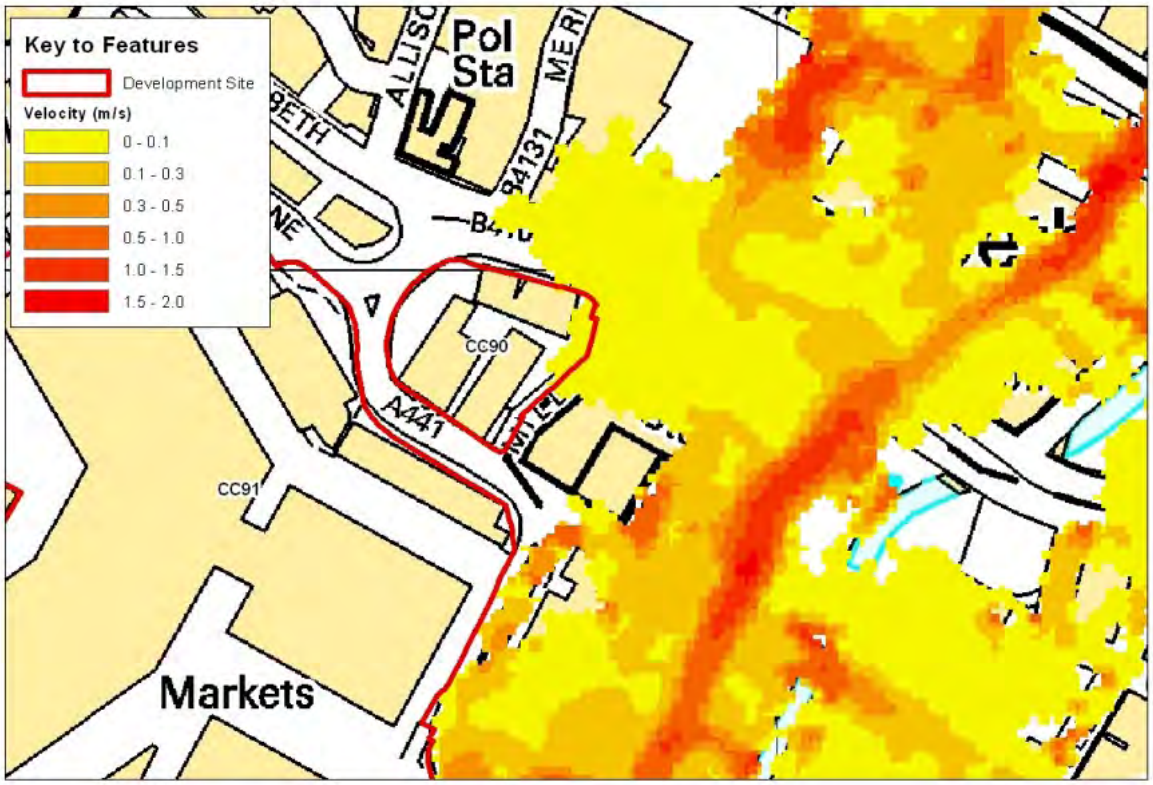
Fluvial Flood Risk Map



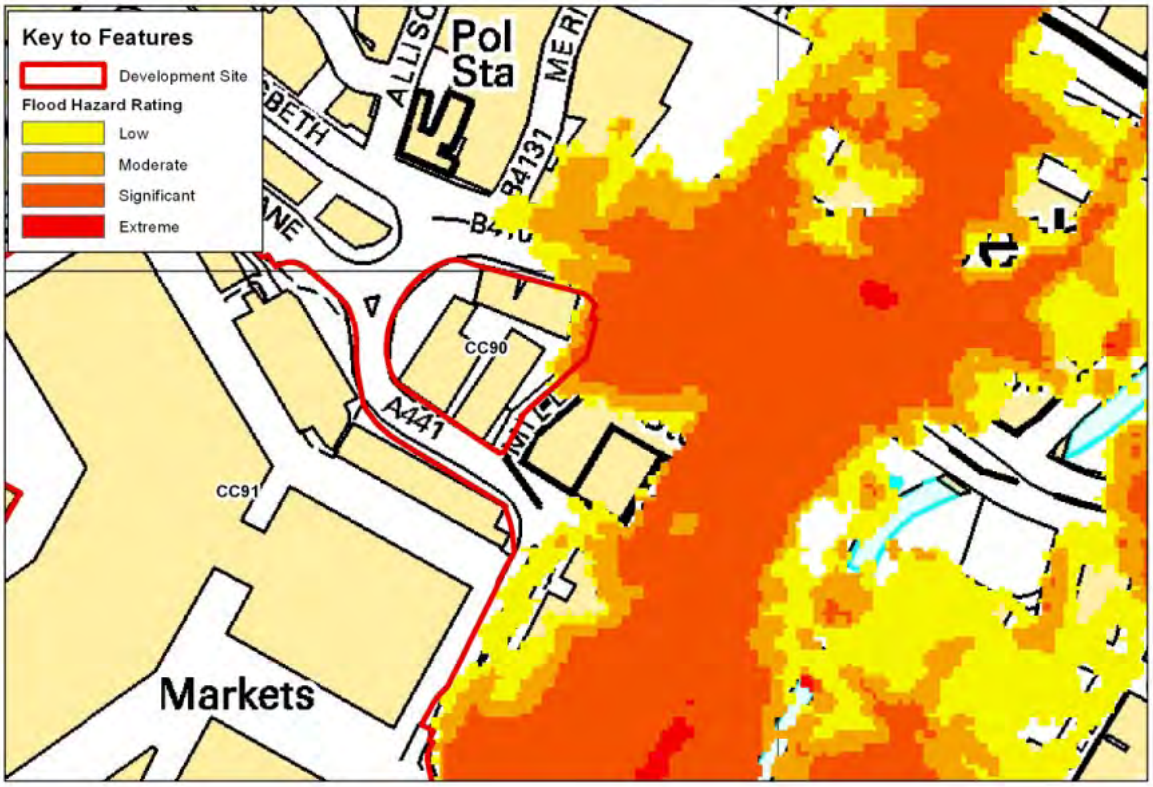
1% AEP Event Flood Depth Map



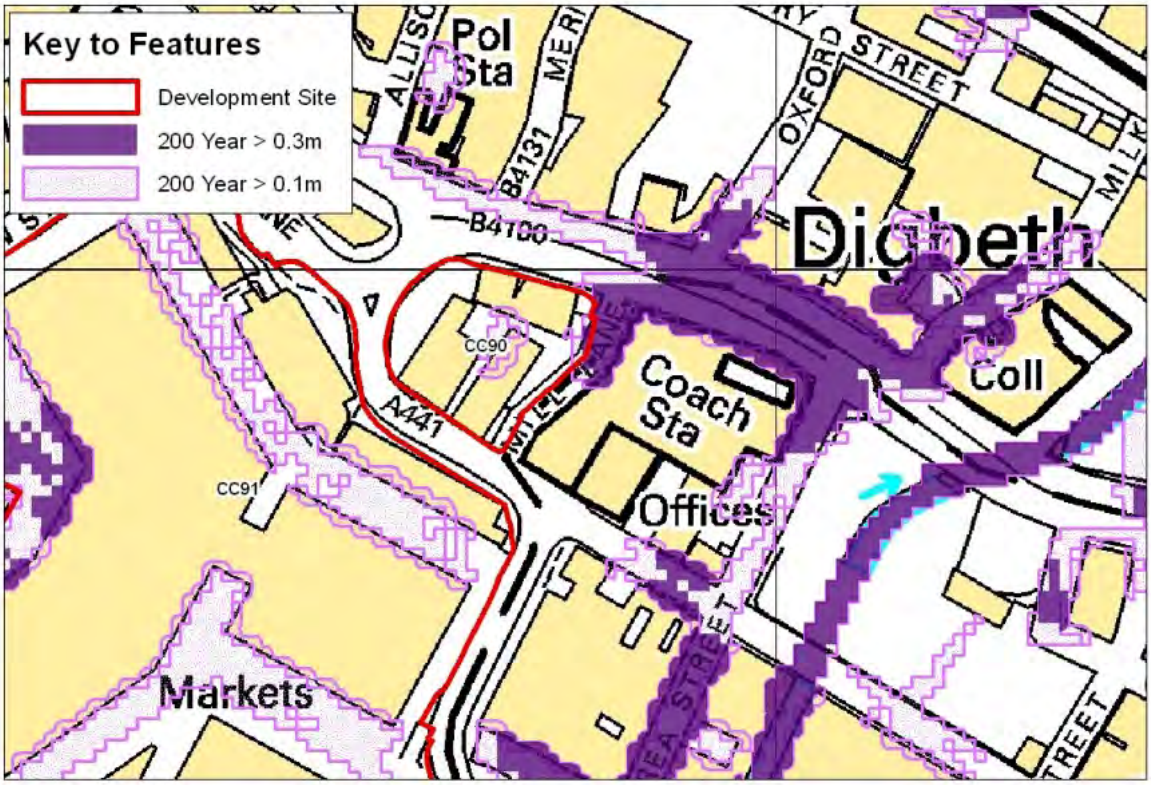
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

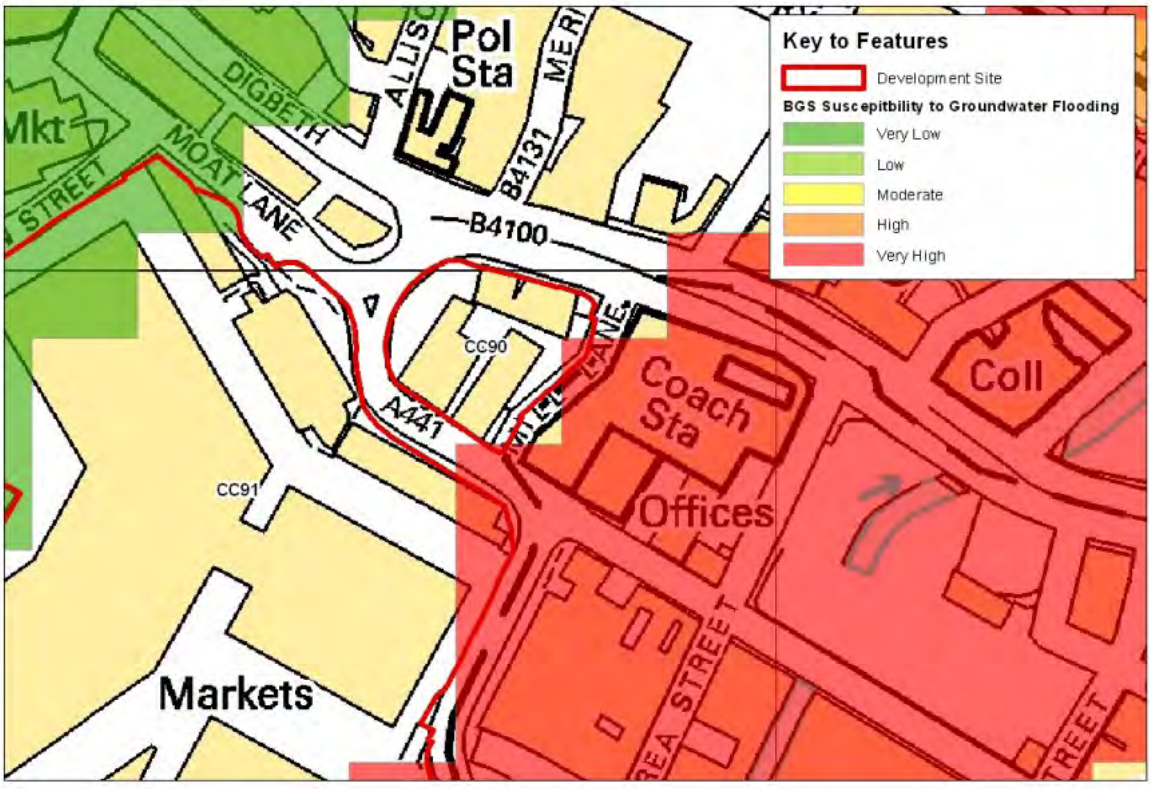


Flood Map for Surface Water (FMfSW)

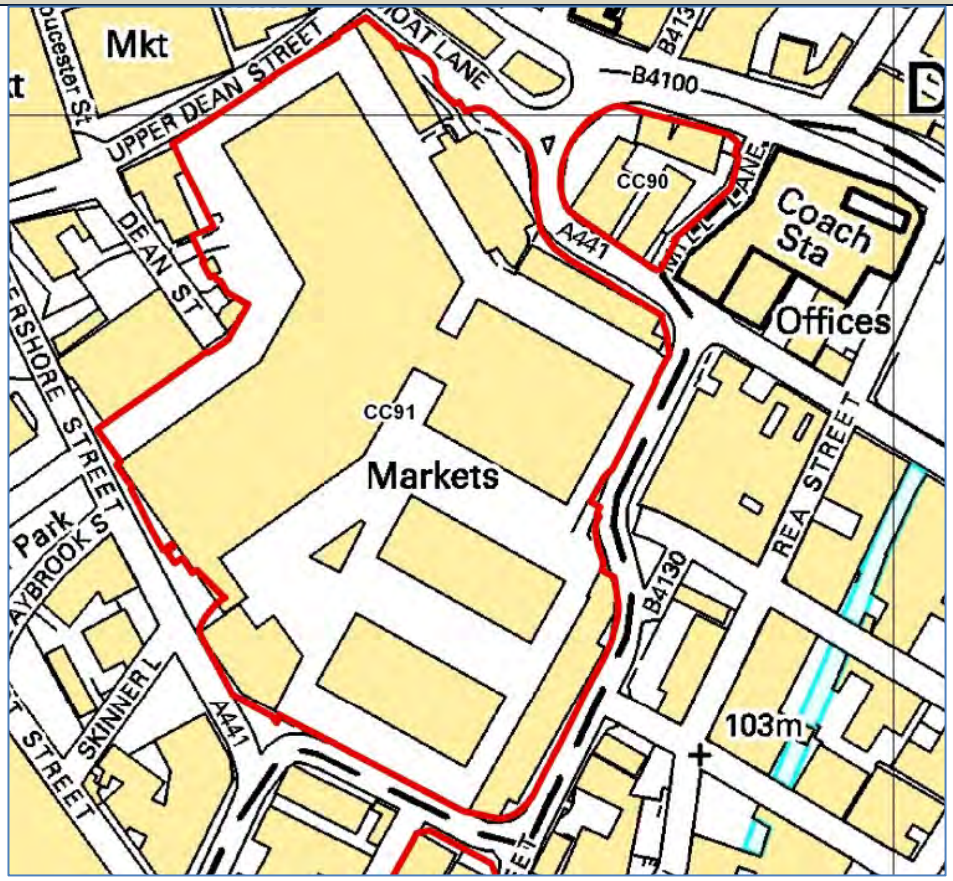


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: CC91 Wholesale Markets



Site Name	CC91 - Wholesale Markets
Site Address	Barford Street, Digbeth
National Grid Reference	SP 07430 86270
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from the River Rea
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	8.50
Area within FZ1 (Ha)	8.14 (96%)
Area within FZ2 (Ha)	0.36 (4%)
Area within FZ3a (Ha)	0.36 (4%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Flooding from the River Rea to the east. Surface and groundwater sources.
Is the site at risk from surface water flooding?	Yes. 0.30Ha >0.3m deep based on the FMfSW (0.5% AEP event). 1.54Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. Small sections of the eastern and south eastern areas of the site are considered to have a Very High susceptibility to groundwater flooding.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 96% of the site is located in FZ1 with flood free access and egress routes up to and including the 0.1% AEP event. More vulnerable development is acceptable.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is a brownfield area and is completely covered by areas of hard standing and industrial units. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes. Dry access and egress routes are available via Pershore Road along the western boundary of the site and northwards along Dean Street.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	No. The eastern boundary of the site along Barford Street borders a Flood Warning area (River Rea at Highgate, Deritend and Digbeth), but the site itself is not within the Flood Warning area.
Is compensatory flood storage required?	No, unless the southern block of the Wholesale Markets Precinct were to be developed.
Can the loss of floodplain be compensated for within the site boundaries?	Yes. 96% of the site is located in FZ1.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water, although the effectiveness of these may be limited due to the Very High groundwater flooding risk in some parts of the site. Furthermore, part of the site is in a Source Protection Zone and consideration of the use of infiltration techniques would therefore be necessary.
What is the Likelihood of the Exception Test being passed?	Good. The site is on an area of previously developed land and is largely flood free up to and including the 0.1% AEP event.
Recommendations / Future Data Needs	Modelling outputs show flood water to be constrained at the 1% AEP event year (FZ3a) by the Southern Block of the Wholesale Markets Precinct. However, the Flood Zone outline shows it to be within FZ3a. It is suggested that the EA Flood Zones be updated so that they are consistent with the modelled outputs.

Table 1: Hazard to people as a function of velocity and depth

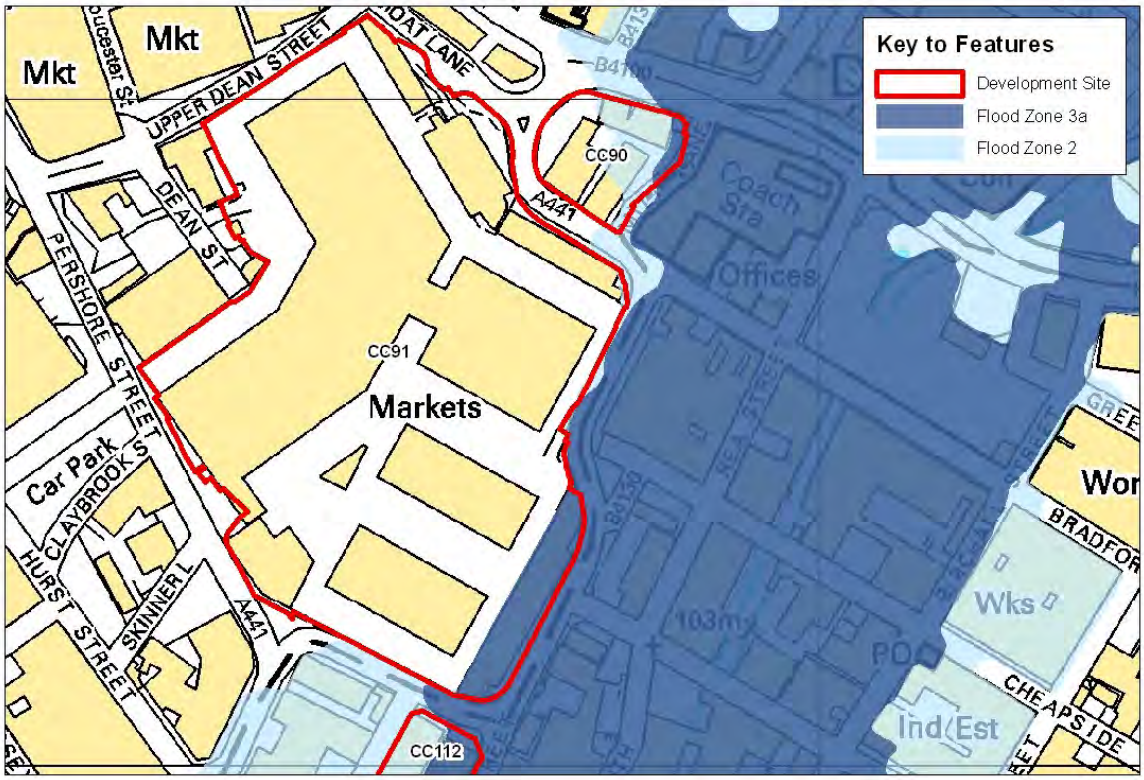
Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

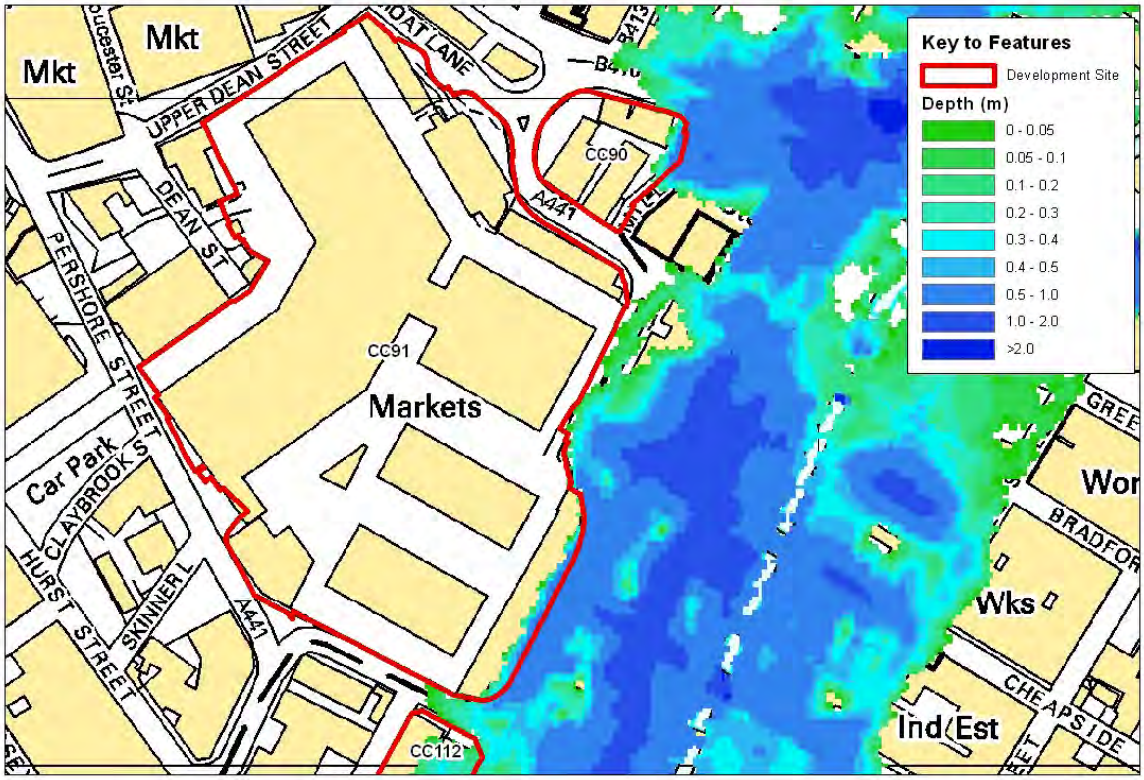
Modelling Methodology Summary

The flood risk, depth, hazard and velocity mapping outputs below were produced as part of the South Birmingham Flood Hazard Mapping project, completed in July 2010.

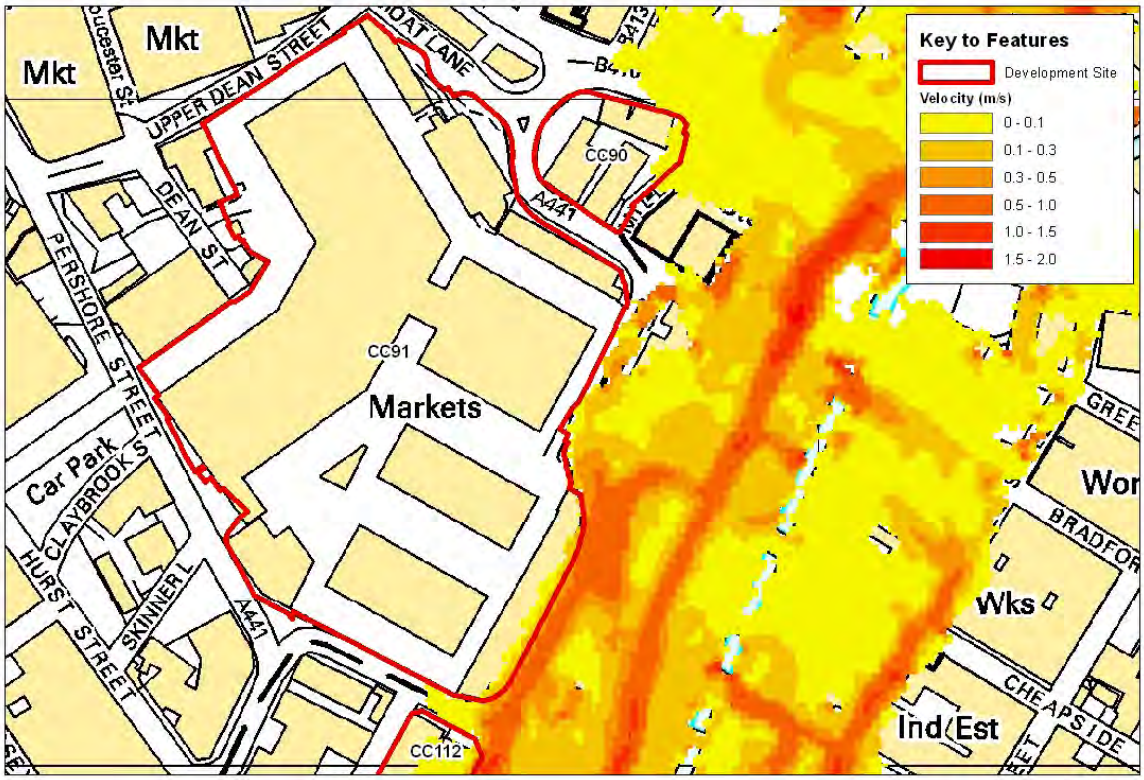
Fluvial Flood Risk Map



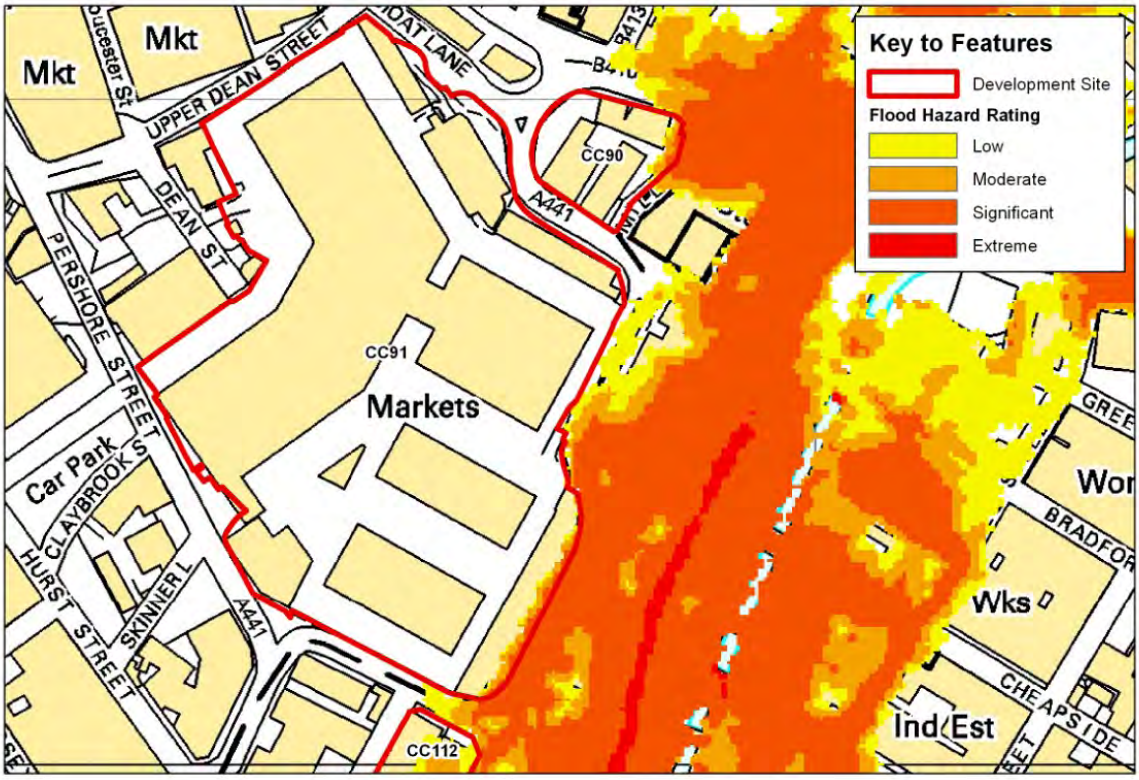
1% AEP Event Flood Depth Map



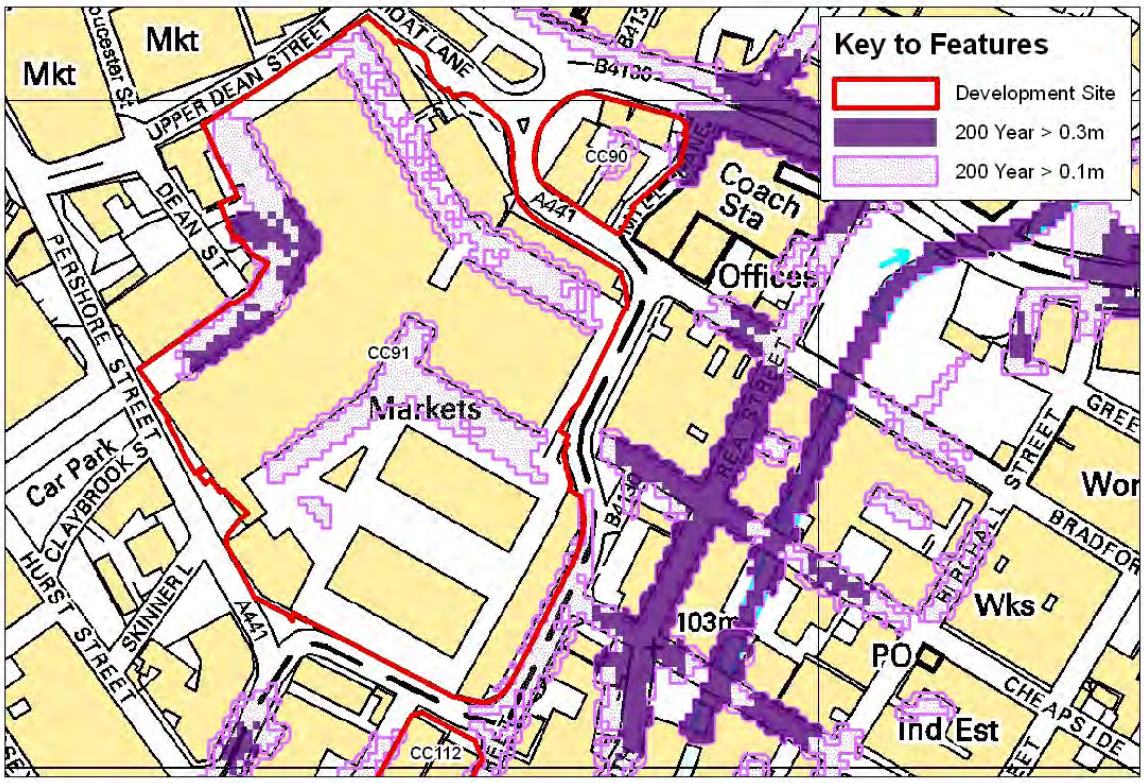
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

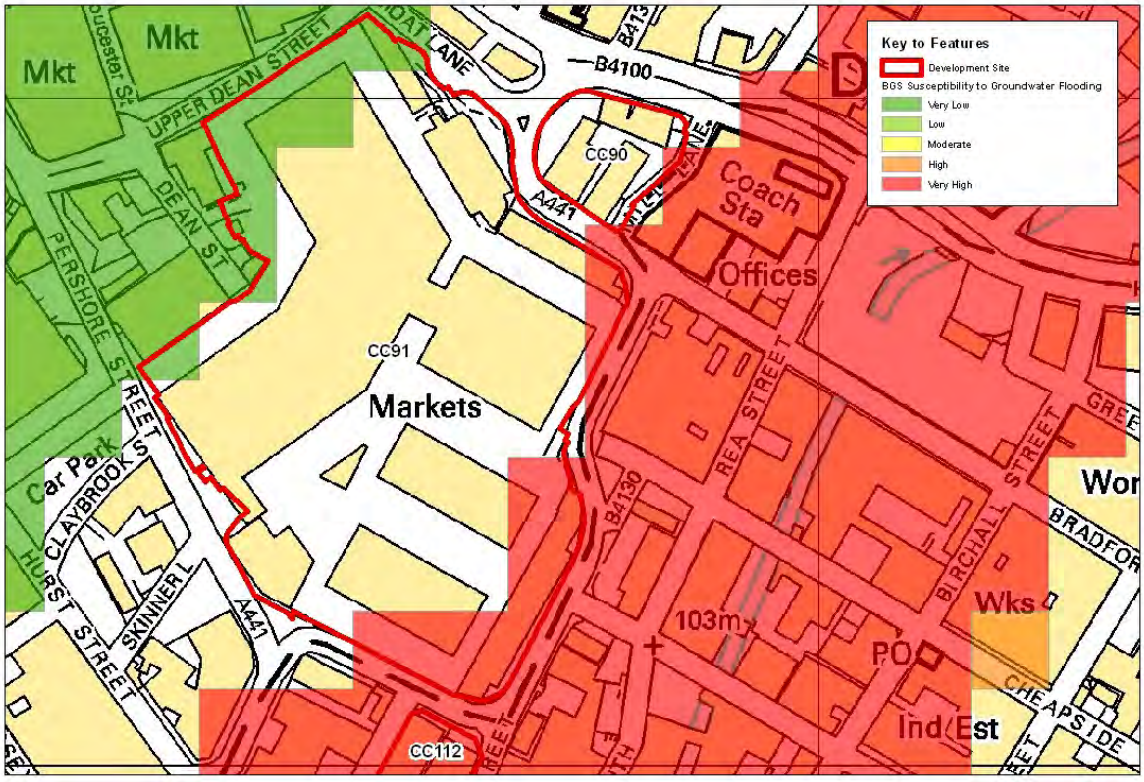


Flood Map for Surface Water (FMfSW)

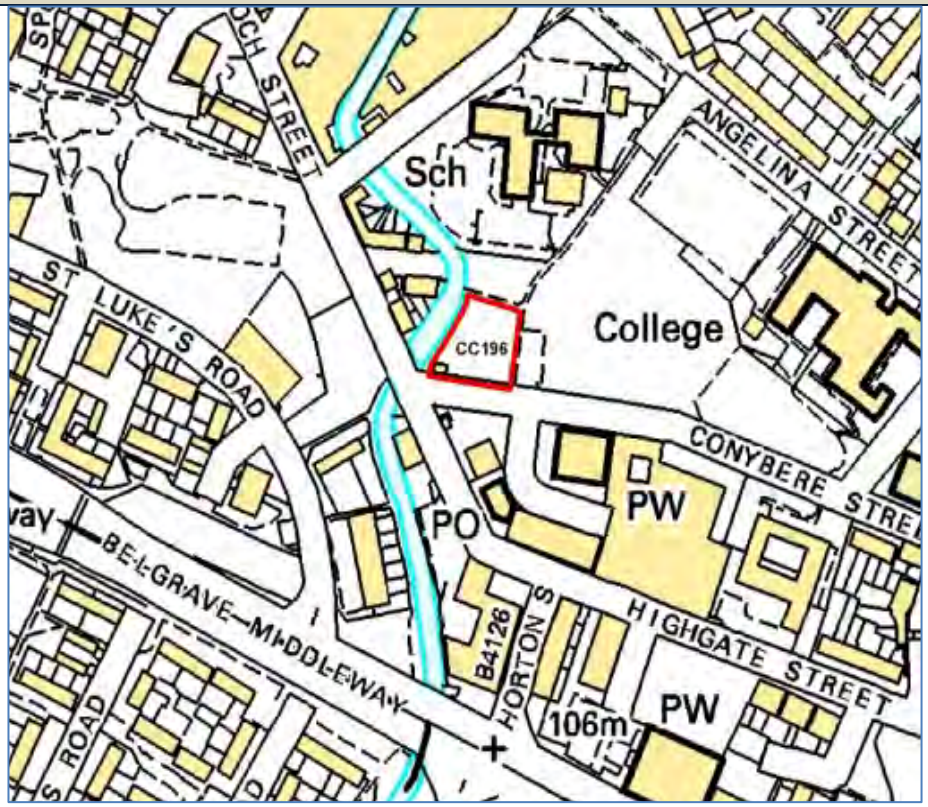


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: CC196 junction of Conybere Street and Gooch Street



Site Name	CC196 – Adjacent to Chandos Primary School
Site Address	Junction between Conybere Street & Gooch Street
National Grid Reference	SP 07437 86015
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from River Rea
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.15
Area within FZ1 (Ha)	0
Area within FZ2 (Ha)	0.15 (100%)
Area within FZ3a (Ha)	0.04 (27%)
Area within FZ3b (Ha)	0.004 (3%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Low. The flood hazard modelling shows that the majority of the site (73%) is outside FZ3a. The western boundary of the site borders the River Rea and has an 'extreme' (>2.5) hazard rating. Part of Conybere Street has a 'significant'' (1.25 – 2.5) hazard rating, although east of the site it is flood free.
Is the site at risk from surface water flooding?	Yes. 0.01Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.01Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes, the entire site is considered as having a Very High susceptibility to groundwater flooding. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 73% of the site is outside the FZ3a extent. Development should be avoided in the remaining 27%.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Yes. Safe access and egress would be possible along Conybere Street.
Is the site covered by flood warnings?	Yes. The site is within the River Rea at Highgate, Deritend and Digbeth Flood Warning area.
Is compensatory flood storage required?	No providing development is located away from the western part of the site, which is in FZ3a.
Can the loss of floodplain be compensated for within the site boundaries?	N/A.
Can the development reduce flood risk?	There is unlikely to be an opportunity to reduce surface water runoff as the site is currently greenfield, but as part of the proposed development landscaping could be designed to increase floodplain storage. However, the site is in a Source Protection Zone and has a Very High susceptibility to groundwater flooding; hence careful consideration of appropriate SuDS techniques will be required.
What is the Likelihood of the Exception Test being passed?	As the site is outside FZ3a and has dry access and egress the Exception Test is likely to be passed. The reported groundwater flooding should be investigated further.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere and no alternative brownfield sites are available.

Table 1: Hazard to people as a function of velocity and depth

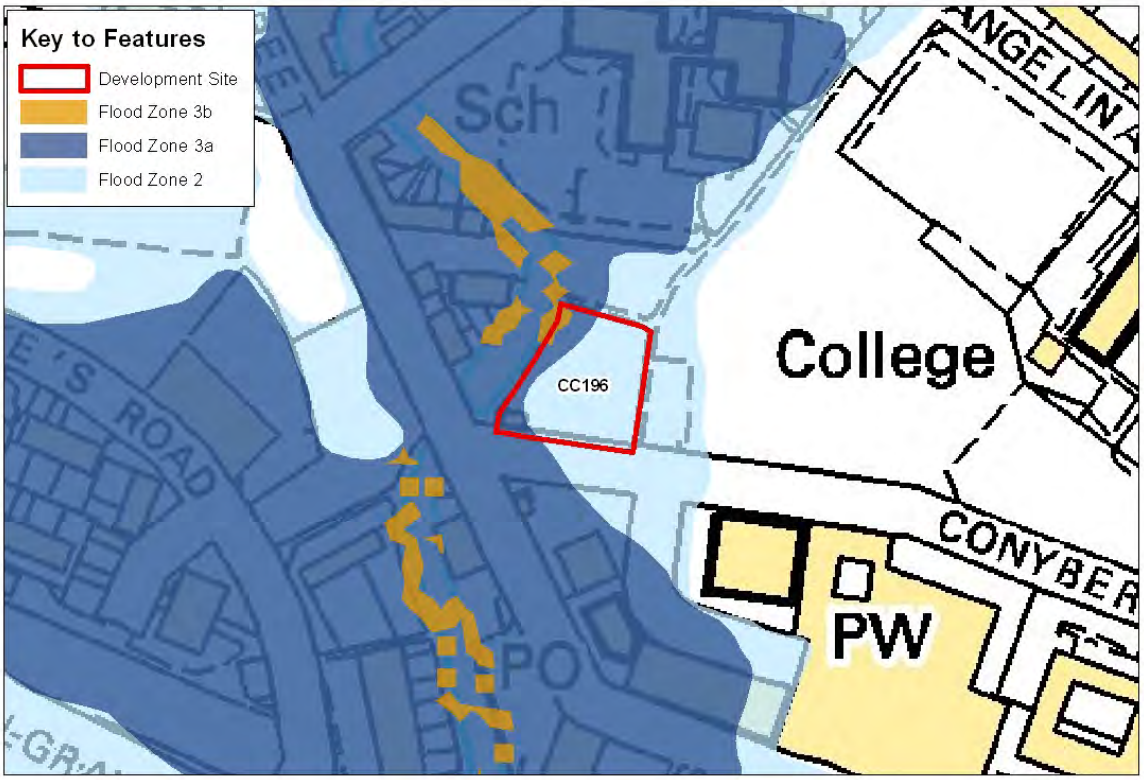
Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

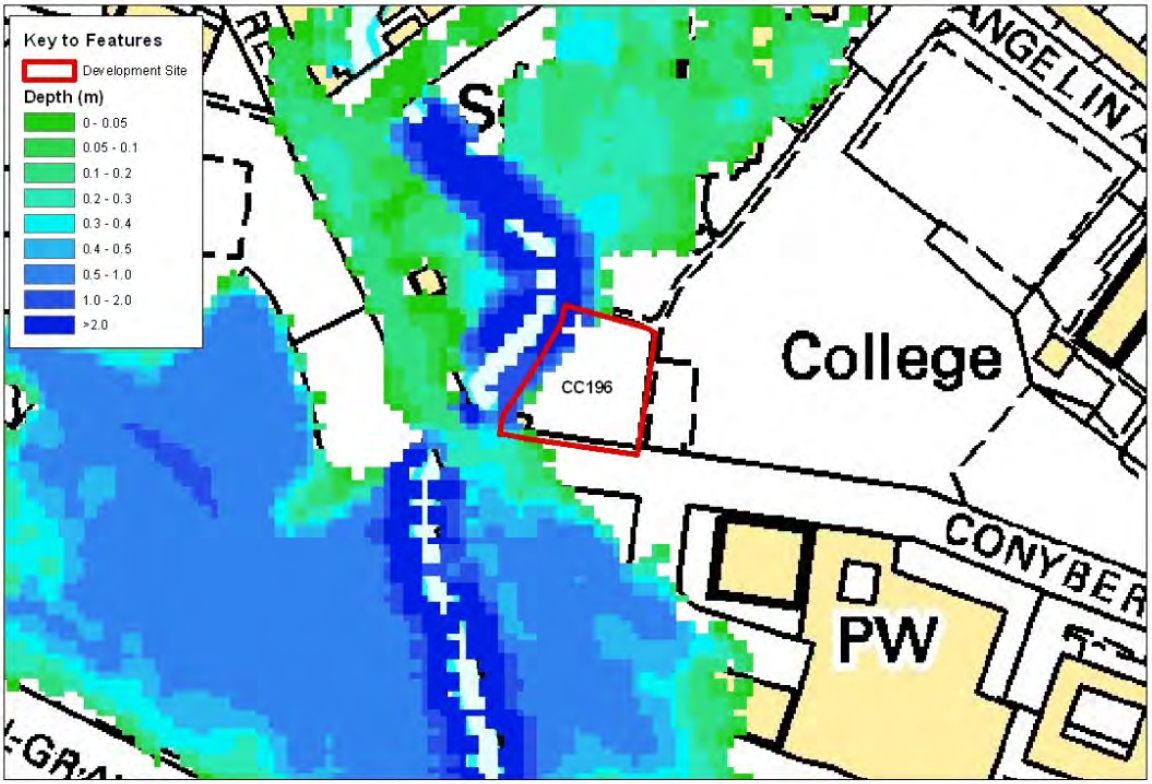
Modelling Methodology Summary

The flood risk, depth, hazard and velocity mapping outputs below were produced as part of the South Birmingham Flood Hazard Mapping project, completed in July 2010.

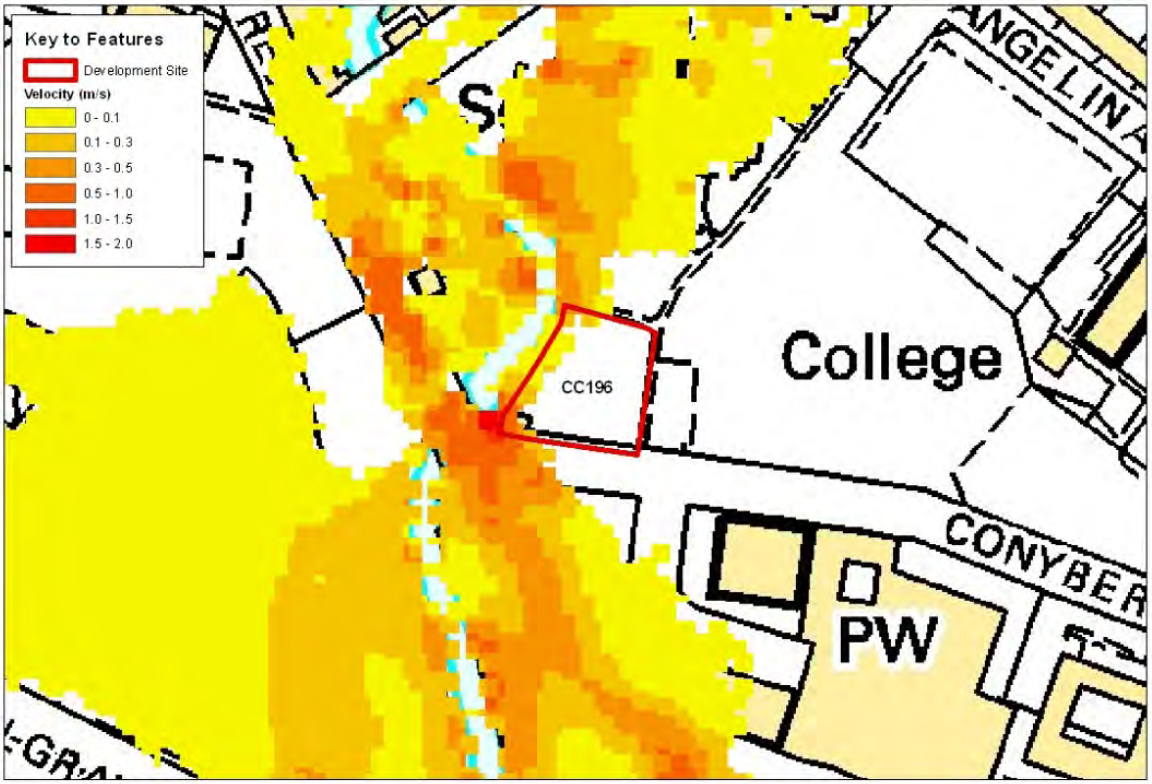
Fluvial Flood Risk Map



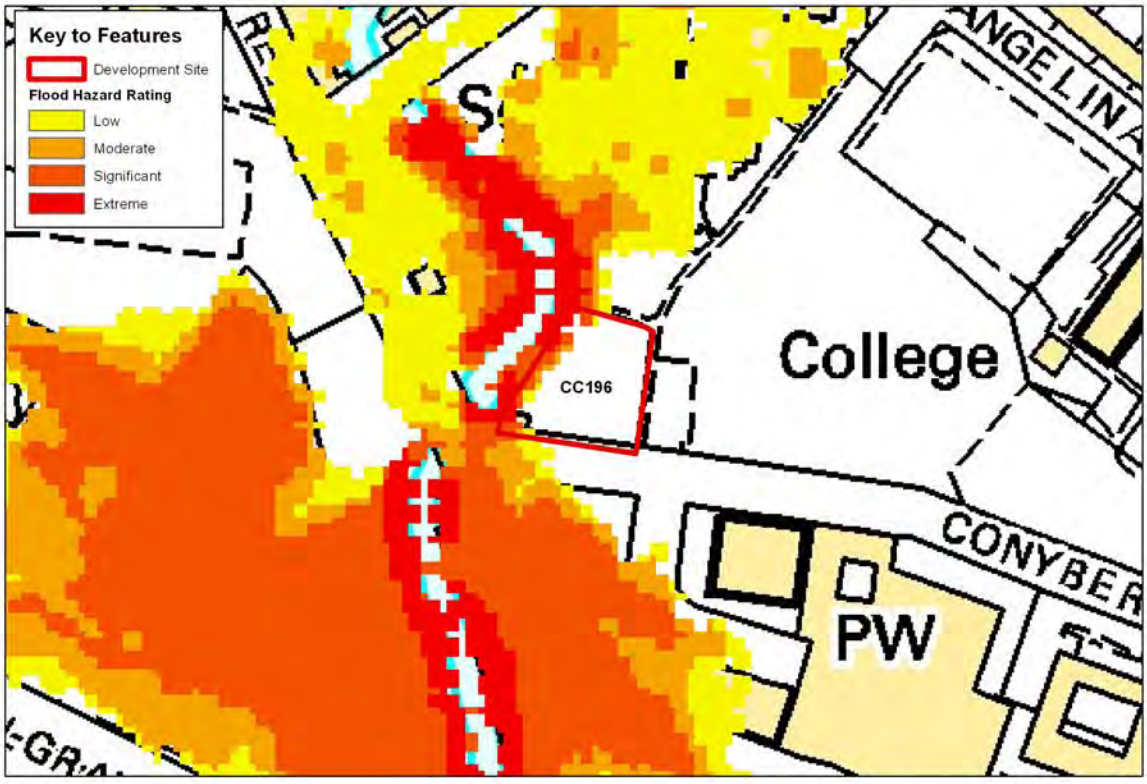
1% AEP Event Flood Depth Map



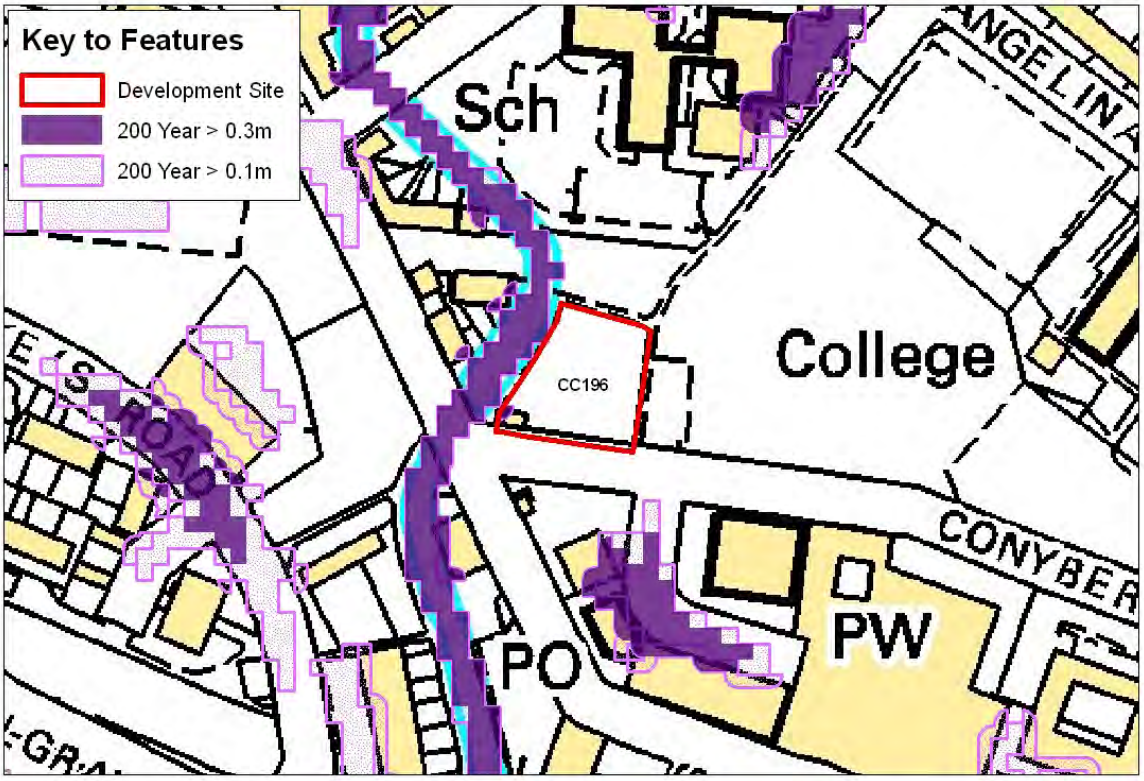
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

