

Strategic Flood Risk Assessment

LOCAL DEVELOPMENT FRAMEWORK

ROYAL BOROUGH OF KINGSTON UPON THAMES

Level 1 and 2 | April 2011



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Executive Summary

Royal Borough of Kingston upon Thames is subject to fluvial (flooding caused by rivers) flood risk from the River Thames and its tributaries. The UK Climate Change projections indicate that extreme flooding events are predicted to occur more frequently in the future and this will result in increased risk of damage to infrastructure and homes. Kingston upon Thames is also affected by surface water flooding and experienced localised flooding in the summer of 2007. Flooding represents a risk to both property and life. It is essential therefore that planning decisions are informed, and take due consideration of the flooding risk posed to and by future development.

Kingston Town Centre is a vibrant commercial centre with considerable pressure for growth and redevelopment. To facilitate this demand, the Council prepared Kingston Town Centre Area Action Plan K+20 (Adopted 2008). The Kingston Town Centre Strategic Flood Risk Assessment Level 2 (SFRA) (Jacobs, 2007) was undertaken to inform this planning policy document and assessed K+20 proposal sites referred to here after as the SFRA (2007). A Borough-wide Strategic Flood Risk Assessment Level 1 was produced by Jacobs in 2008, referred to hereafter as SFRA (2008). This updated SFRA supersedes the SFRA (2007) and SFRA (2008) and incorporates the findings of both of these documents.

Why carry out a Strategic Flood Risk Assessment?

Flooding can result not only in costly damage to property, but can also pose a risk to life and livelihood. It is essential that future development is planned carefully, steering it away from areas that are most at risk from flooding, and ensuring that it does not exacerbate existing known flooding problems.

Planning Policy Statement 25: Development and Flood Risk (PPS25) has been developed to underpin decisions relating to future development (including urban regeneration) within areas that are subject to flood risk. In simple terms, PPS25 requires local planning authorities to review the variation in flood risk across their district, and to steer vulnerable development (e.g. housing) towards areas of lowest risk. Where this cannot be achieved and development is to be permitted in areas that may be subject to some degree of flood risk, PPS25 requires the Council to demonstrate that there are sustainable mitigation solutions available should flooding occur that will ensure that the risk to property and life is minimised (throughout the lifetime of the development).

The SFRA is the first step in this process, and it provides the building blocks upon which the Council's planning and development management decisions will be made. This SFRA has been updated in accordance with Planning Policy Statement 25: Development and Flood Risk 2010 (PPS25).

What is a Strategic Flood Risk Assessment?

The Royal Borough of Kingston upon Thames SFRA has been carried out to meet the following key objectives:

- To collate all known sources of flooding, including river, surface water (local drainage), sewers and groundwater, that may affect existing and/or future development within the Borough;
- To delineate areas that have a 'low', 'medium' and 'high' probability of flooding within the Borough, in accordance with PPS25, and to map these:

- Areas of 'high' probability of flooding are assessed as having a 1 in 100 or greater chance of

river flooding (>1%) in any year, and are referred to as High Risk Zone 3;

- Areas of 'medium' probability of flooding are assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% to 0.1%) in any year, and are referred to as Zone 2 Medium Probability;

- Areas of 'low' probability of flooding are assessed as having a less than 1 in 1000 chance of flooding (<0.1%) in any year, and are referred to as Zone 1 Low Probability.

- Within flood affected areas, to recommend appropriate land uses in accordance with the PPS25 *Sequential Test* that will not unduly place people or property at risk of flooding.
- Where flood risk has been identified as a potential constraint to future development, recommend possible flood mitigation solutions that may be integrated into the design (by the developer) to minimise the risk to property and life should a flood occur in accordance with the PPS25 *Exception Test*.

The Sequential Test

The primary objective of PPS25 is to steer vulnerable development towards areas of lowest flood risk. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. **Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may**

potentially be at risk of flooding) be contemplated. This is referred to as the Sequential Test.

As an integral part of the sequential approach, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur.

The Exception Test

Many towns within England are situated adjacent to rivers, and are at risk of flooding. The future sustainability of these communities relies heavily upon their ability to grow and prosper. PPS25 recognises that, in some Boroughs, including Royal Borough of Kingston upon Thames, restricting residential development from areas designated as Zone 3a High Probability may compromise the viability of existing communities within the Borough.