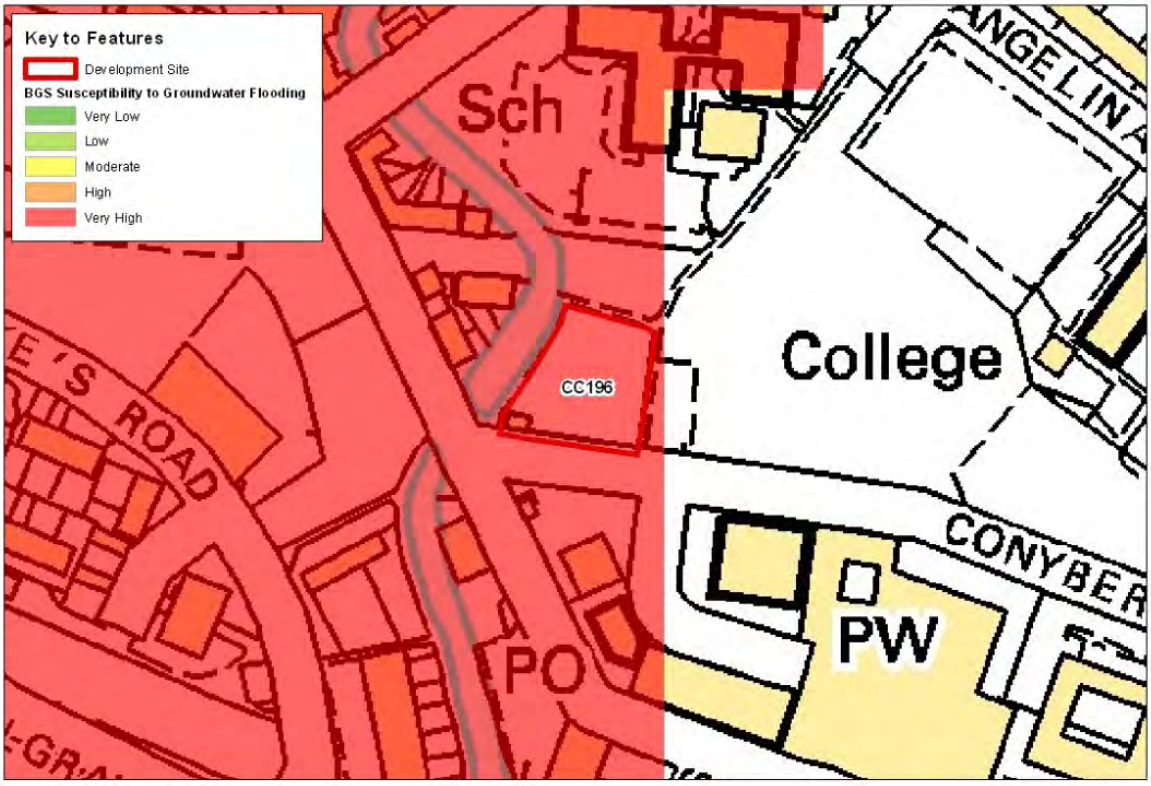


Flood Map for Surface Water (FMfSW)

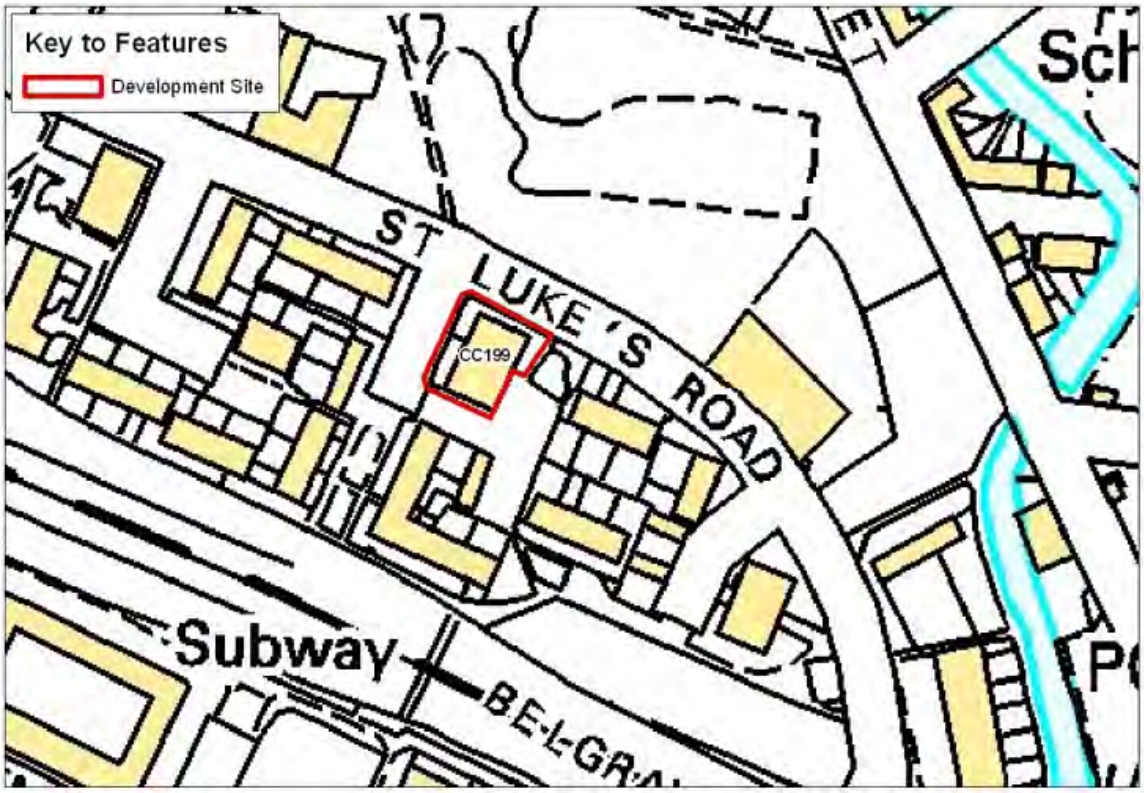


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



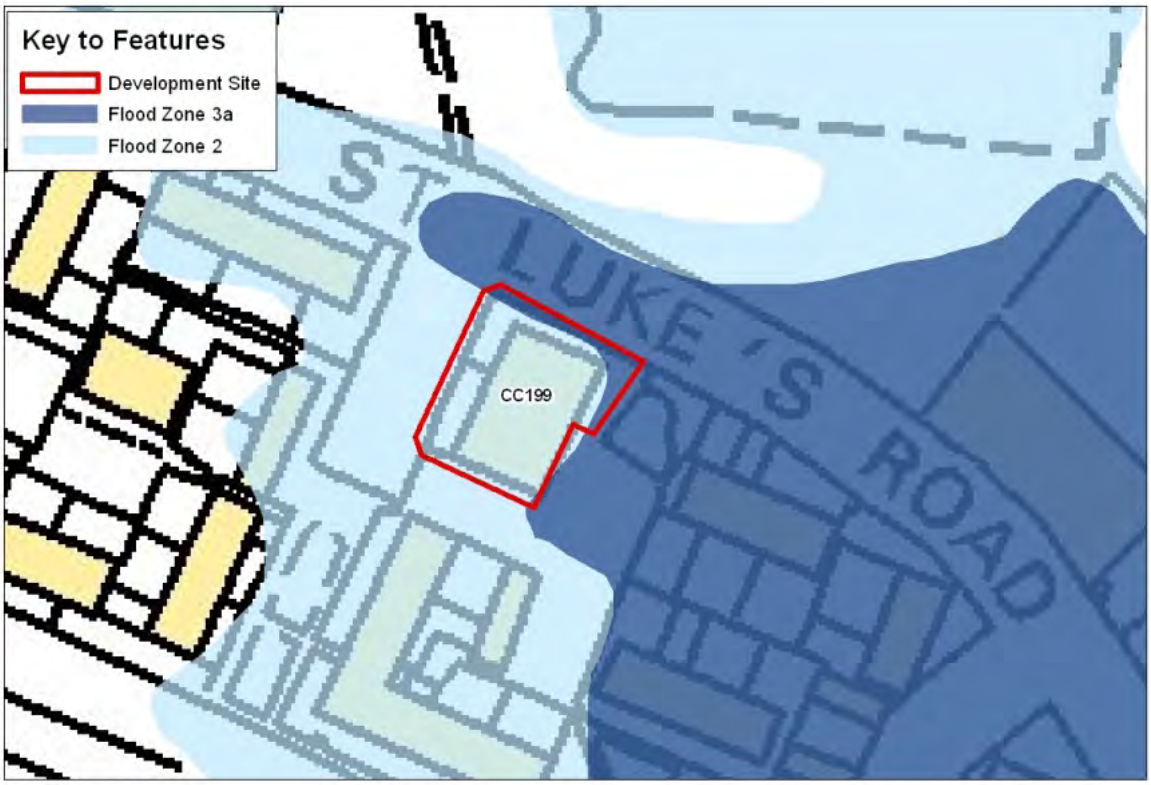
Site Summary Sheet: CC199 Barrow Walk/St Luke's Road



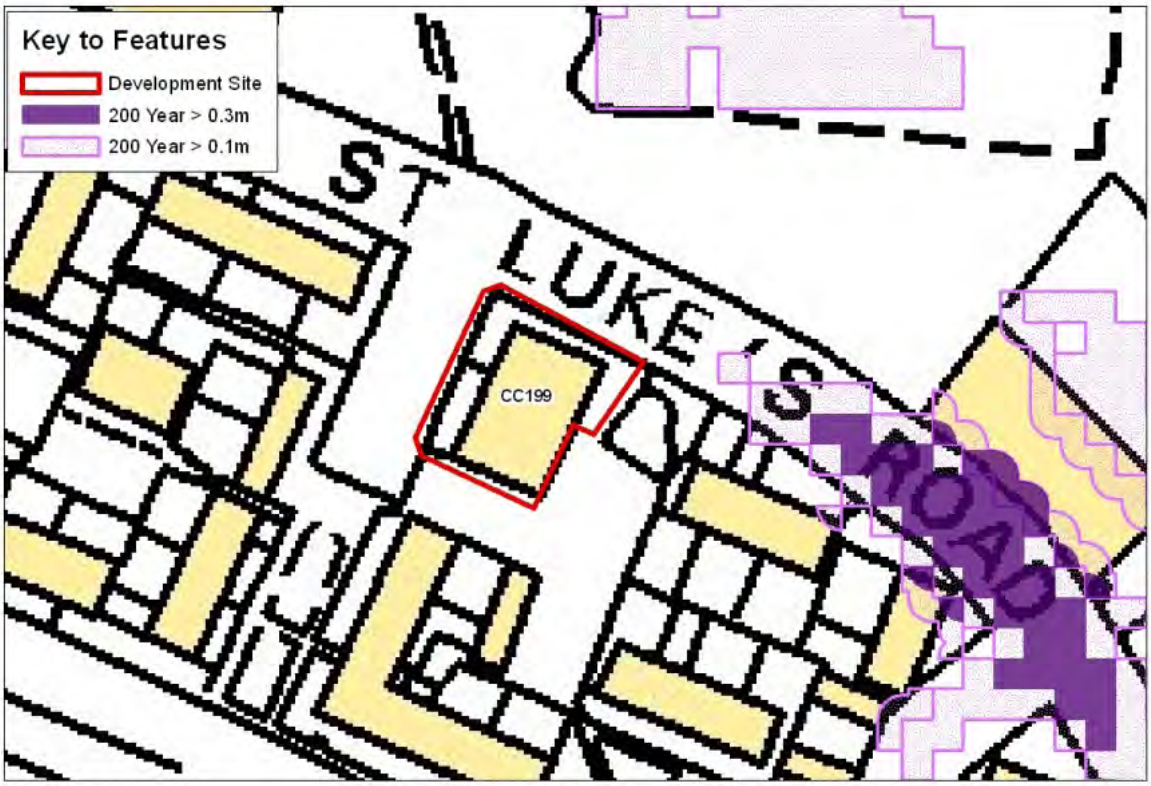
Site Name	CC199
Site Address	Barrow Walk, St Luke's Road
National Grid Reference	SP 07223 85405
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from River Rea
Secondary Sources of Flood Risk	Groundwater
Site Area (Ha)	0.07
Area within FZ1 (Ha)	0
Area within FZ2 (Ha)	0.07 (100%)
Area within FZ3a (Ha)	0.009 (13%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	The fluvial flood outline show that the entire site is in Flood Zone 2 with medium probability of flooding. The north western boundary of the site is in flood Zone 3a with High Probability of Flooding. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	No
Is the site at risk from groundwater flooding?	Yes, the entire site is considered as having a Very High susceptibility to groundwater flooding. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 87% of the site is outside the FZ3a extent. Development should be avoided in the remaining 13%.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Barrow Walk
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above
Is the site covered by flood warnings?	No
Is compensatory flood storage required?	No providing development is located away from the north western part of the site, which is in FZ3a.
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the majority of the site is outside FZ3a and has dry access and egress the Exception Test is likely to be passed. The reported groundwater flooding should be investigated further.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a.

Fluvial Flood Risk Map



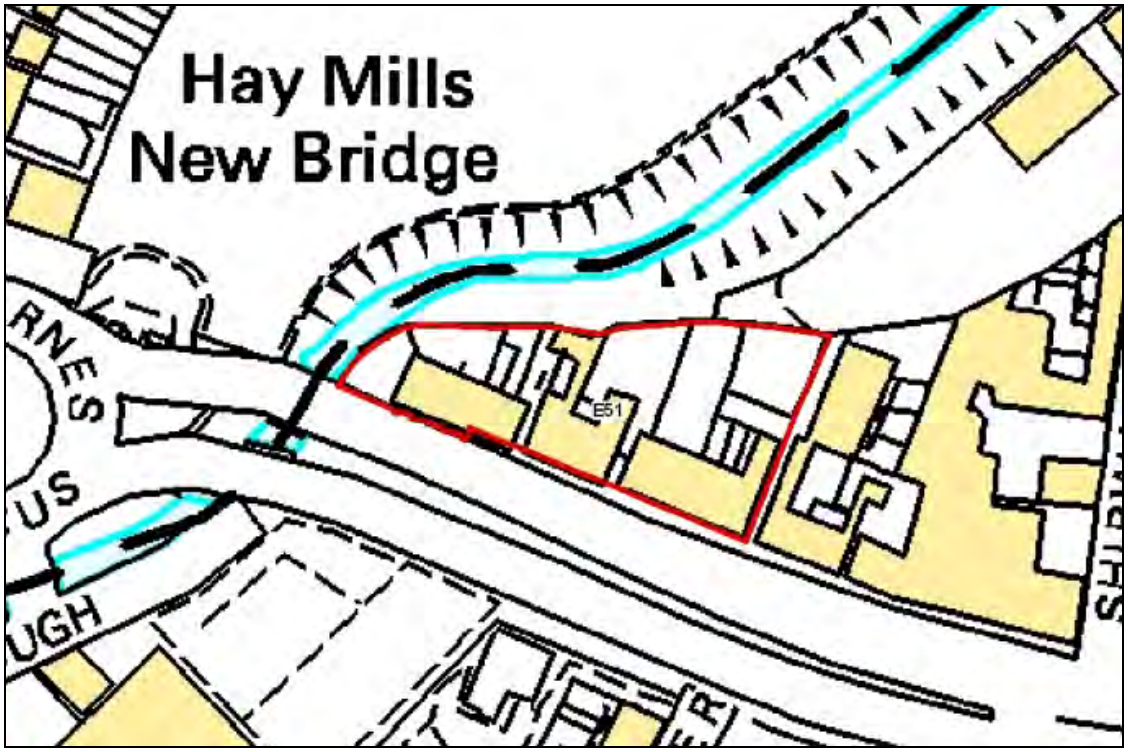
Flood Map for Surface Water (FMfSW)



This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding

Site Summary Sheet: E51 Coventry Road



Site Name	E51 – Plough and Harrow
Site Address	Coventry Road, South Yardley
National Grid Reference	SP 11174 85148
Catchment	River Cole
Primary Source of Flood Risk	Surface Water
Secondary Sources of Flood Risk	Fluvial
Site Area (Ha)	0.53
Area within FZ1 (Ha)	0
Area within FZ2 (Ha)	0.53 (100%)
Area within FZ3a (Ha)	0.04 (7%)
Area within FZ3b (Ha)	0.02 (4%)
Is the site protected by flood risk management assets?	Yes. A re-graded raised bank runs along the right bank of the River Cole adjacent to this site (NFCDD Asset Reference: 0331031430501L02).
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	'Low' (<0.75) across the central section of the site, rising to 'Moderate' (0.75-1.25) and 'Significant' (1.25-2.5) across the eastern section of the site.
Is the site at risk from surface water flooding?	Yes. 0.02Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.07Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes the entire site is defined as having a Very High susceptibility to groundwater flooding. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes, the development should avoid the 0.02ha of the site within the functional floodplain (FZ3b).

Will the development result in offsite impacts, e.g. increased runoff?	No. The site is previously developed brownfield land and is completely covered by impervious surfaces. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via the A45 / Coventry Road.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	Yes, the site falls within the River Cole at Hay Mills Flood Warning area.
Is compensatory flood storage required?	Yes.
Can the loss of floodplain be compensated for within the site boundaries?	Yes, compensatory flood storage would be required for land in the north western corner of the site (0.04ha), leaving approximately 93% of the site available to provide compensatory storage.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water, although the effectiveness of these may be limited due to the Very High groundwater flooding risk. The site is in a Source Protection Zone and consideration of the use of infiltration techniques would therefore be necessary.
What is the Likelihood of the Exception Test being passed?	Good, providing the 0.02ha of the site within FZ3b is not developed. Based on the Environment Agency FZs 93% of the site is outside of FZ3a, the site has safe access and egress routes, and is on previously developed land.
Recommendations / Future Data Needs	Development of the site should be steered away from the north-western corner of the site which lies in FZ3b and FZ3a. It is recommended that the River Cole Integrated InfoWorks model is used to assess flood risk when the site specific Flood Risk Assessment is undertaken. A site specific Flood Risk Assessment has been completed for this site in relation to the proposed development of the Plough and Harrow PH, and subsequently planning permission was granted in 2009.

Table 1: Hazard to people as a function of velocity and depth

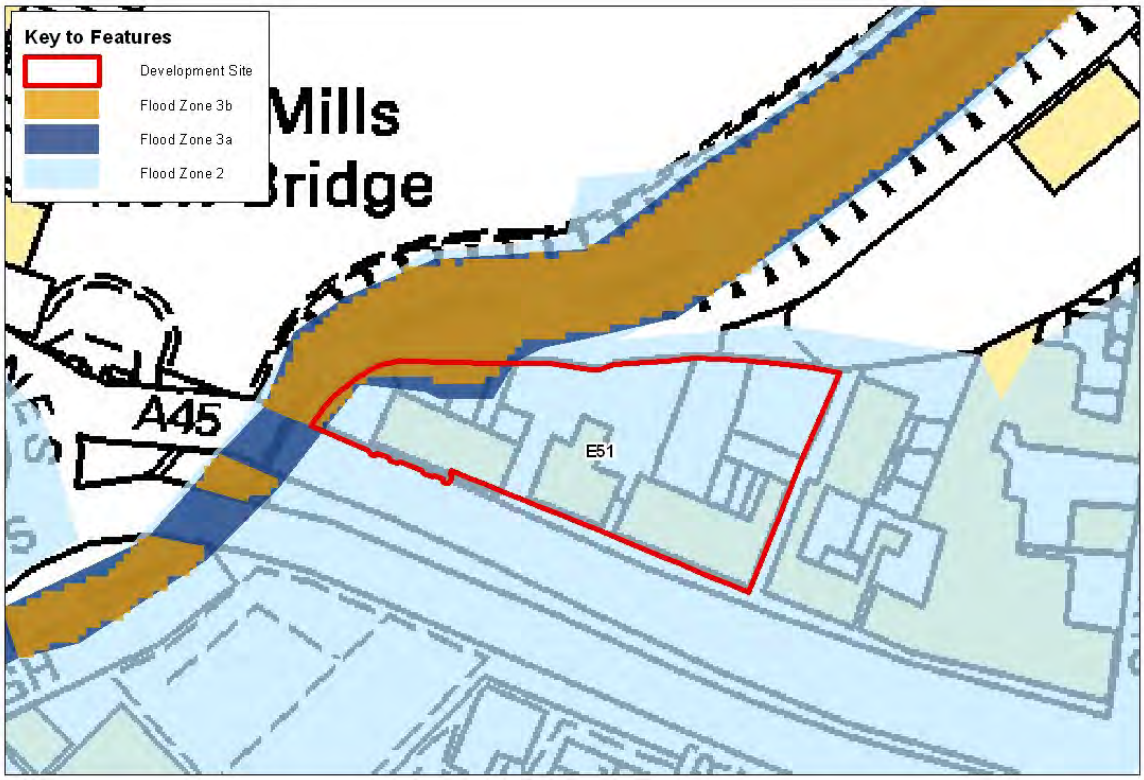
Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

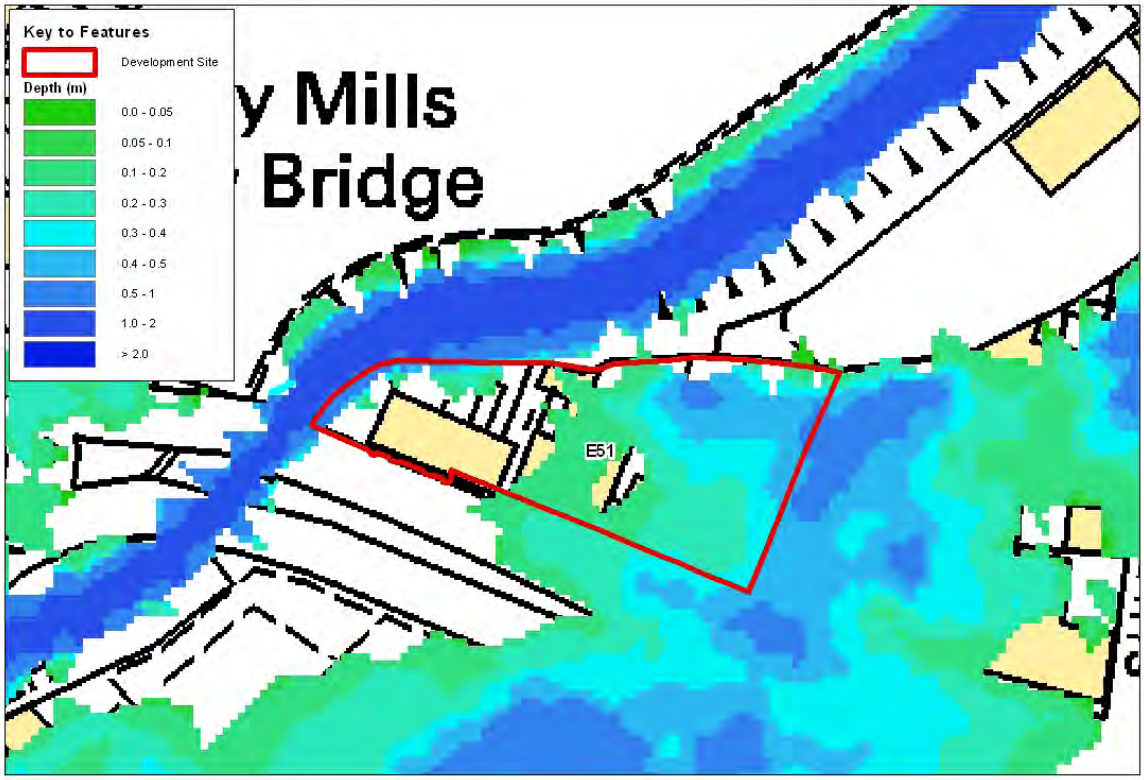
Modelling Methodology Summary

The flood risk, depth, hazard and velocity mapping outputs below were produced as part of the South Birmingham Flood Hazard Mapping project, completed in July 2010.

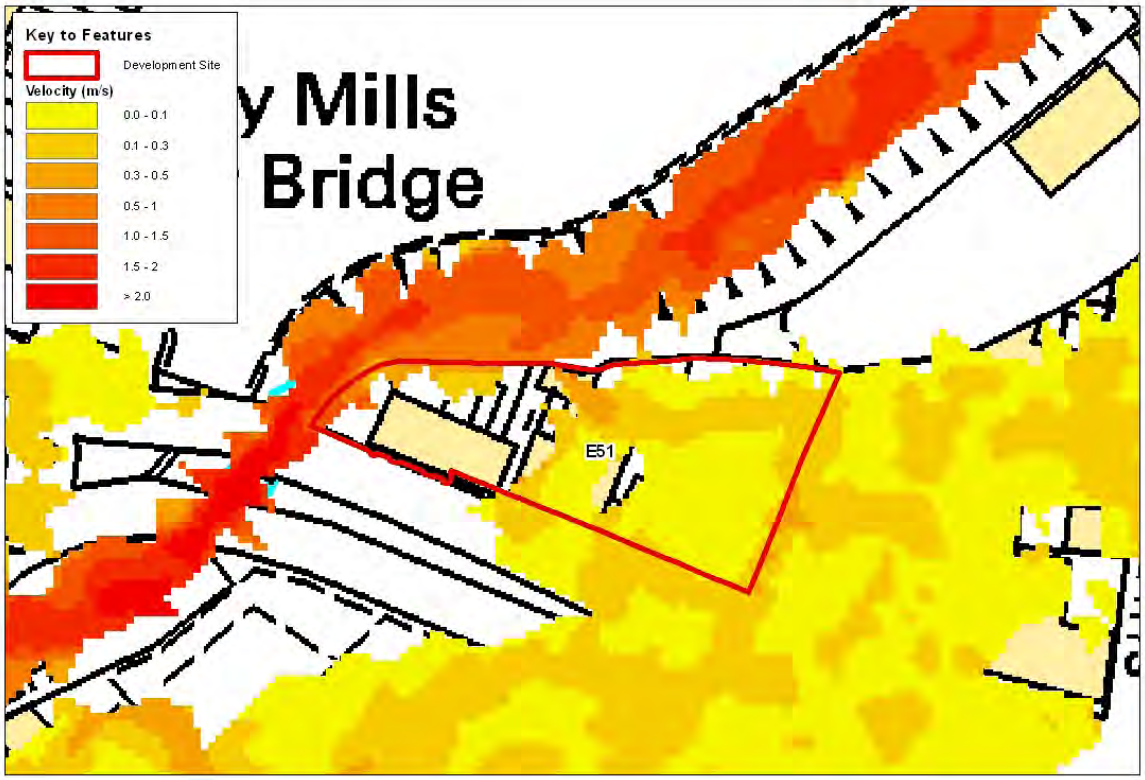
Fluvial Flood Risk Map



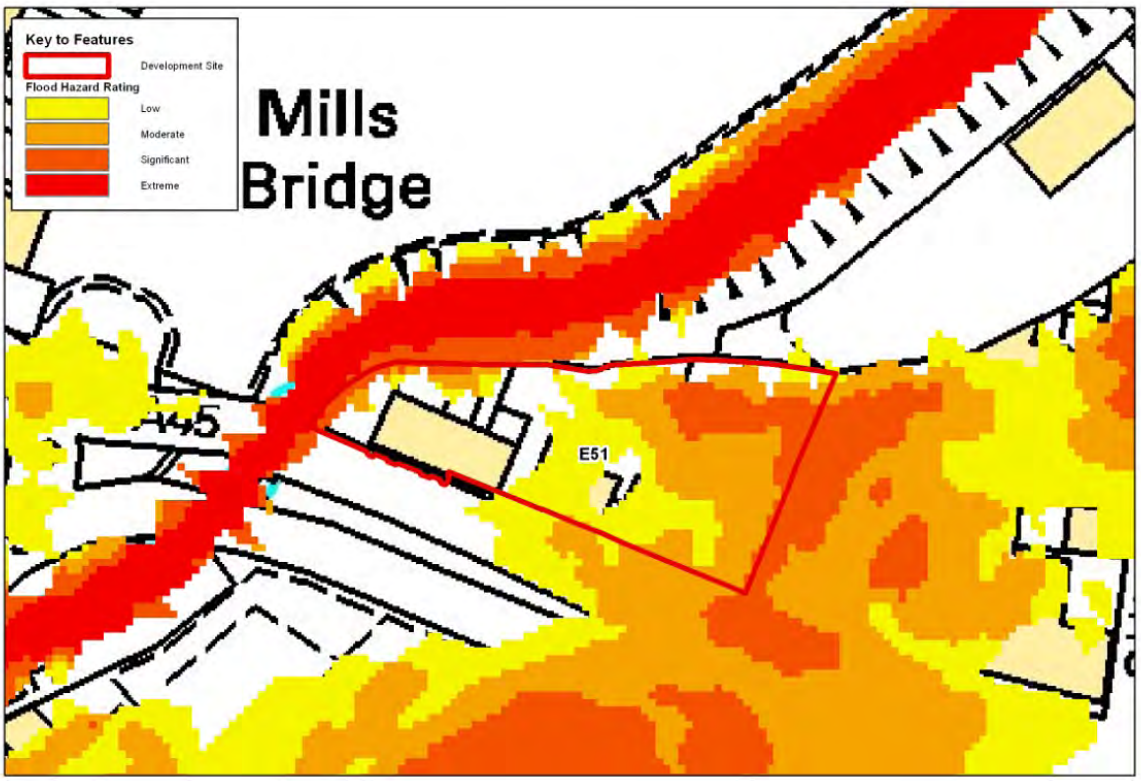
1% AEP Event Flood Depth Map



1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

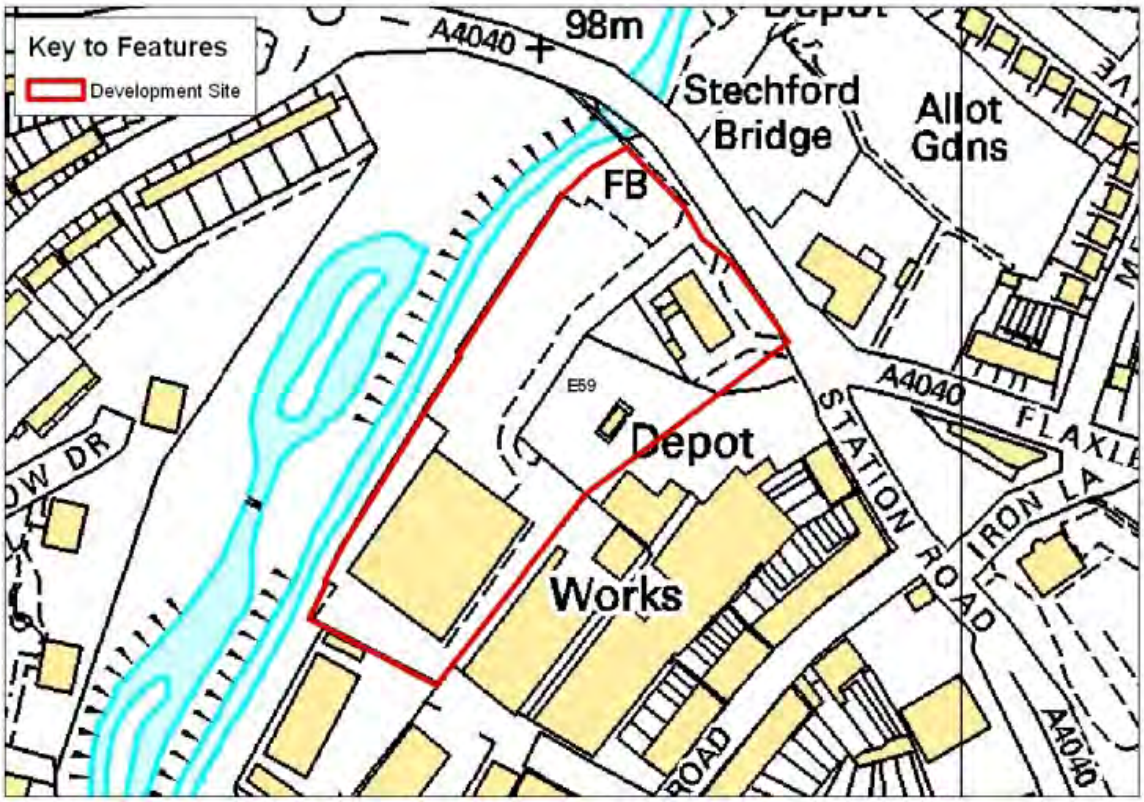


Flood Map for Surface Water (FMfSW)

This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding

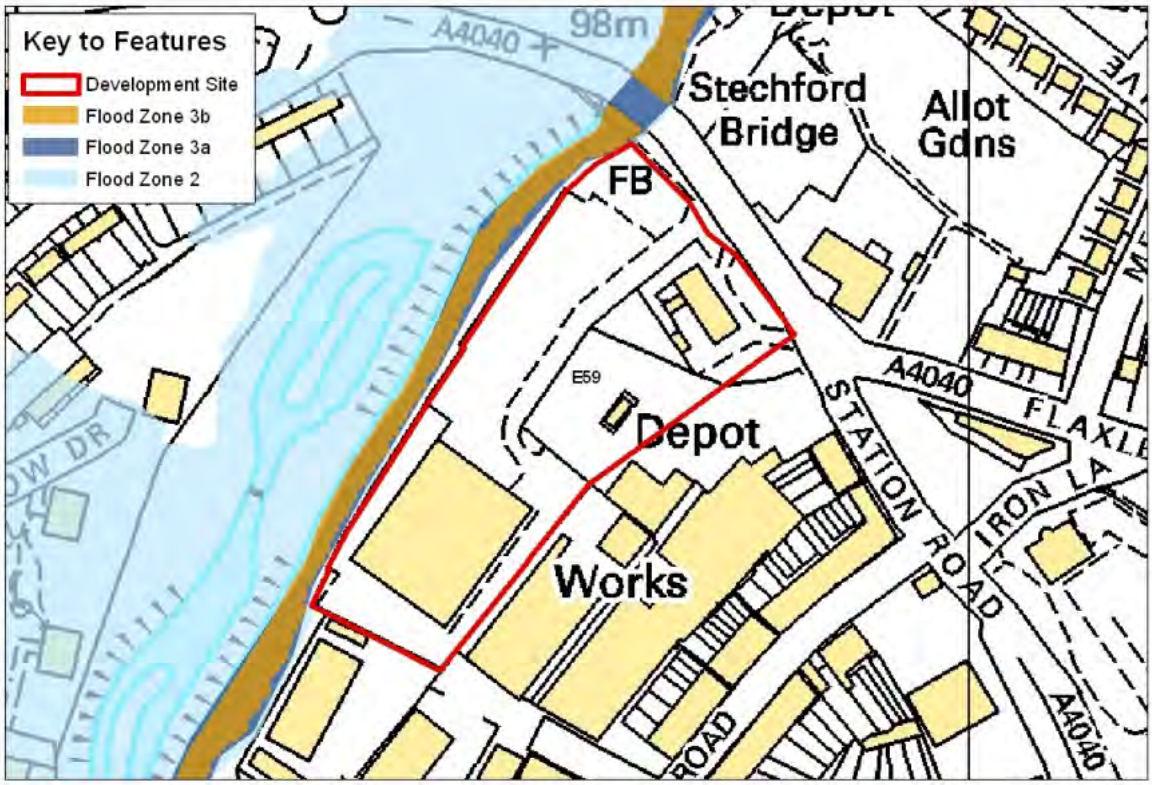
Site Summary Sheet: E59 Station Road



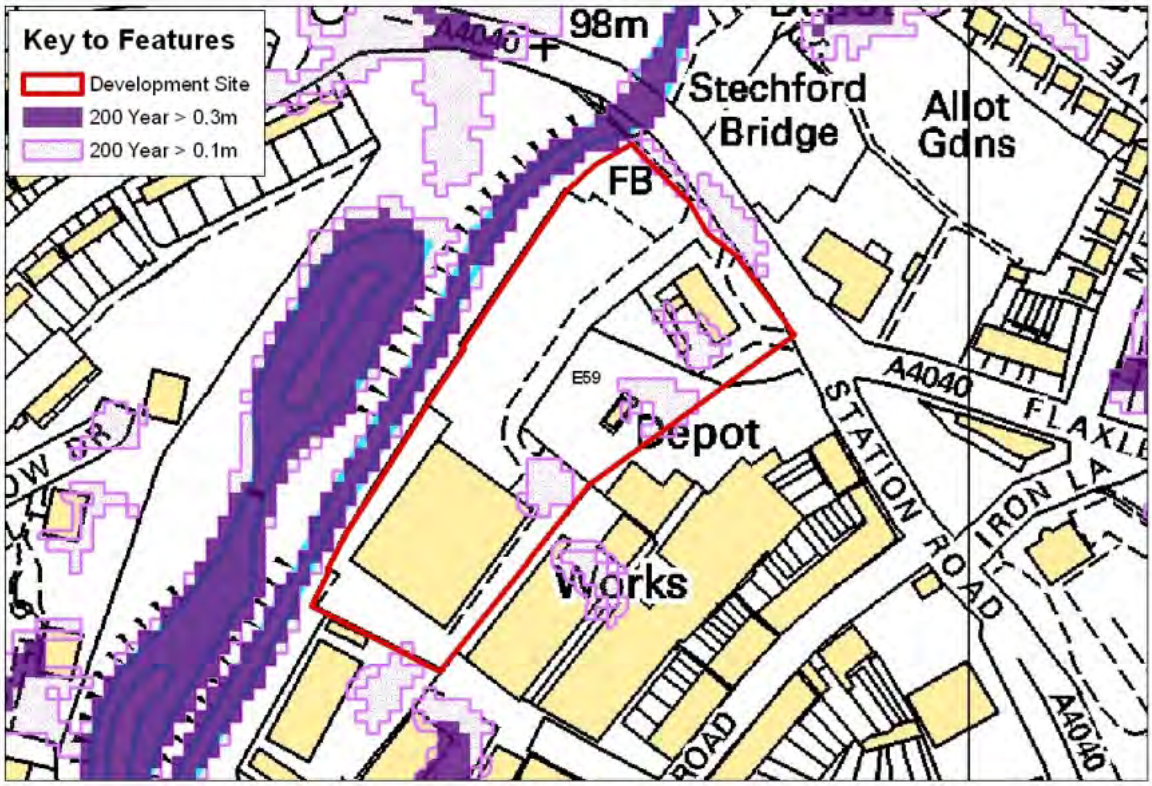
Site Name	E59
Site Address	B&Q Site Station Road Stechford
National Grid Reference	SP 12721 87793
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Cole
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	2.00
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.0009 (0.045%)
Area within FZ3a (Ha)	0.0002 (0.01%)
Area within FZ3b (Ha)	0 (0%)
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	Only the northern corner of the site is at risk of flooding, with less than 1% of the total site area being in Flood Zone 3a. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.15Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The site is defined as having a High and Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes, less than 1% of the site is at risk of fluvial flooding, vulnerable uses can be avoided on this small area of land.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Stechford Lane.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	No.
Can the loss of floodplain be compensated for within the site boundaries?	No.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere and no alternative brownfield sites are available. The developer should work closely with the Environment Agency to ensure that any proposals consider the treatment of the River Cole corridor.

Fluvial Flood Risk Map

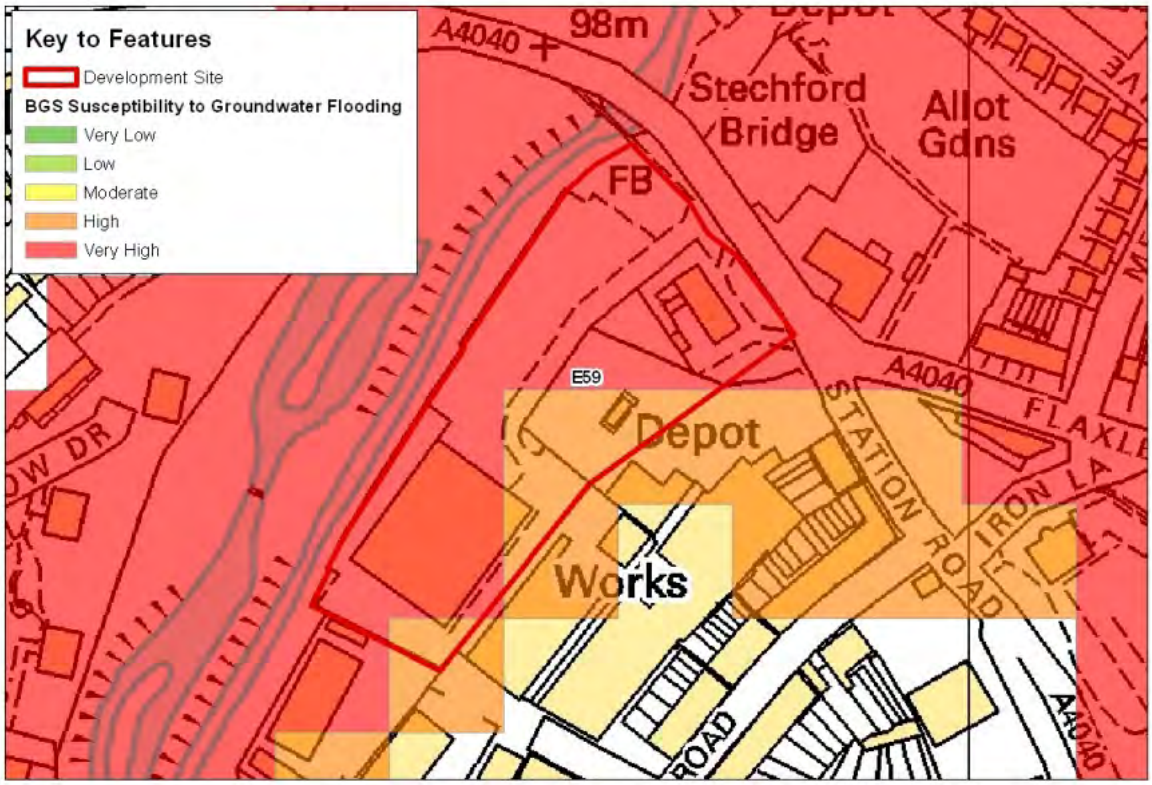


Flood Map for Surface Water (FMfSW)

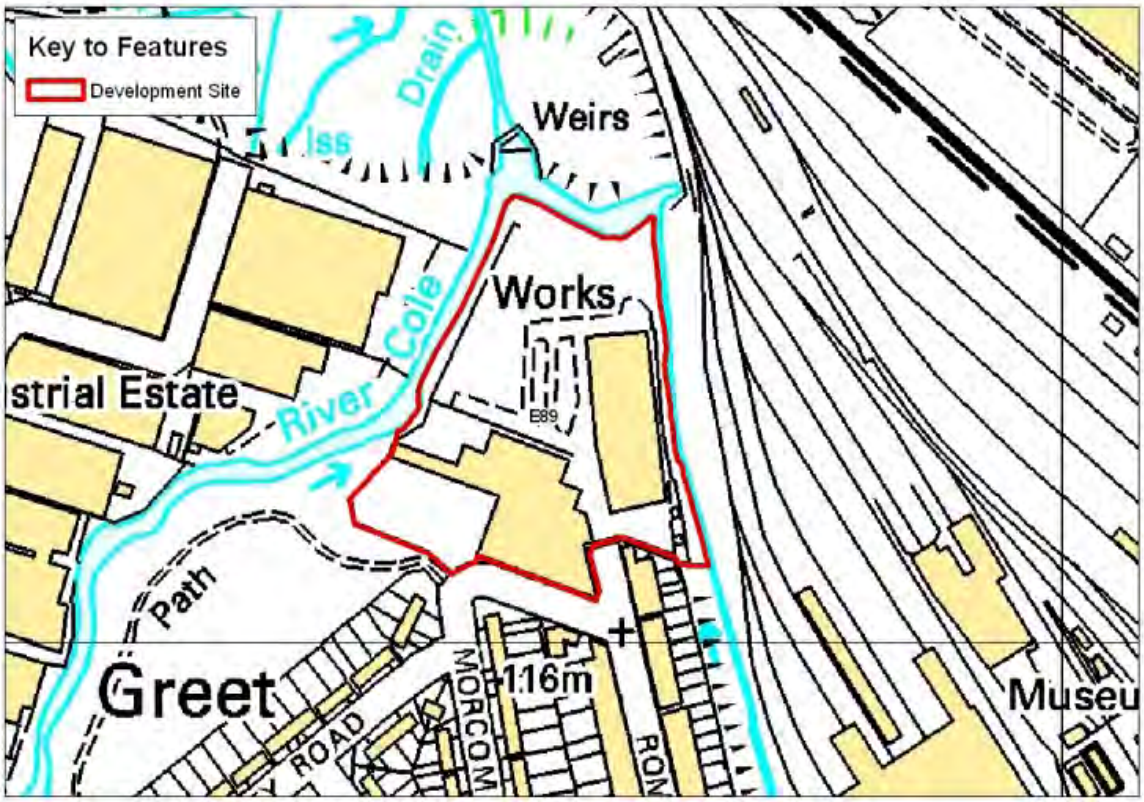


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



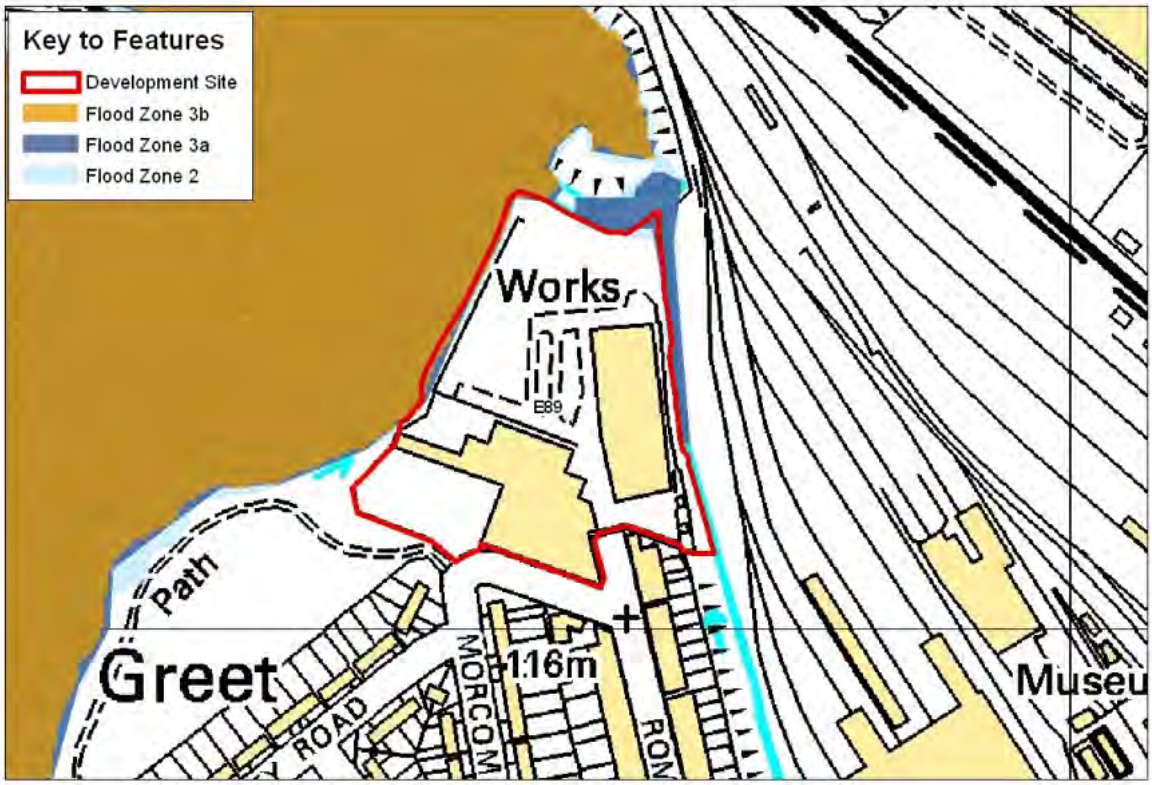
Site Summary Sheet : E89 Land off Roma Road



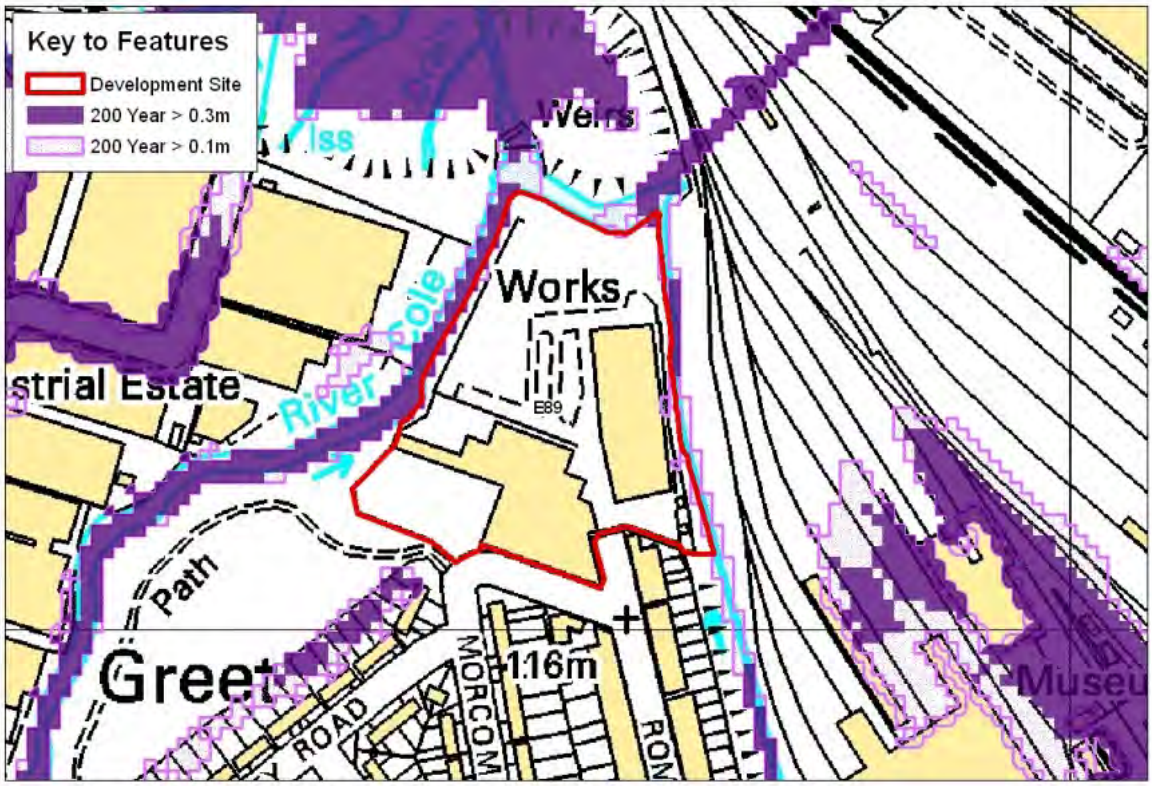
Site Name	E89
Site Address	Land off Roma Road
National Grid Reference	SP 10376 84268
Catchment	River Cole
Primary Source of Flood Risk	Fluvial from River Cole and Tyseley Brook
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	1.85
Area within FZ1 (Ha)	1.77 (96%)
Area within FZ2 (Ha)	0.08 (4%)
Area within FZ3a (Ha)	0.06 (3%)
Area within FZ3b (Ha)	0.03 (2%)
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	Only the north and east boundary of the site adjacent to Tyseley Brook and the west boundary of the site adjacent to River Cole is at risk of flooding, with less than 2% of the total site area being in Flood Zone 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.04Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. 2/3 of the site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes, only 4% of the site is at risk of fluvial flooding, vulnerable uses can be avoided on this small area of land.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Roma Road.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	No
Is compensatory flood storage required?	No
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere and no alternative brownfield sites are available. The developer should work closely with the Environment Agency to ensure that any proposals consider the treatment of the River Cole corridor.

Fluvial Flood Risk Map

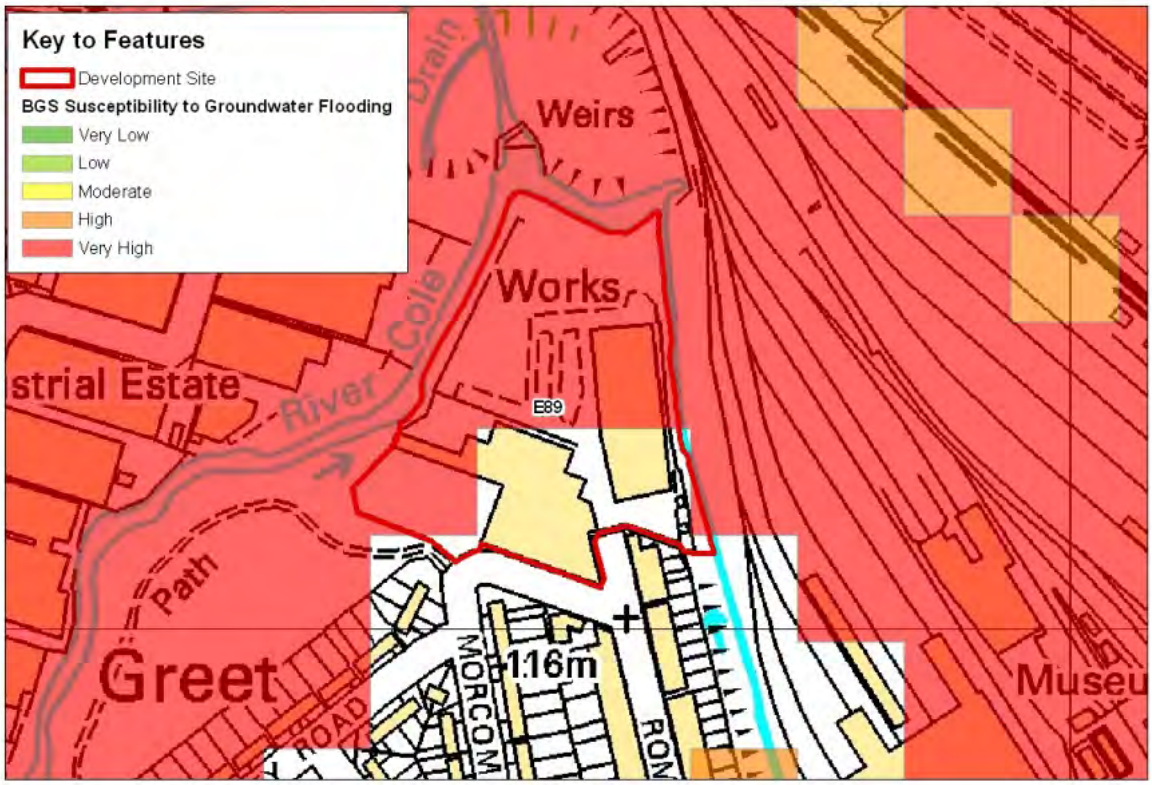


Flood Map for Surface Water (FMfSW)

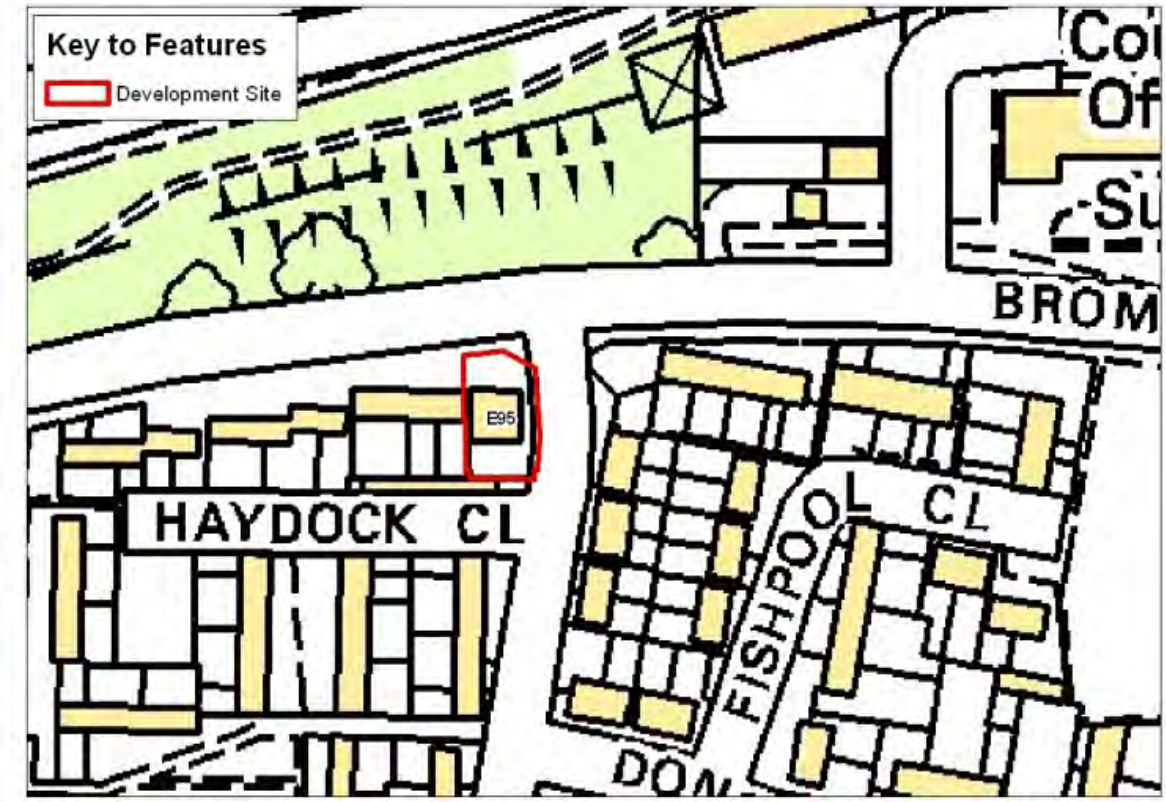


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: E95 Bromford Drive and Reynoldstown Road

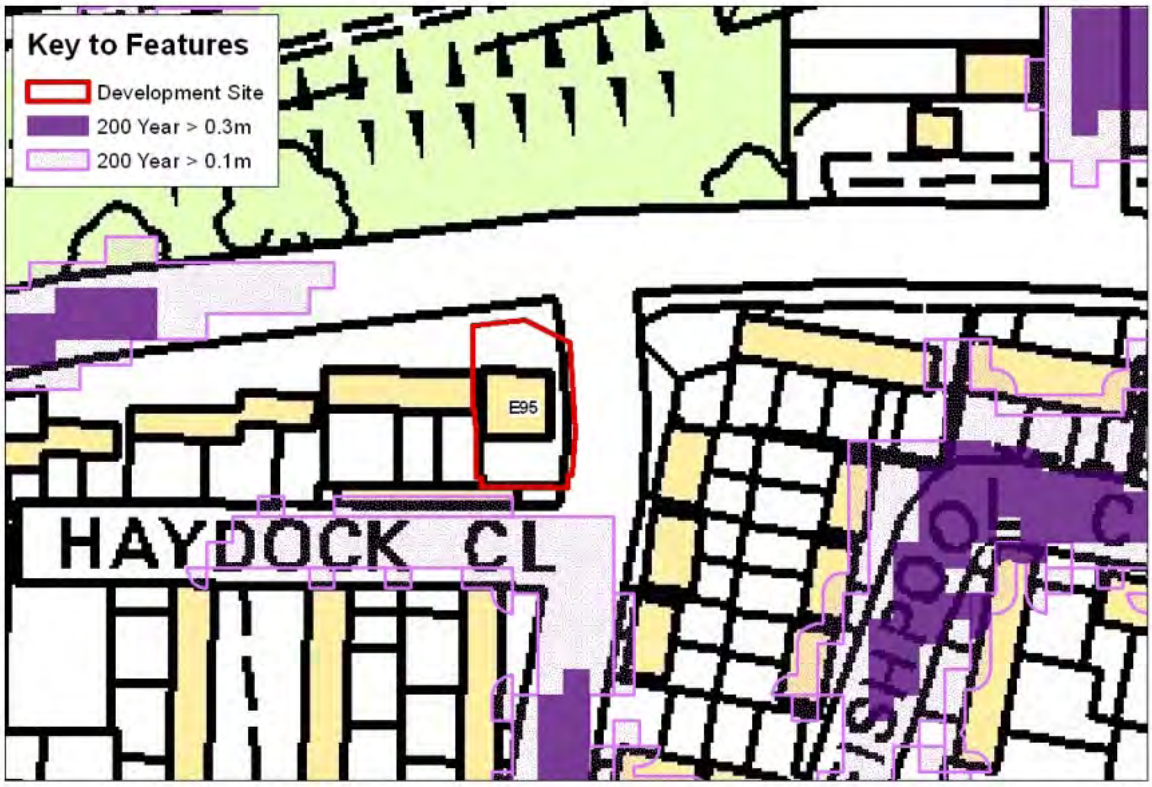


Site Name	E95
Site Address	Junction of Bromford Drive and Reynoldstown Road
National Grid Reference	SP 12317 89782
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Groundwater
Site Area (Ha)	0.06
Area within FZ1 (Ha)	0
Area within FZ2 (Ha)	0.06 (100%)
Area within FZ3a (Ha)	0.06 (100%)
Area within FZ3b (Ha)	0.06 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	no

Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with no pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map

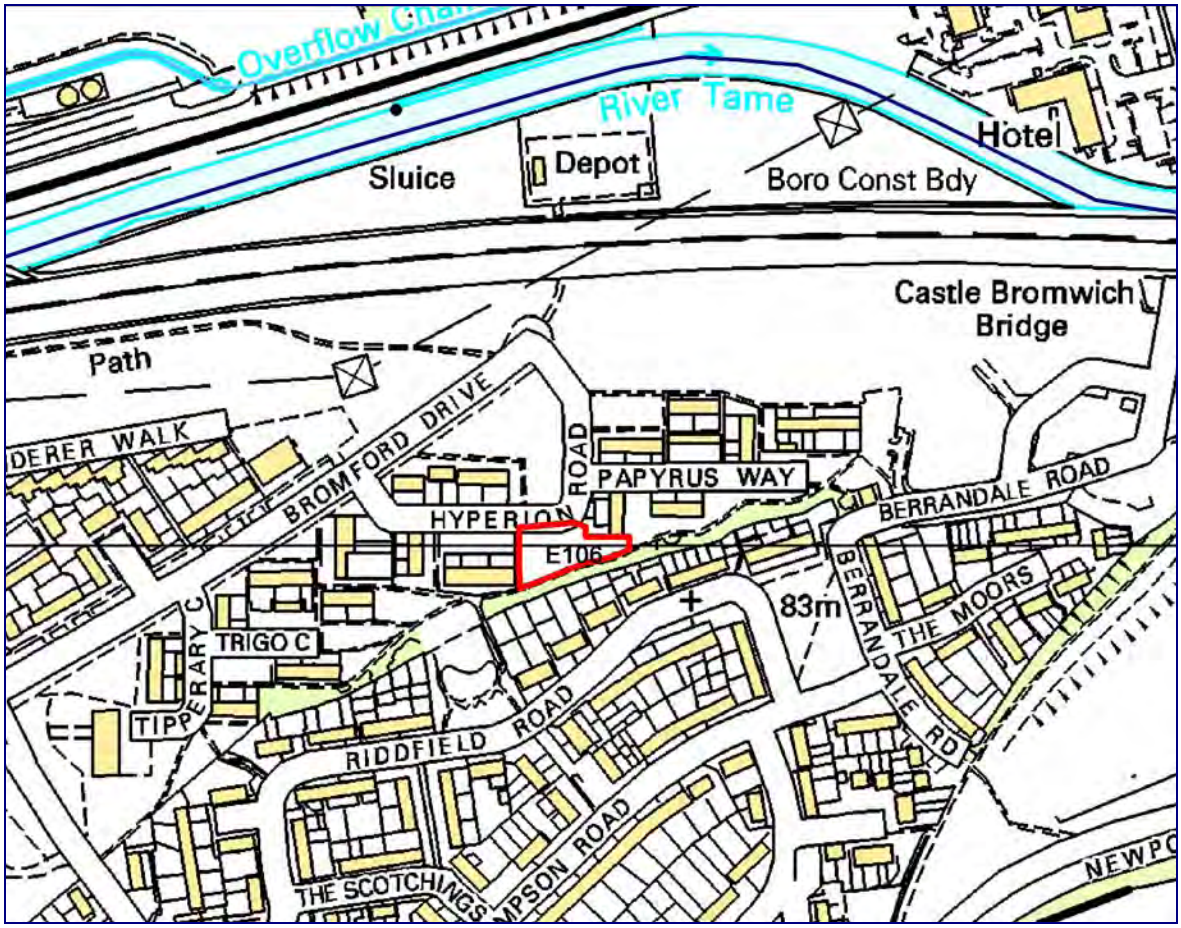
Flood Map for Surface Water (FMfSW)



This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding

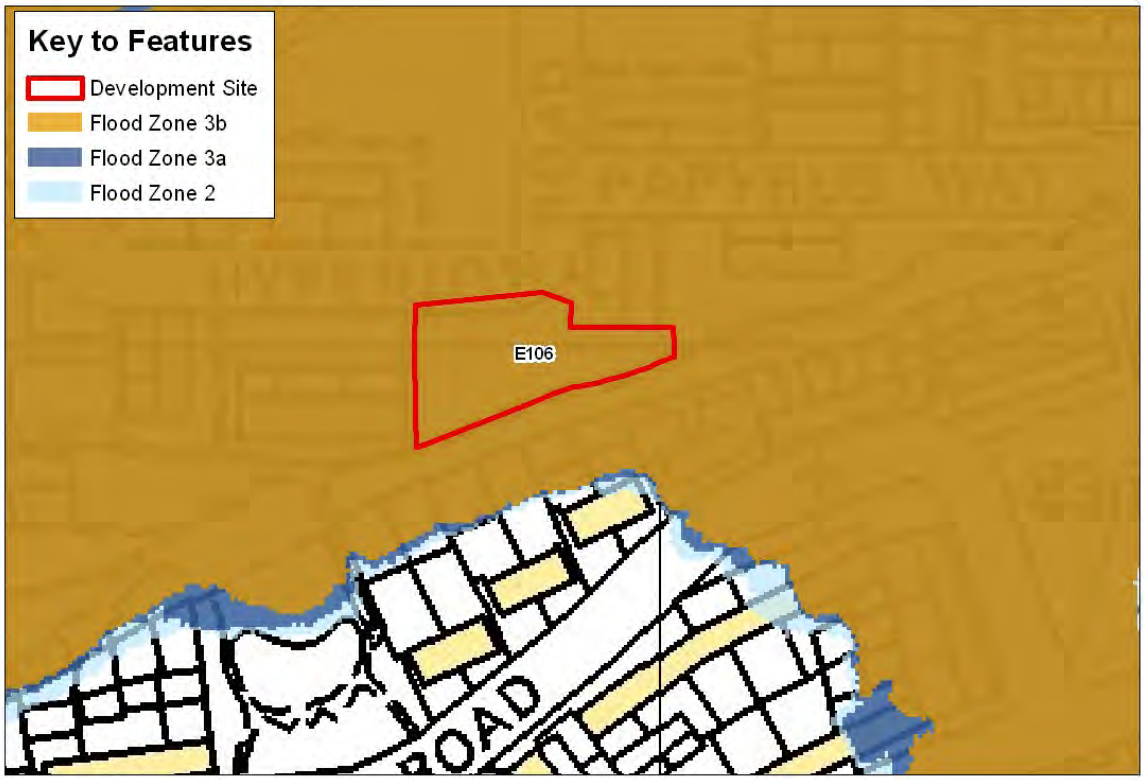
Site Summary Sheet: E106 between 17 Hyperion Road and 7 Papyrus Way



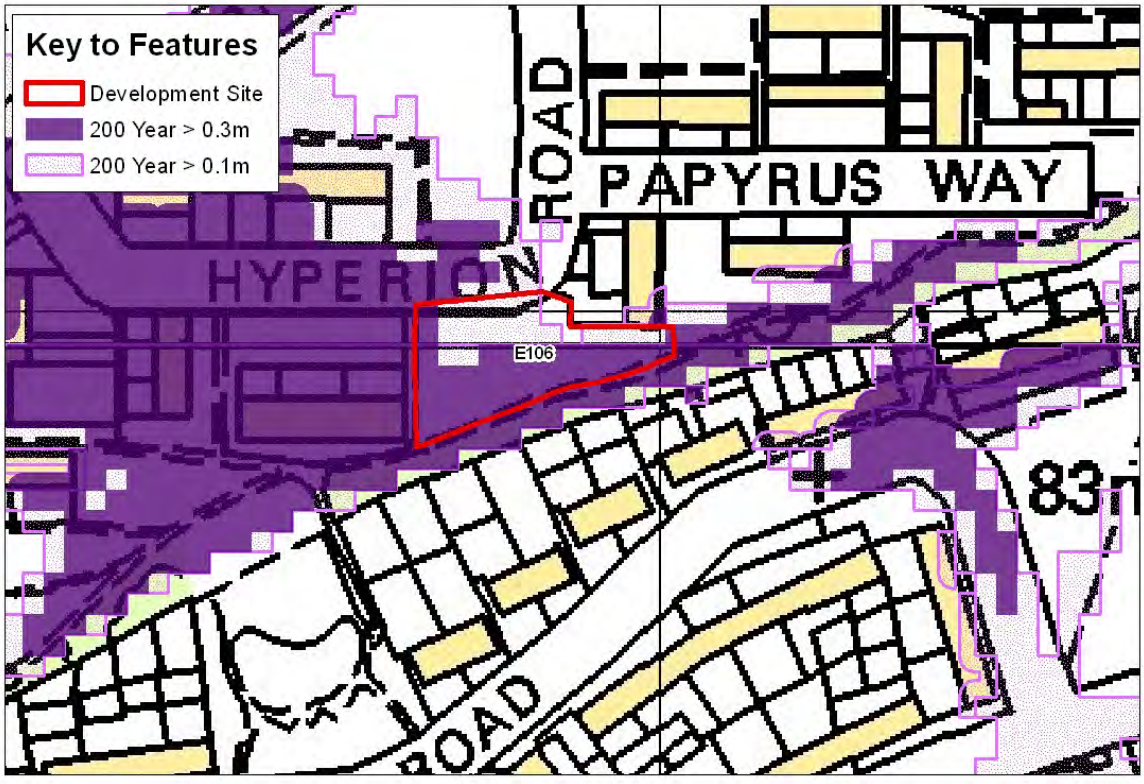
Site Name	E106
Site Address	Btw 17 Hyperion Rd & 7 Papyrus Way
National Grid Reference	SP 13471 90002
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.14
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.14 (100%)
Area within FZ3a (Ha)	0.14 (100%)
Area within FZ3b (Ha)	0.14 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.

Is the site at risk from surface water flooding?	Yes. 0.09Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.13Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The northern half of the site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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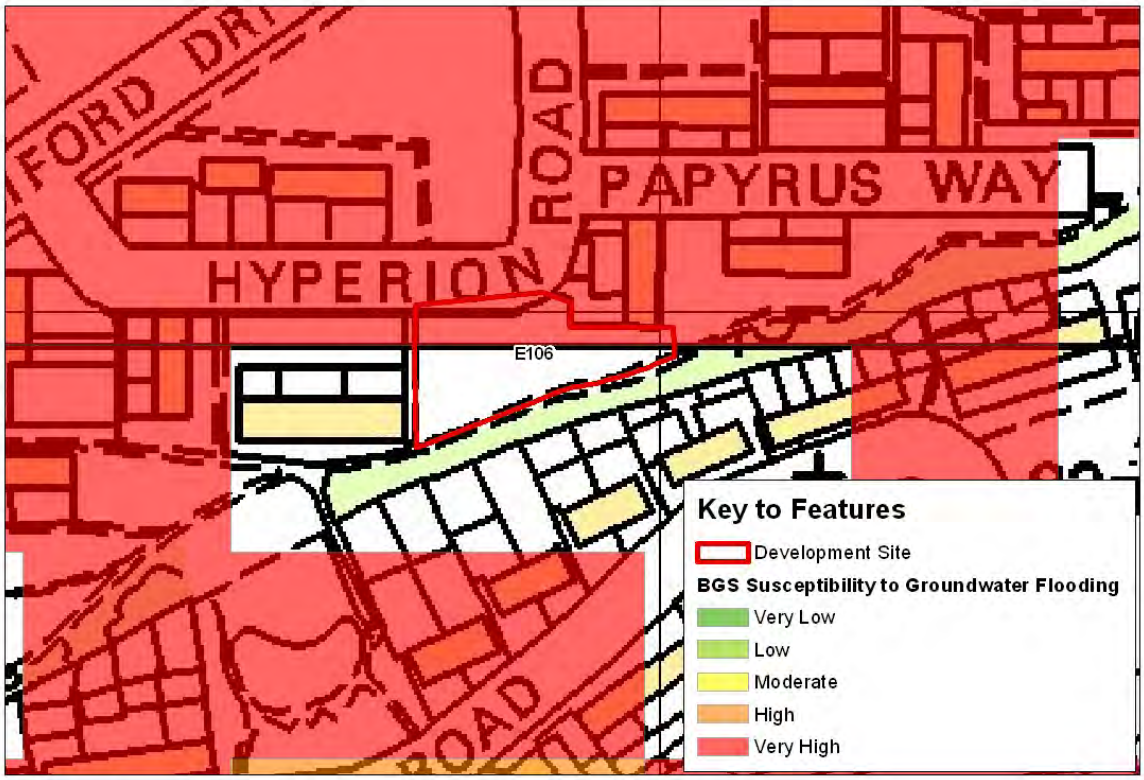
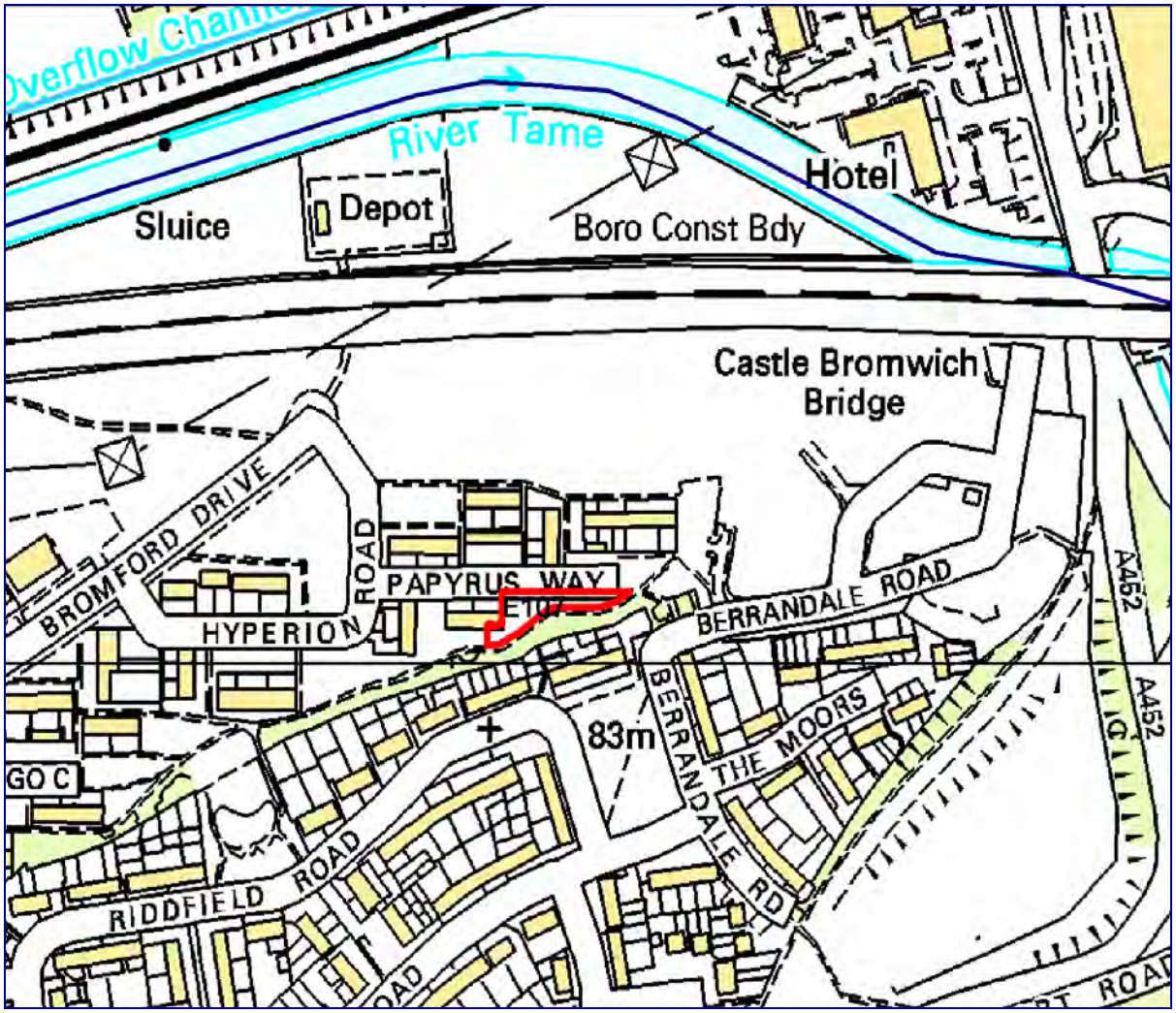
Susceptibility to Groundwater Flooding



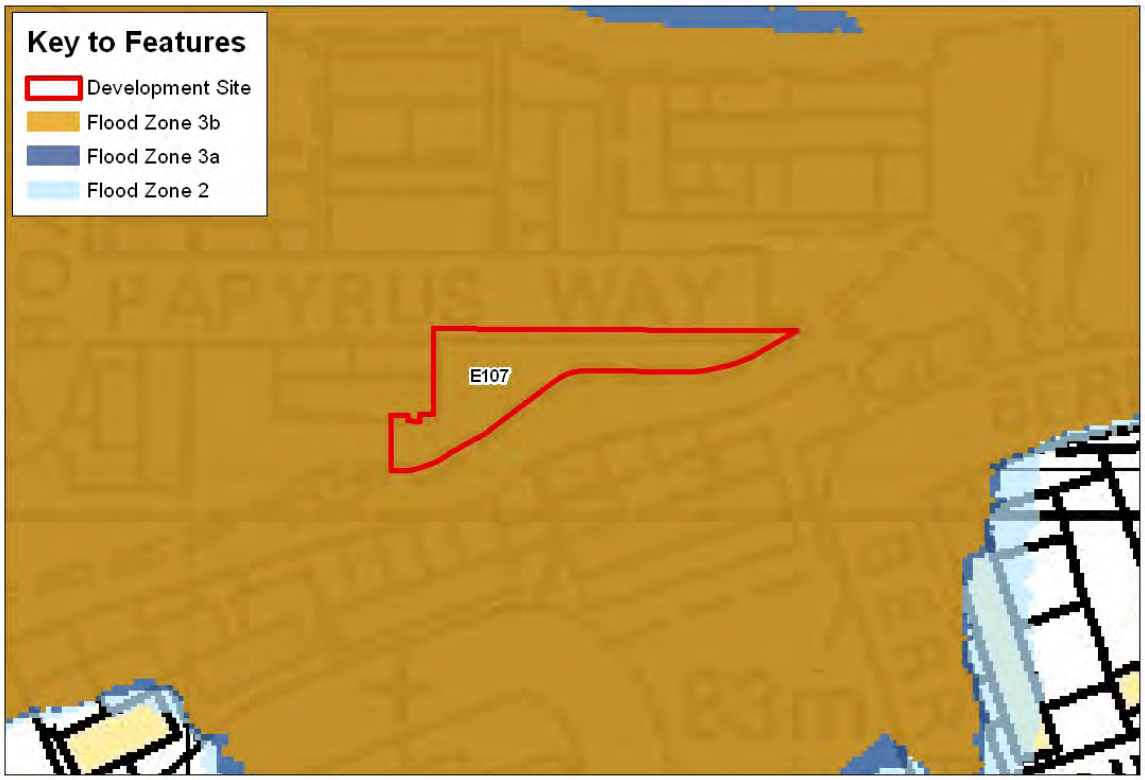
Site Summary Sheet: E107 17 Papyrus Way



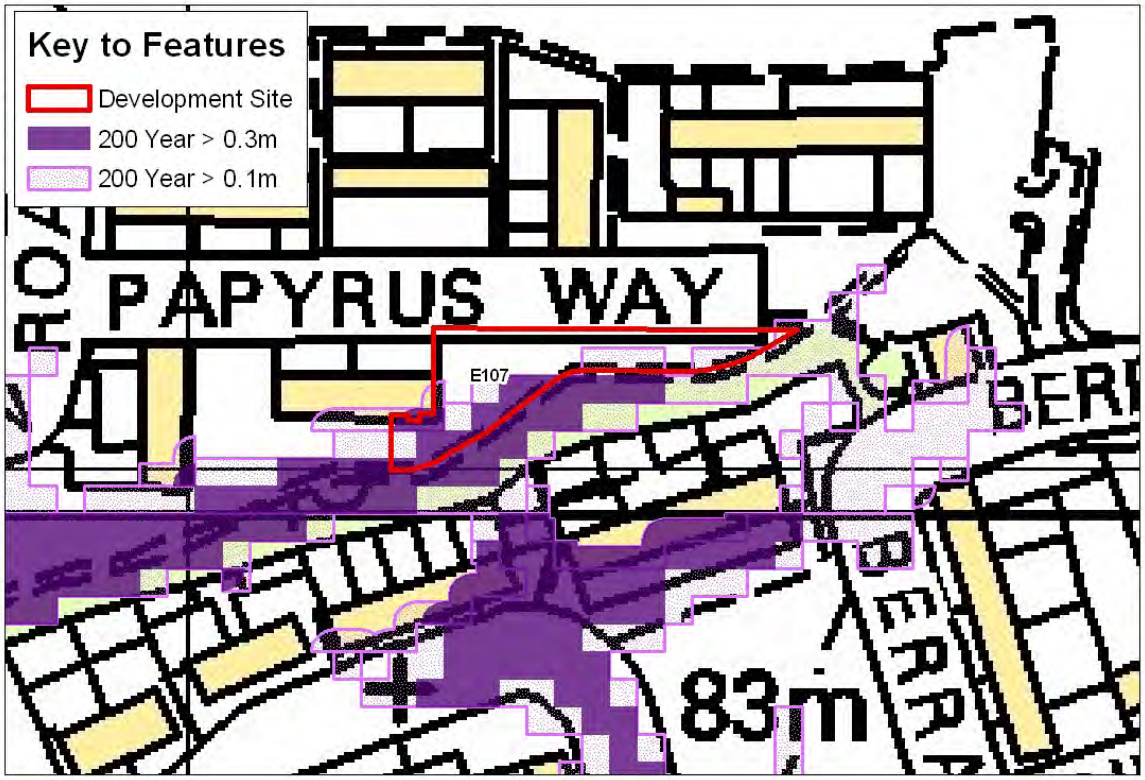
Site Name	E107
Site Address	Adj 17 Papyrus Way
National Grid Reference	SP 13607 90020
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.07
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.07 (100%)
Area within FZ3a (Ha)	0.07 (100%)
Area within FZ3b (Ha)	0.07 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.

What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.02Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.04Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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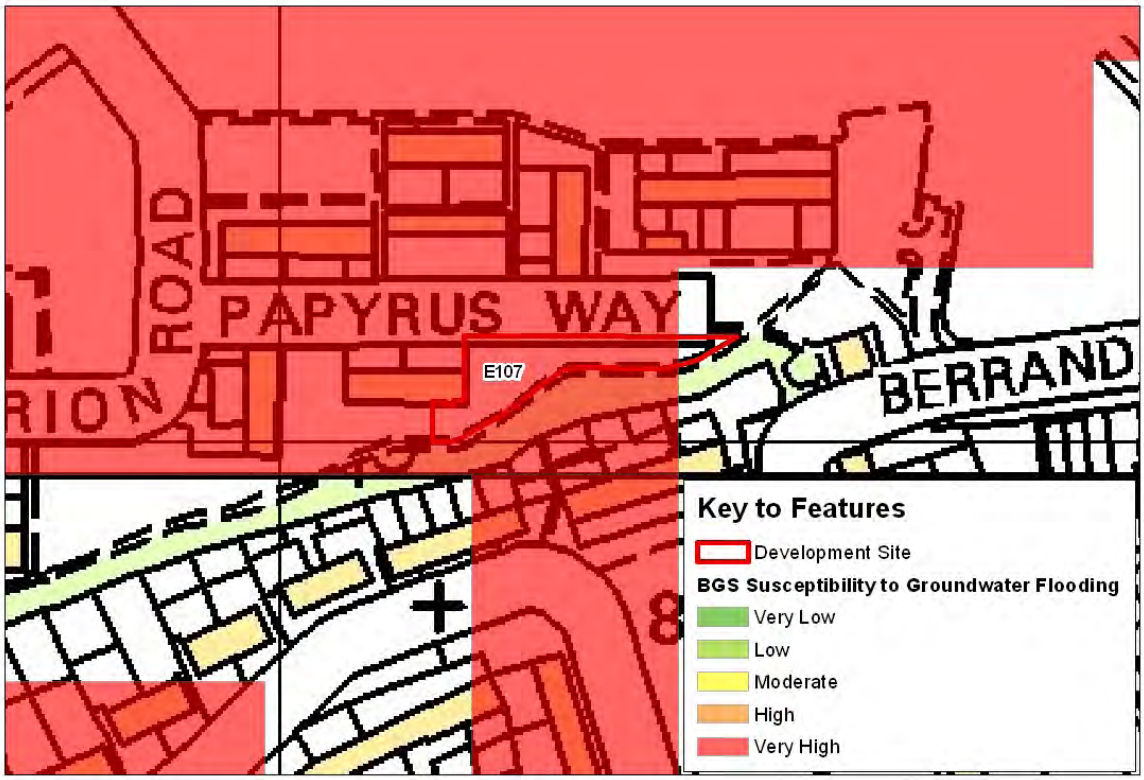
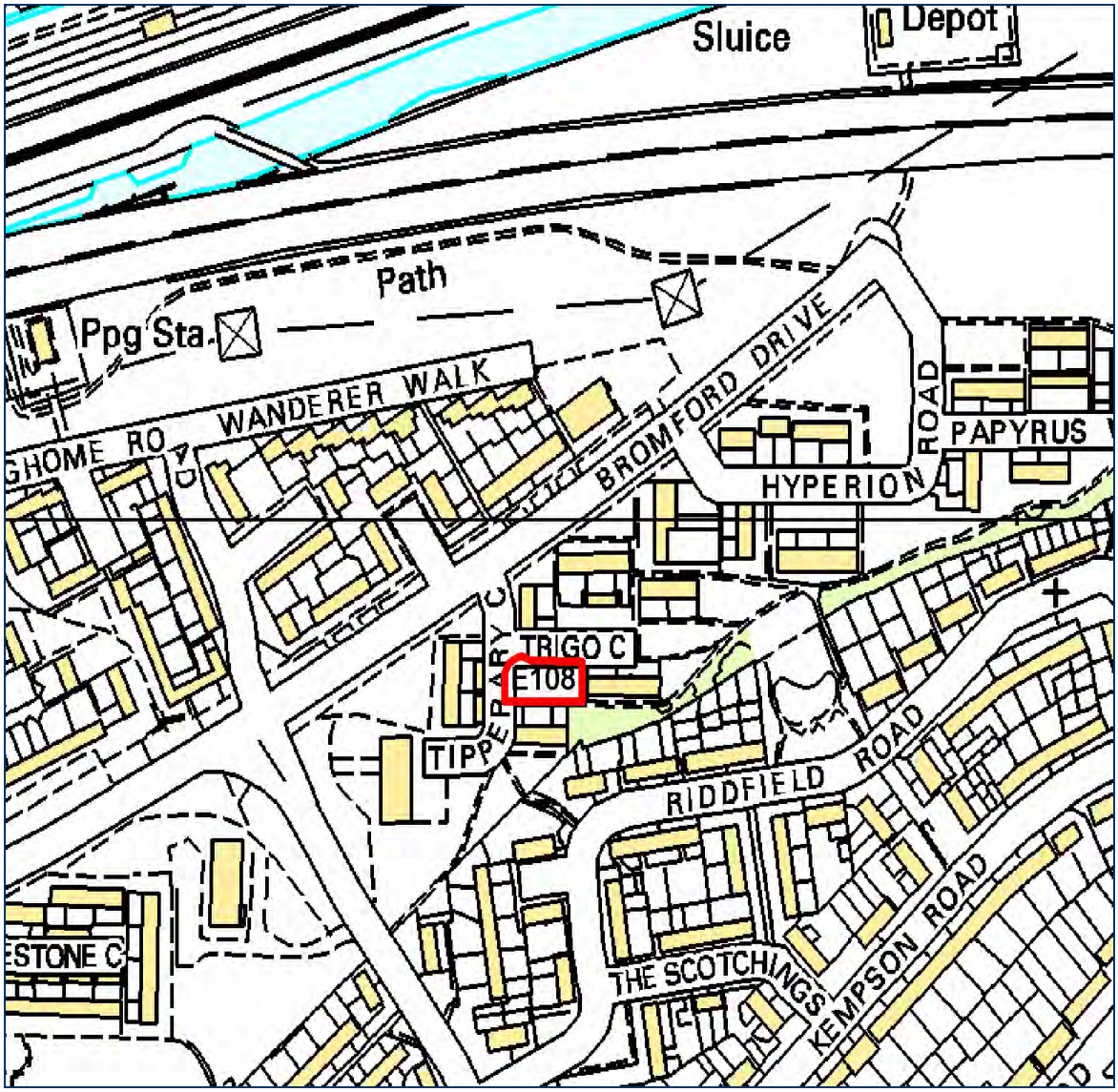
Susceptibility to Groundwater Flooding



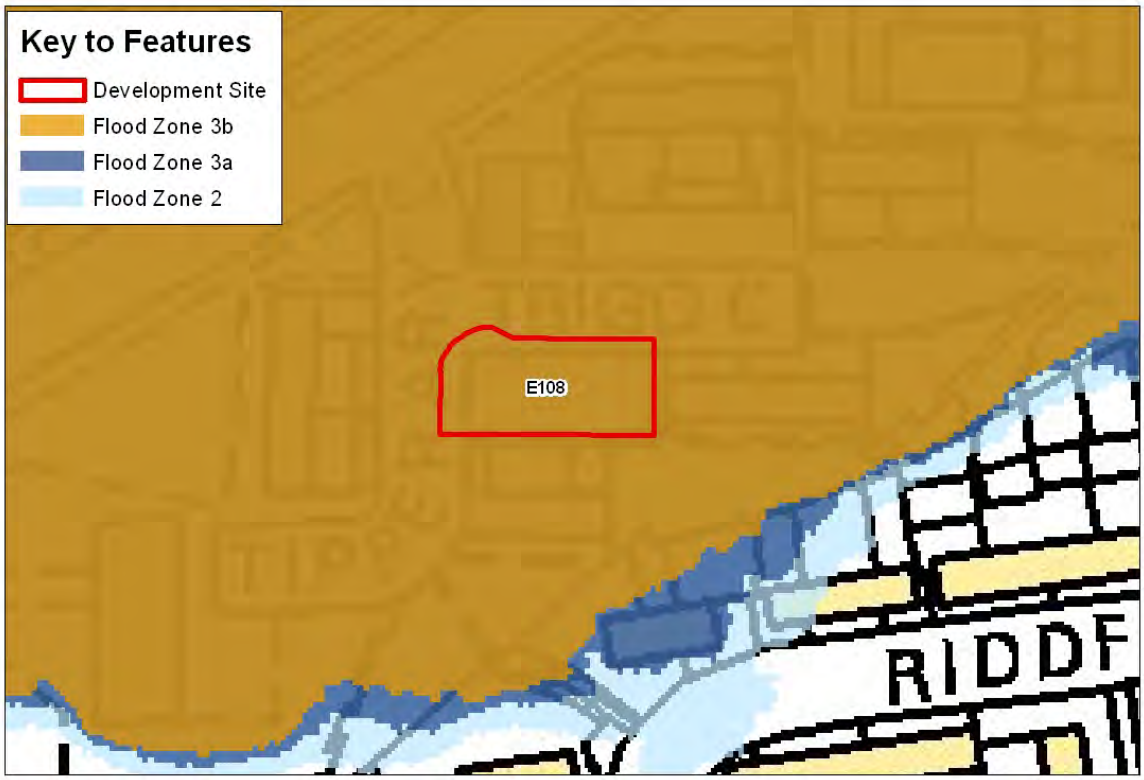
Site Summary Sheet: E108 junction Tipperary Close and Trigo Croft



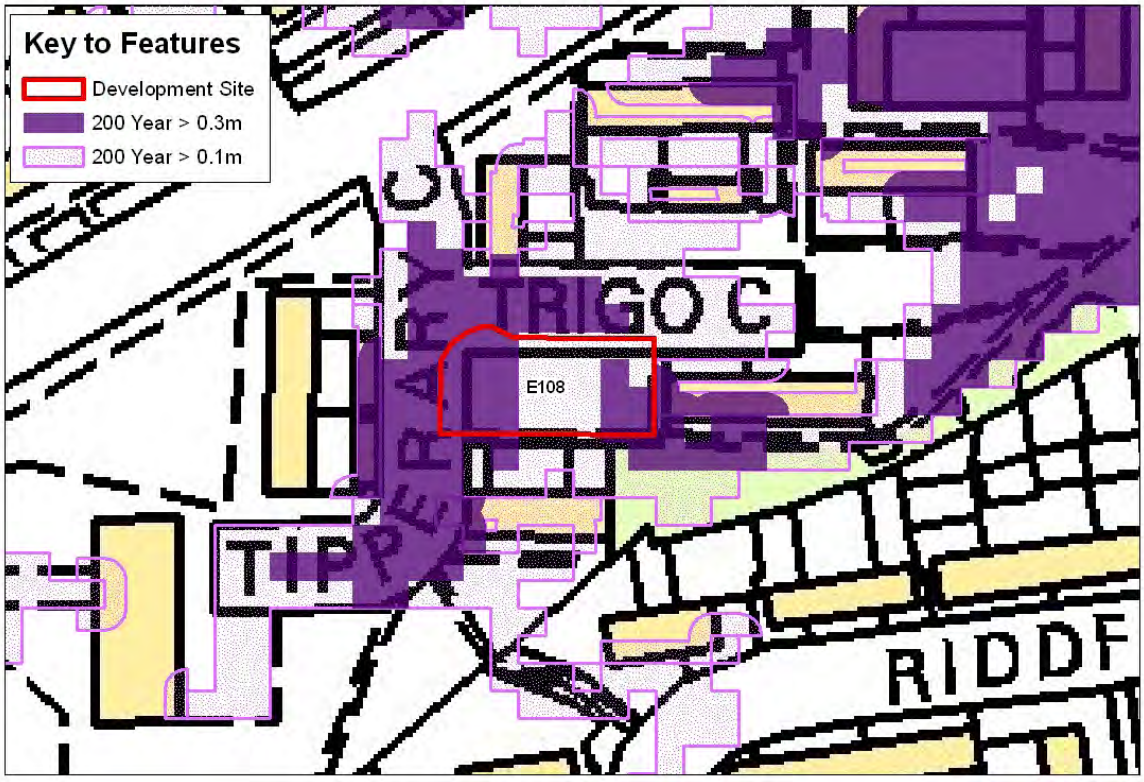
Site Name	E108
Site Address	Junction of Tipperary Close and Trigo Croft
National Grid Reference	SP 13335 89931
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.07
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.07 (100%)
Area within FZ3a (Ha)	0.07 (100%)
Area within FZ3b (Ha)	0.07 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.

What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.04Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.07Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with no pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map



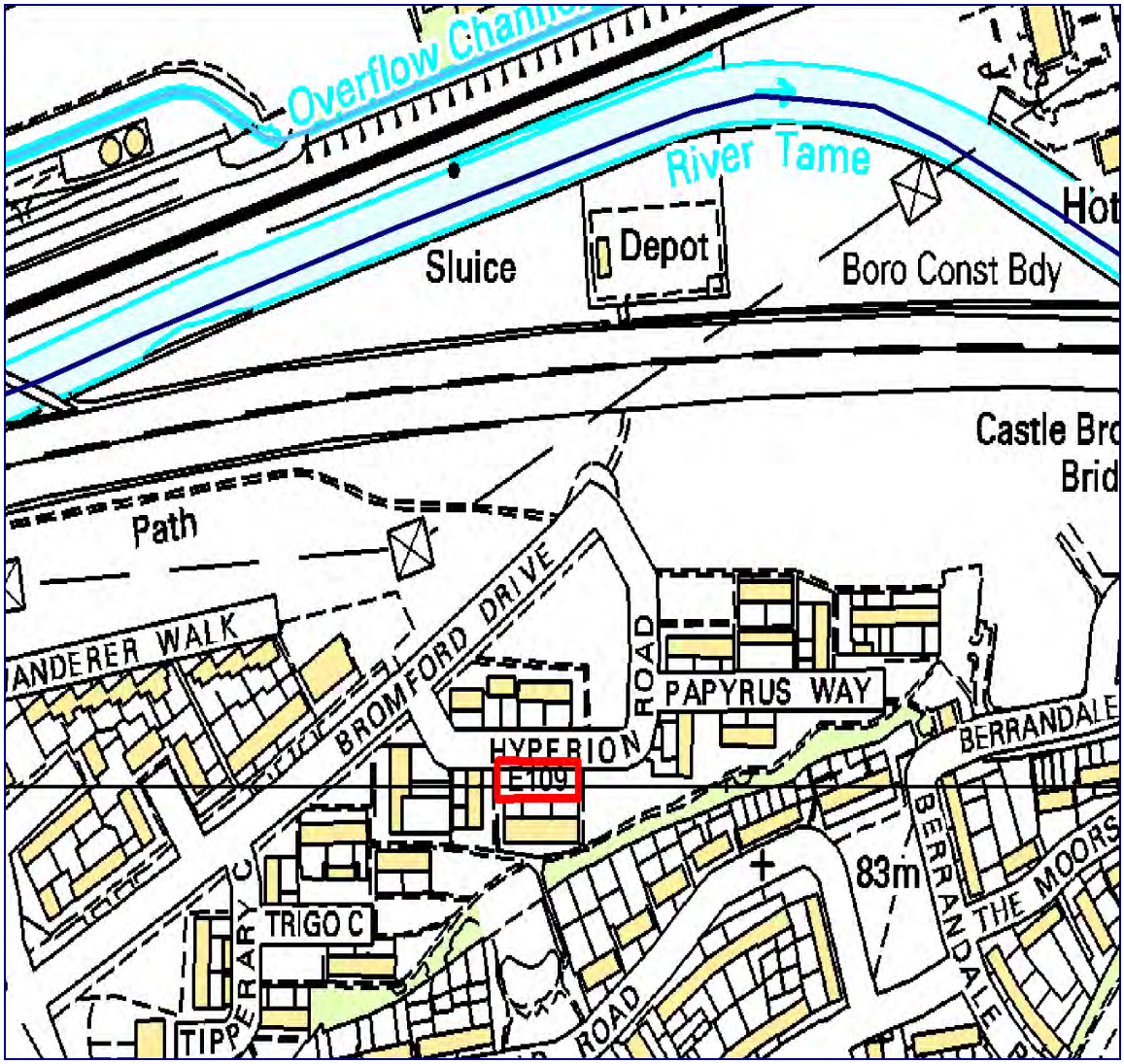
Flood Map for Surface Water (FMfSW)



This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding

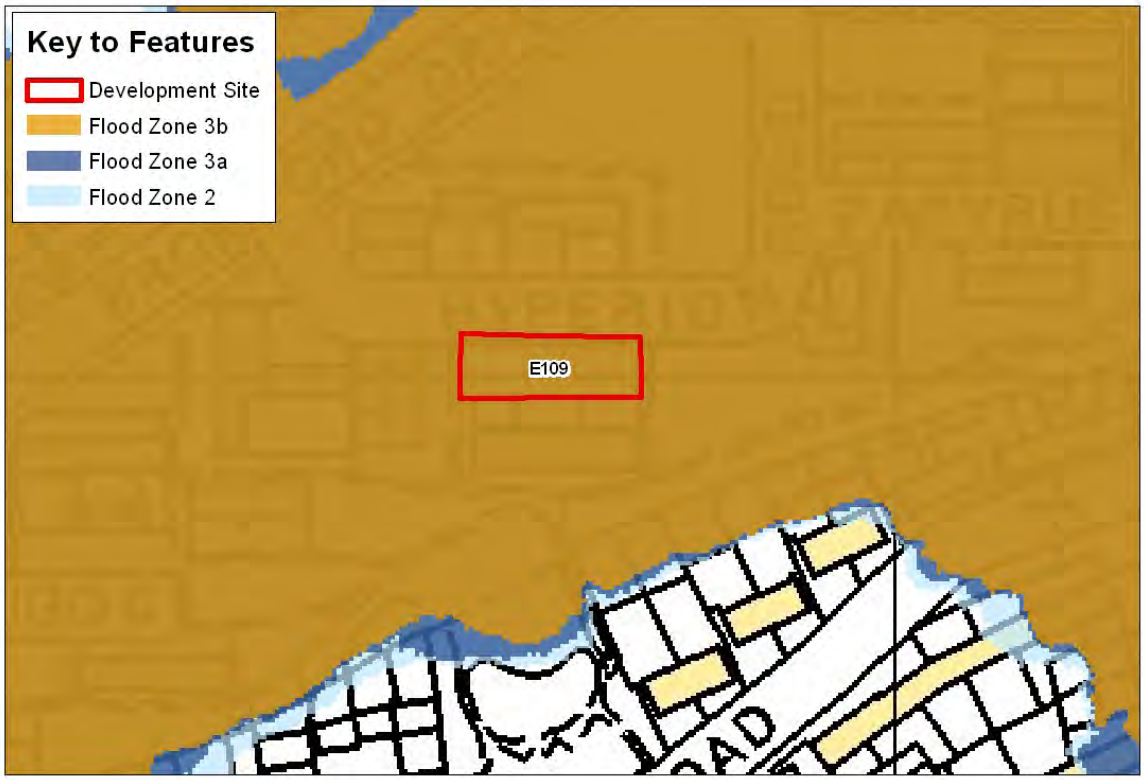
Site Summary Sheet: E109 adjacent 7-17 Hyperion Road



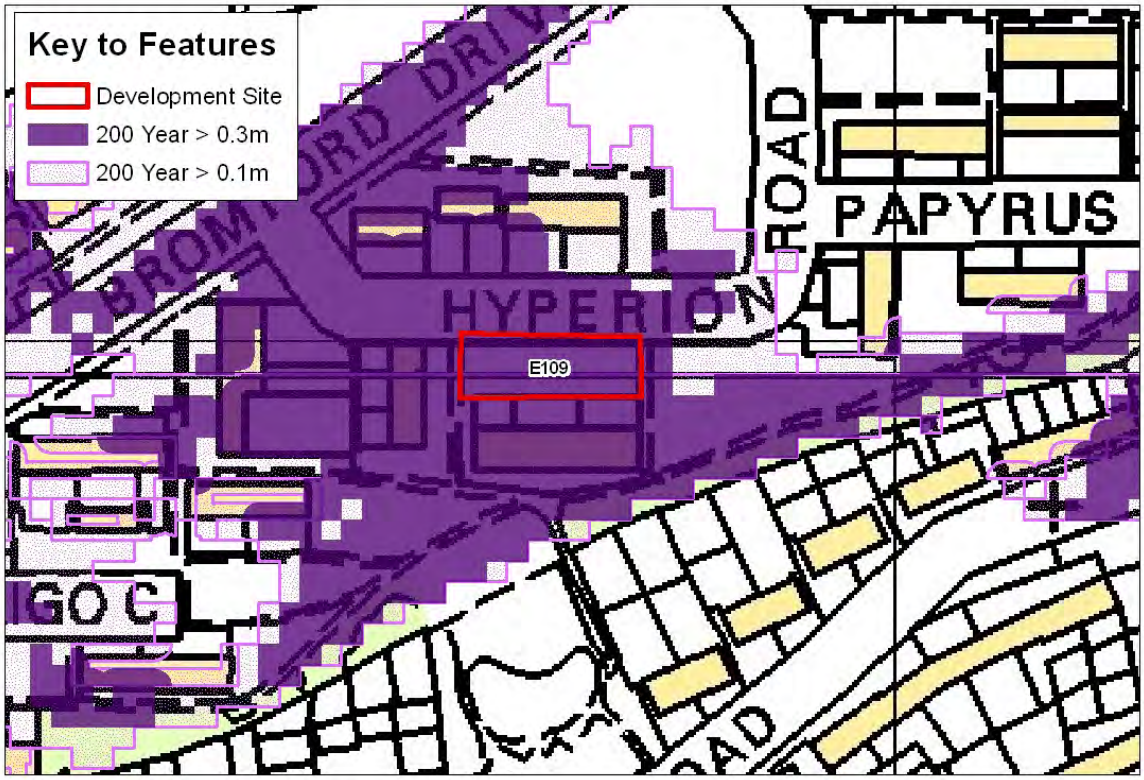
Site Name	E109
Site Address	Adjacent 7-17 Hyperion Rd
National Grid Reference	SP 13470 90002
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.07
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.07 (100%)
Area within FZ3a (Ha)	0.07 (100%)
Area within FZ3b (Ha)	0.07 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.

What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.07Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.07Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The northern half of the site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with no pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map

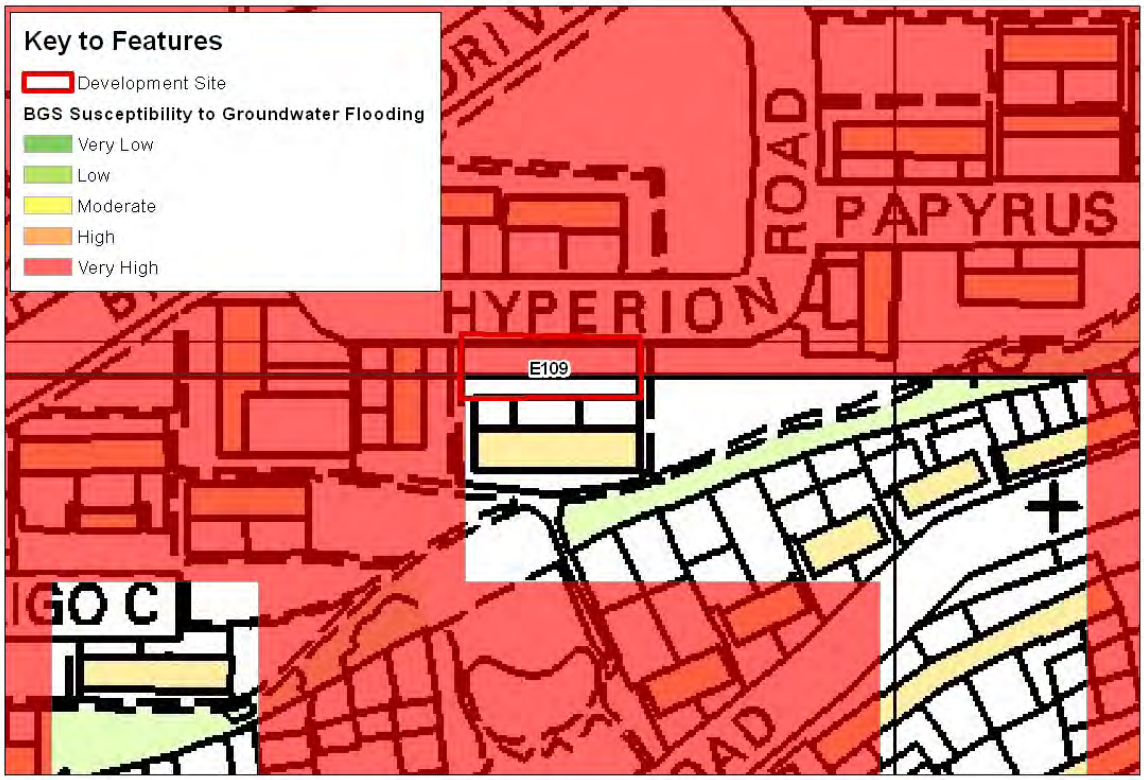


Flood Map for Surface Water (FMfSW)

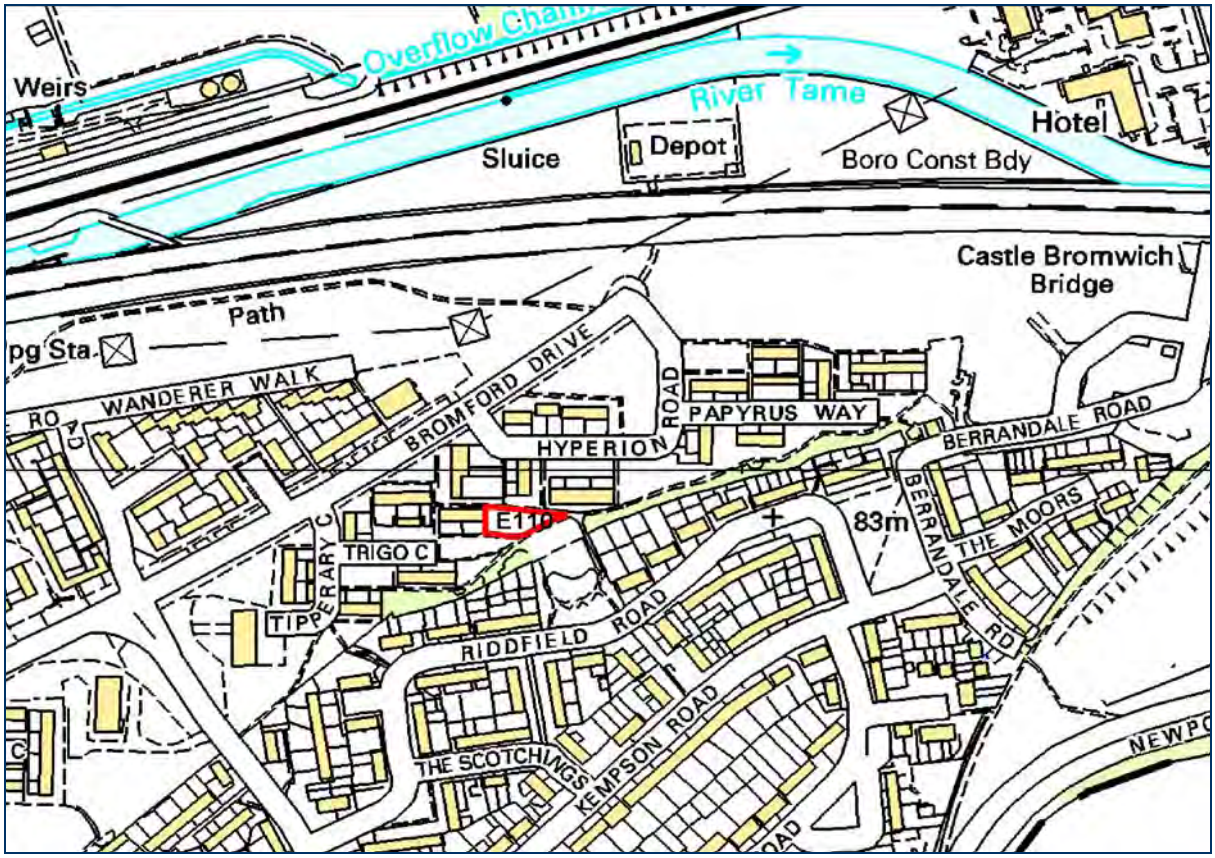


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



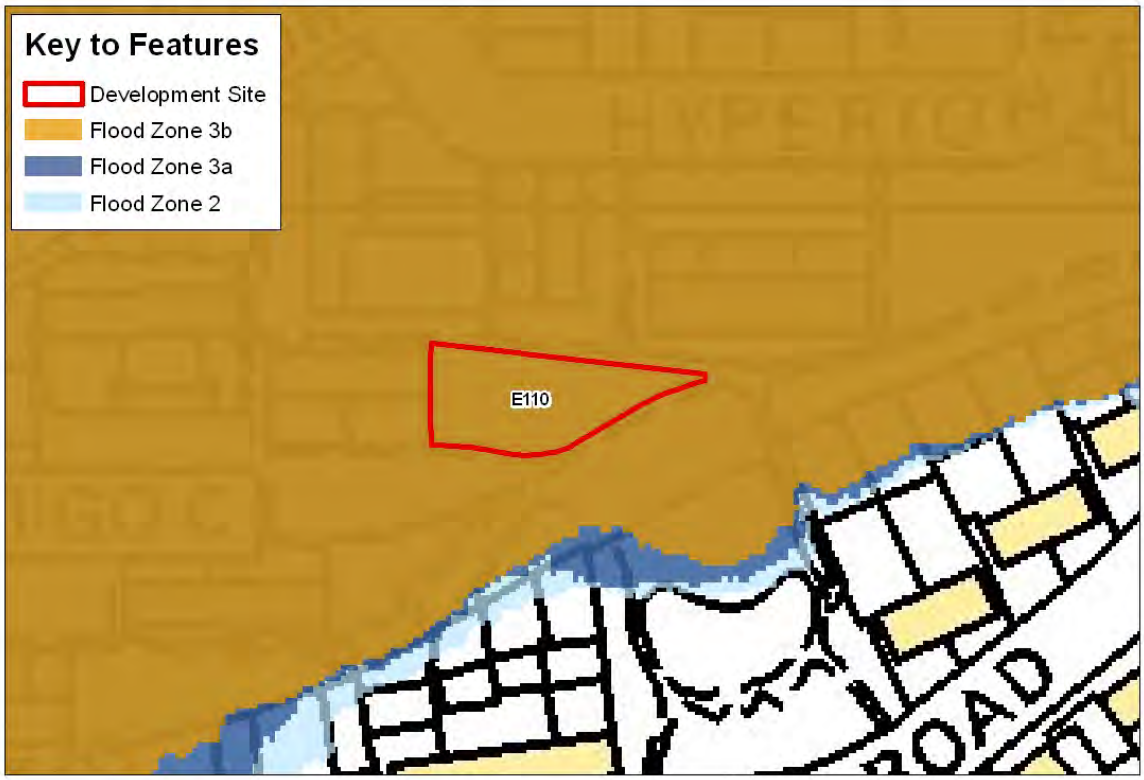
Site Summary Sheet: E110 adjacent to 25 Trigo Croft



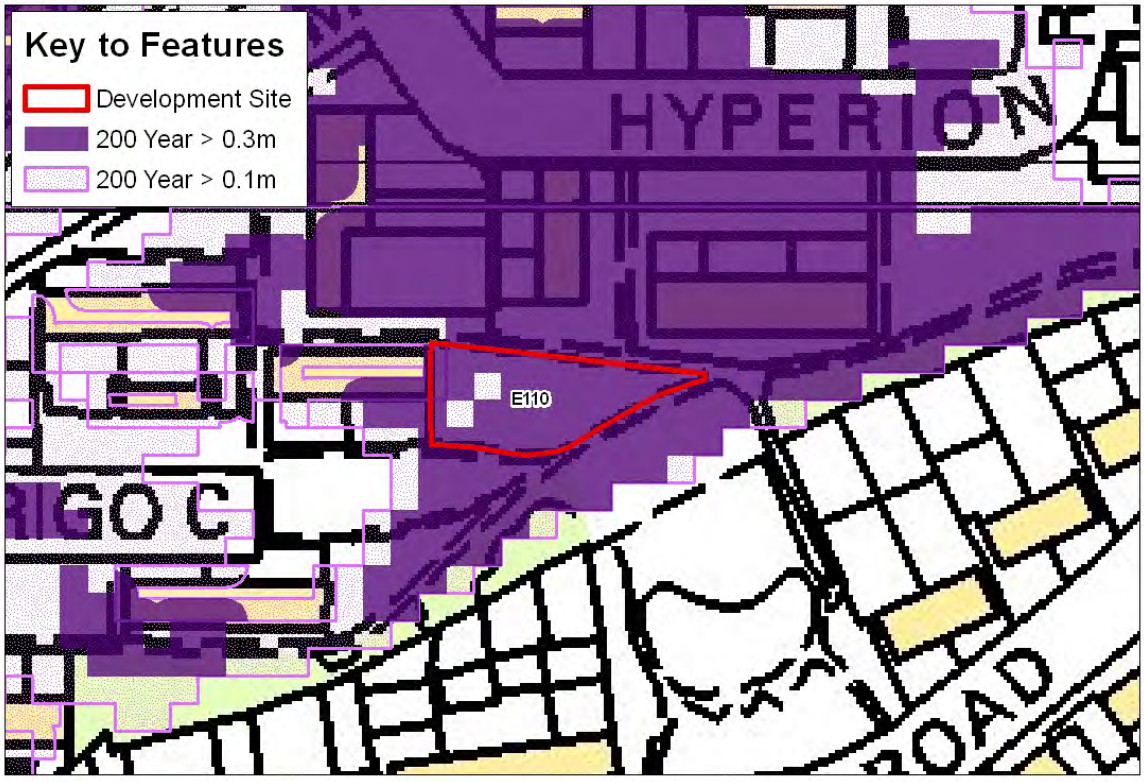
Site Name	E110
Site Address	Land adjacent to 25 Trigo Croft
National Grid Reference	SP 13437 89965
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.06
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.06 (100%)
Area within FZ3a (Ha)	0.06 (100%)
Area within FZ3b (Ha)	0.06 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.06Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.06Ha >0.1m deep based on the FMfSW (0.5% AEP event).

Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map

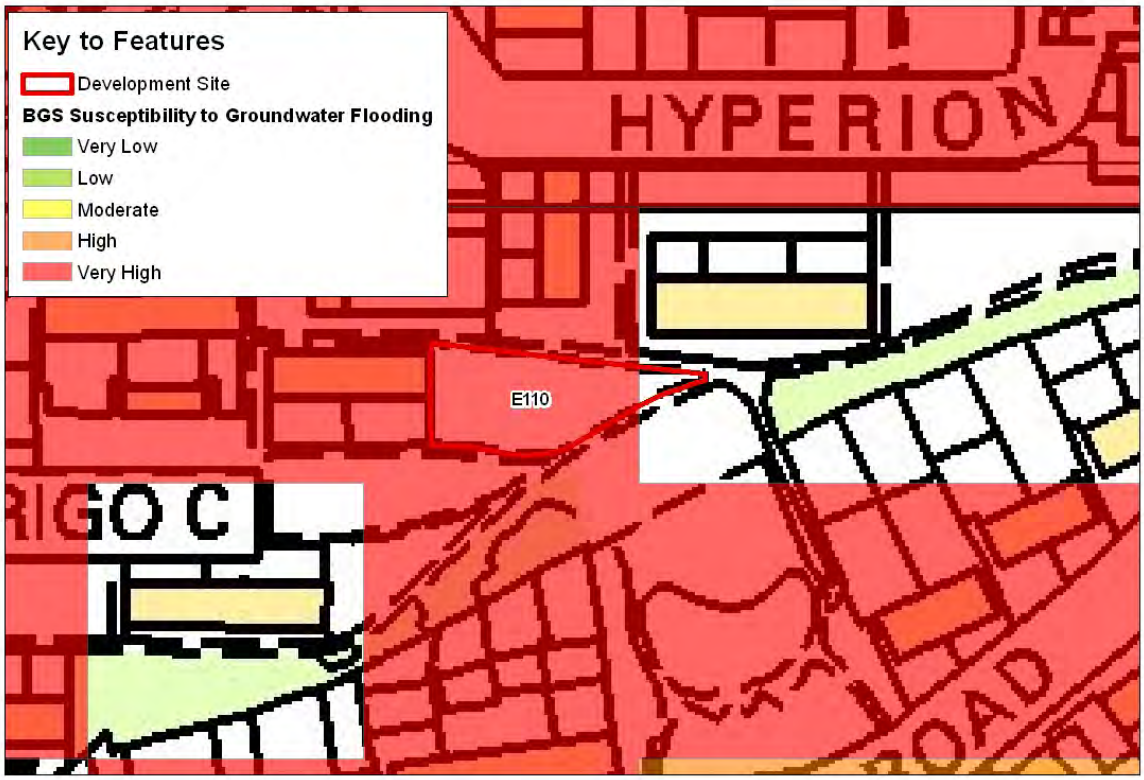


Flood Map for Surface Water (FMfSW)

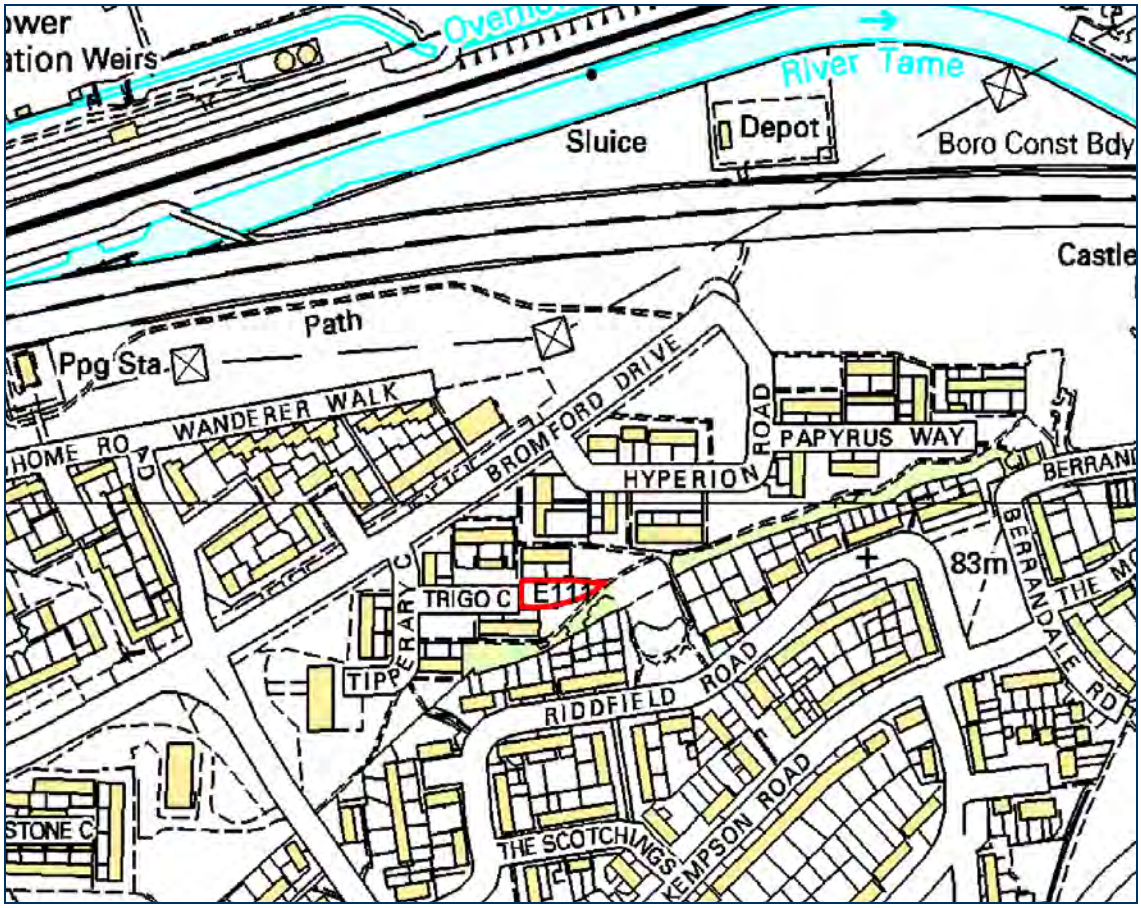


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



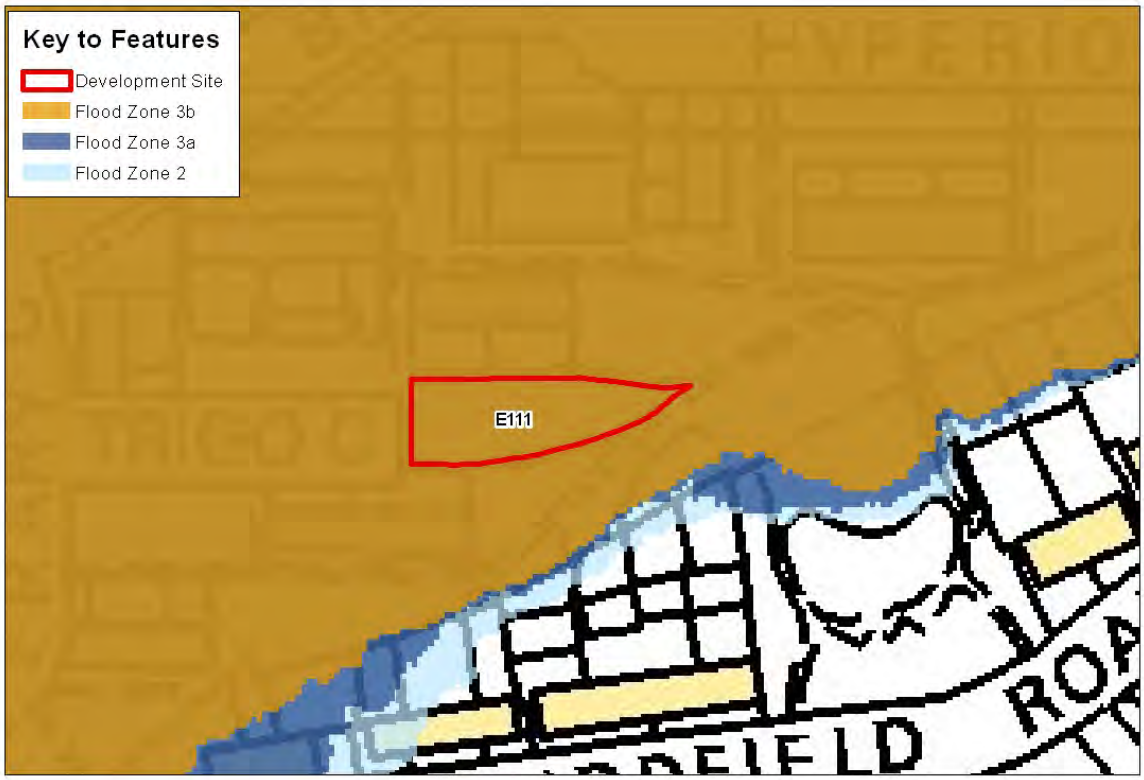
Site Summary Sheet: E111 rear of 19-25 Trigo Croft



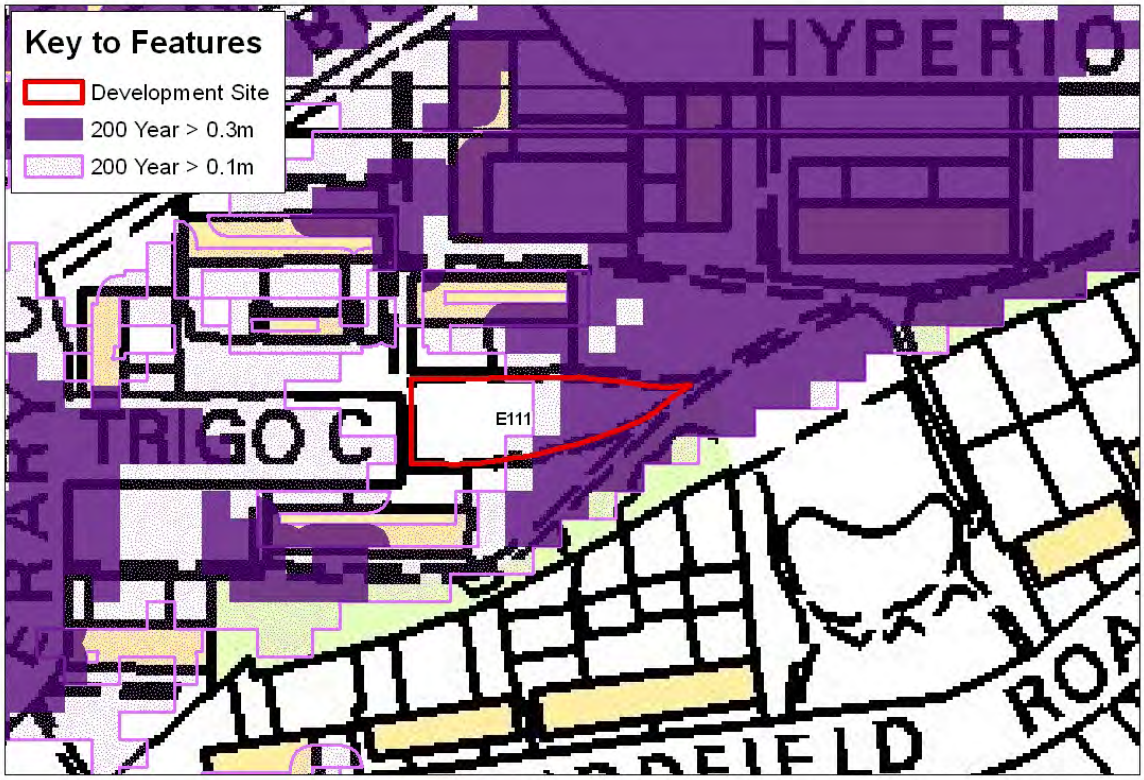
Site Name	E111
Site Address	Rear of 19 - 25 Trigo Croft
National Grid Reference	SP 13408 89948
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	0.06
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.06 (100%)
Area within FZ3a (Ha)	0.06 (100%)
Area within FZ3b (Ha)	0.06 (100%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Bromford which is currently on hold until the effects of HS2 are fully understood. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that the site is at very high probability of flooding, with the entire site within Flood Zone 3b. As the site would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.02Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.03Ha >0.1m deep based on the FMfSW (0.5% AEP event).

Is the site at risk from groundwater flooding?	Yes. The majority of the site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Gravelly Hill).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Bromford are implemented, until this time this site will not be promoted for development.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Bromford mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk.

Fluvial Flood Risk Map

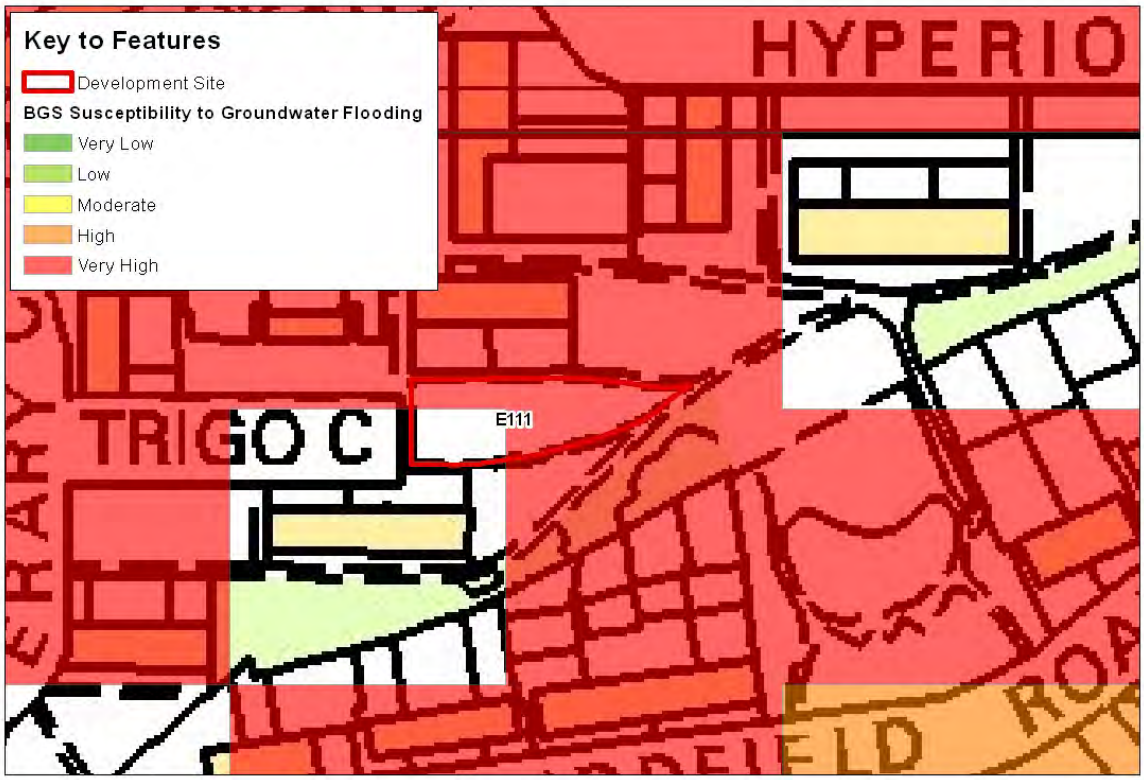


Flood Map for Surface Water (FMfSW)

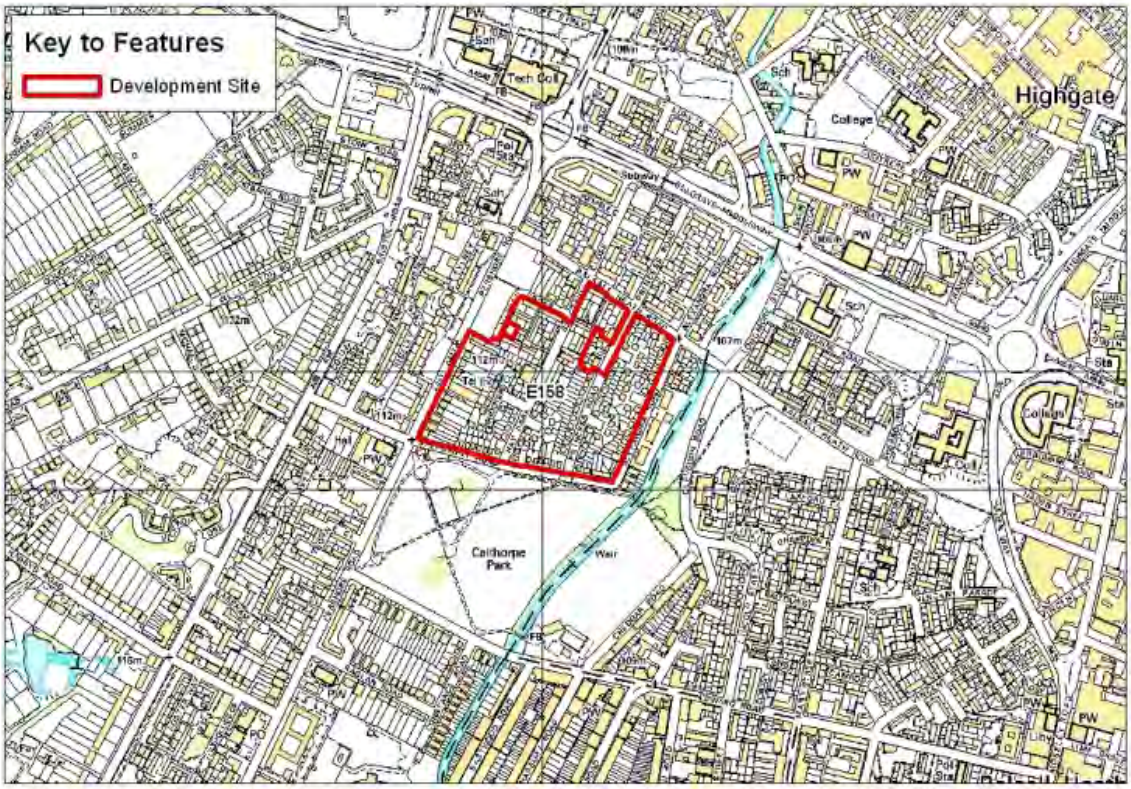


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



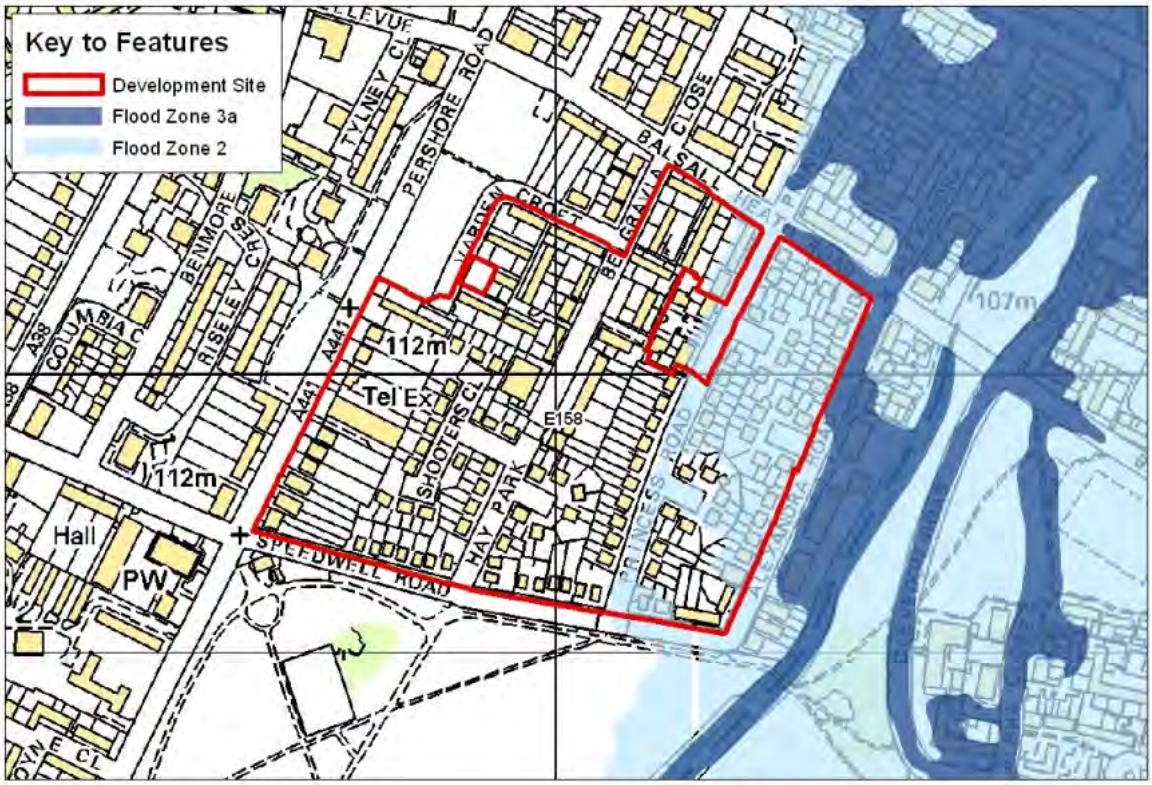
Site Summary Sheet: E158 between Pershore Road and Alexandra Road



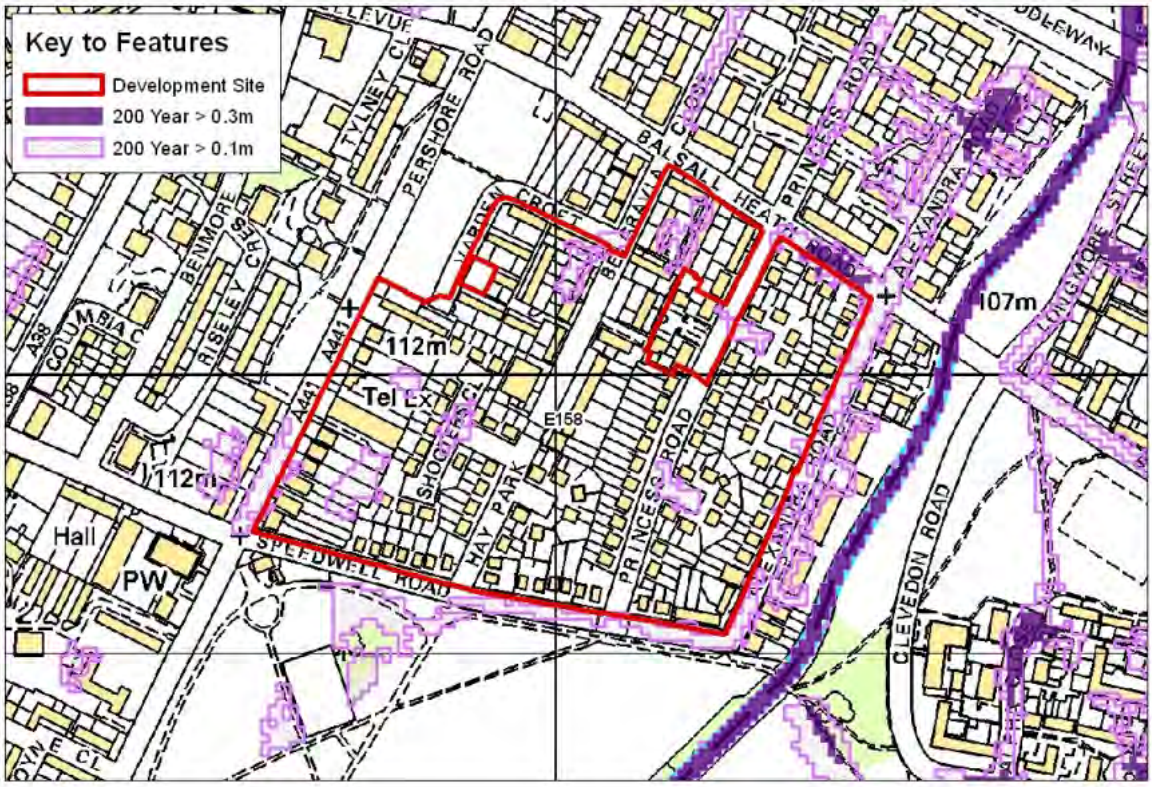
Site Name	E158
Site Address	Between Pershore Road and Alexandra Road
National Grid Reference	SP 07004 84983
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from River Rea
Secondary Sources of Flood Risk	Groundwater and surface water
Site Area (Ha)	8.27
Area within FZ1 (Ha)	6.31 (76%)
Area within FZ2 (Ha)	1.96 (24%)
Area within FZ3a (Ha)	0.009 (0.001%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	The fluvial flood outline shows that the majority of the site is in Flood Zone 1 and hence has a low probability of flooding. The eastern side of the site is in Flood Zone 2 and has a medium probability of flooding. There is a very small section of land adjacent to Basall Heath Road within Flood Zone 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.004Ha >0.3m deep based on the FMfSW (0.5% AEP event) 0.46Ha >0.1m deep based on the FMfSW (0.5% AEP event)
Is the site at risk from groundwater flooding?	Yes, the entire site is considered as having a Very High susceptibility to groundwater flooding. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 76% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where More vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, access and egress via Alexandra Road may need to be avoided in an extreme event.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Yes.
Is the site covered by flood warnings?	Yes, The eastern edge of the site adjacent to Alexandra Road is covered by an EA Flood Warning (River Rea at Calthorpe)
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the site is outside FZ3a and has dry access and egress the Exception Test is likely to be passed. The reported groundwater flooding should be investigated further.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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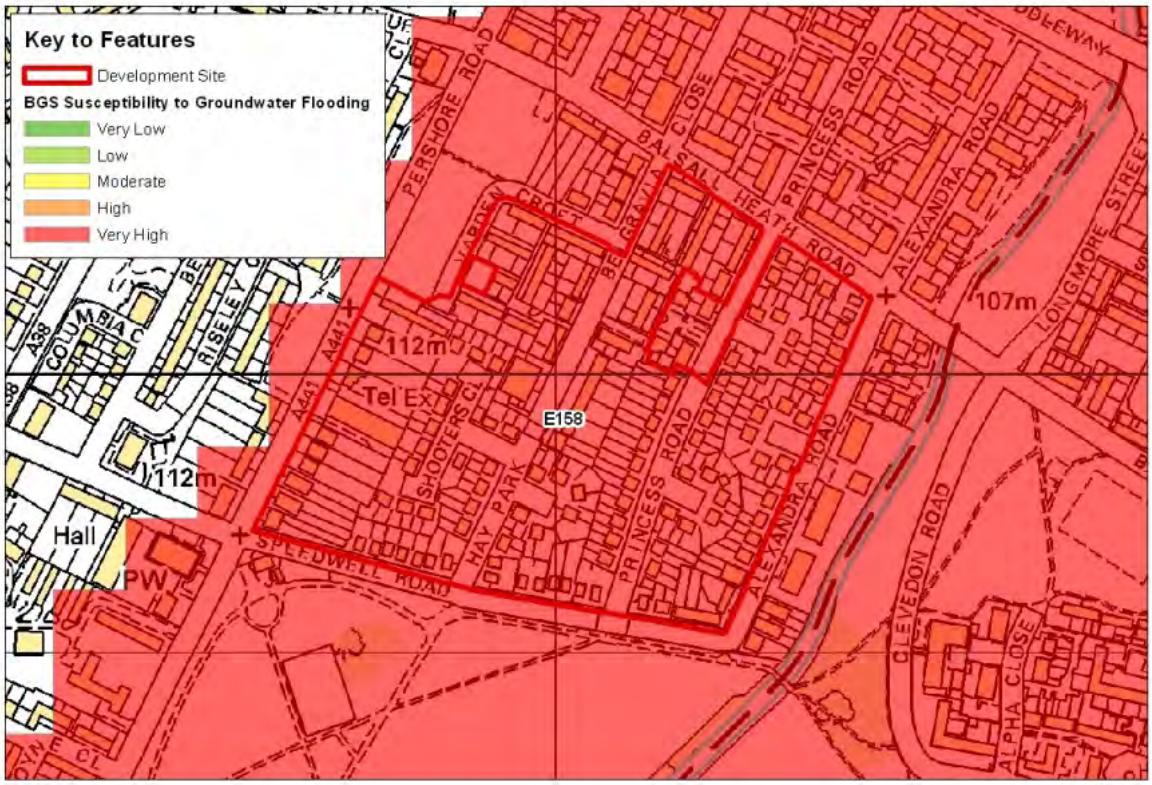
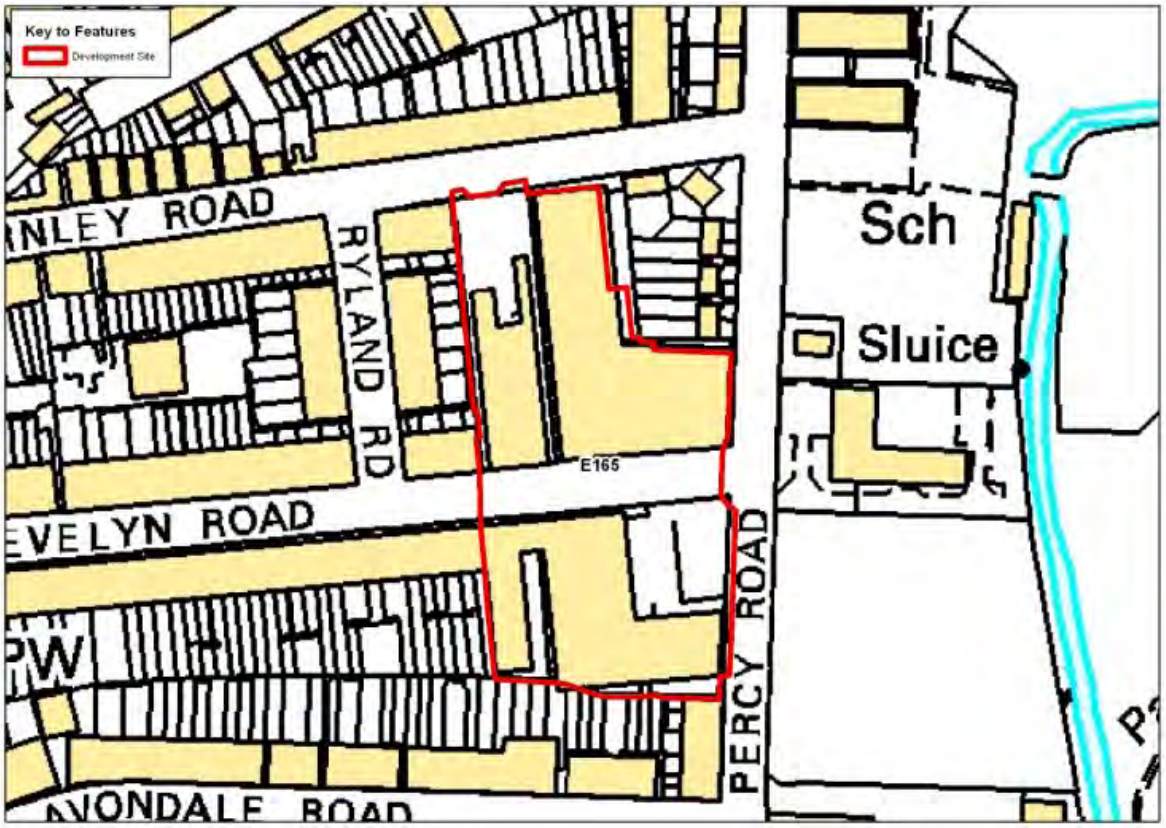
Susceptibility to Groundwater Flooding



Site Summary Sheet: E165 junction Percy Road and Evelyn Road



Site Name	E 165 – Opposite Community Health Centre
Site Address	Junction between Percy Road & Evelyn Road
National Grid Reference	SP 09643 83781
Catchment	River Cole
Primary Source of Flood Risk	Fluvial from River Cole
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	1.30
Area within FZ1 (Ha)	1.08 (83%)
Area within FZ2 (Ha)	0.22 (17%)
Area within FZ3a (Ha)	0.09 (8%)
Area within FZ3b (Ha)	0.11 (9%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Moderate. The eastern boundary of the site bordering Percy Road has a 'significant' (1.25-2.5) hazard rating. The remainder of the site is flood free.
Is the site at risk from surface water flooding?	Yes, from Percy Road. 0.06Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.08Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The eastern boundary of the site off Percy Road has a Very High susceptibility of groundwater flooding.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 91% of the site is outside the FZ3b extent. Development should be avoided in the remaining 9%.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield land and is completely covered by paved areas and industrial units. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Evelyn Road.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	Yes. The site is within the River Cole Flood Warning area.
Is compensatory flood storage required?	No, providing development is located away from the eastern areas of the site which are located in FZ3b and FZ3a.
Can the loss of floodplain be compensated for within the site boundaries?	If development were to proceed based on the current site boundary (excluding the area in the functional floodplain – FZ3b) floodplain compensation would be required for the 0.09ha of the site within FZ3a. Since 92% of the site is outside of FZ3a it would seem likely that sufficient compensatory storage could be found within the site boundary.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and may therefore reduce flood risk elsewhere. However, the site is in a Source Protection Zone and careful consideration of the use of infiltration techniques would therefore be necessary.
What is the Likelihood of the Exception Test being passed?	Good, providing development does not go ahead in the 0.11ha within the functional floodplain (FZ3b). 92% of the site is outside FZ3a, the site is previously developed land, and safe access and egress routes are available.
Recommendations / Future Data Needs	Development of the site should be steered away from the northern and eastern areas of the site along Percy Road. The functional floodplain (FZ3b) outline is greater than the 1% AEP event outline (FZ3a); this should be investigated as part of the site specific Flood Risk Assessment. It is recommended that the River Cole Integrated InfoWorks model is used to assess flood risk when the site specific Flood Risk Assessment is undertaken.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

Modelling Methodology Summary

To ensure consistency with the floodplain maps on the EA website the Flood Zones included here are the same as the EA Flood Zones. Whereas, the depth, velocity and hazard grids are based on the River Cole Integrated InfoWorks hydraulic model outputs. This more detailed model shows a greater level of flood risk than that indicated by the EA Flood Zones, as fluvial, pluvial and sewer flooding are all considered.

The River Cole Integrated model was developed by Atkins in March / April 2011 using InfoWorks CS 2D (Version 12). The model has been verified. The critical storm duration for this area was a 480-minute storm profile. Both Summer and Winter profiles were run and the worst-case scenario applied to the site. Model outputs were generated using the 2D results triangles, but removing areas containing a depth of less than 0.1m.

Fluvial Flood Risk Map

River Cole Integrated Model Flood Risk Map

1% AEP Event Flood Depth Map

1% AEP Event Flood Velocity Map

1% AEP Event Flood Hazard Map

Flood Map for Surface Water (FMfSW)

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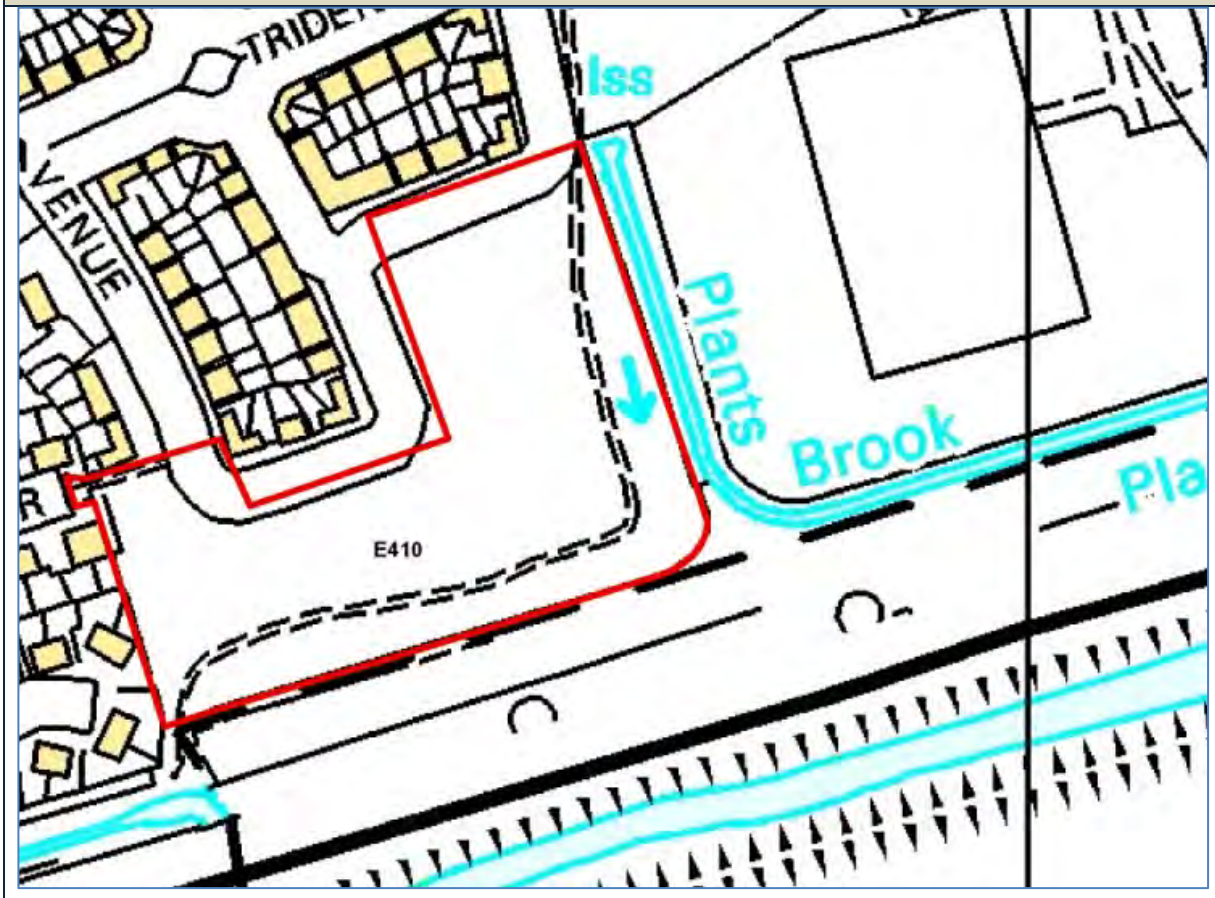
Susceptibility to Groundwater Flooding

Site Summary Sheet: E410 land off Javelin Road



Site Name	E410
Site Address	Land off Javelin Avenue
National Grid Reference	SP 14818 90775
Catchment	Plants Brook
Primary Source of Flood Risk	Fluvial from Plants Brook
Secondary Sources of Flood Risk	Surface water and groundwater
Site Area (Ha)	1.72
Area within FZ1 (Ha)	1.48 (86%)
Area within FZ2 (Ha)	0.24 (14%)
Area within FZ3a (Ha)	0.20 (12%)
Area within FZ3b (Ha)	0.06 (3%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Low. The flood hazard modelling shows that the majority of the site (86%) is outside FZ2. The south eastern part of the site along the footpath has a 'low' (<0.75) hazard rating. The south eastern boundary bordering Plants Brook has a 'moderate' (0.75 – 1.25) hazard rating.
Is the site at risk from surface water flooding?	Yes. 0.02Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The entire site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. The majority of the site (86%) is outside FZ2 and can be developed. Development should avoid the south eastern part of the site which is located in FZ3a. This area could only be developed by sacrificing part of the site currently outside FZ3a (1.52 hectares) to compensatory storage in order to offset loss of floodplain.
Will the development result in offsite impacts, e.g. increased runoff?	Yes. The site is greenfield land with no impervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes. Dry access and egress routes are available via Javelin Avenue up to and including the 0.1% AEP flood event.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Yes. Flood hazard modelling shows that 86% of the site is outside FZ2.
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Castle Bromwich).
Is compensatory flood storage required?	Compensatory flood storage would only be required for land in the south eastern corner of the site (0.2ha).
Can the loss of floodplain be compensated for within the site boundaries?	Yes, as 88% of the site is outside of FZ3a it would seem likely that the loss of floodplain could be compensated for within the site boundary.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	As the site is mainly in FZ1 and dry access and egress the Exception Test is likely to be passed. The reported groundwater flooding must be investigated further.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere and no alternative brownfield sites are available. Flood risk at the site is likely to be sensitive to the downstream boundary applied at the confluence with the River Tame. The site specific Flood Risk Assessment will need to demonstrate that this has been tested appropriately before development can proceed. The proposed HS2 route passes alongside the River Tame and is planning to alter the course of the River Tame south of this site. The detailed Flood Risk Assessment would need to take this into account and assess the potential impact of changes on the River Tame on the Plants Brook and thus the development site.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

Modelling Methodology Summary

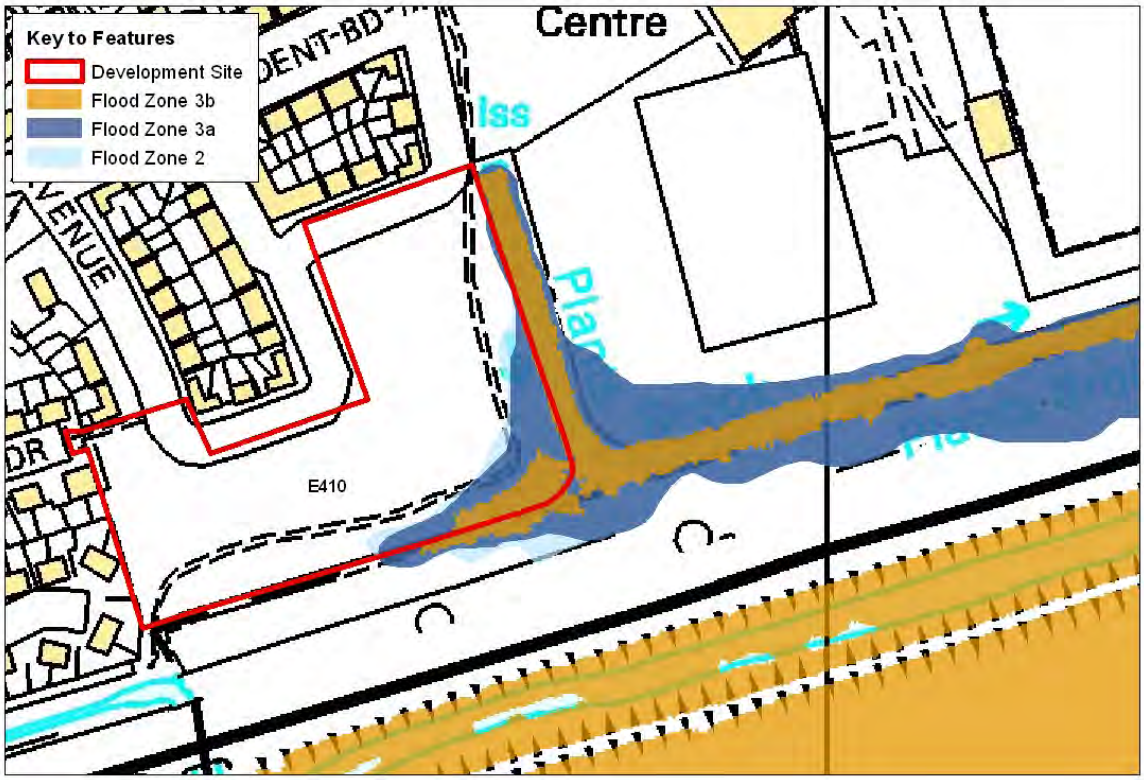
The flood risk, depth, hazard and velocity mapping outputs above were produced as part of Plants Brook Flood Risk Mapping project, completed in February 2010.

This was undertaken by Royal Haskoning using a linked ISIS-TUFLOW model. Version 3.3 of ISIS and version 2009-07-AB of TUFLOW were used.

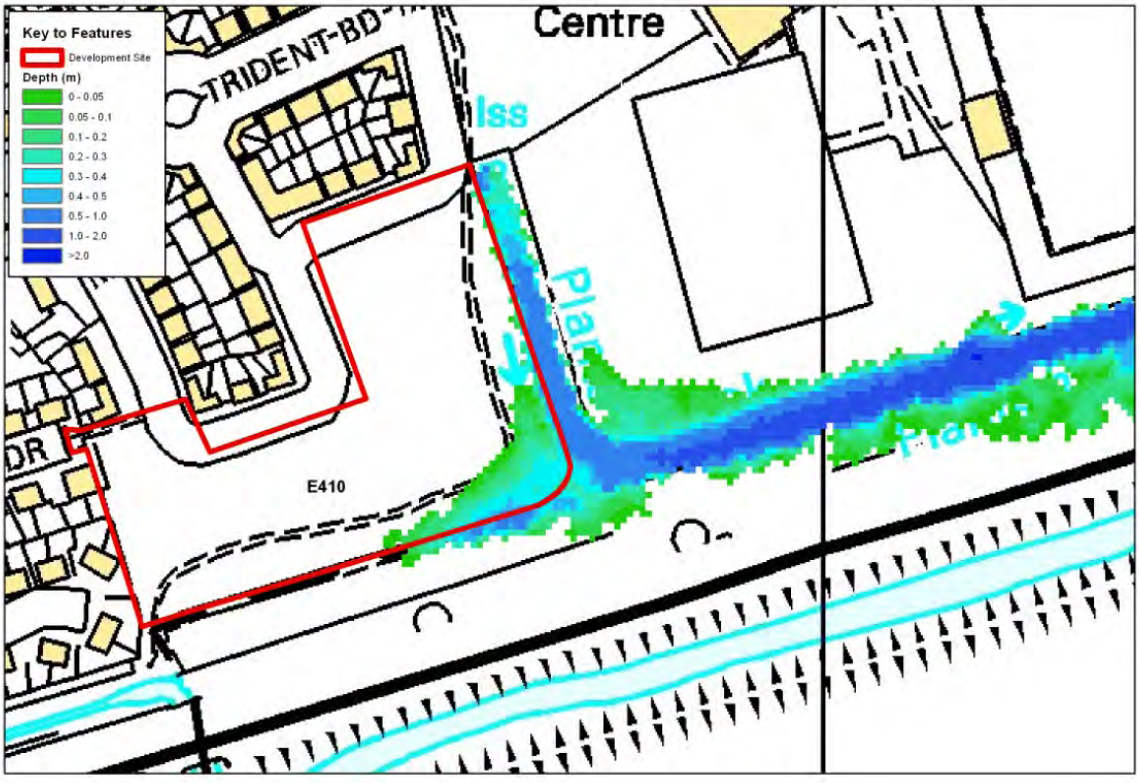
It should be noted that the scaling factor used to generate the 0.1% AEP event flows in the ISIS models differed from that quoted in the Hydrology Report (Table 9 of Appendix D). A scaling factor of 0.271 was used in the modelling when a value of 0.197 was quoted in Table 9. The value of 0.271 related to the 1% AEP event and may have been applied to the 0.1% AEP event inflows in error.

If this is the case then the 0.1% AEP flood (FZ2) extent has been overestimated and should be rerun using the correct scaling factor of 0.197. However, since FZ2 and FZ3 are broadly the same at this site it is unlikely that this change will have a tangible impact on the FZ2 outline.

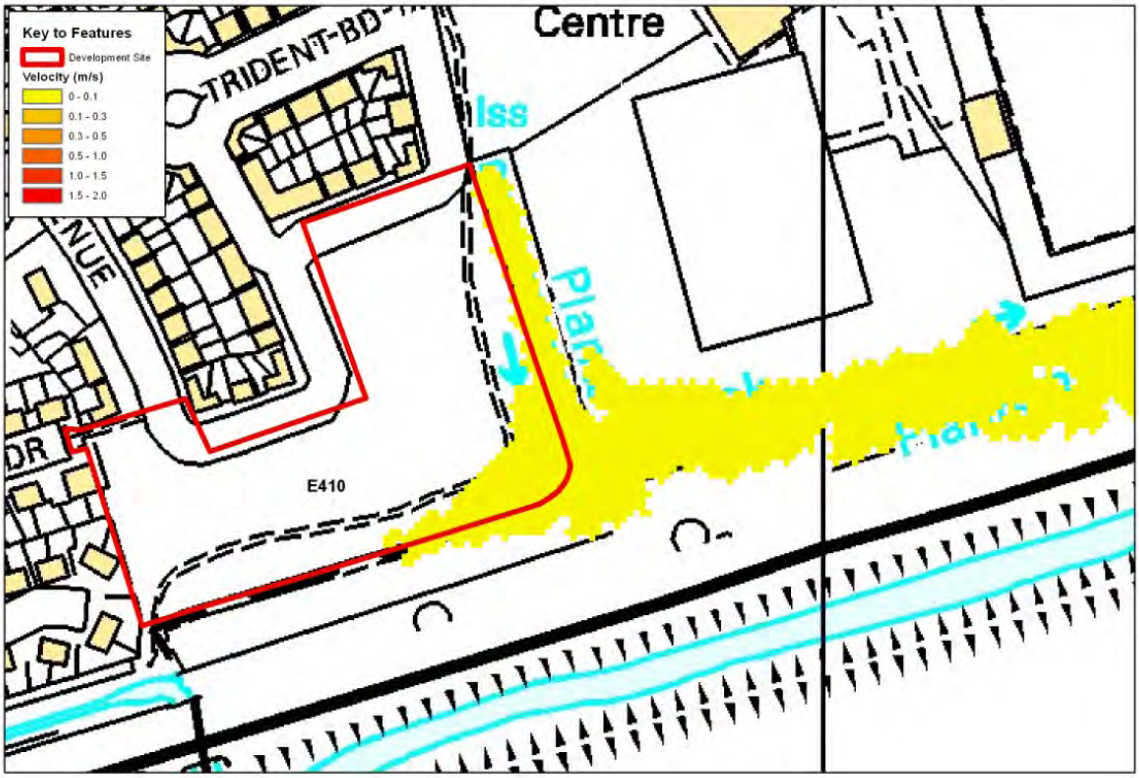
Fluvial Flood Risk Map



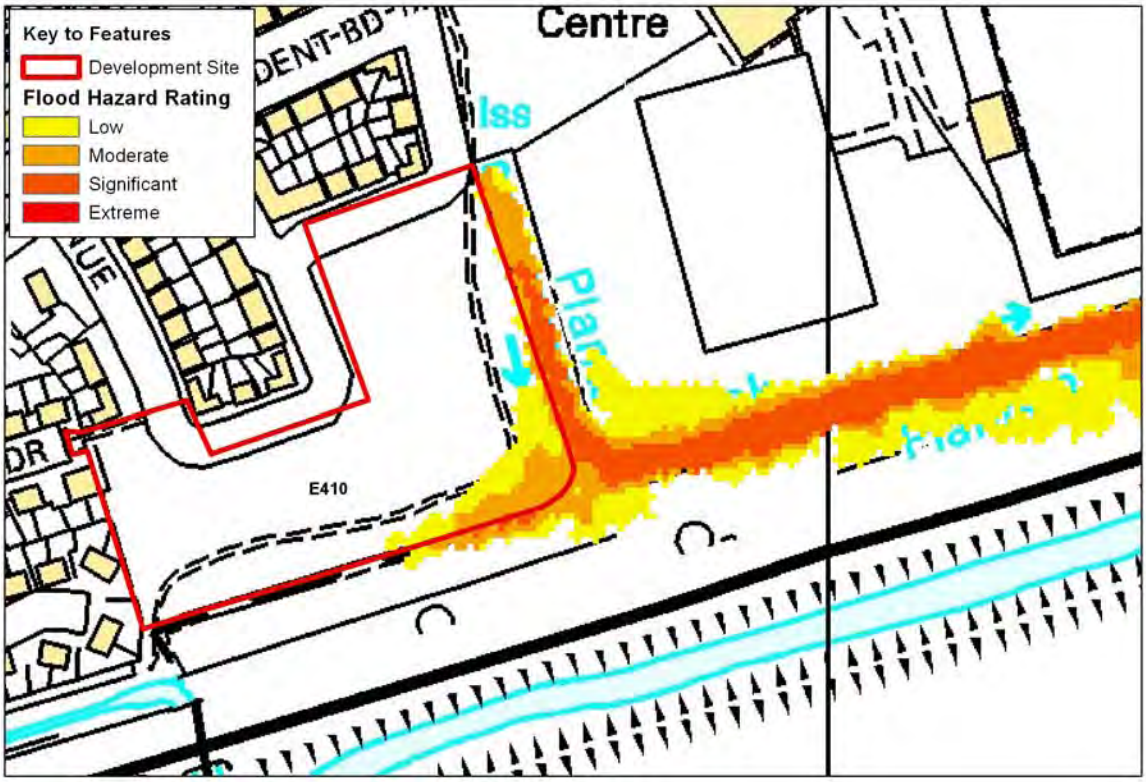
1% AEP Event Flood Depth Map



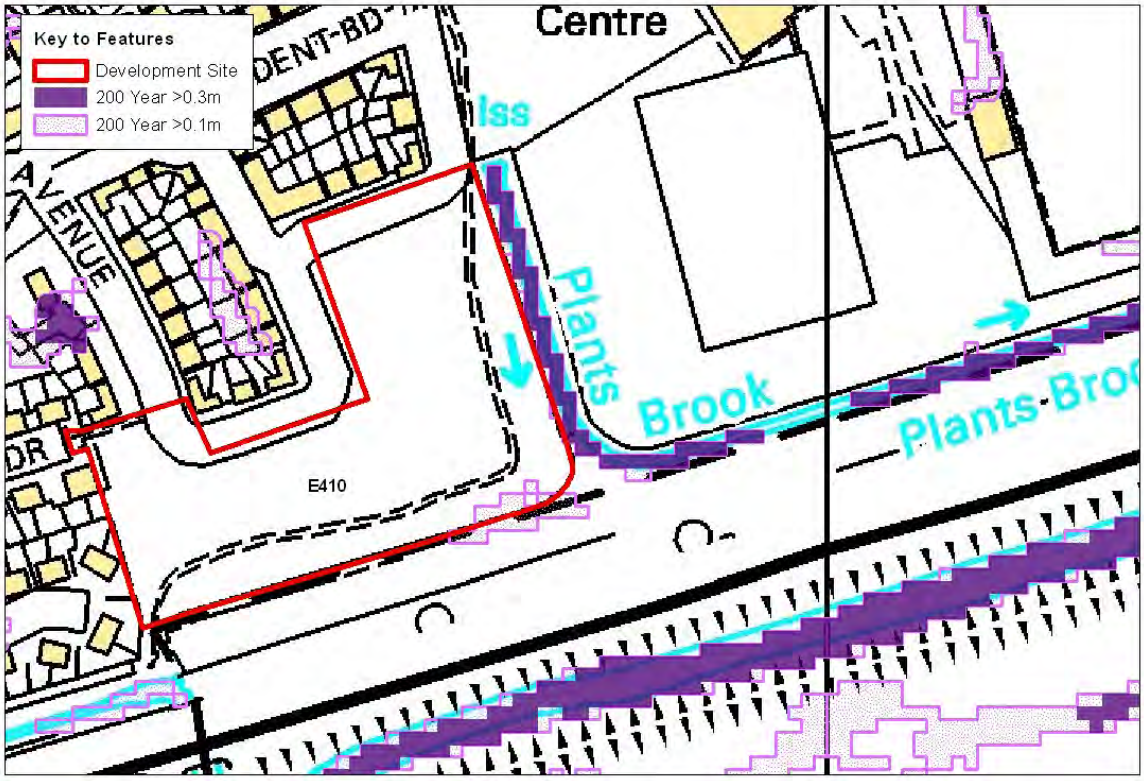
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

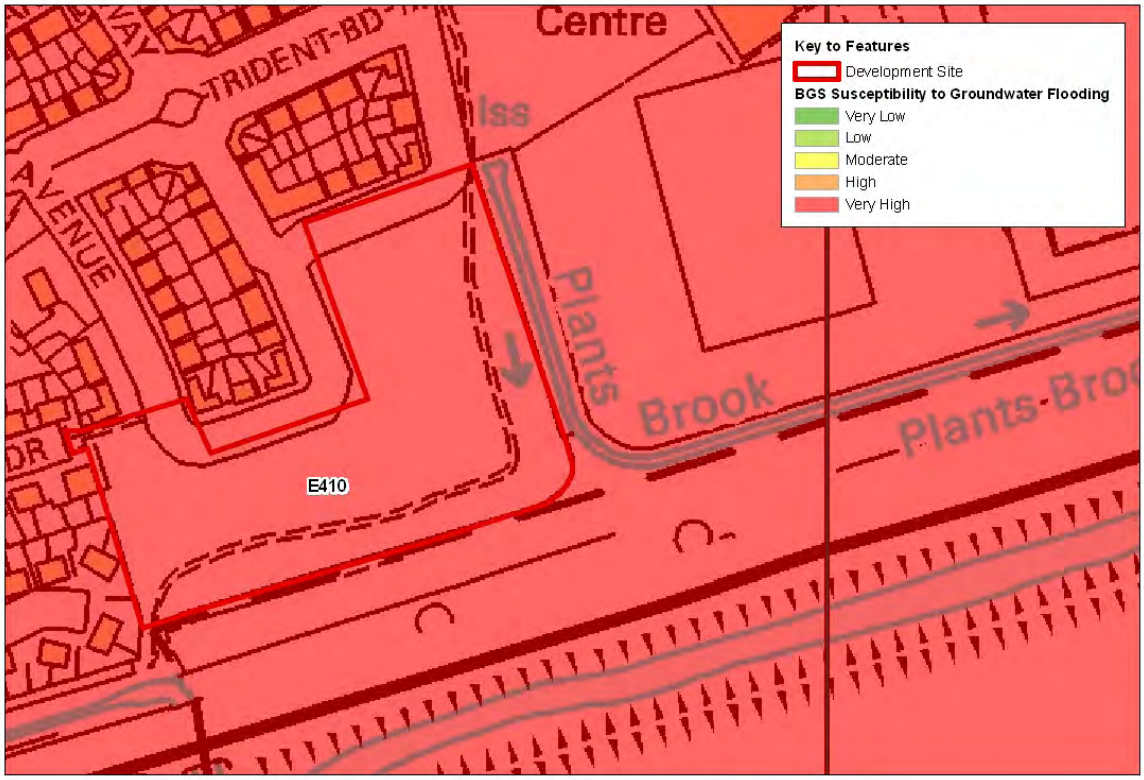


Flood Map for Surface Water (FMfSW)

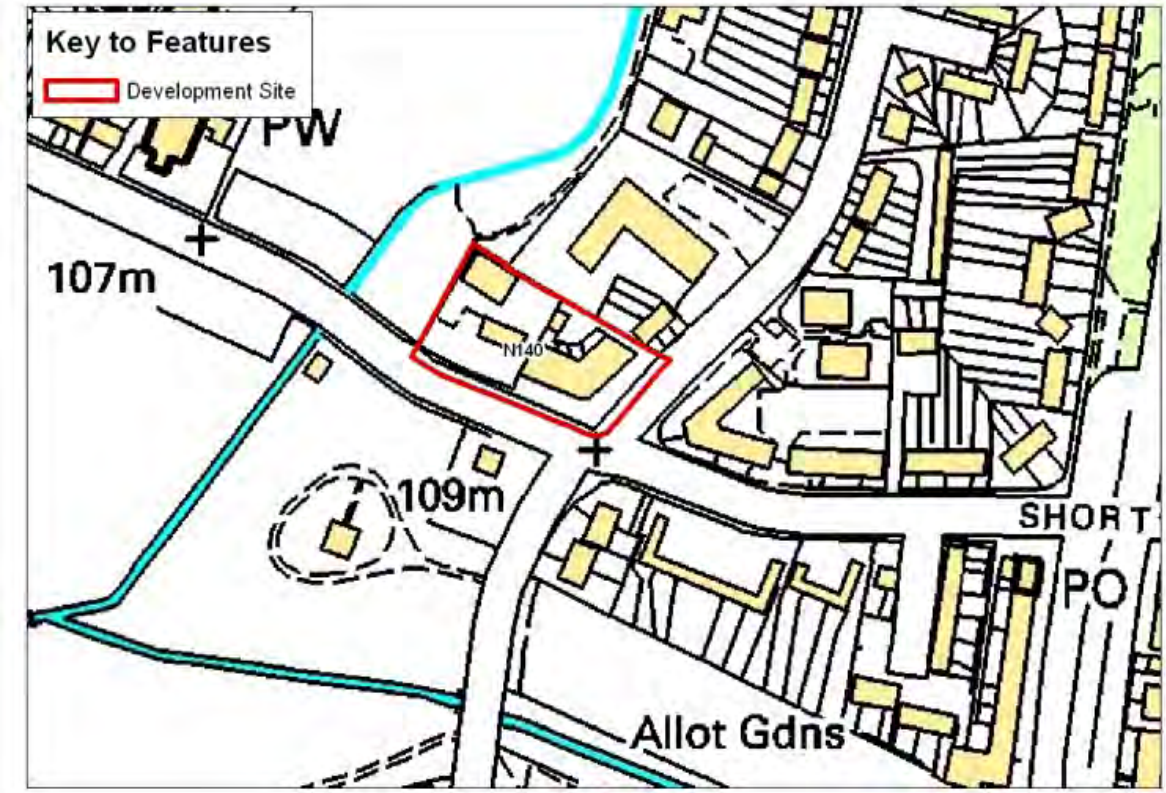


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



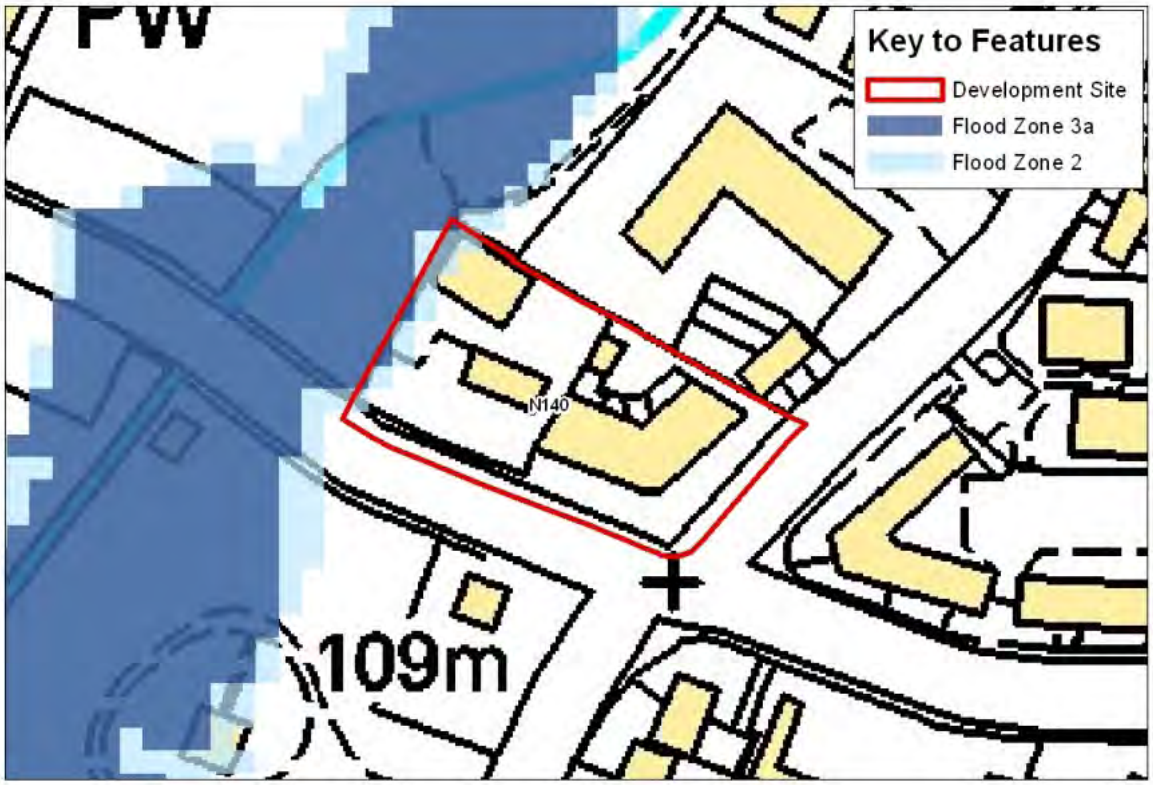
Site Summary Sheet: N140 Perry Common Road and Turfpit Lane



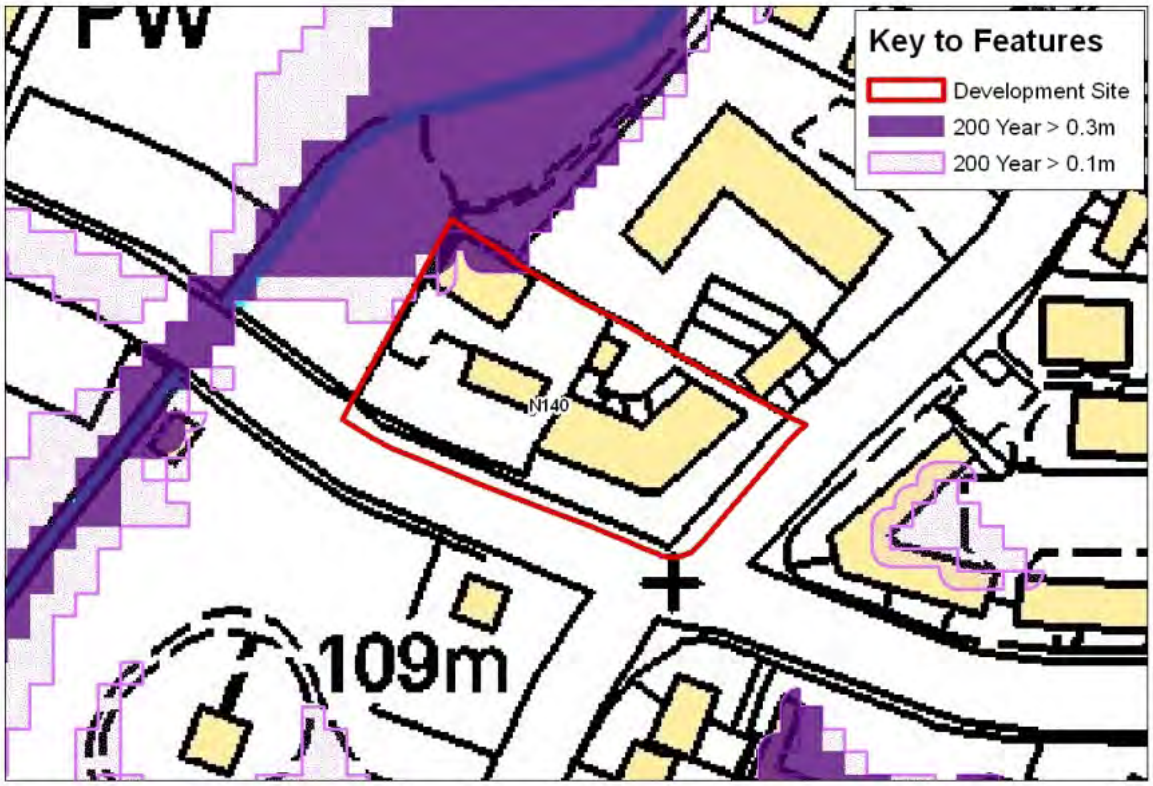
Site Name	N140
Site Address	Perry Common Road and Turfpit Lane
National Grid Reference	SP 09485 92690
Catchment	Hawthorn Brook
Primary Source of Flood Risk	Fluvial from Hawthorn Brook
Secondary Sources of Flood Risk	Groundwater and surface water
Site Area (Ha)	0.39
Area within FZ1 (Ha)	0.36 (92%)
Area within FZ2 (Ha)	0.03 (8%)
Area within FZ3a (Ha)	0.005 (1%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	Only the western boundary of the site is at risk of flooding, with 1% of the total site area being in Flood Zone 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.01Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.02Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. 2/3 of the site is defined as having a High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 92% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where More vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Perry Common Road or Turfpit Lane
Is there safe access and egress to the site during a flood event for emergency service vehicles?	As above
Is the site covered by flood warnings?	No
Is compensatory flood storage required?	No
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the site is primarily outside FZ3a and has dry access and egress the Exception Test is likely to be passed. The reported groundwater flooding should be investigated further.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the small area of the site in Flood Zone 3a.

Fluvial Flood Risk Map

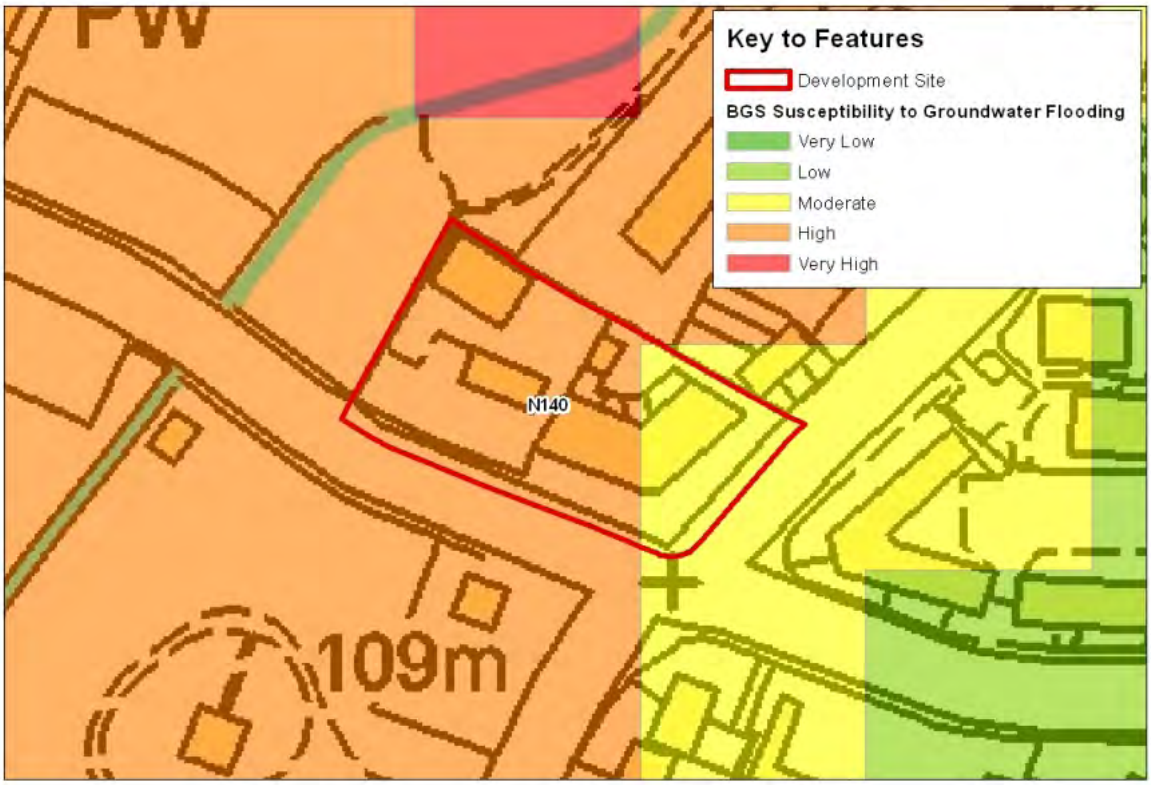


Flood Map for Surface Water (FMfSW)

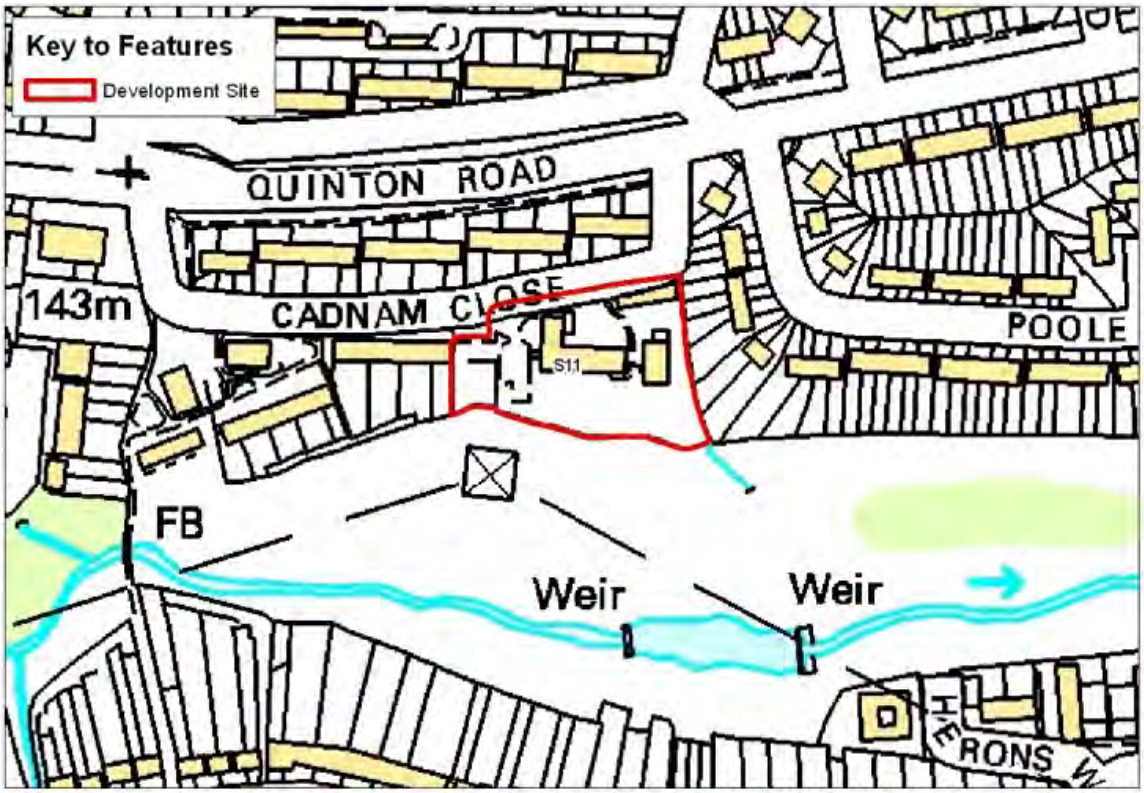


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



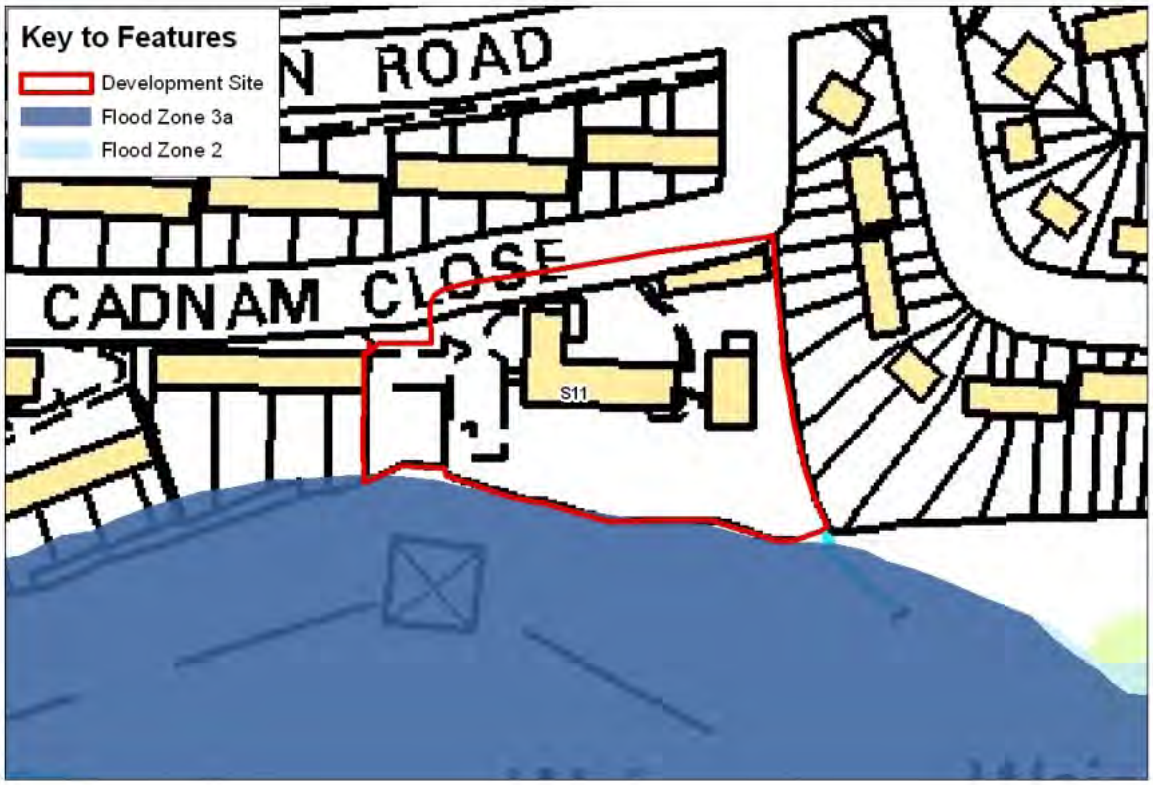
Site Summary Sheet: S11 Cadnam Close



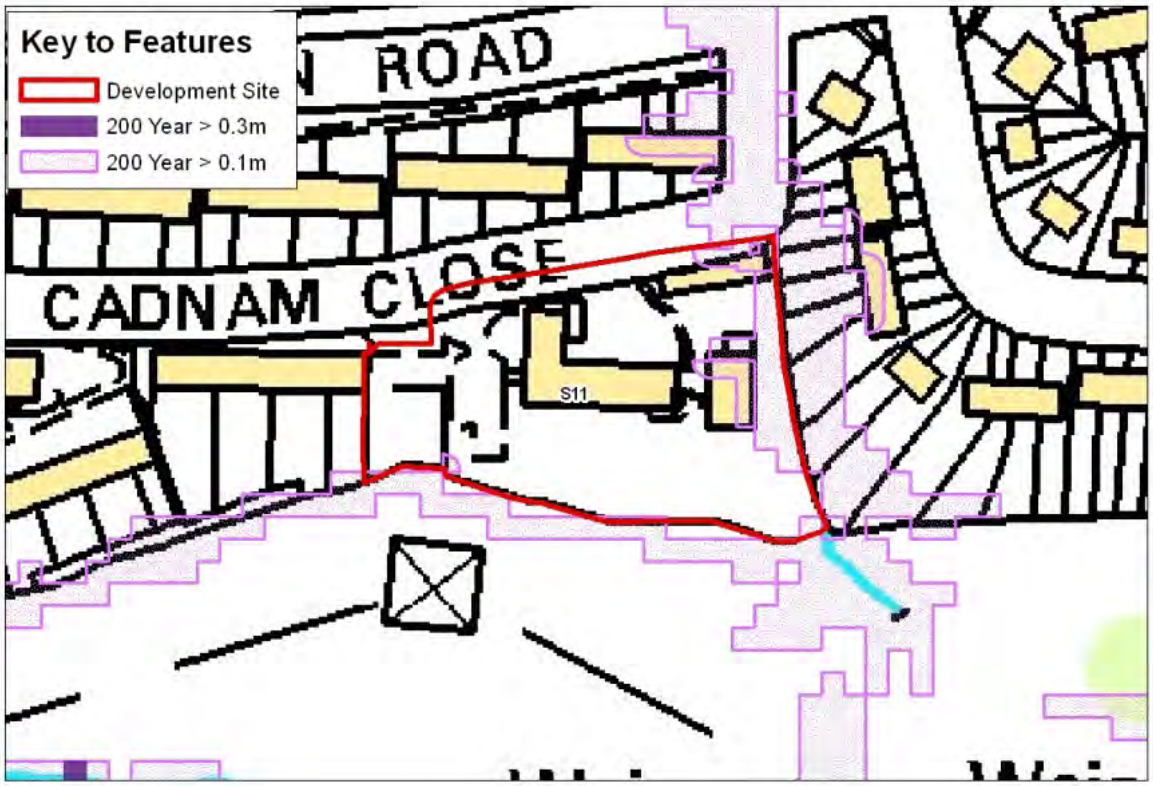
Site Name	S11
Site Address	Cadnam Close
National Grid Reference	SP 03264 83229
Catchment	Bourn Brook
Primary Source of Flood Risk	Surface Water
Secondary Sources of Flood Risk	Fluvial flooding from Bourn Brook
Site Area (Ha)	0.5
Area within FZ1 (Ha)	0.498 (99.6%)
Area within FZ2 (Ha)	0.002 (0.4%)
Area within FZ3a (Ha)	0.002 (0.4%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	Only the southern boundary of the site is at risk of flooding, with less than 1% of the total site area being in Flood Zone 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.06Ha >0.1m deep based on the FMfSW (0.5% AEP event)
Is the site at risk from groundwater flooding?	No
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes, less than 1% of the site is at risk of fluvial flooding, vulnerable uses can be avoided on this small area of land.

Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Cadnam Close
Is there safe access and egress to the site during a flood event for emergency service vehicles?	As above.
Is the site covered by flood warnings?	No
Is compensatory flood storage required?	No
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the site is outside FZ3a and has dry access and egress the Exception Test is likely to be passed.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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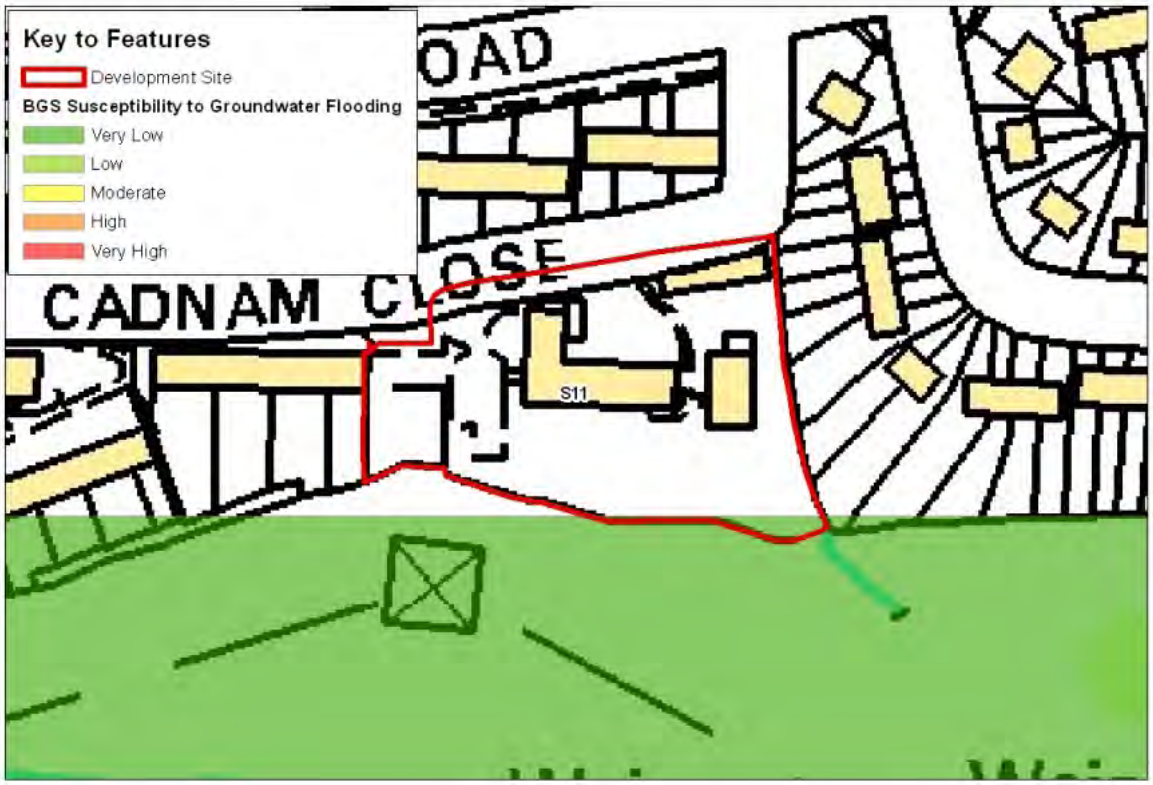
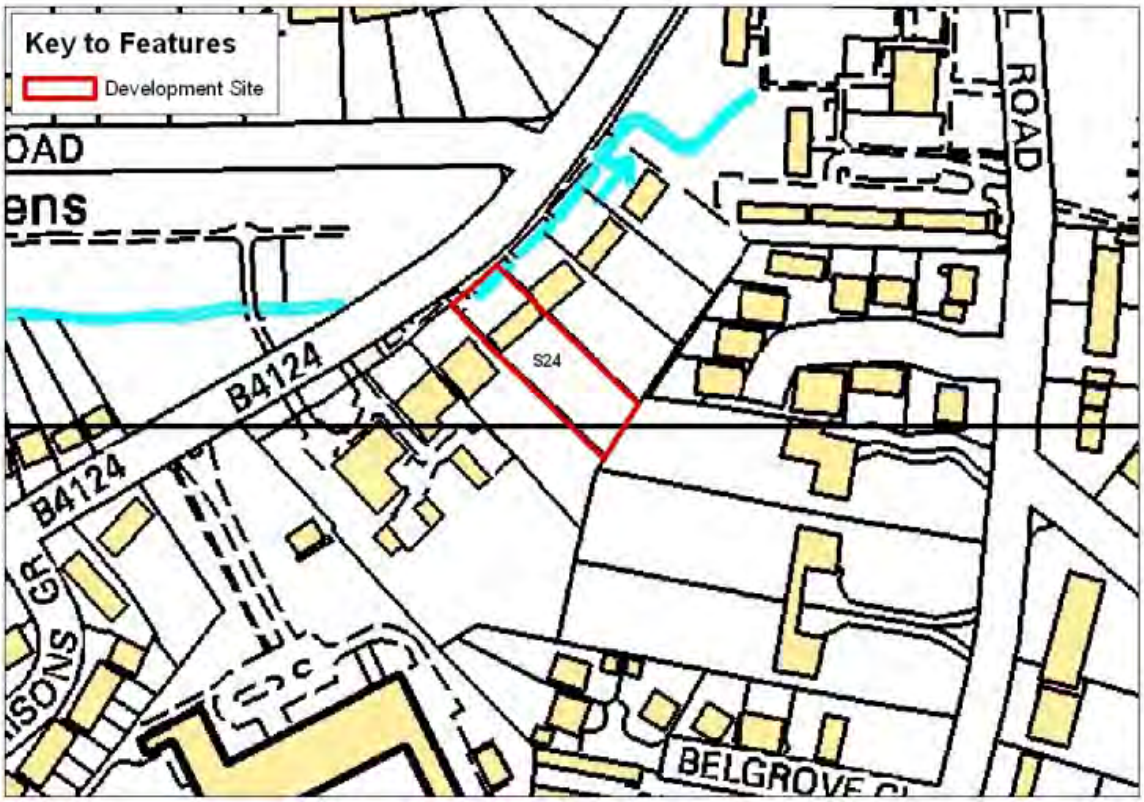
Susceptibility to Groundwater Flooding



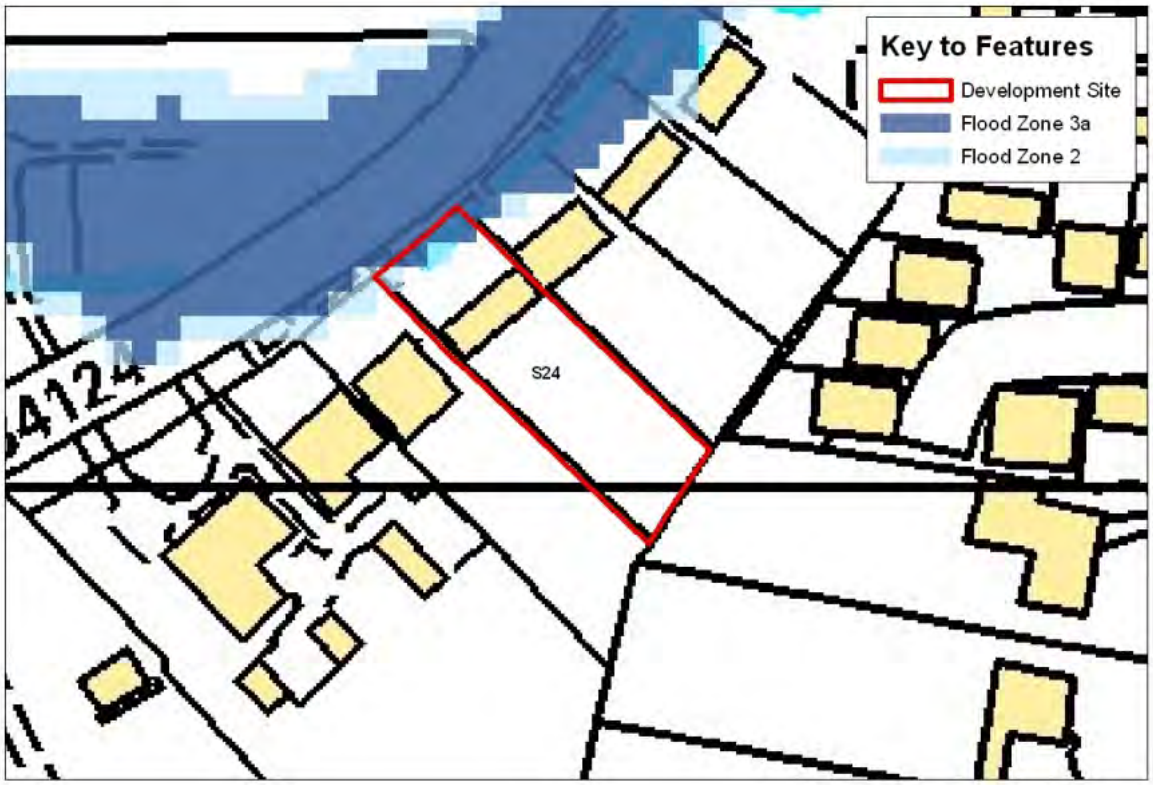
Site Summary Sheet: S24 Harborne Road



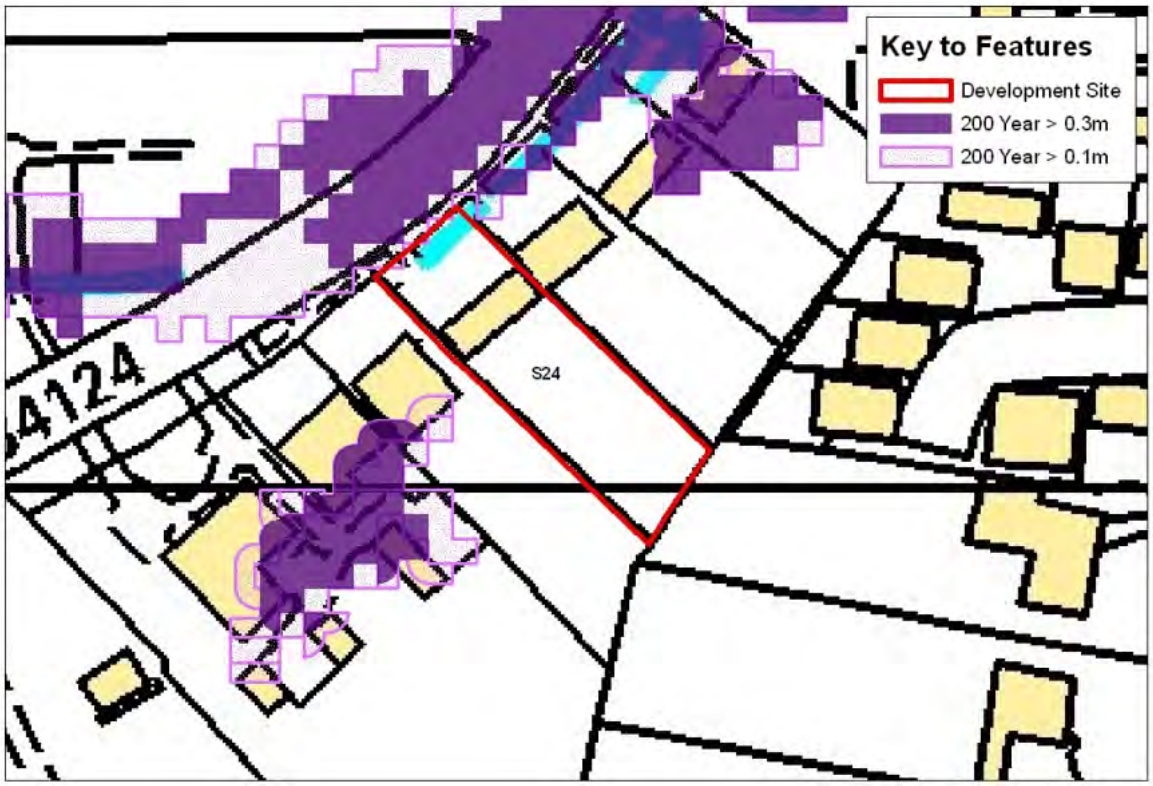
Site Name	S24
Site Address	184 Harborne Road
National Grid Reference	SP 04378 85023
Catchment	Chad Brook
Primary Source of Flood Risk	Fluvial from Chad Brook
Secondary Sources of Flood Risk	None
Site Area (Ha)	0.17
Area within FZ1 (Ha)	0.158 (93%)
Area within FZ2 (Ha)	0.012 (7%)
Area within FZ3a (Ha)	0.008 (5%)
Area within FZ3b (Ha)	0 (0%)
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	The fluvial flood outline shows that the majority of the site is in Flood Zone 1 and hence has a low probability of flooding. The north western side of the site is in Flood Zone 2 and has a medium probability of flooding. There is a very small section of land adjacent to Harborne Road within Flood Zone 3a. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	No
Is the site at risk from groundwater flooding?	No

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 93% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where More vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Based on the EA FZs it does not look likely that safe access and egress routes can be provided for the proposed development. However, the modelling the FZs are based on is a high level, catchment scale model, therefore a site specific FRA which includes more detailed modelling of the Chad Brook, along with investigation of potential mitigation measures such as land raising and Flood Warning may allow development to proceed.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The Exception Test will only be passed if a site specific FRA is able to demonstrate that safe access can be provided.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a.

Fluvial Flood Risk Map

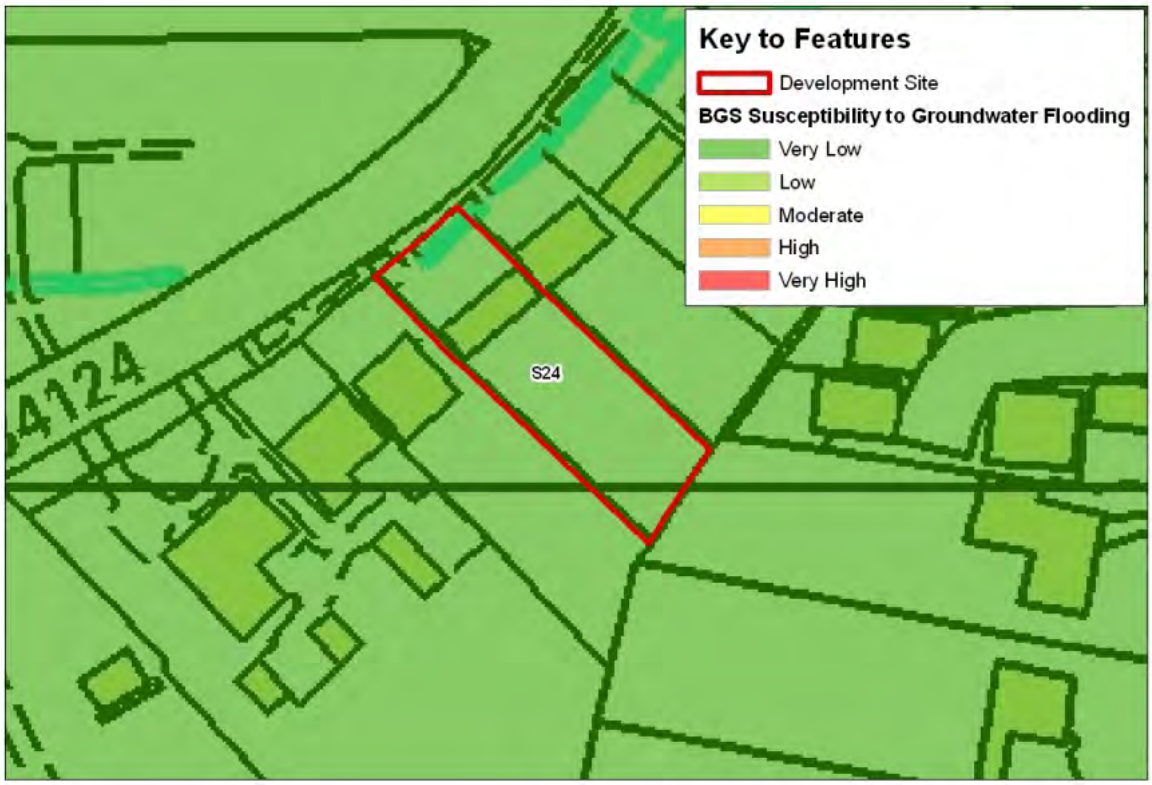


Flood Map for Surface Water (FMfSW)

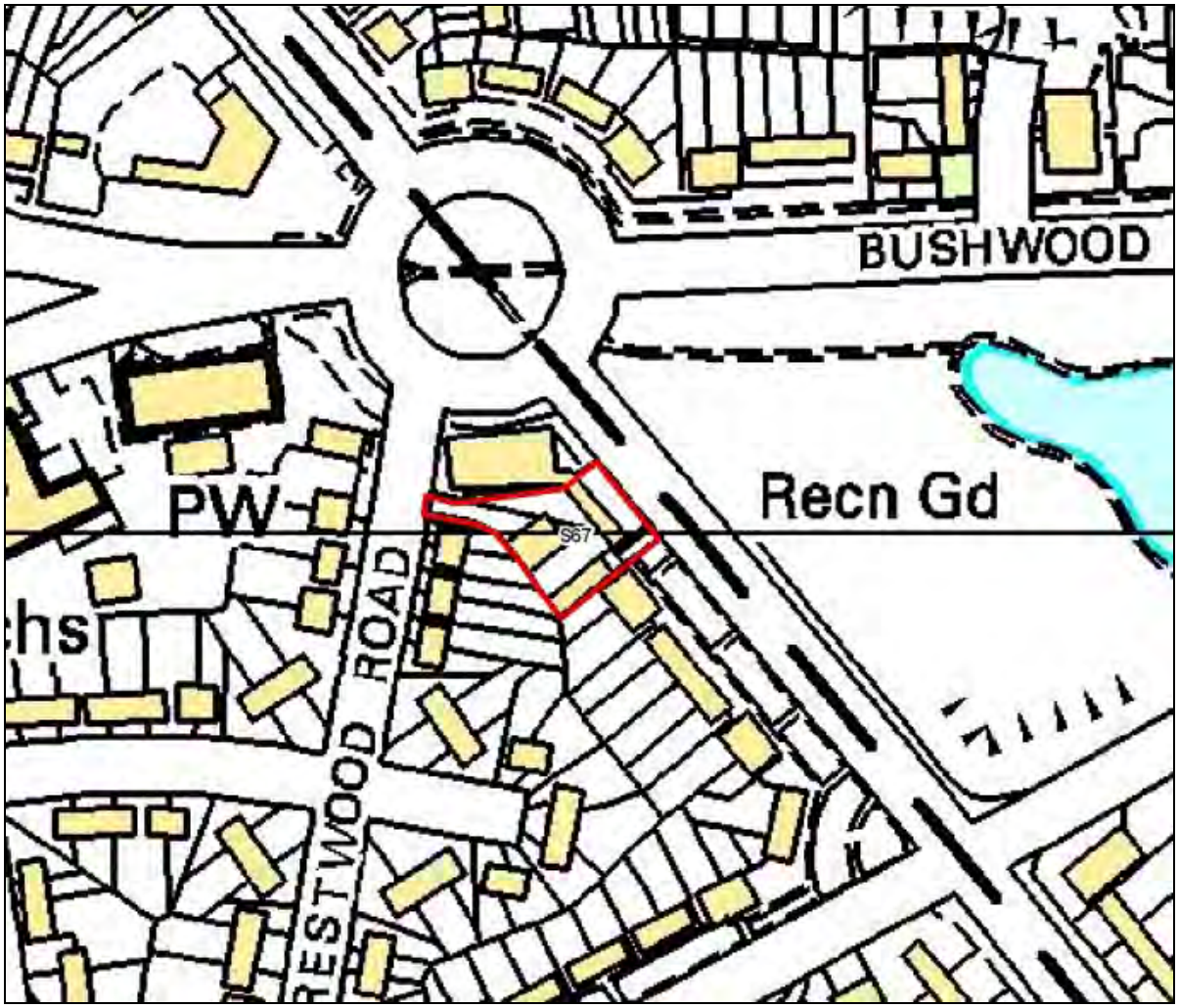


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: S67 Prestwood Road



Site Name	S67
Site Address	Prestwood Road, Garage Site
National Grid Reference	SP 02800 81997
Catchment	Wood Brook
Primary Source of Flood Risk	Fluvial from the Wood Brook
Secondary Sources of Flood Risk	Surface Water
Site Area (Ha)	0.12
Area within FZ1 (Ha)	0.03 (24%)
Area within FZ2 (Ha)	0.09 (76%)
Area within FZ3a (Ha)	0.08 (70%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Low (Flood Hazard Rating <0.75) across the entire site.
Is the site at risk from surface water flooding?	Yes. 0.03Ha >0.1m deep based on the FMfSW (0.5% AEP event).

Is the site at risk from groundwater flooding?	The site is identified as being at Very Low susceptibility from groundwater flooding.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. Although only a small percentage (30%) of the site is located outside of FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is previously developed brownfield land and is completely covered by impervious surfaces. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	No. Although a small proportion of the site remains flood free at the 1% AEP event, allowing access to Prestwood Road, this is unlikely to allow safe evacuation of the whole site. However, the flood depths predicted by the Wood Brook Integrated model are very low.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Yes. The depths of water predicted by the Wood Brook Integrated model are very low (<0.01m) for the 1% AEP event, and emergency service vehicles would be able to pass.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	Yes.
Can the loss of floodplain be compensated for within the site boundaries?	This is unlikely to be technically feasible given the proportion of the site covered by FZ3a.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water onsite.
What is the Likelihood of the Exception Test being passed?	Not good. Only 30% of the site is outside of FZ3a, safe access and egress routes are lacking, and there is potentially a shortage of compensatory flood storage land. However, the site is on previously developed land.
Recommendations / Future Data Needs	The differences in flood risk between the EA Flood Zones and those shown by the Wood Brook Integrated InfoWorks model should be investigated as part of the detailed, site specific Flood Risk Assessment for this site. It is recommended that the Wood Brook Integrated InfoWorks model is used to assess flood risk when the site specific Flood Risk Assessment is undertaken.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

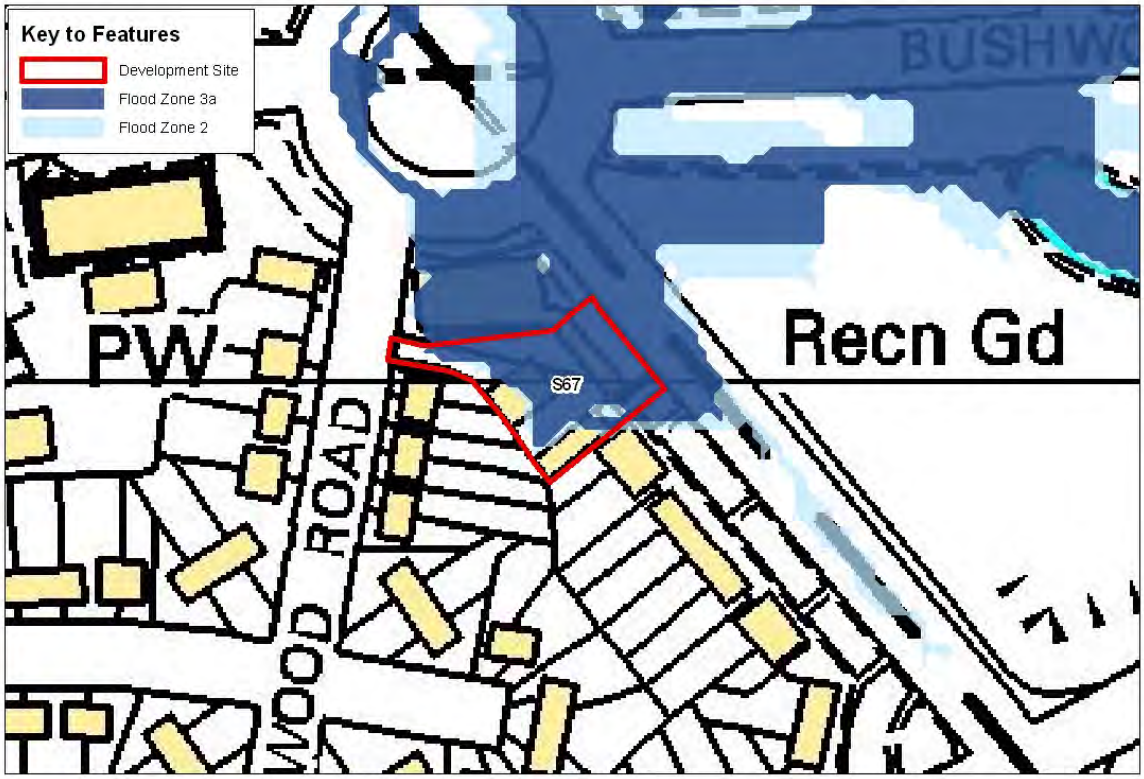
Modelling Methodology Summary

To ensure consistency with the floodplain maps on the EA website the Flood Zones included here are the same as the EA Flood Zones. Whereas, the depth, velocity and hazard grids are based on the Wood Brook Integrated InfoWorks hydraulic model outputs. This more detailed model shows a greater level of flood risk than that indicated by the EA Flood Zones, as fluvial, pluvial and sewer flooding are all considered.

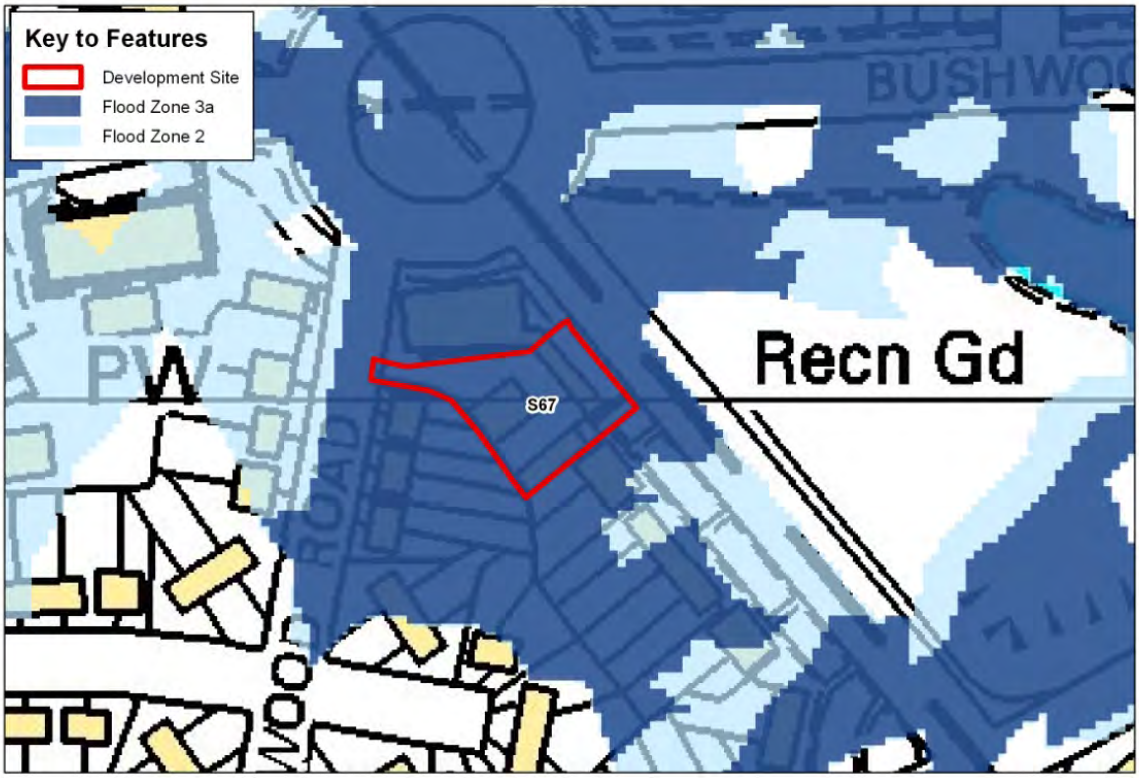
The Wood Brook Integrated model was built by Atkins in January 2009 using InfoWorks CS 2D (Version 12). The model has been verified. The critical storm duration for this area was a 60-minute summer storm profile, and the model geometry file applied was without buildings.

Model outputs were generated using the 2D results triangles, with no depth threshold set. It should be noted that if a depth threshold of 0.1m is applied (i.e. removing flooding locations with depths <0.1m) the site is shown to be flood free at the 1% AEP event.

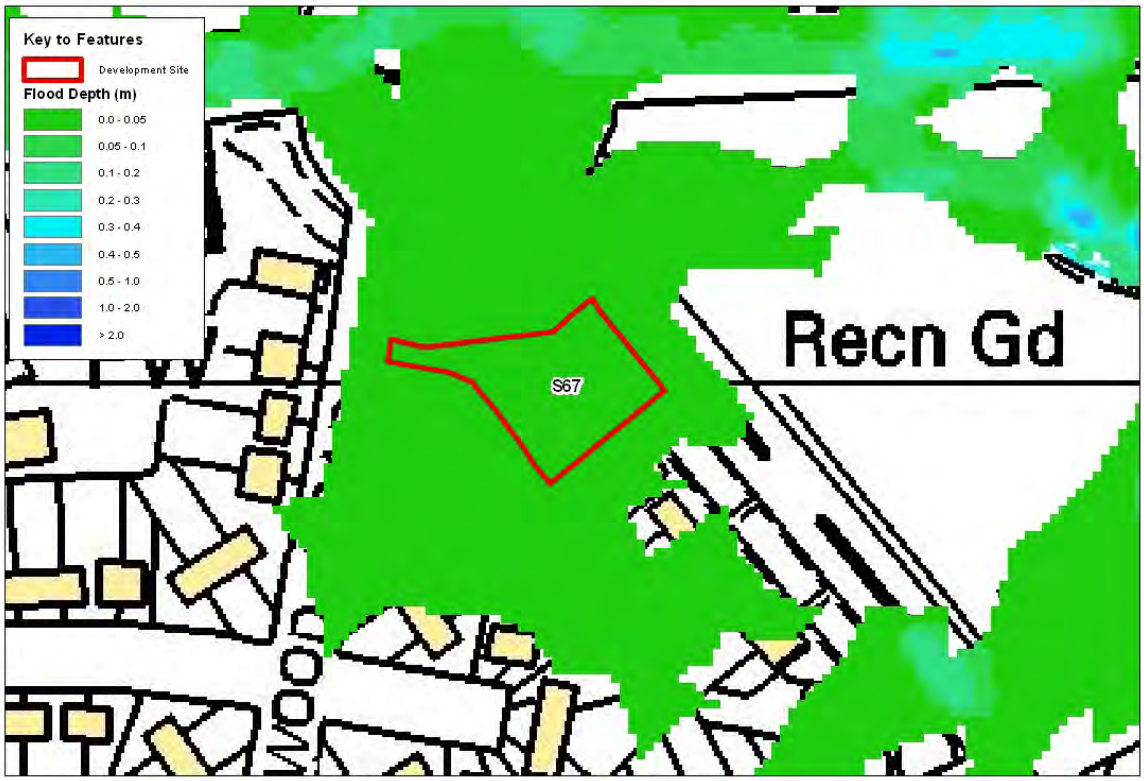
Fluvial Flood Risk Map



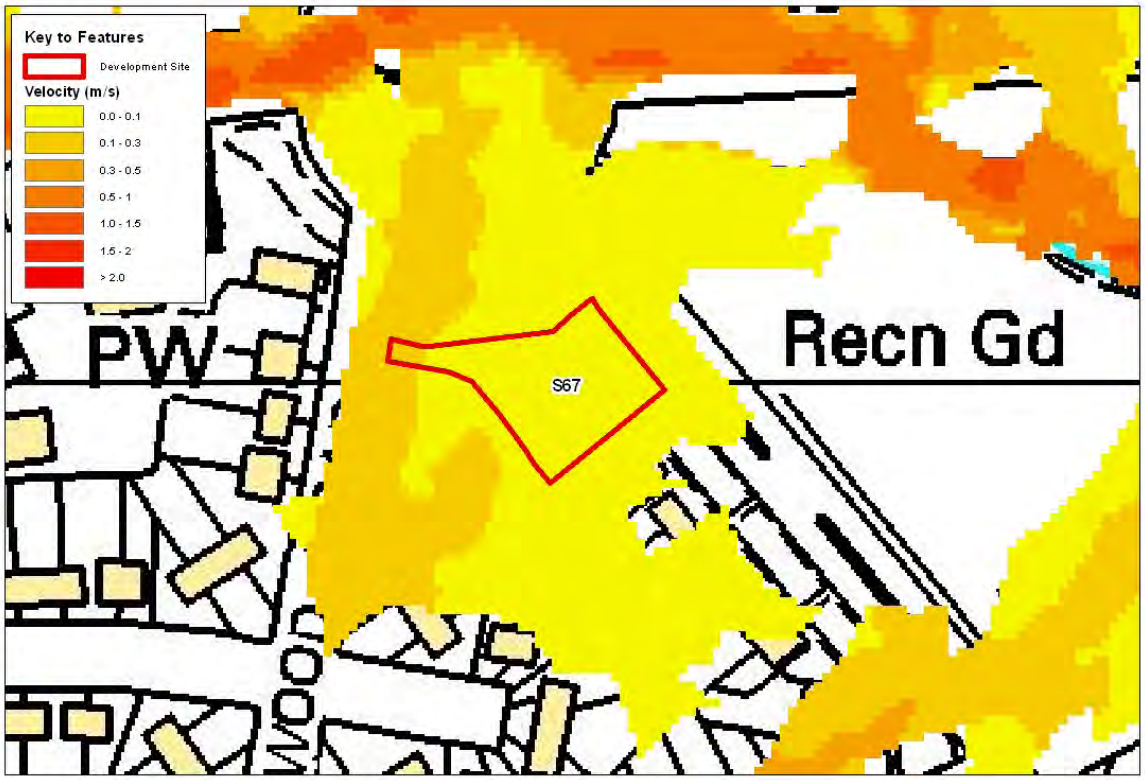
Wood Brook Integrated Model Flood Risk Map



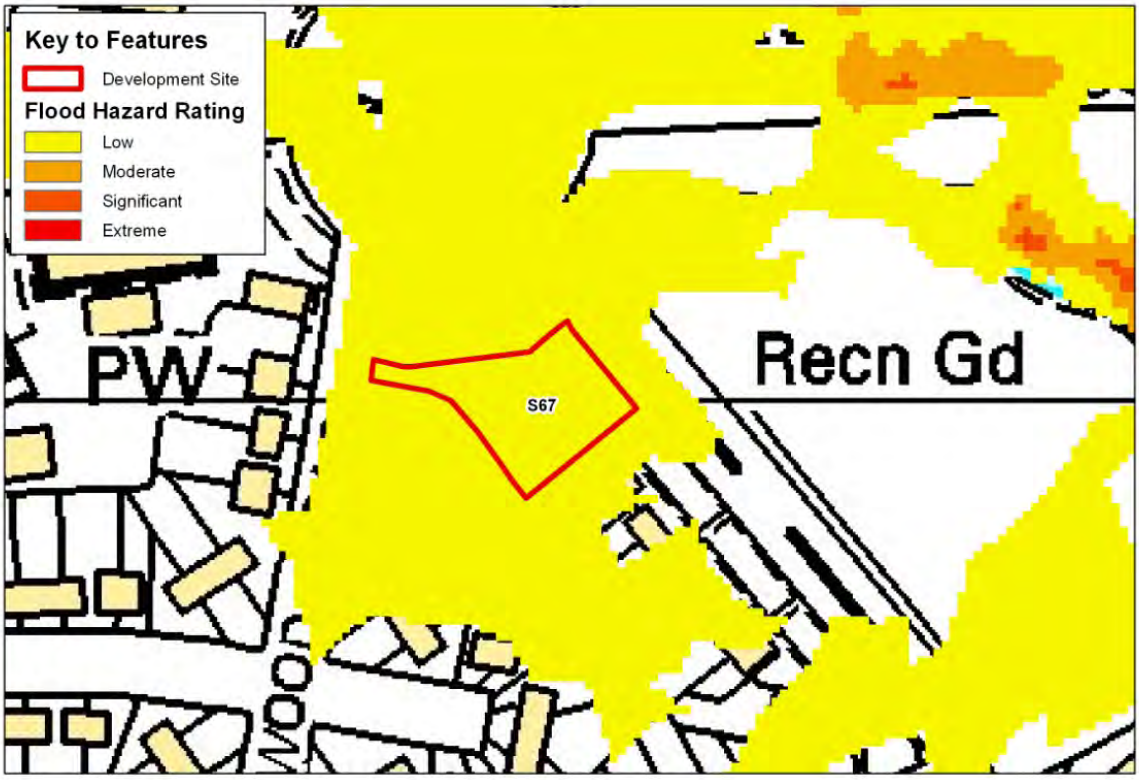
1% AEP Event Flood Depth Map



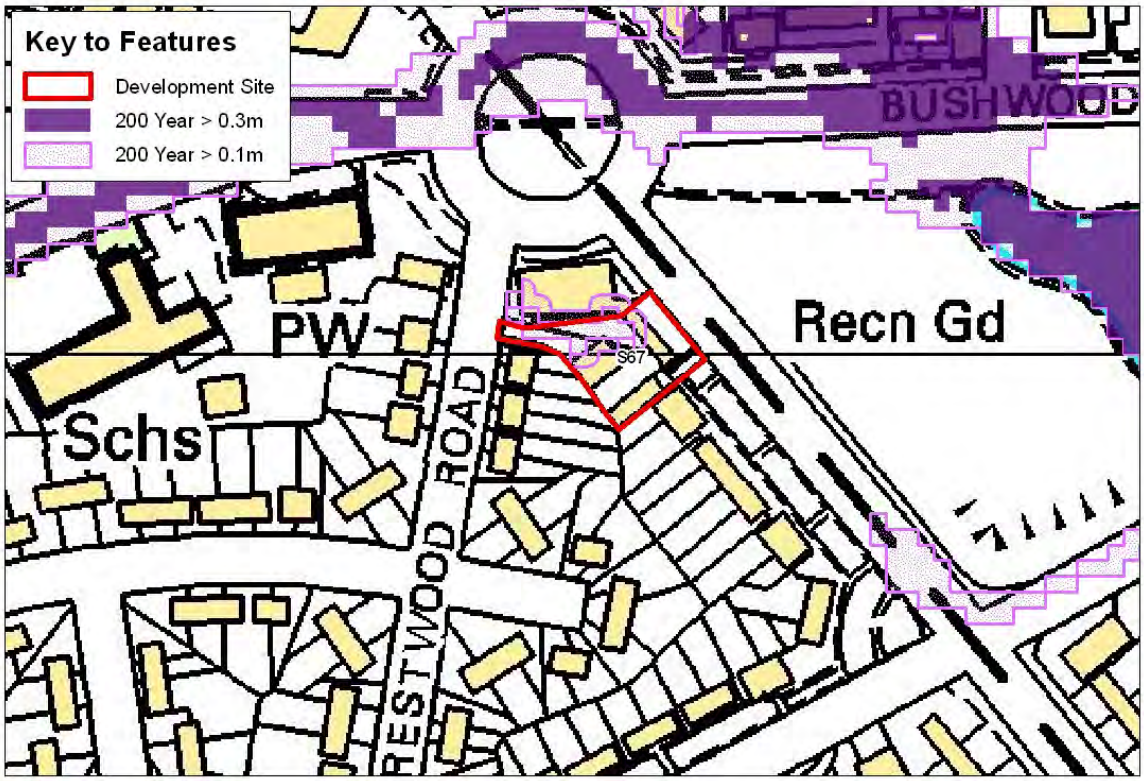
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

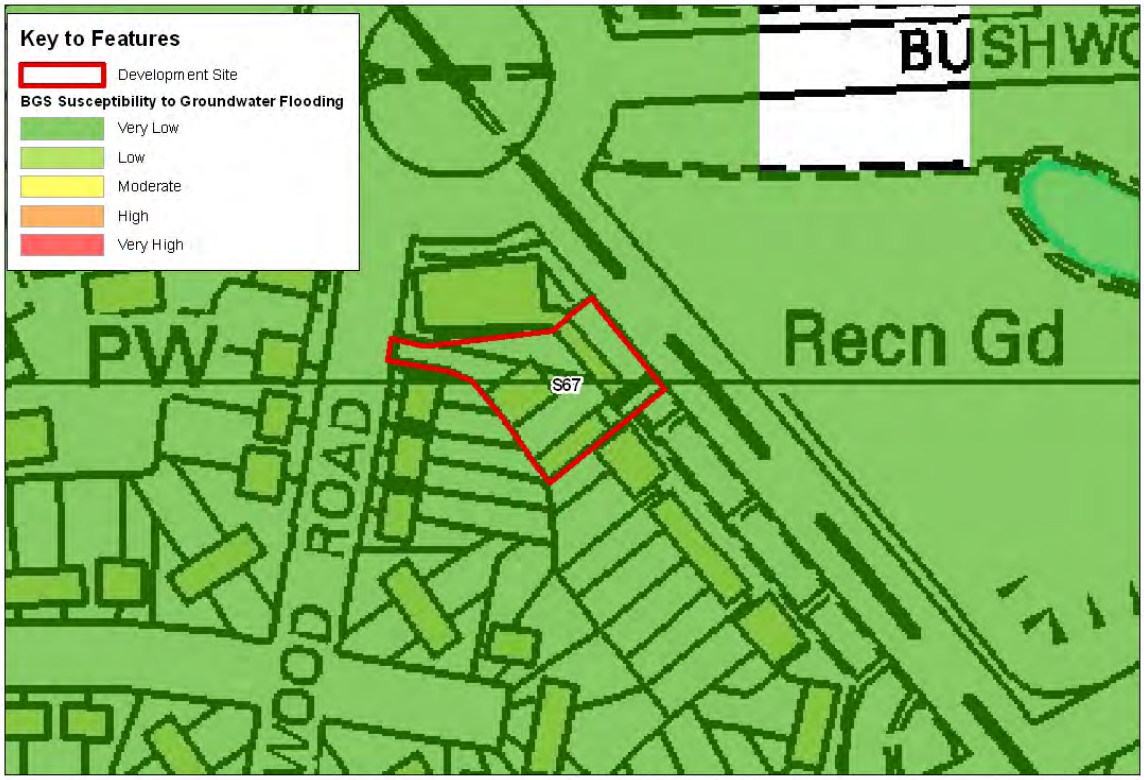


Flood Map for Surface Water (FMfSW)

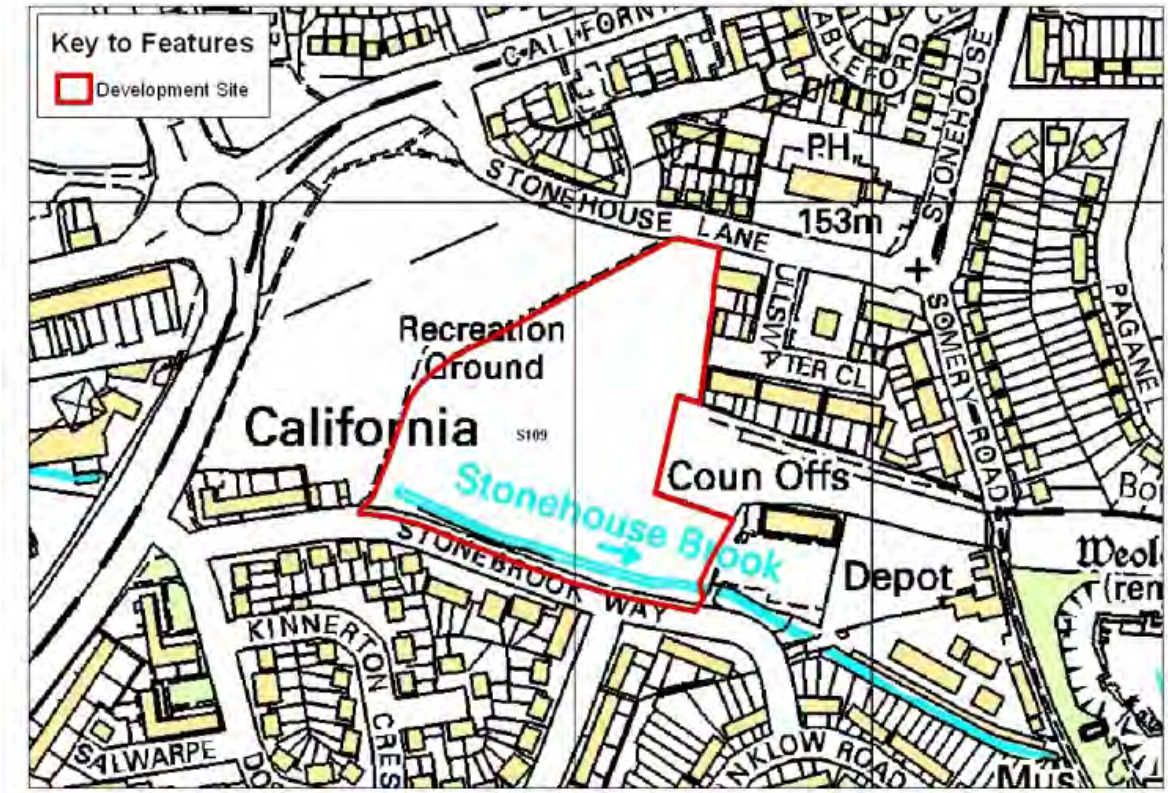


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: S109 Stonebrook Way



Site Name	S109
Site Address	Land fronting 17-35 Stonebrook Way
National Grid Reference	SP 01835 82890
Catchment	Stonehouse Brook
Primary Source of Flood Risk	Fluvial from Stonehouse Brook
Secondary Sources of Flood Risk	Surface water
Site Area (Ha)	2.01
Area within FZ1 (Ha)	1.68 (84%)
Area within FZ2 (Ha)	0.33 (16%)
Area within FZ3a (Ha)	0.25 (12%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Low. The flood hazard modelling shows that the majority of the site (88%) is outside FZ3a. The southern boundary of the site borders the Stonehouse Brook and has a 'low' (0.5 – 0.75) hazard rating. The south eastern corner of the site has a 'moderate'' (0.75 - 1.25) hazard rating.
Is the site at risk from surface water flooding?	Yes. 0.16Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.22Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	The site has very low susceptibility to groundwater flooding

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 84% of the site is located in FZ1.Development can avoid the small area of land in FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is historically brownfield however it currently is predominantly pervious. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Stonehouse Lane
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Flood hazard mapping shows the main access and egress route along Stonebrook Way to be at 'moderate risk'. This constitutes danger to some (children and the elderly). Access for emergency services would still be possible.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	Only if development in the southern edge of the site adjacent to Stonehouse Brook is proposed.
Can the loss of floodplain be compensated for within the site boundaries?	Yes. The remainder of the site is flood free up to and including the 0.1% AEP event.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water on site.
What is the Likelihood of the Exception Test being passed?	Good.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a.

Table 1: Hazard to people as a function of velocity and depth

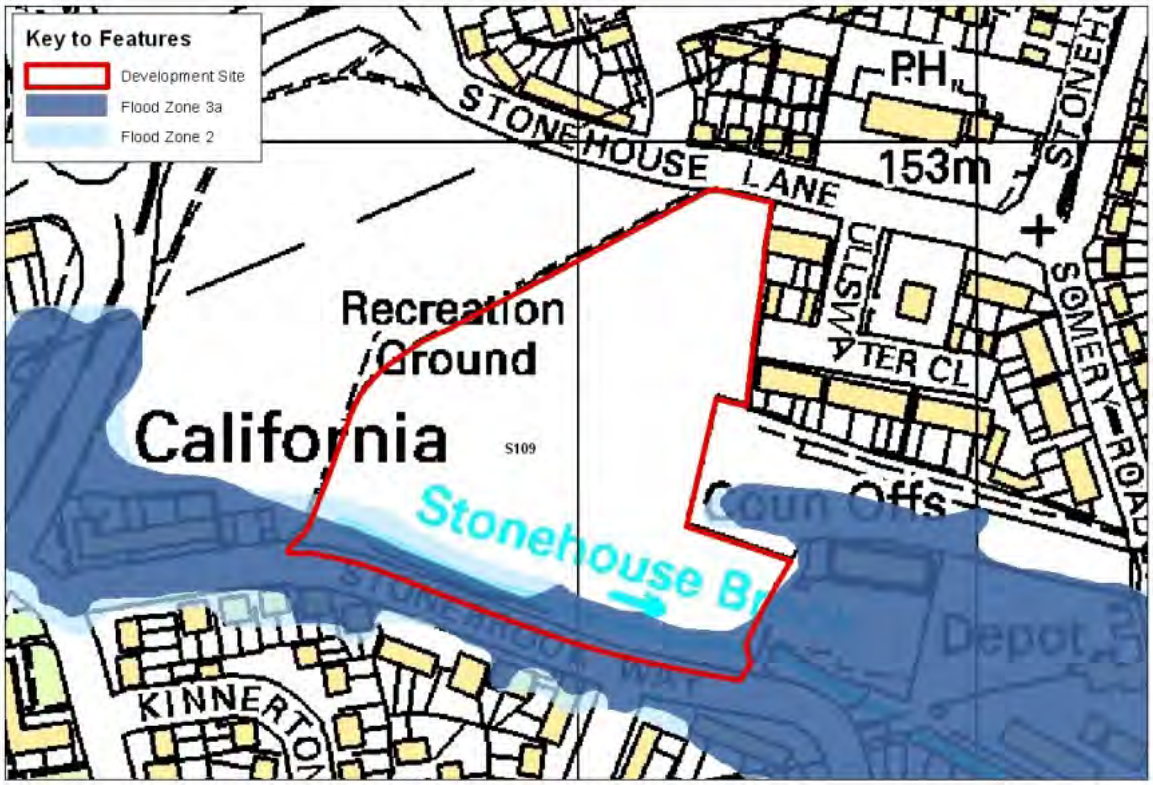
Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

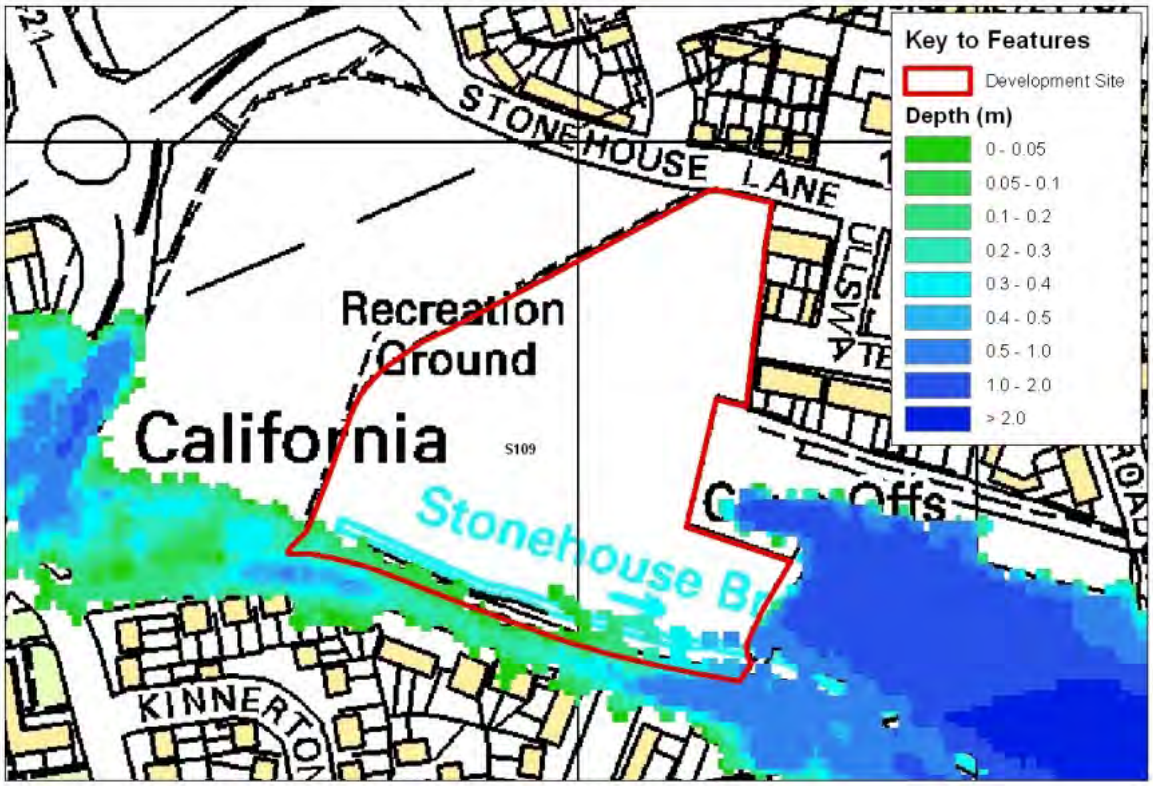
Modelling Methodology Summary

The flood risk, depth, hazard and velocity mapping outputs below were produced as part of the South Birmingham Flood Hazard Mapping project, completed in July 2010.

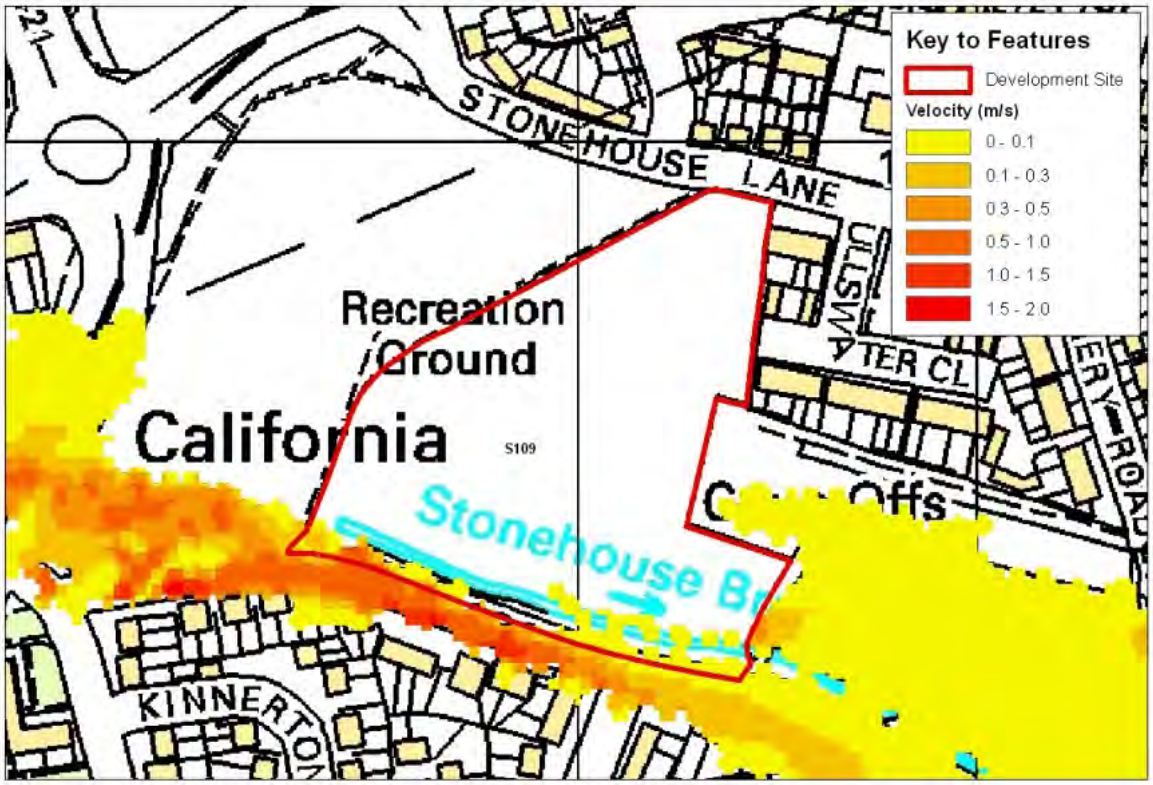
Fluvial Flood Risk Map



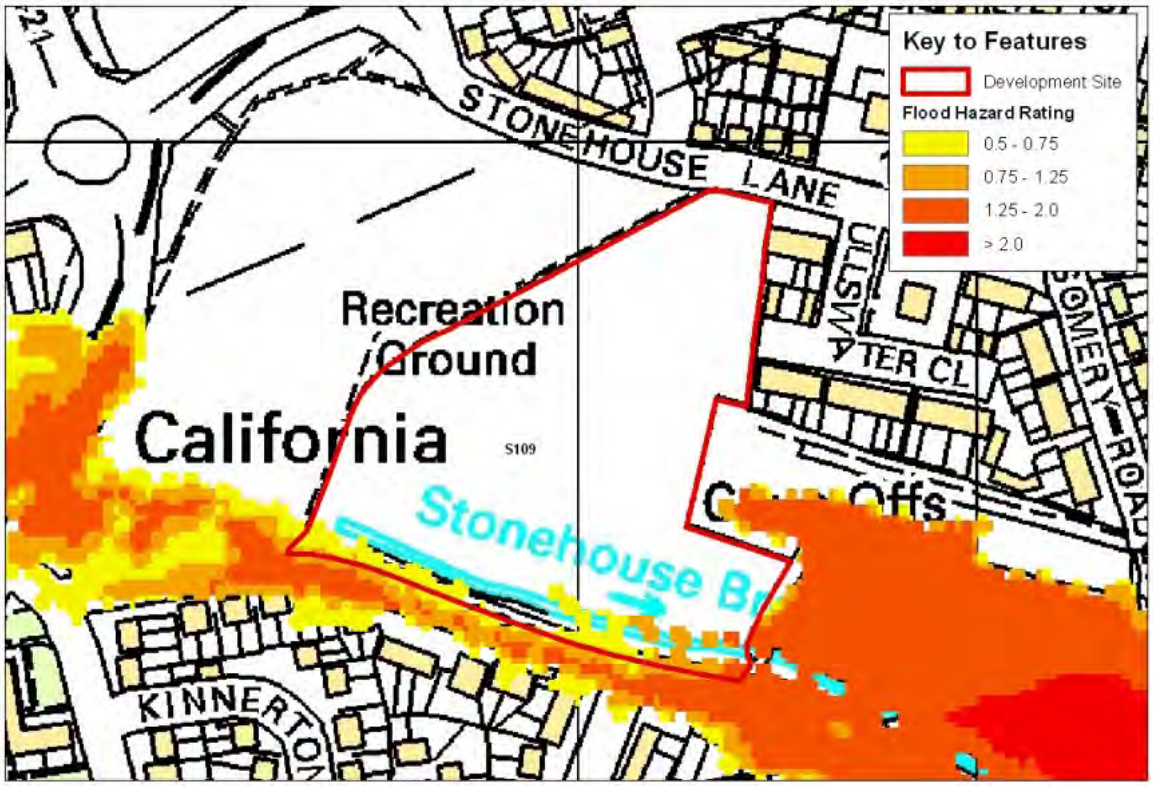
1% AEP Event Flood Depth Map



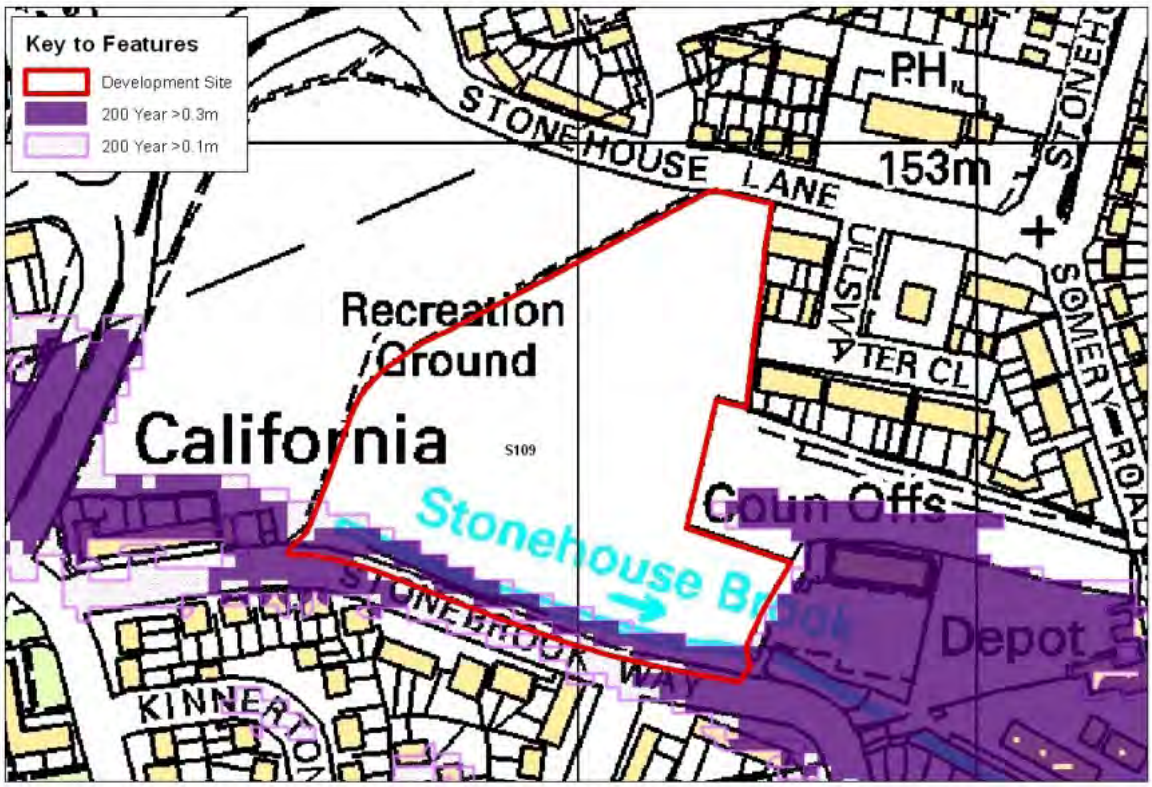
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

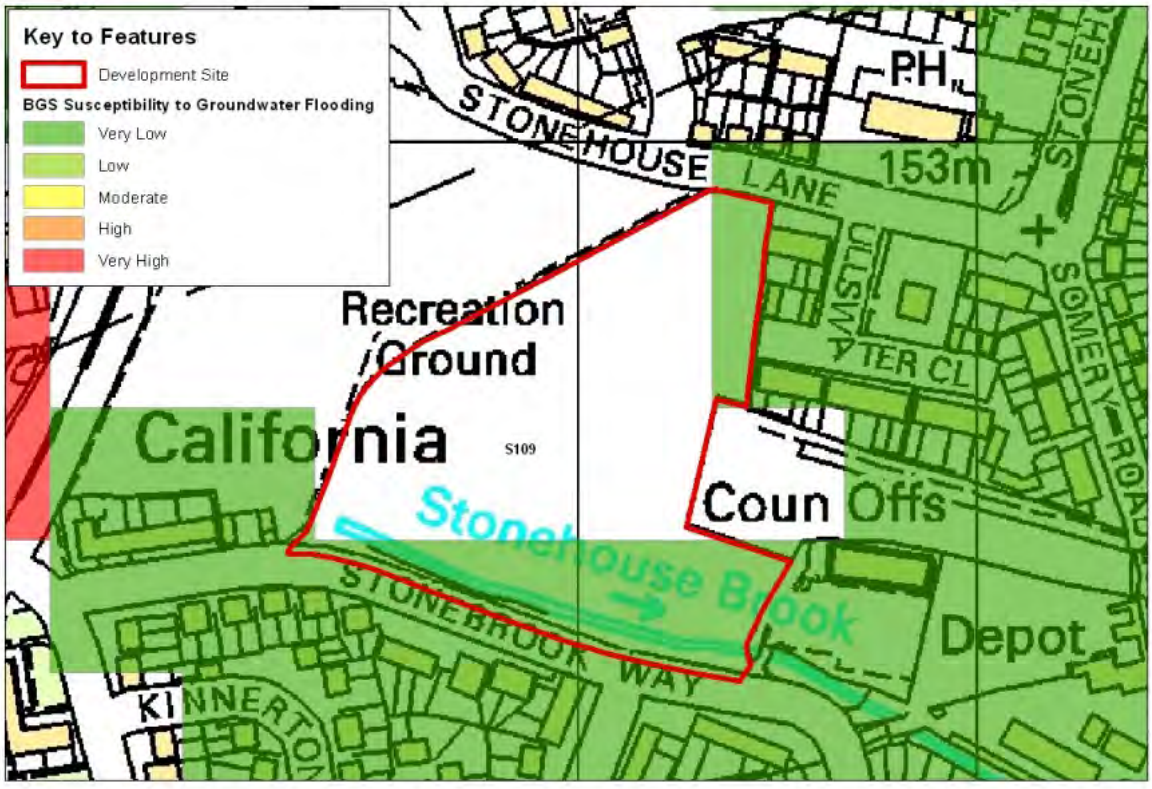


Flood Map for Surface Water (FMfSW)

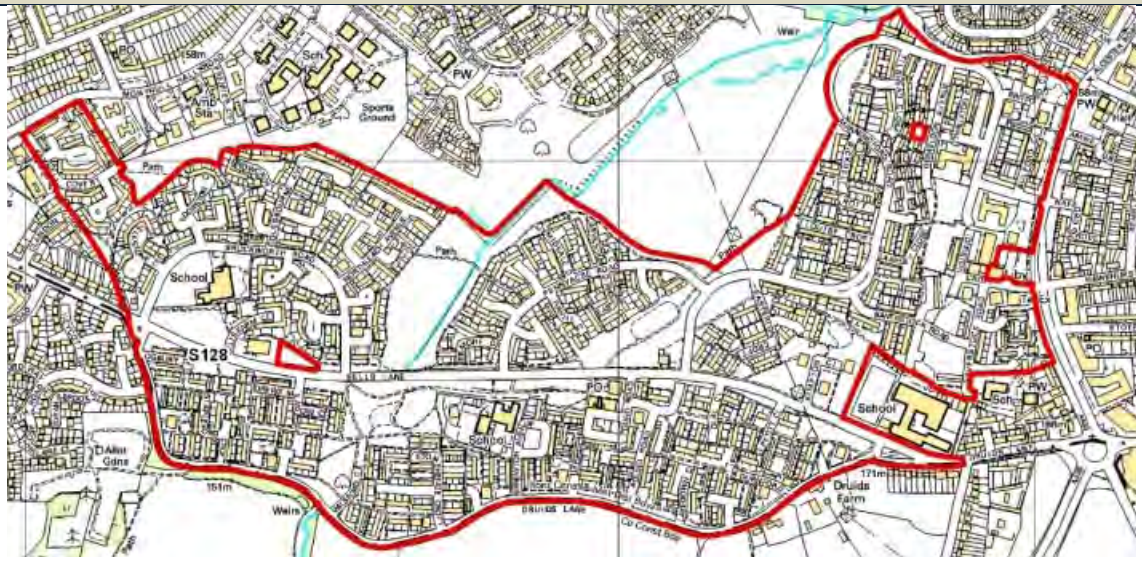


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: S128 Bells Lane



Site Name	S128 – Residential and Light Industrial Units
Site Address	Off Bells Lane, South of Brandwood End
National Grid Reference	SP 09643 83781
Catchment	Chinn Brook
Primary Source of Flood Risk	Surface water and groundwater
Secondary Sources of Flood Risk	Fluvial from the Chinn Brook (to be confirmed)
Site Area (Ha)	84.4
Area within FZ1 (Ha)	81.5 (97%)
Area within FZ2 (Ha)	2.9 (3%)
Area within FZ3a (Ha)	2.6 (3%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	There is no predicted flood hazard to the site, based on available hydraulic modelling.
Is the site at risk from surface water flooding?	Yes, at various locations across the site including the route of the Chinn Brook. Several of the roadways including Bells Lane, Manningford Road, Wilsford Close and Stapleford Croft. 2.02Ha >0.3m deep based on the FMfSW (0.5% AEP event). 7.47Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	Yes. The western boundary of the site around Bells Farm Primary School and Brockworth Road are predicted to have High to Very High susceptibility to groundwater flooding. Saxelby Close on the eastern perimeter of the site has High susceptibility to groundwater flooding.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is predominantly brownfield land. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.

Is there dry access and egress to the site during a flood event for occupants?	Yes, via Bells Lane and adjoining streets.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	Yes, although the amount required is uncertain at this stage as this will depend on what type of development (if any) is proposed within the floodplain of the Chinn Brook.
Can the loss of floodplain be compensated for within the site boundaries?	Yes, the site is of sufficient size to be able to provide compensatory storage within the bounds of the development.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and may therefore reduce flood risk elsewhere. The site is also outside any Source Protection Zones.
What is the Likelihood of the Exception Test being passed?	Good.
Recommendations / Future Data Needs	The current hydraulic model of the Chinn Brook does not cover the proposed development site. The model could be extended upstream of Druids Lane so that fluvial flood risk to the site can be assessed more accurately. However, given the size of the development site it is proposed that the development areas are set back from the Chinn Brook and the culverts removed. Therefore, hydraulic modelling may not be required as improvements to the watercourse would be included as part of the development.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

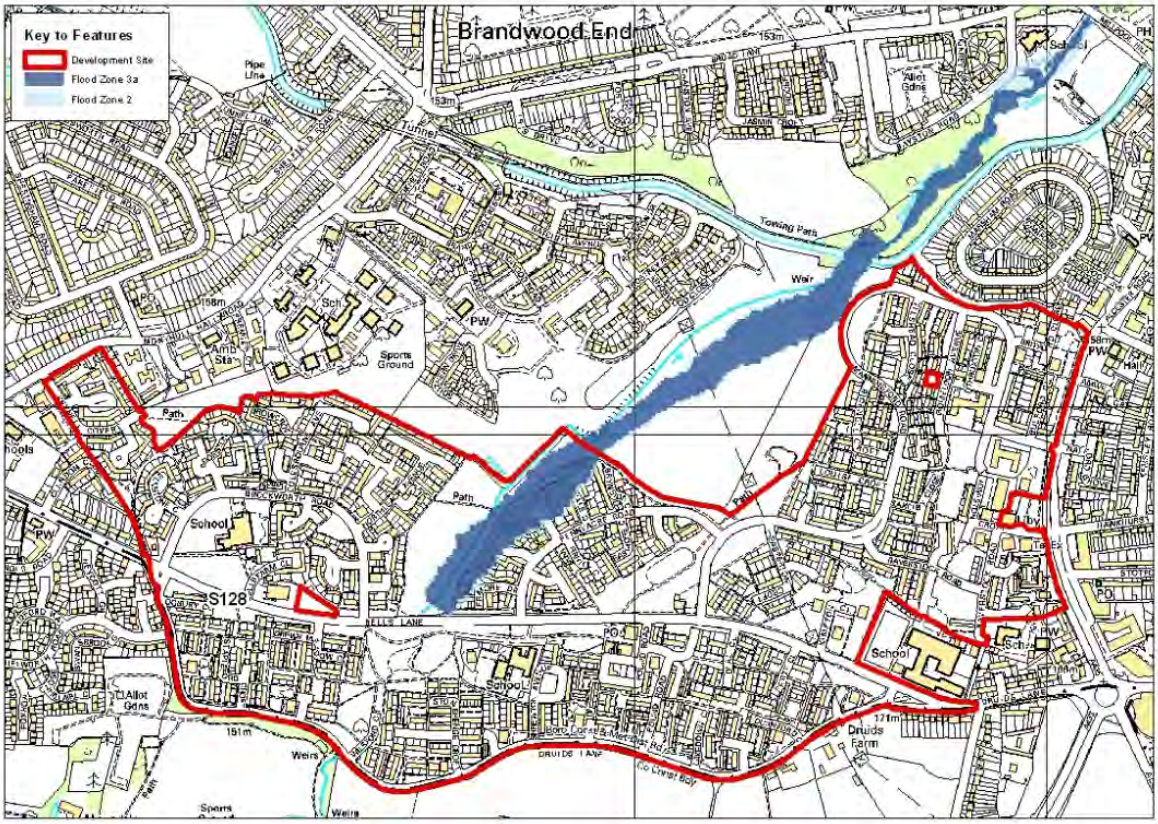
Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

Modelling Methodology Summary

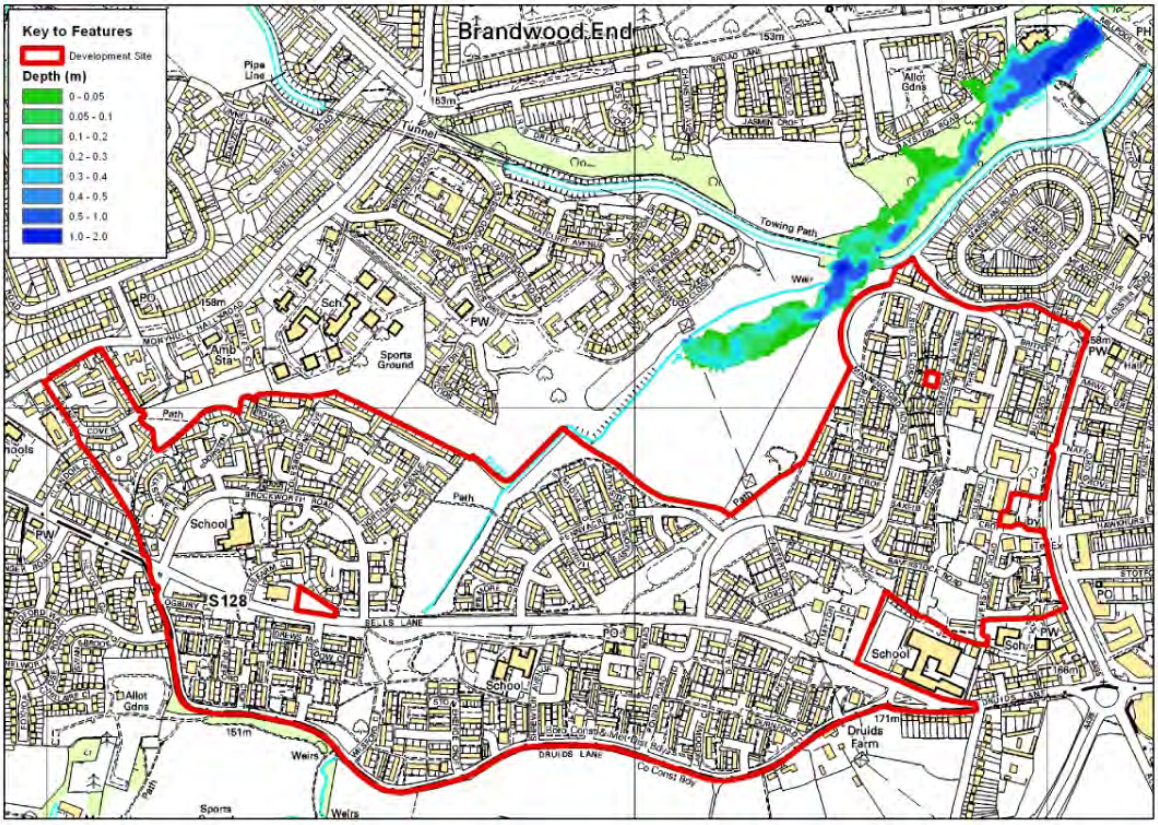
Flood outlines are based on the EA Flood Zones whereas the depth, velocity and hazard grids were generated from the 2D results triangles extracted from the River Cole Integrated InfoWorks model using interpolation techniques. This explains the difference between the EA flood outlines, based on a broadscale JFLOW model of the catchment, and the depth, velocity and hazard outputs from the more detailed InfoWorks model of the River Cole and Chinn Brook.

The River Cole (and Chinn Brook) Integrated model does not extend sufficiently far upstream to cover the proposed SHLAA site. The model could be extended upstream of Druids Lane to allow flood risk to be assessed more accurately, and help inform the configuration of the proposed development site.

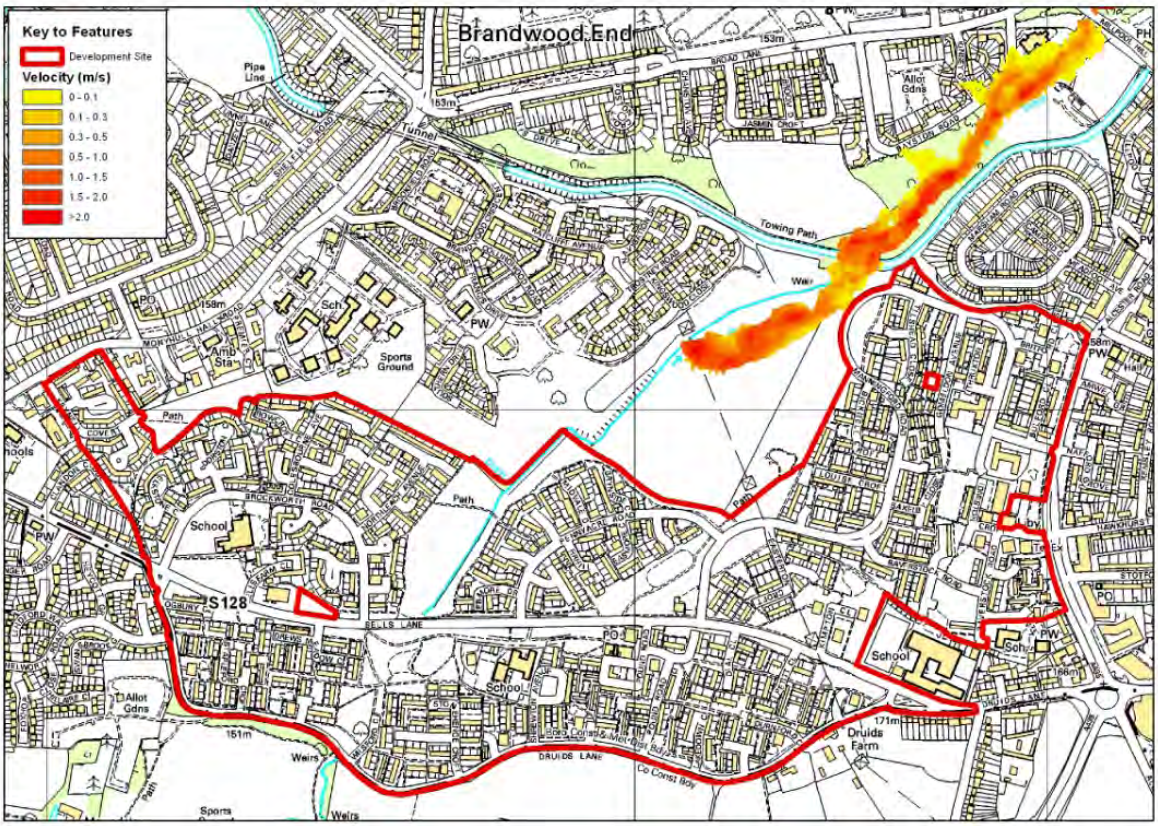
Fluvial Flood Risk Map



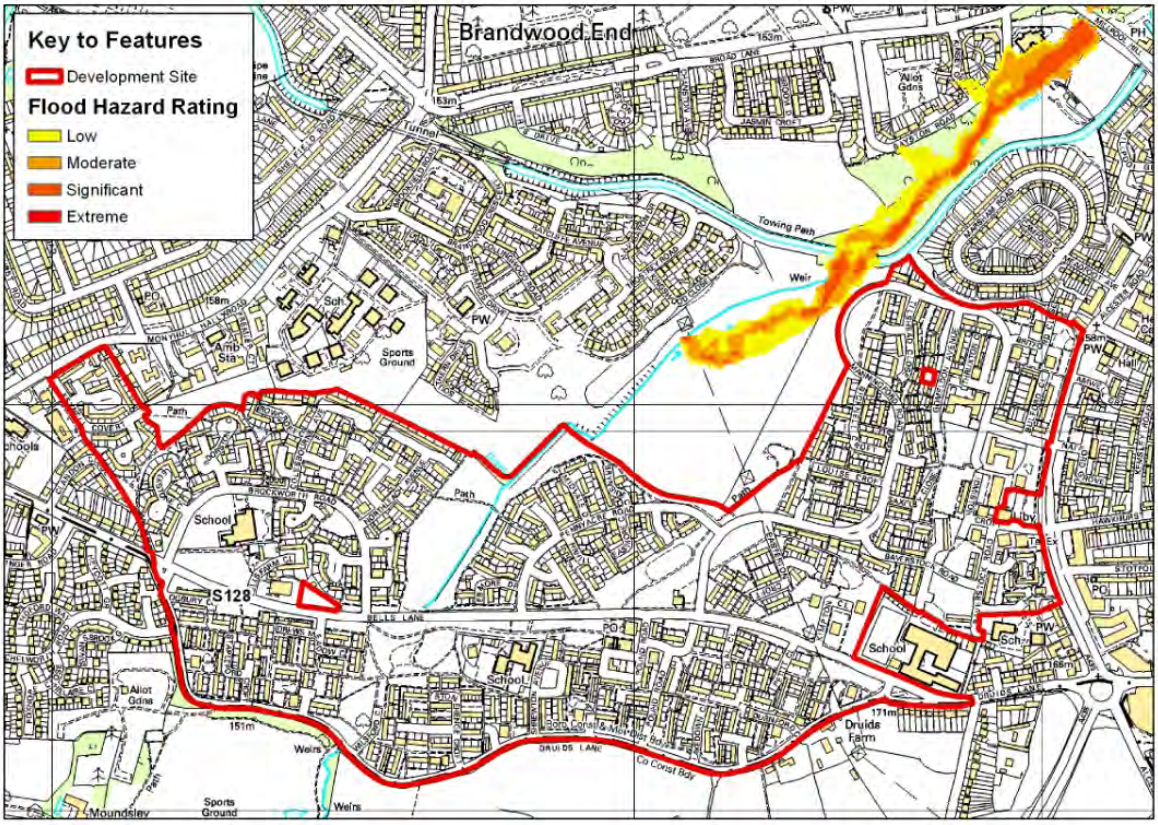
1% AEP Event Flood Depth Map



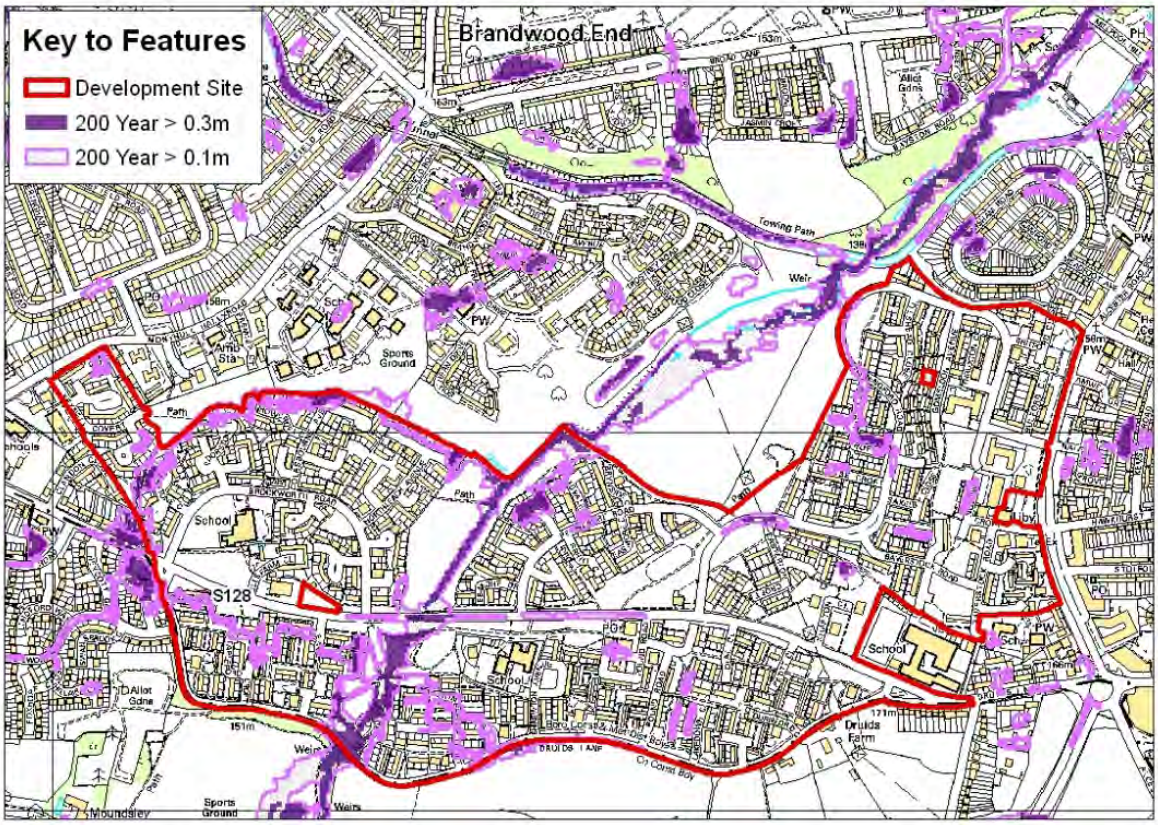
1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map

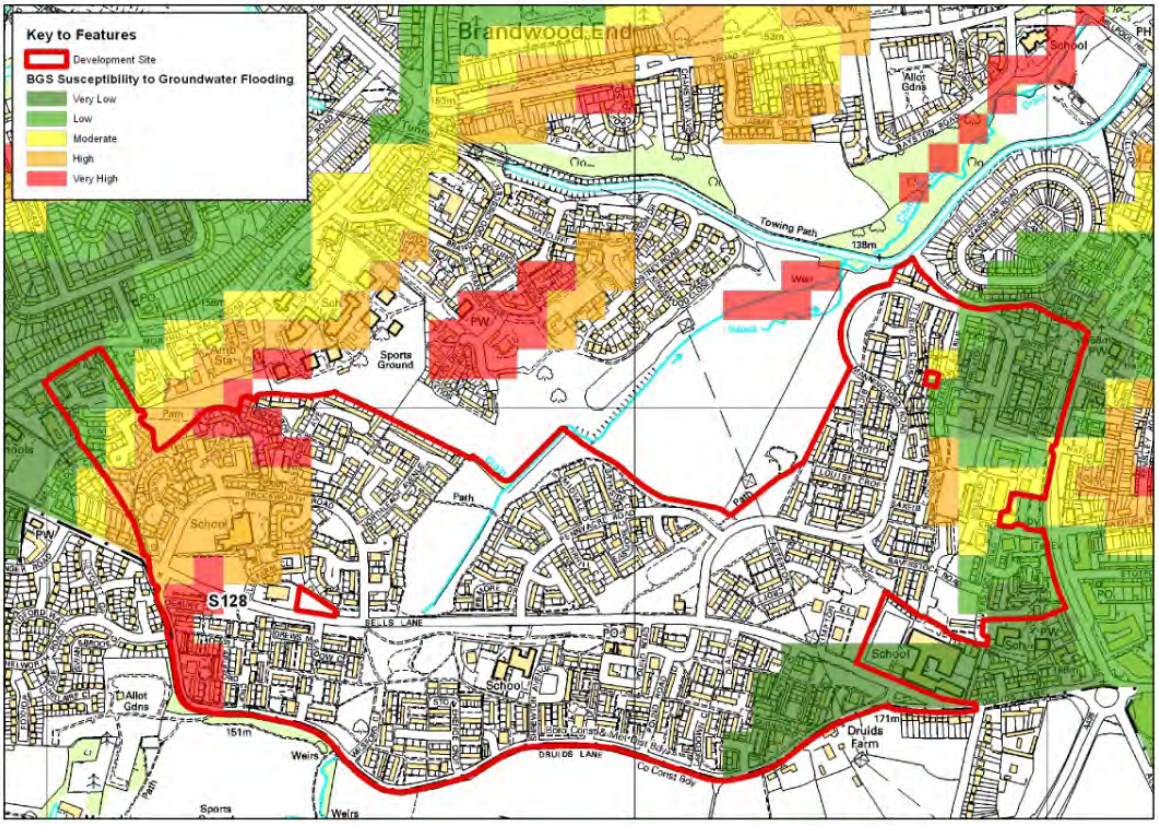


Flood Map for Surface Water (FMfSW)

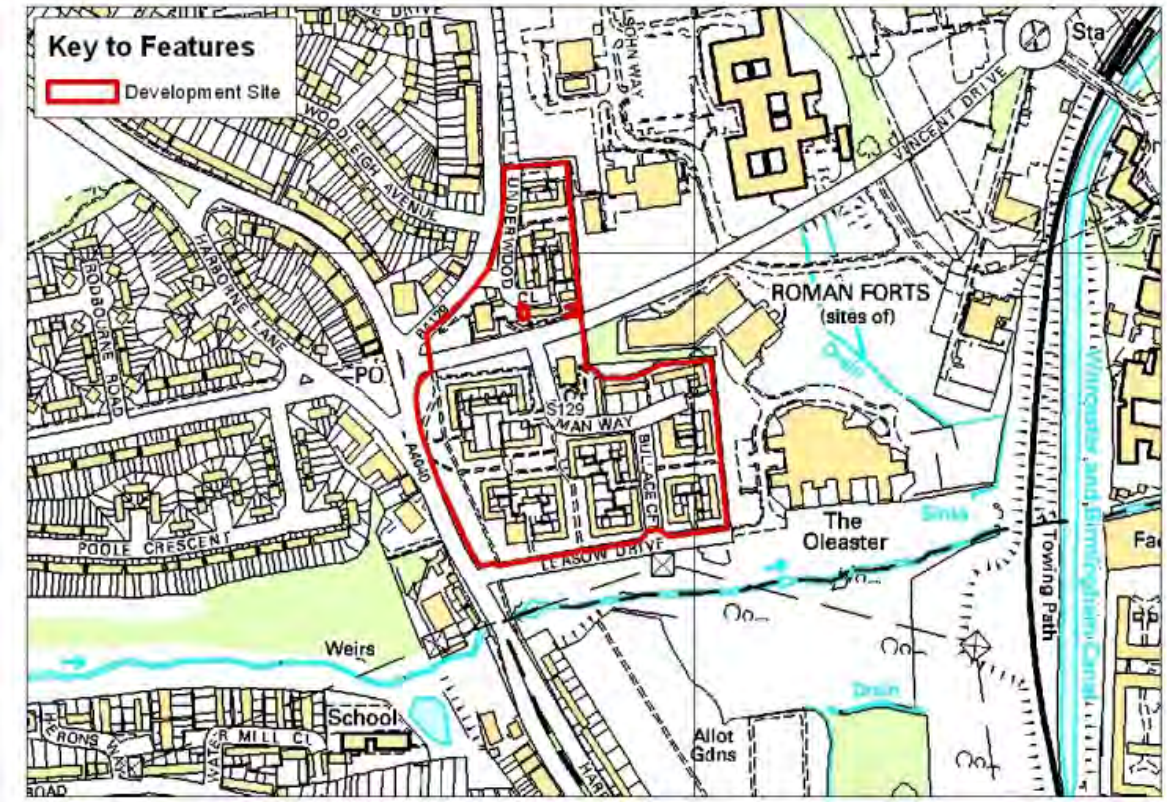


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



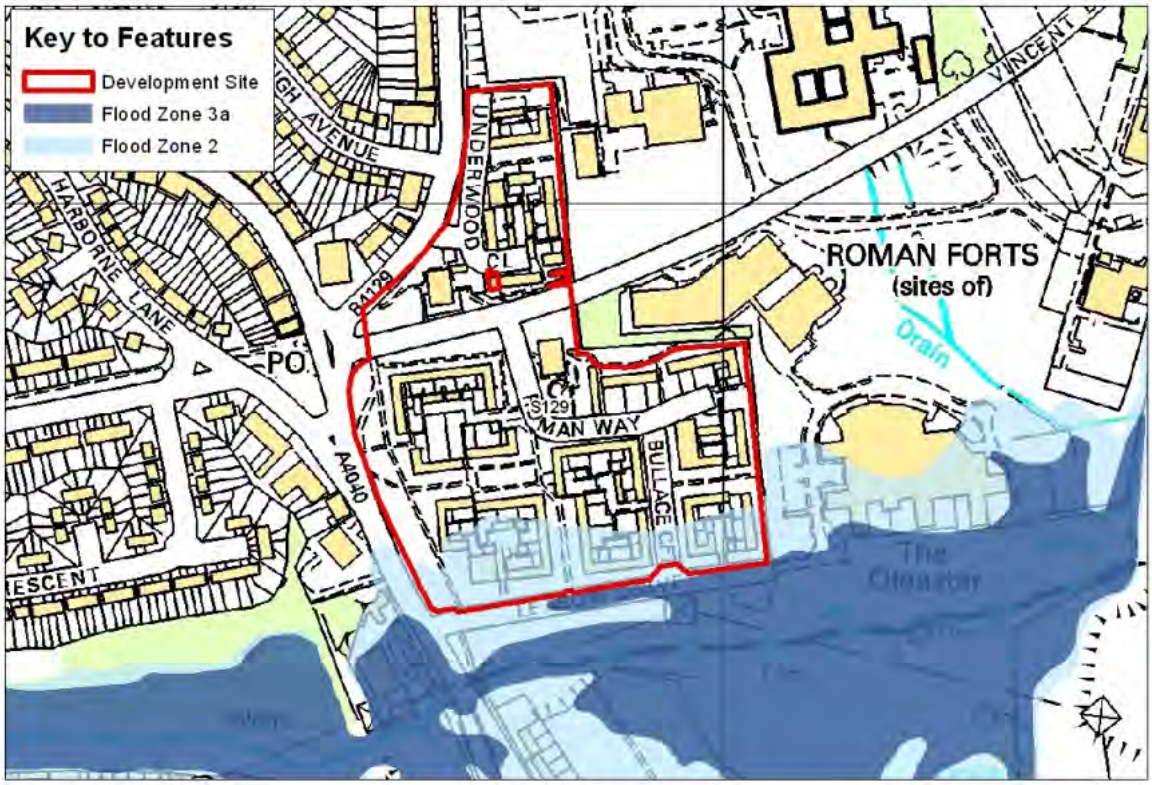
Site Summary Sheet: S129 Leasow Drive



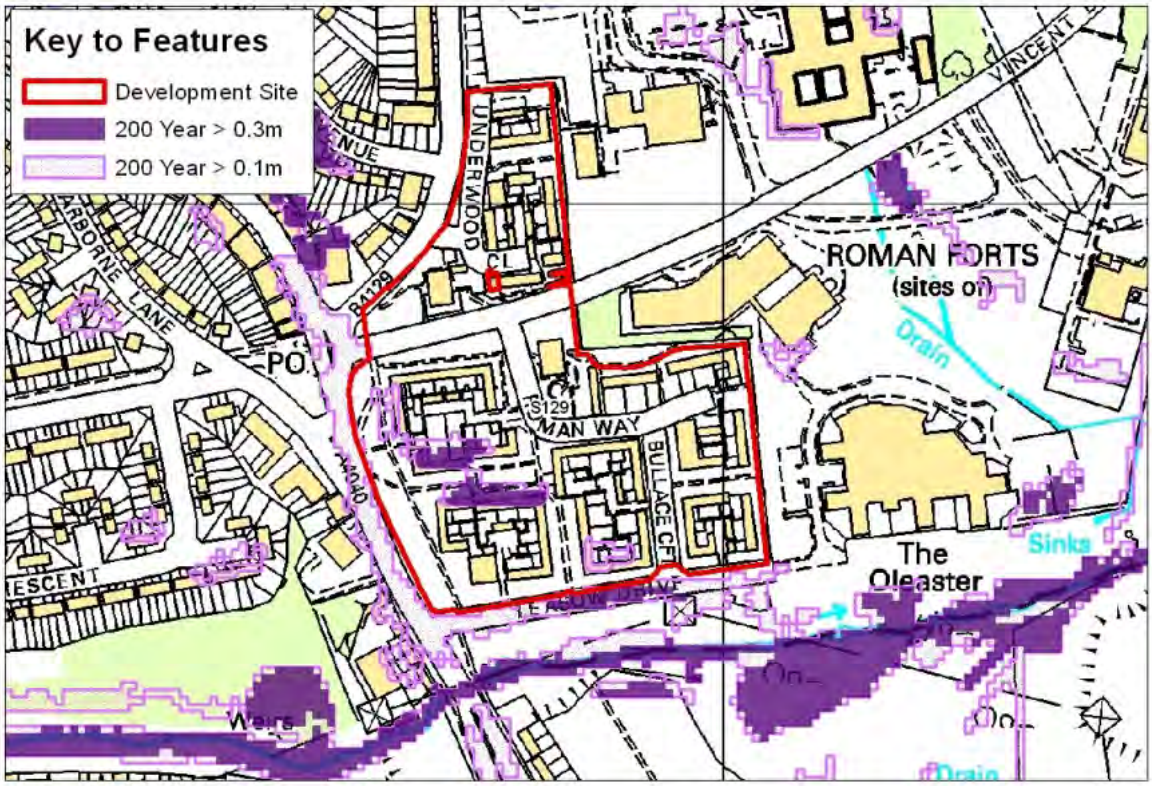
Site Name	S129
Site Address	2-100 Leasow Drive
National Grid Reference	SP 03888 83407
Catchment	Bourn Brook
Primary Source of Flood Risk	Fluvial from Bourn Brook
Secondary Sources of Flood Risk	Surface Water
Site Area (Ha)	5.82
Area within FZ1 (Ha)	4.82 (83%)
Area within FZ2 (Ha)	1.00 (17%)
Area within FZ3a (Ha)	0.002 (0.03%)
Area within FZ3b (Ha)	0
Is the site protected by flood risk management assets?	No
What is the flood risk / flood hazard to the site?	The fluvial flood outline shows that the majority of the site is in Flood Zone 1 and hence has a low probability of flooding. The eastern side of the site is in Flood Zone 2 and has a medium probability of flooding. There is a very small section of land adjacent to Leasow Drive within Flood Zone 3a. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.13Ha >0.3m deep based on the FMfSW (0.5% AEP event) 0.31Ha >0.1m deep based on the FMfSW (0.5% AEP event)
Is the site at risk from groundwater flooding?	No

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 83% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where More vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, access and egress via Leasow Drive may need to be avoided in an extreme event.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Yes.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the site is outside FZ3a and has dry access and egress the Exception Test is likely to be passed.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a.

Fluvial Flood Risk Map

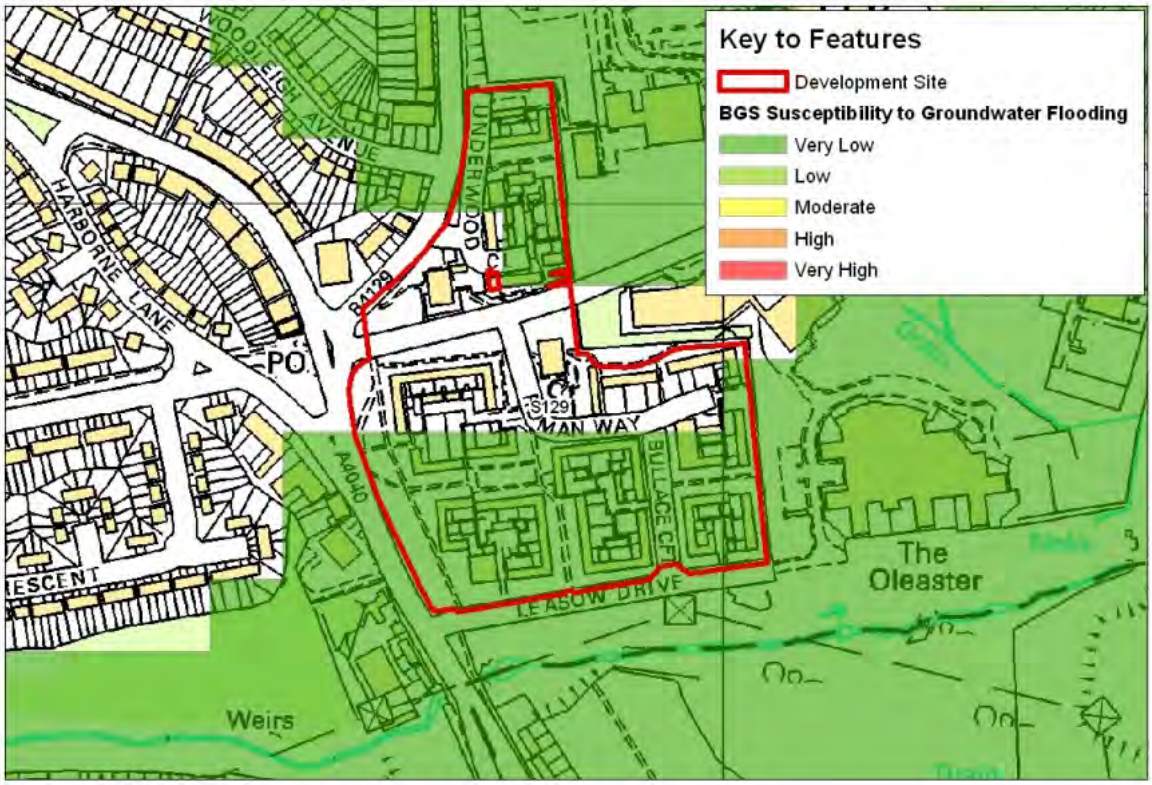


Flood Map for Surface Water (FMfSW)

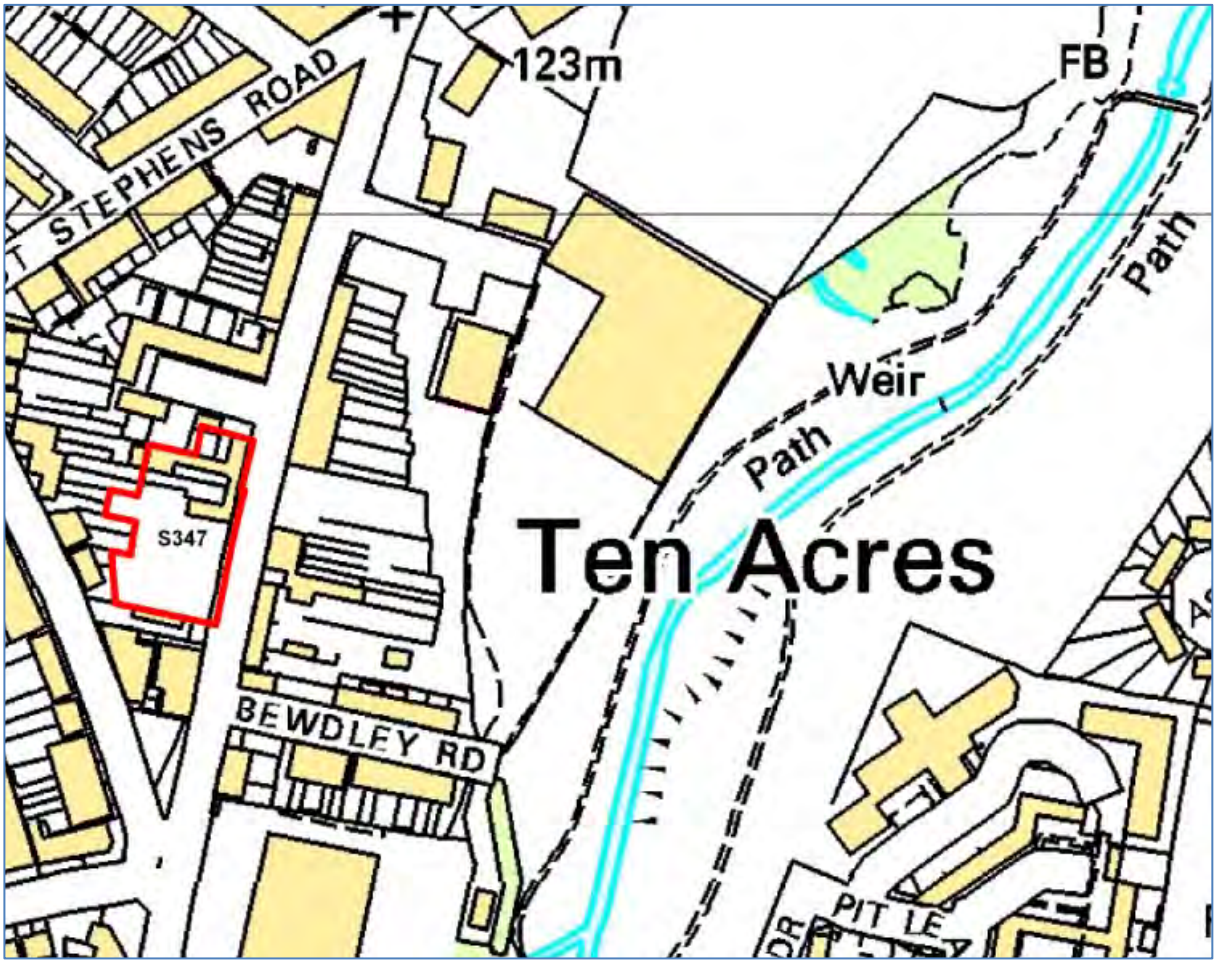


This map gives an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. It is not suitable for use at an individual property scale due to the method used. Data supplied by the EA © Environment Agency copyright 2012. All rights reserved.

Susceptibility to Groundwater Flooding



Site Summary Sheet: S347 Pershore Road



Site Name	SS347
Site Address	1125 – 1157 Pershore Road, Bewdley
National Grid Reference	SP 05595 81756
Catchment	River Rea
Primary Source of Flood Risk	Fluvial from River Rea
Secondary Sources of Flood Risk	Fluvial from River Bourn and surface water
Site Area (Ha)	0.28
Area within FZ1 (Ha)	0.22 (79%)
Area within FZ2 (Ha)	0.06 (21%)
Area within FZ3a (Ha)	0.06 (21%)
Area within FZ3b (Ha)	0.002 (<1%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site? **(See Table 1 for Hazard Rating definitions)**	Low. The flood hazard modelling shows that 79% of the site is within FZ1. The eastern boundary of the site has a 'low' (<0.75) hazard rating. The A441 has a 'moderate' (0.75 – 1.25) hazard rating.
Is the site at risk from surface water flooding?	Yes. 0.01Ha >0.1m deep based on the FMfSW (0.5% AEP event).
Is the site at risk from groundwater flooding?	No.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 79% of the site is outside FZ2 and FZ3a so development is considered acceptable. The north eastern corner of the site is located within FZ3a. Development there would only be possible by providing compensatory storage elsewhere on the site.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield land and is completely covered by impervious surfaces. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	No. The primary access and egress route is via Pershore Road (A441) which is flooded at the 1% AEP event.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	Flood hazard mapping shows the main access and egress route along Pershore Road to be at 'moderate risk'. This constitutes danger to some (children and the elderly). Access for emergency services would still be possible.
Is the site covered by flood warnings?	No.
Is compensatory flood storage required?	Only if development in the north-eastern corner of the site is proposed.
Can the loss of floodplain be compensated for within the site boundaries?	Yes. The remainder of the site is flood free up to and including the 0.1% AEP event.
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water on site.
What is the Likelihood of the Exception Test being passed?	The Exception Test is unlikely to be passed. The main access and egress route onto the site is flooded during the 1% AEP event.
Recommendations / Future Data Needs	The site could only be developed if a safe access and egress route can be provided. This would need to remain viable over the lifetime of the development.

Table 1: Hazard to people as a function of velocity and depth

Hazard Rating (d(v+0.5)+DF)	Degree of Flood Hazard	Description
<0.75	Low	Caution *"Flood zone with shallow flowing water or deep standing water"*
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) *"Danger: Flood zone with deep or fast flowing water"*
1.25 - 2.5	Significant	Dangerous for most people *"Danger: Flood zone with deep fast flowing water"*
>2.5	Extreme	Dangerous for all *"Extreme danger: Flood zone with deep fast flowing water"*

Source: Table 3.2, Flood Risks to People, Phase 2, FD2321/TR1, The Flood Risks to People Methodology, Defra, March 2006)

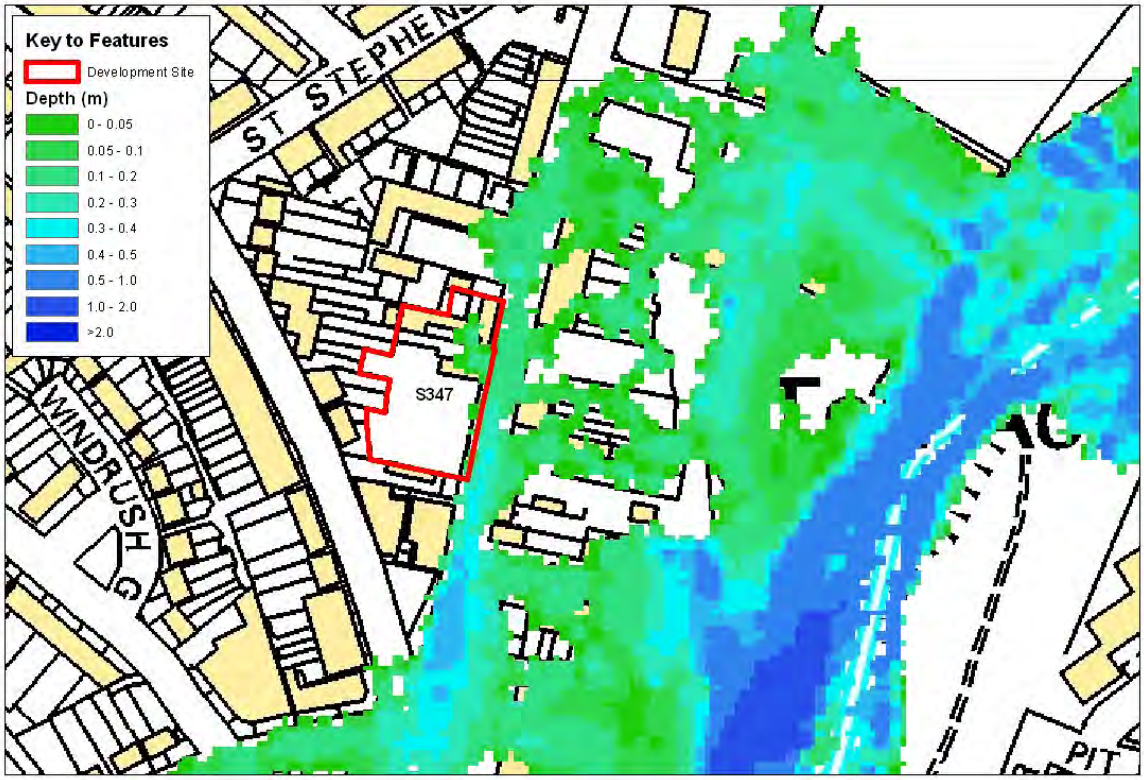
Modelling Methodology Summary

The flood risk, depth, hazard and velocity mapping outputs above were produced as part of South Birmingham Flood Hazard Mapping project, completed in July 2010.

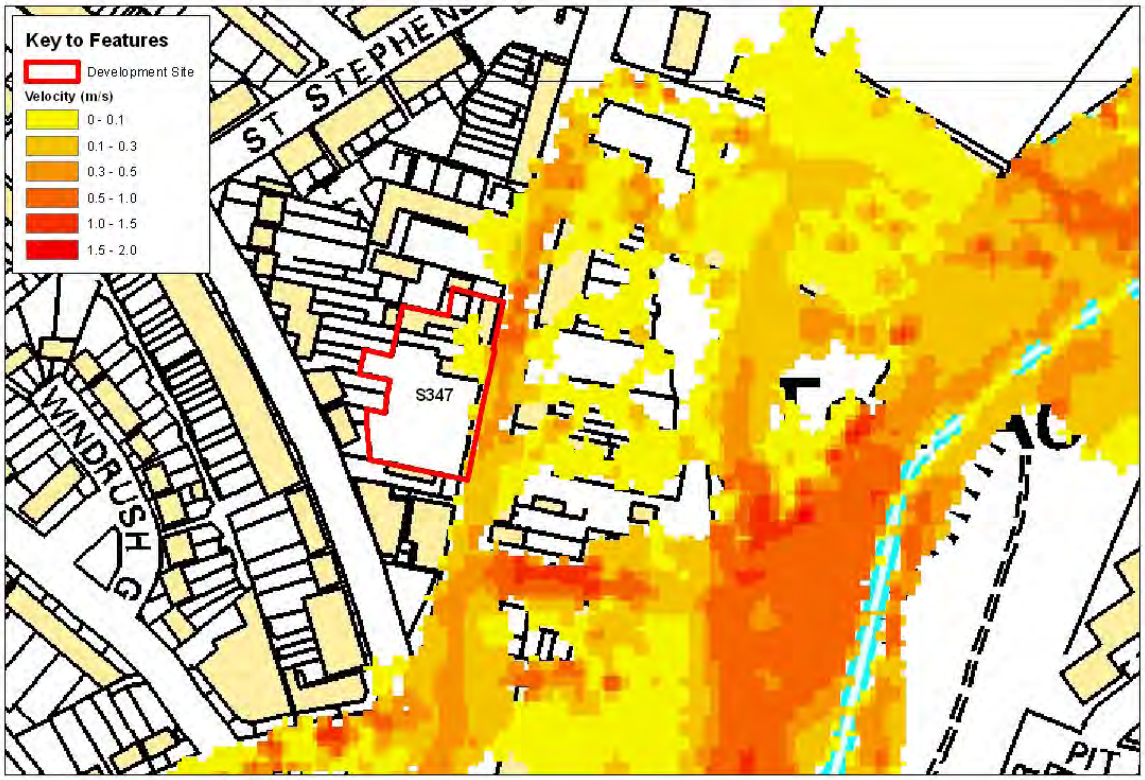
This was undertaken by Royal Haskoning using a linked ISIS-TUFLOW model. Version 3.3 of ISIS and version 2009-07-AD of TUFLOW were used.

Fluvial Flood Risk Map

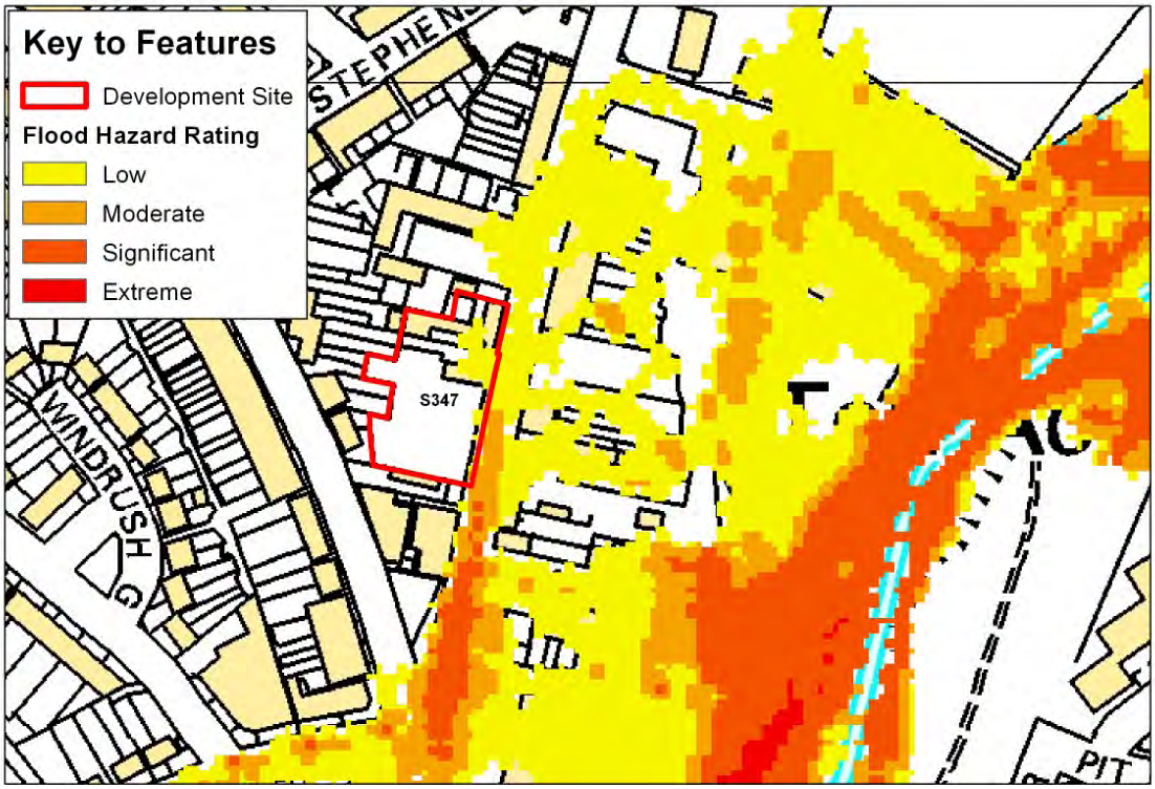
1% AEP Event Flood Depth Map



1% AEP Event Flood Velocity Map



1% AEP Event Flood Hazard Map



Flood Map for Surface Water (FMfSW)

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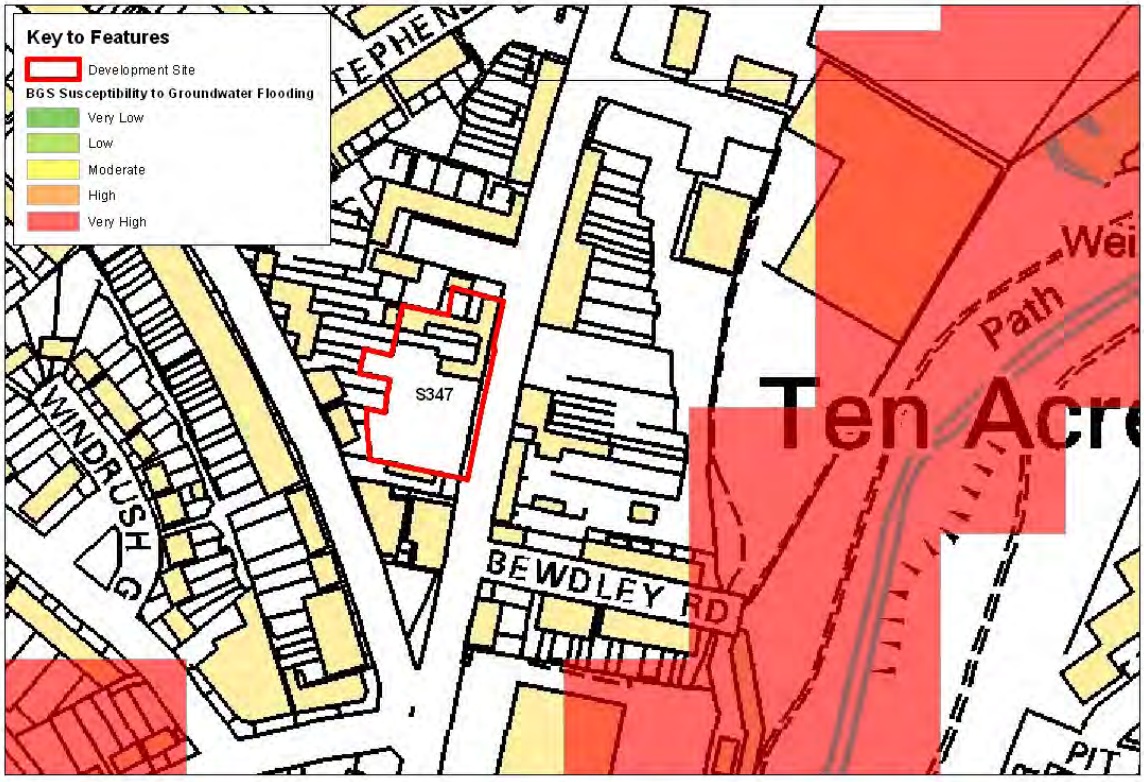
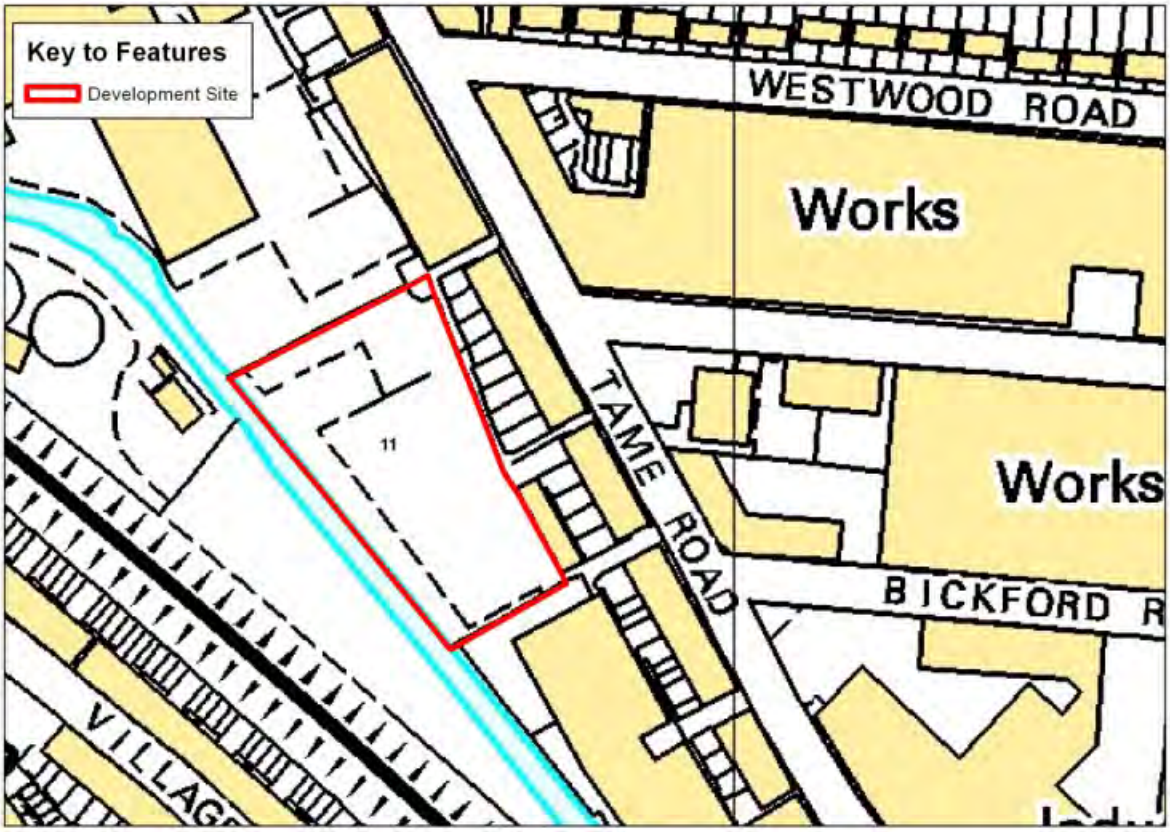
Susceptibility to Groundwater Flooding



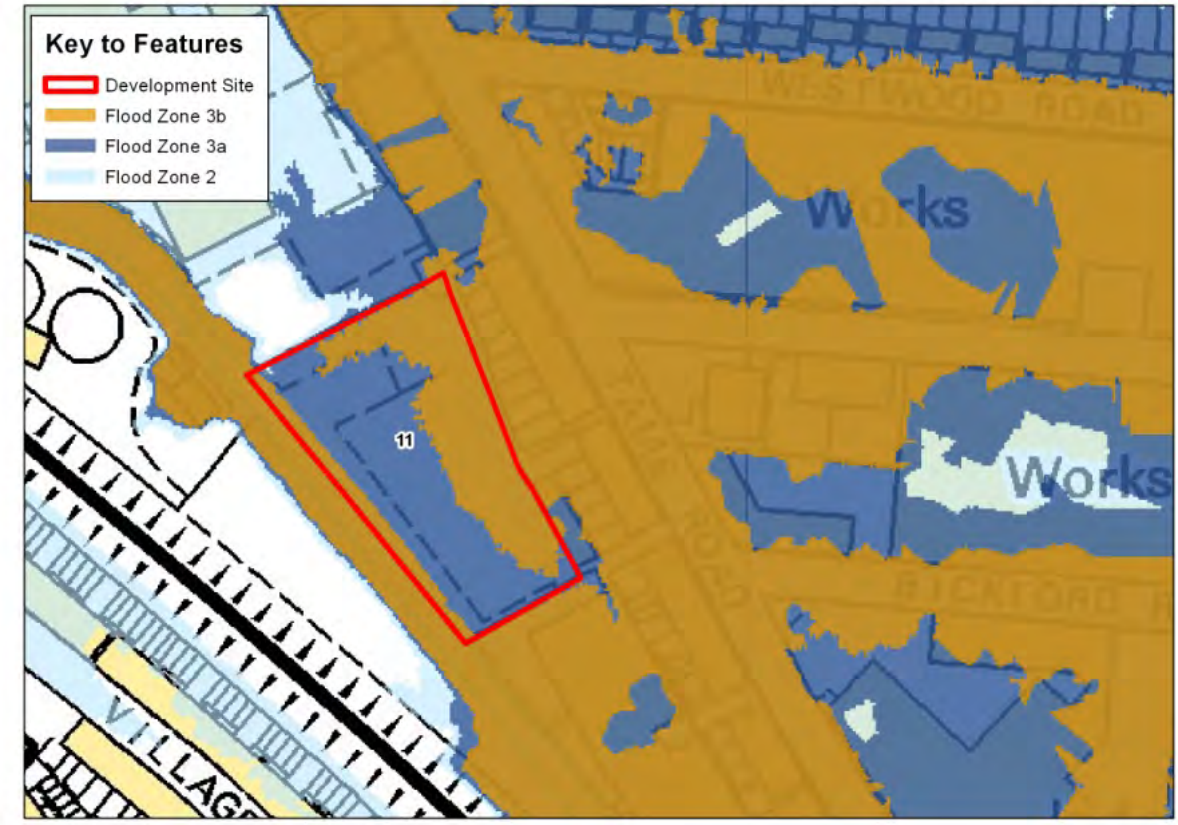
Site Summary Sheet: Site 11 – Tame Road (Aston Lozells and Newtown AAP)



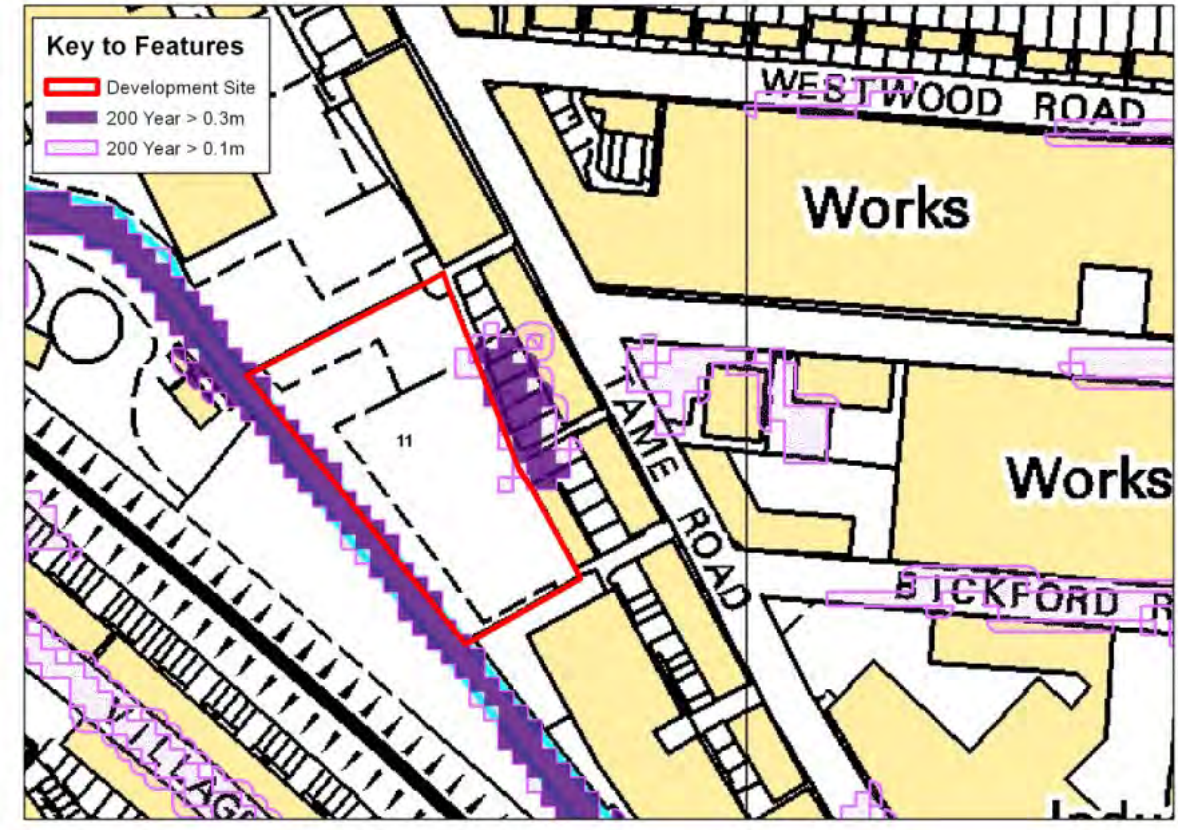
Site Name	AAP - 11
Site Address	Tame Road
National Grid Reference	SP 08235 90382
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Groundwater and surface water
Site Area (Ha)	0.7
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.7 (100%)
Area within FZ3a (Ha)	0.699 (99.8%)
Area within FZ3b (Ha)	0.333 (47.6%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Witton. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk. This is reinforced in the Aston, Lozells and Newtown AAP.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that almost half of the site is at very high probability being within Flood Zone 3b and the remainder of the site is at high probability of flooding being within Flood Zone 3a. As the site would only be brought forward if the Tame Strategy for Witton mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	Yes. 0.03Ha >0.3m deep based on the FMfSW (0.5% AEP event). 0.05Ha >0.1m deep based on the FMfSW (0.5% AEP event).

Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, the site is covered by an EA Flood Warning service (River Tame at Witton and Salford Park).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Witton are implemented, until this time this site will not be promoted for development. This is reinforced in the Aston, Lozells and Newtown AAP.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Witton mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk as outline in the Aston, Lozells and Newtown AAP.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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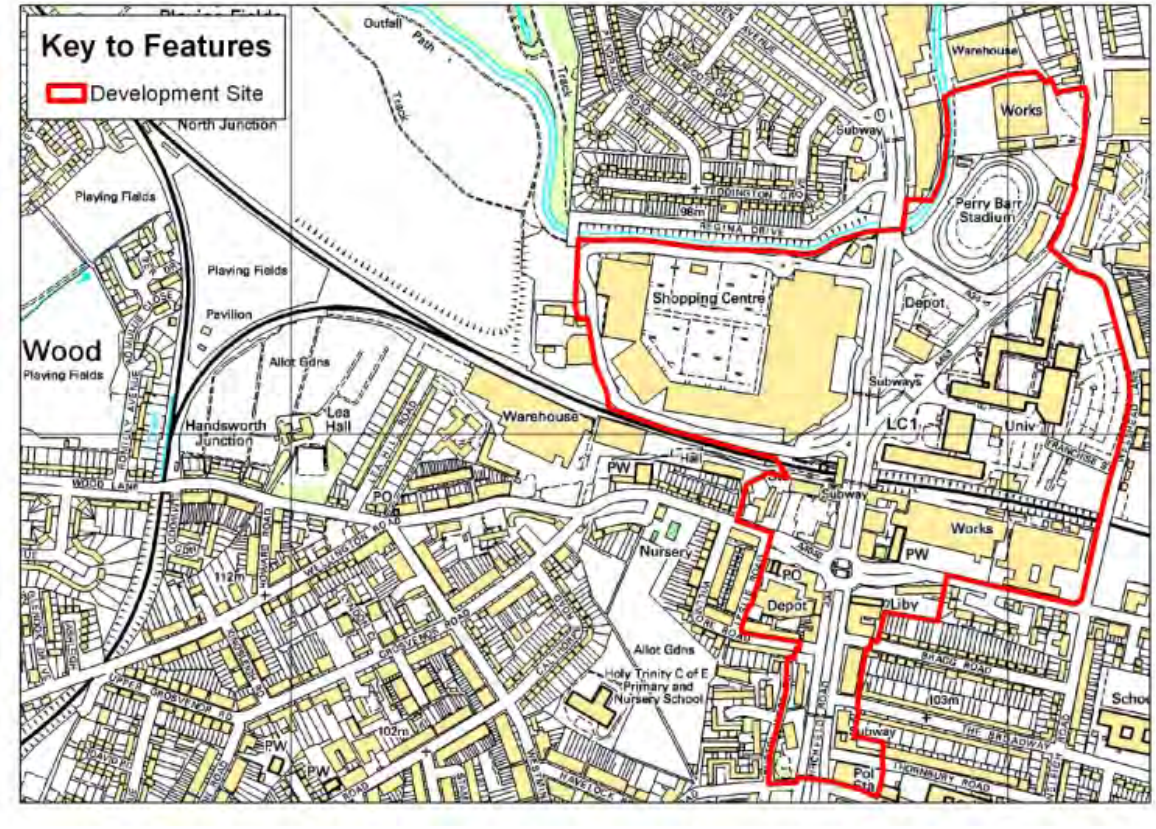
Susceptibility to Groundwater Flooding

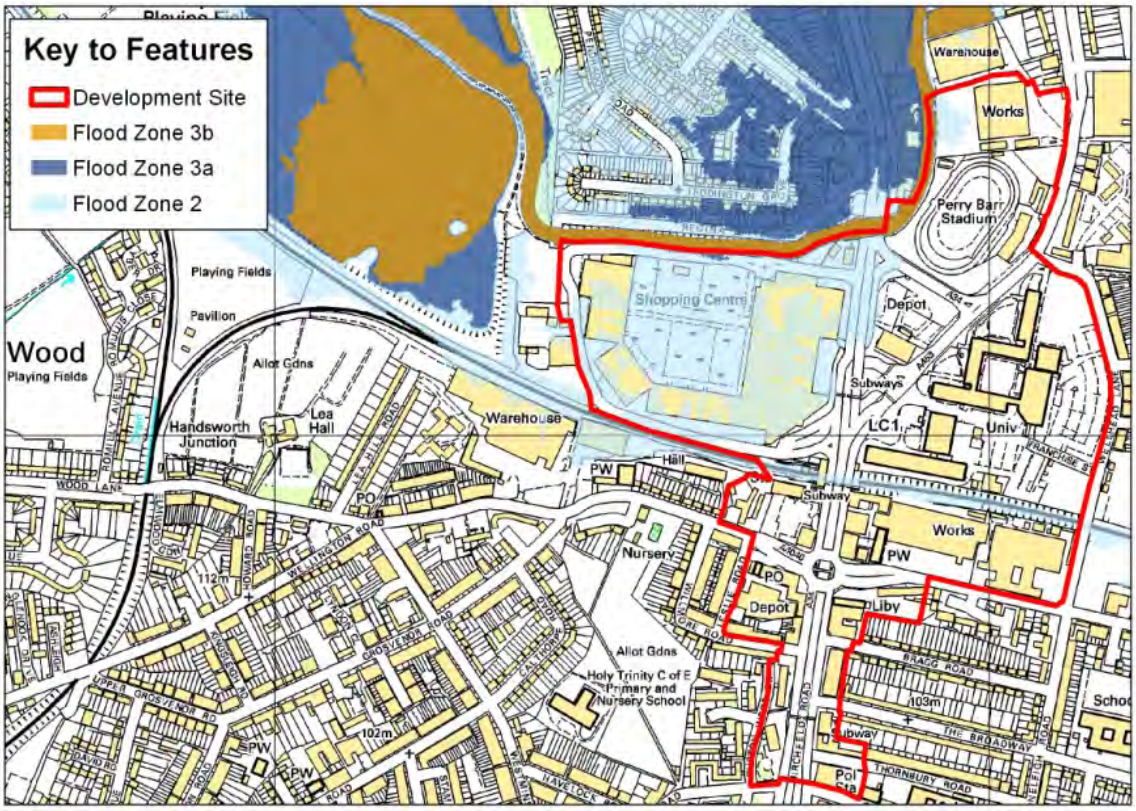
Site Summary Sheet: LC1 Perry Barr/Birchfield (Aston Lozells and Newtown AAP)



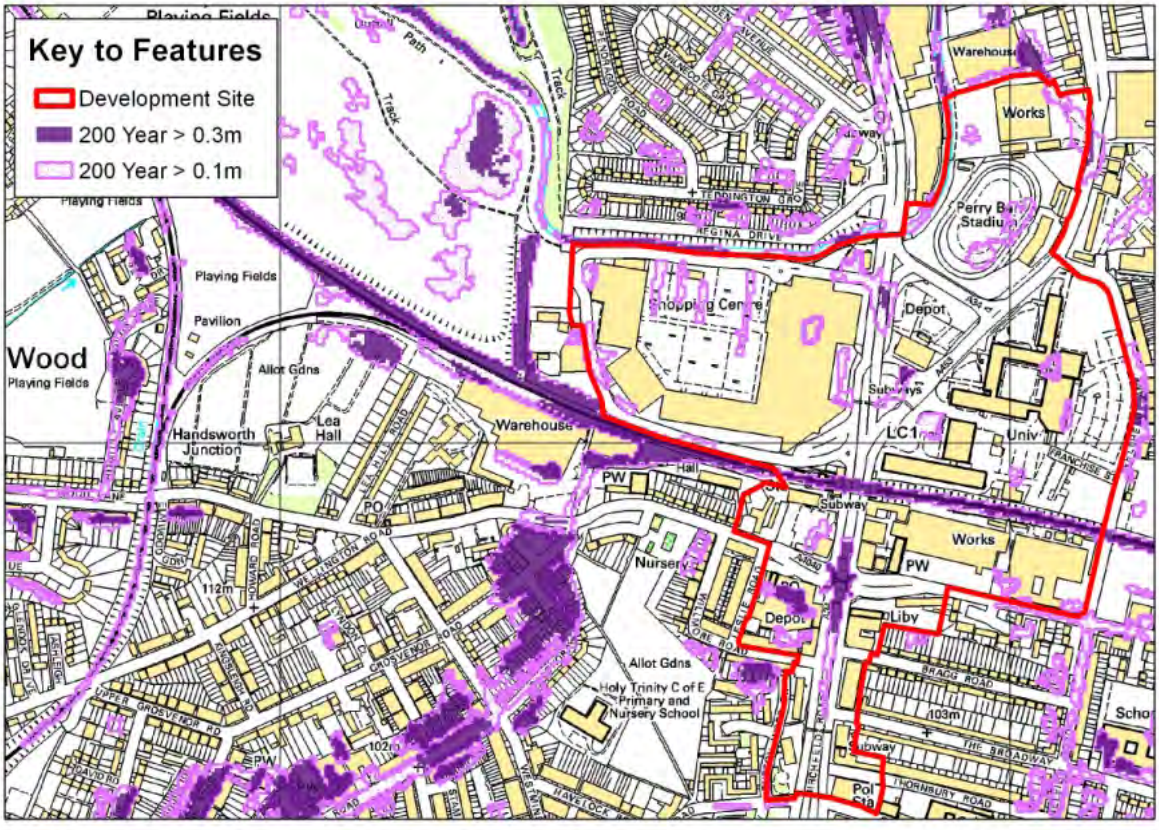
Site Name	AAP – LC1
Site Address	Perry Barr/Birchfield
National Grid Reference	SP 06783 90898
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Groundwater and surface water
Site Area (Ha)	38.3
Area within FZ1 (Ha)	28.4 (74%)
Area within FZ2 (Ha)	9.9 (26%)
Area within FZ3a (Ha)	0.6 (1.6%)
Area within FZ3b (Ha)	0.5 (1.3%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site?	The fluvial flood outline shows that the majority of the site is in Flood Zone 1 and hence has a low probability of flooding. The majority of the western side of the site is in Flood Zone 2 and has a medium probability of flooding. There is a very small section of land adjacent to northern boundary of the site in Flood Zone 3a and 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.9Ha >0.3m deep based on the FMfSW (0.5% AEP event) 3.2Ha >0.1m deep based on the FMfSW (0.5% AEP event)
Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.

Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 74% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where Less Vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a and 3b.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via the A34
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Perry Barr).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the majority of the site is outside FZ3a and FZ3b and has dry access and egress the Exception Test is likely to be passed.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a or 3b. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk as outline in the Aston, Lozells and Newtown AAP.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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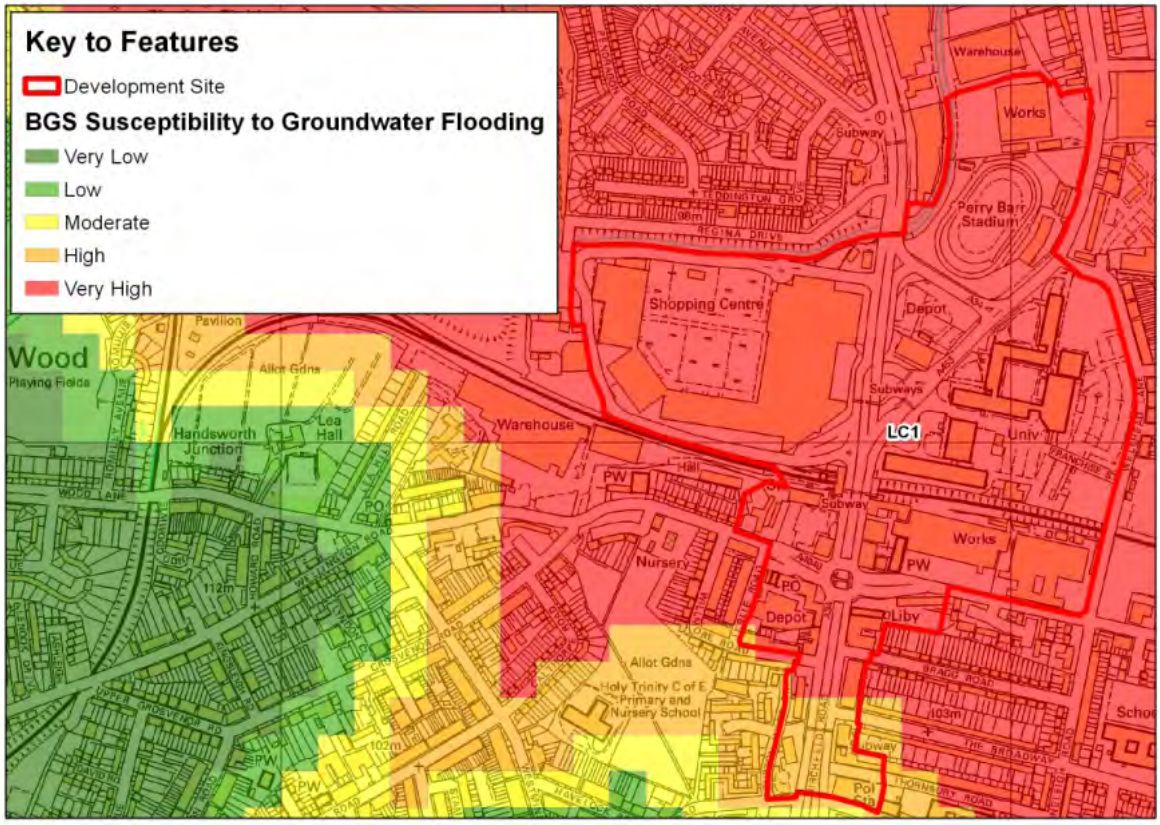
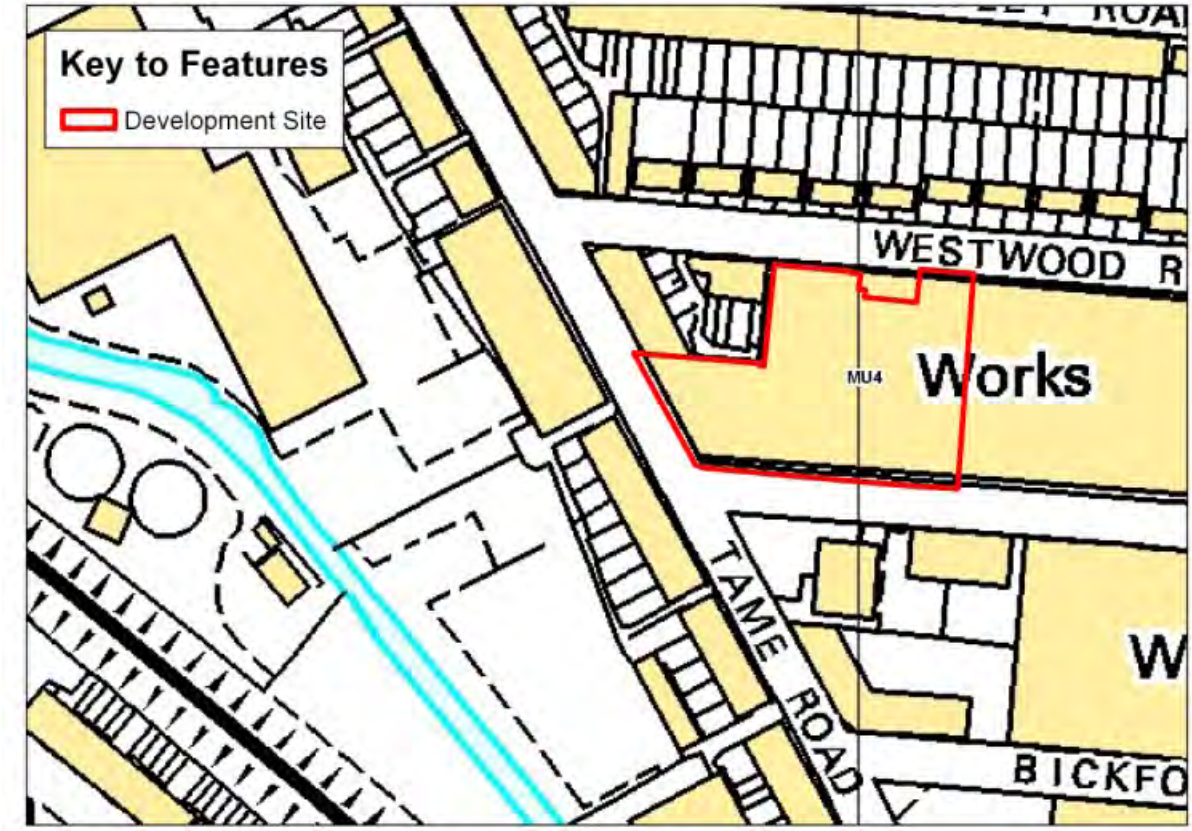
Susceptibility to Groundwater Flooding



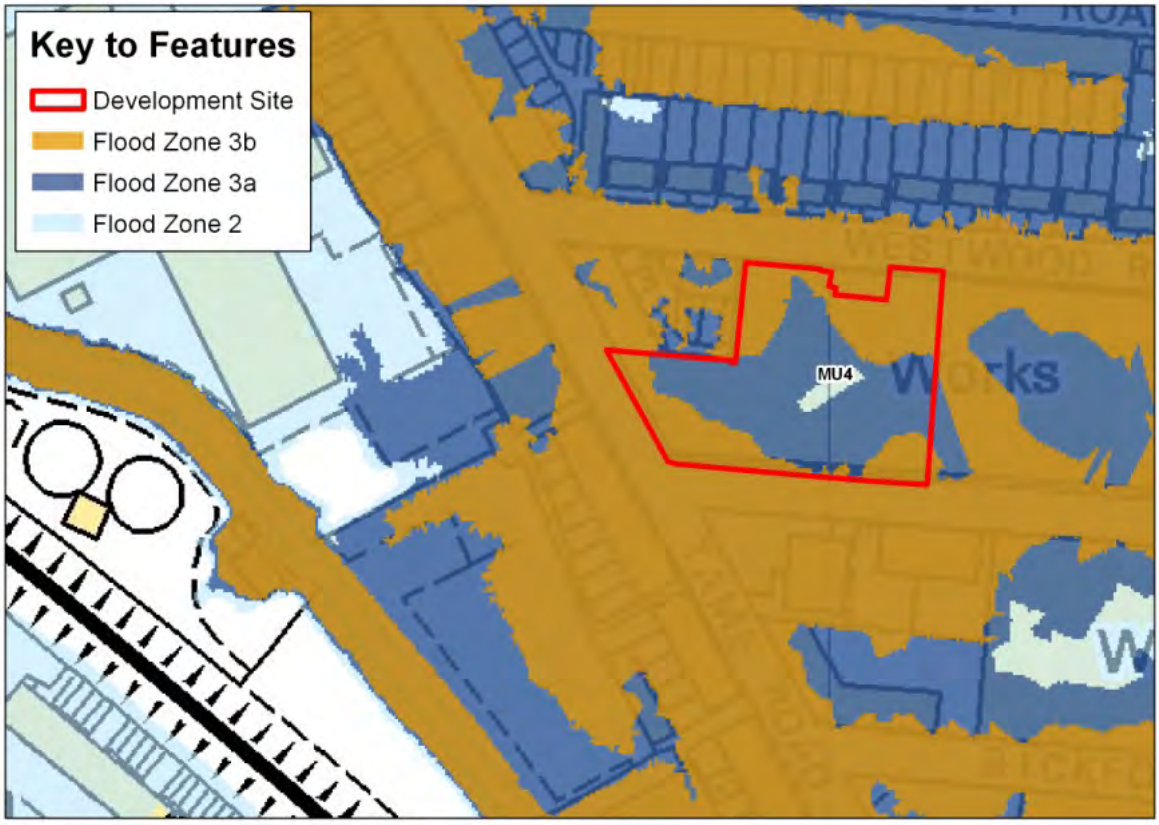
Site Summary Sheet: MU4 Westwood Road/Dulverton Road (Aston Lozells and Newtown AAP)



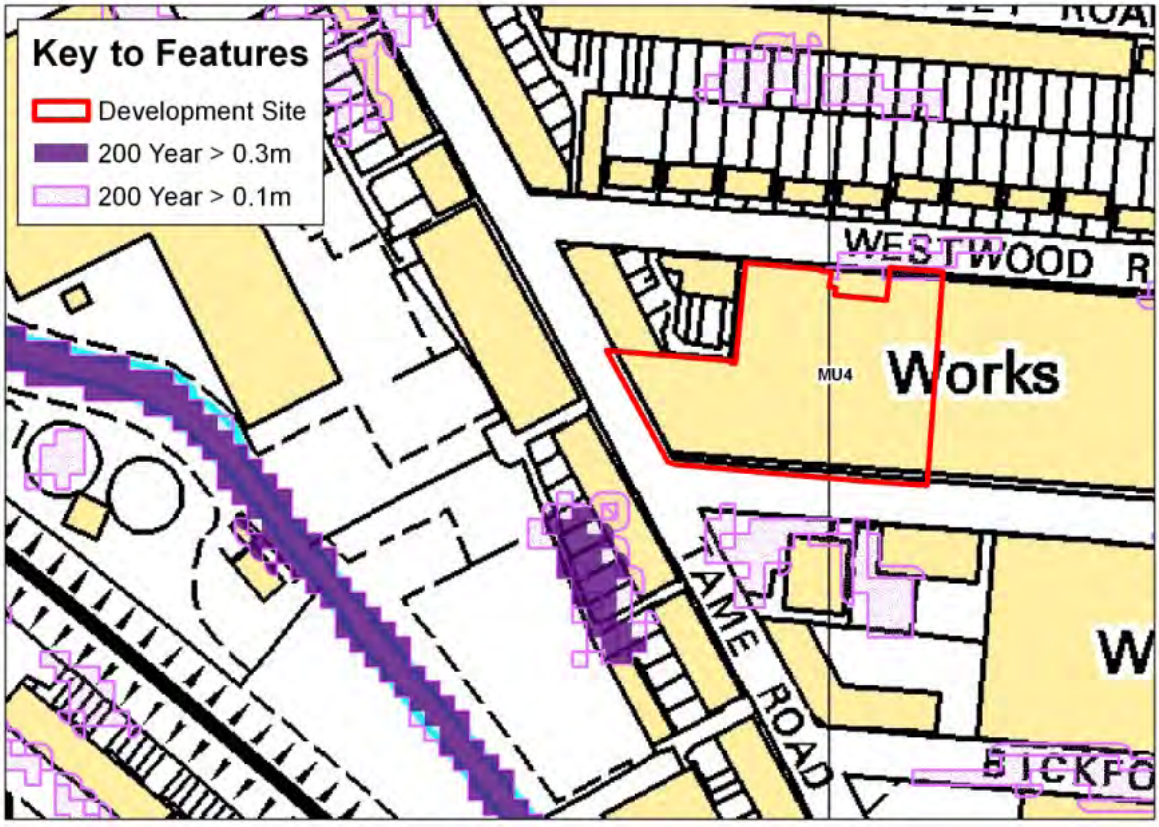
Site Name	AAP – MU4
Site Address	Westwood Road / Dulverton Road
National Grid Reference	SP 08333 90469
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Groundwater
Site Area (Ha)	0.58
Area within FZ1 (Ha)	0 (0%)
Area within FZ2 (Ha)	0.58 (100%)
Area within FZ3a (Ha)	0.57 (98%)
Area within FZ3b (Ha)	0.26 (45%)
Is the site protected by flood risk management assets?	Not currently, however this site is likely to benefit from the River Tame Strategy for Witton. This site would not be promoted in the short term and would only be brought forward if the Tame Strategy mitigates against the current flood risk. This is reinforced in the Aston, Lozells and Newtown AAP.
What is the flood risk / flood hazard to the site?	The fluvial flood outlines show that almost half of the site is at very high probability being within Flood Zone 3b and the remainder of the site is at high probability of flooding being within Flood Zone 3a. As the site would only be brought forward if the Tame Strategy for Witton mitigates against the current flood risk flood hazard mapping has not been undertaken for the site as it currently stands.
Is the site at risk from surface water flooding?	No

Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Not currently, development would only be brought forward if the Tame Strategy mitigates against the current flood risk.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	N/A
Is there safe access and egress to the site during a flood event for emergency service vehicles?	N/A
Is the site covered by flood warnings?	Yes, the site is covered by an EA Flood Warning service (River Tame at Witton and Salford Park).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	The site would not currently pass the Exception Test. The site is likely pass the Exception Test if the works proposed in the Tame Strategy for Witton are implemented, until this time this site will not be promoted for development. This is reinforced in the Aston, Lozells and Newtown AAP.
Recommendations / Future Data Needs	This site would not be promoted in the short term and would only be brought forward if the Tame Strategy for Witton mitigates against the current flood risk and the developer FRA demonstrates that the residual risk can be managed. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk as outline in the Aston, Lozells and Newtown AAP.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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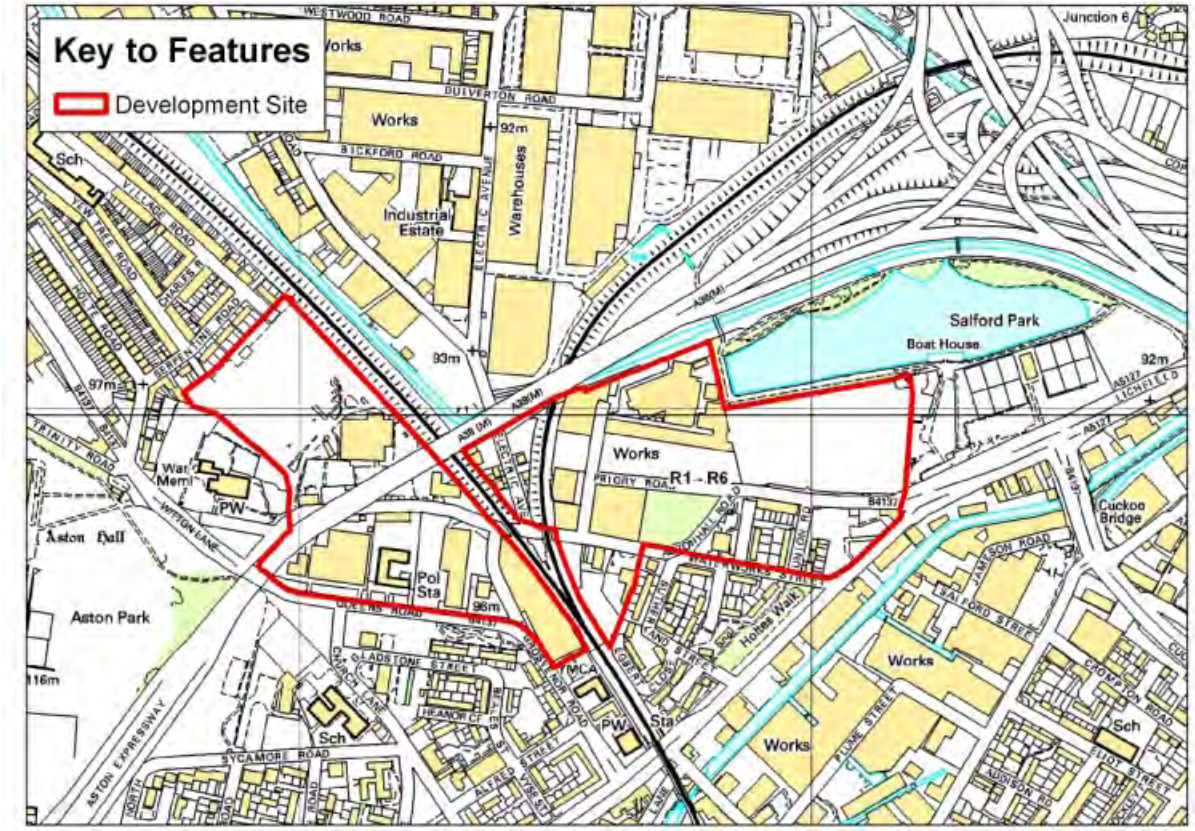
Susceptibility to Groundwater Flooding

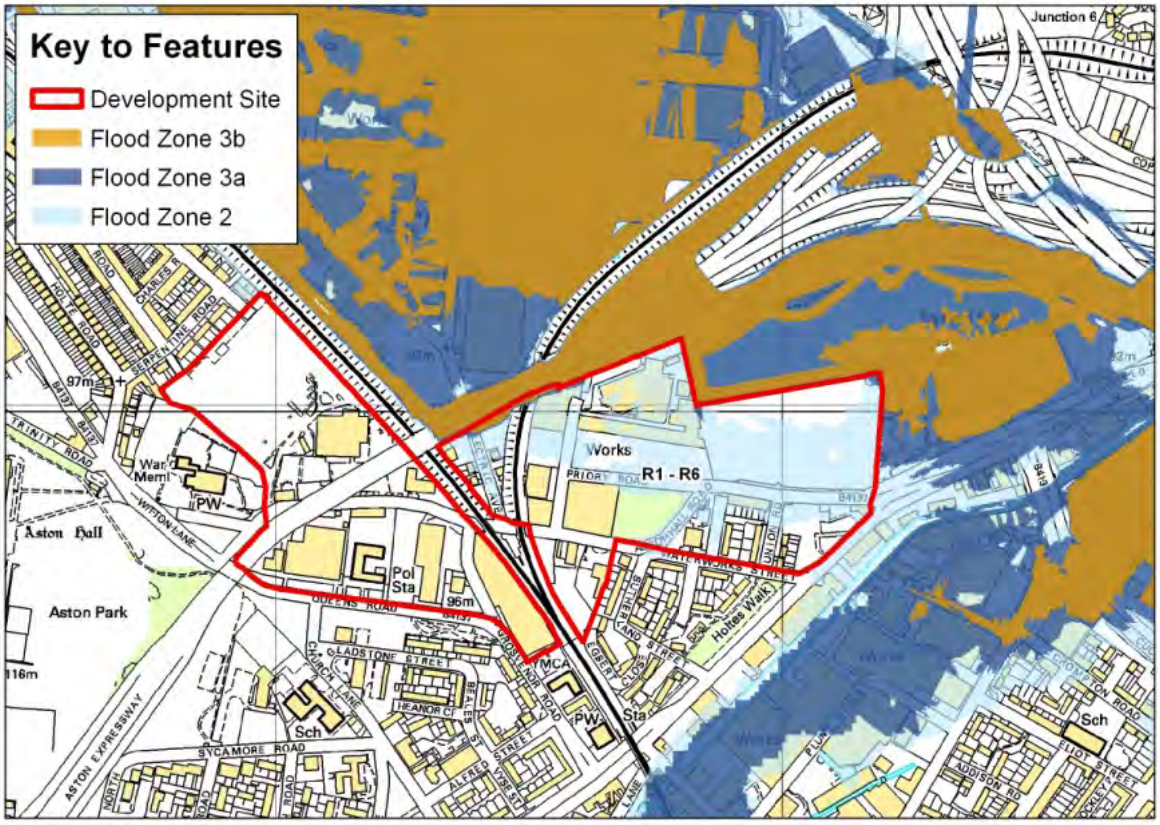
Site Summary Sheet: R1-R6 (Regional Investment Site) (Aston Lozells and Newtown AAP)



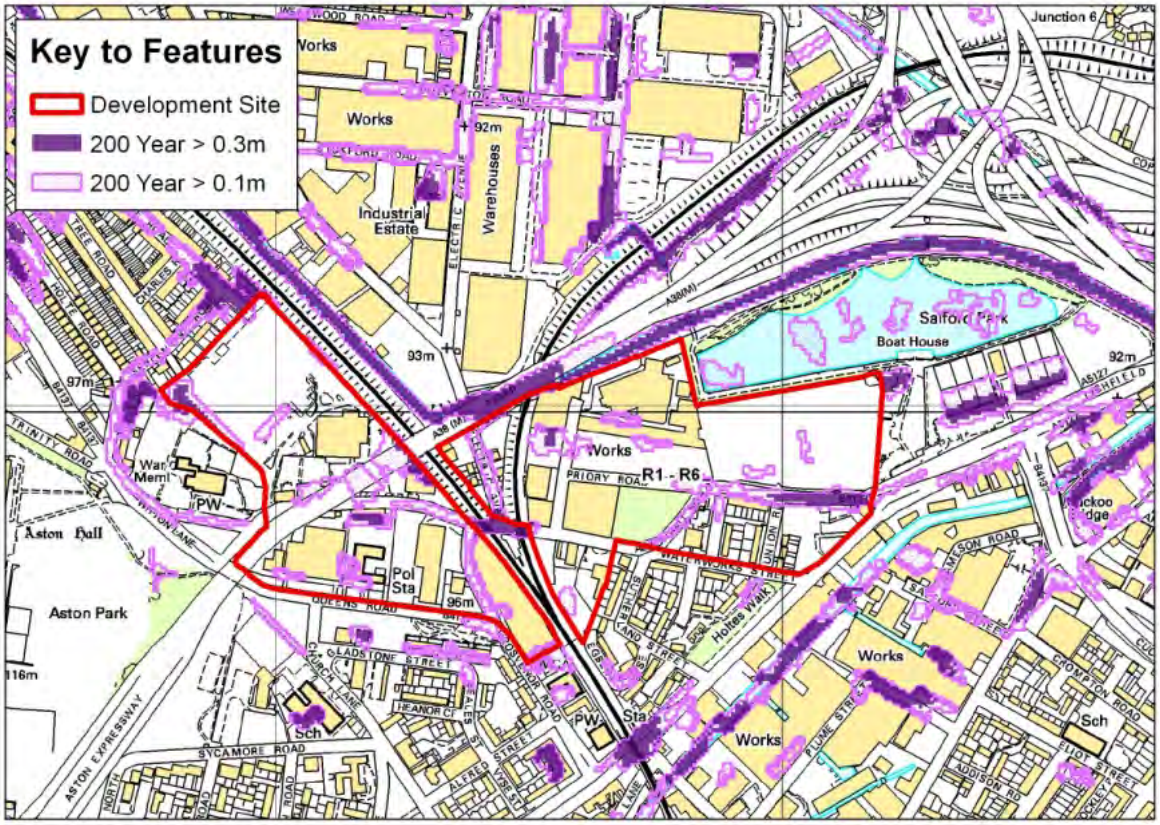
Site Name	AAP – R1-R6 (Regional Investment Site)
Site Address	Aston Hall Road/Priory Road/Queens Road
National Grid Reference	SP 08844 89899
Catchment	River Tame
Primary Source of Flood Risk	Fluvial from River Tame
Secondary Sources of Flood Risk	Groundwater and surface water
Site Area (Ha)	20.7
Area within FZ1 (Ha)	14.3 (69%)
Area within FZ2 (Ha)	6.4 (31%)
Area within FZ3a (Ha)	0.3 (1.4%)
Area within FZ3b (Ha)	0.1 (0.7%)
Is the site protected by flood risk management assets?	No.
What is the flood risk / flood hazard to the site?	The fluvial flood outline shows that the majority of the site is in Flood Zone 1 and hence has a low probability of flooding. The majority of the eastern side of the site is in Flood Zone 2 and has a medium probability of flooding. There is a very small section of land adjacent to northern boundary of the site in Flood Zone 3a and 3b. Flood hazard mapping has not been undertaken due to the limited extent of flood risk.
Is the site at risk from surface water flooding?	Yes. 0.5Ha >0.3m deep based on the FMfSW (0.5% AEP event) 2.5Ha >0.1m deep based on the FMfSW (0.5% AEP event)

Is the site at risk from groundwater flooding?	Yes. The site is defined as having a Very High susceptibility of flooding from groundwater sources. This will need further investigation to ensure the site is suitable for development.
Can the site be developed sequentially to avoid vulnerable uses on areas with high probability?	Yes. 83% of the site is located in FZ1, the majority of the remainder of the site is in FZ2 where Less Vulnerable development is acceptable. Development can avoid the very small area of land in FZ3a and 3b.
Will the development result in offsite impacts, e.g. increased runoff?	No. The site is brownfield with little pervious areas. As outlined in the Level 1 SFRA run-off should be attenuated to greenfield rate. A surface water drainage assessment must also be undertaken to demonstrate that the surface water run-off can be effectively managed without increasing flood risk elsewhere.
Is there dry access and egress to the site during a flood event for occupants?	Yes, via Aston Hall Road and Waterworks Street.
Is there safe access and egress to the site during a flood event for emergency service vehicles?	See above.
Is the site covered by flood warnings?	Yes, part of the site is covered by an EA Flood Warning service (River Tame at Witton and Salford Park).
Is compensatory flood storage required?	N/A
Can the loss of floodplain be compensated for within the site boundaries?	N/A
Can the development reduce flood risk?	Yes. Sustainable Drainage Systems (SuDS) can be used to attenuate surface water and reduce flood risk elsewhere by attenuating surface water. Although the potential groundwater flooding issues would need to be taken into account in designing the SuDS.
What is the Likelihood of the Exception Test being passed?	Good, as the majority of the site is outside FZ3a and FZ3b and has dry access and egress the Exception Test is likely to be passed.
Recommendations / Future Data Needs	Development will be possible if it can be demonstrated that flood risk will not be exacerbated elsewhere. Development should not be proposed within the area of the site in Flood Zone 3a or 3b. The developer should work closely with the Environment Agency to ensure that any proposals are complimentary to the Tame Strategy. Developer contributions may be sought for measures to reduce flood risk as outline in the Aston, Lozells and Newtown AAP.

Fluvial Flood Risk Map



Flood Map for Surface Water (FMfSW)



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Susceptibility to Groundwater Flooding