For this reason, PPS25 provides an Exception Test. Where a local planning authority has identified that there is a strong planning based argument for a development to proceed that does not meet the requirements of the Sequential Test, it will be necessary for the Council to demonstrate that the Exception Test can be satisfied. For the Exception Test to be passed it must be demonstrated that:

- *"...the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage, the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
- *the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonable*

- alternative sites on previously developed land; and*

a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.”

Summary of the Main Changes

The SFRA (2008) recommended that the document is reviewed on a regular basis because it is a 'Living Document'. This updated SFRA reflects new knowledge of flood risk within the Borough and national, regional and local planning policy amendments. It is worth noting that the

structure of the document has changed and has now been split into two parts. The first part of the SFRA provides key information for development management, planning applicants and forward planning. The second part sets out the the policy and legal background, sustainable management of flood risk, local community actions to reduce flood damage, emergency planning, insurance and conclusions. Information on data collection and interpretation are located in the appendices. Most of the changes in this SFRA are minor, however the more substantial changes from the SFRA (2007) and SFRA (2008) are listed below. They are as follows:

Table 1 : Summary of SFRA Main Changes

Section	Summary
Flood Risk in Kingston upon Thames	<ul style="list-style-type: none"> • New section on surface water flooding (including SWMP information, Surface Water maps) • New section on sewer flooding • Update on Climate Change section with regard to UK Climate Projections (2009) • Update on Life of Development, in line with published PPS25 Practice Guide
Planning & Development Management	<ul style="list-style-type: none"> • Update to Planning and Development Management • Update to Spatial Planning & Development Management Recommendations Table
SFRA Interpretation	<ul style="list-style-type: none"> • New section on Kingston Town Centre K+20 Character Areas • Update to Kingston Town Centre K+20 Proposal Sites, in particular to PS10 and PS14 • Update to Borough Character Areas, in particular to areas adjacent to Beverley Brook due to a shrinkage of flood zone 3b • Update to Unitary Development Plan Proposal Sites, in particular PS35

Section	Summary
Detailed Flood Risk Assessments	<ul style="list-style-type: none"> ● New section on Flood Warning and Evacuation Plans ● Update to Basements ● Update to Sustainable Drainage Systems section, particularly with regard to drainage hierarchy
Legal and Policy Requirements	<ul style="list-style-type: none"> ● Flood and Water Management Act (2010) ● Flood Risk Regulations (2009) ● Update on PPS25 (March 2010) and Practice Guide Companion (2009) ● Update on Supplement PPS1: Planning and Climate Change (2007) ● Update in line with adopted London Plan (2008) and consultation of the draft replacement London Plan (2009) ● Update in line with adopted Regional Flood Risk Appraisal (2009) ● Update on Local Planning Policy in line with Core Strategy publication version (January 2011)
Sustainable Management of Flood Risk	<ul style="list-style-type: none"> ● Update on Lead Local Flood Authority ● Update to Thames Catchment Flood Management Plan (2008) ● Updated on Lower Thames Strategy ● Update to Thames Estuary 2100 Strategy
Local Community Actions to Reduce Flood Damage	<ul style="list-style-type: none"> ● Update of Local Community Actions to Reduce Flood Damage, particularly with regard to designing for flood risk, including flood resistance and resilience
Emergency Planning	<ul style="list-style-type: none"> ● Update on Environment Agency's Flood Warning Service
Insurance	<ul style="list-style-type: none"> ● Update in line with latest information

Section	Summary
Data Collection	<ul style="list-style-type: none"> • Areas Susceptible to Surface Water (2009) • Flood Map for Surface Water (2010) • Flood Map Flood Zones (latest version available from the Environment Agency) • Beverley Brook detailed flood risk mapping (2009) • Hogsmill detailed flood risk mapping (2006) • Lower Thames (Reach 4) detailed flood risk mapping (2010)
Data Interpretation	<ul style="list-style-type: none"> • Update on Climate Change • Flood Hazard
*Deletions	<ul style="list-style-type: none"> • Appendix B – removal of Environment Agency Flood Warning Service as this is included in Emergency Planning section • Appendix C – removal of Delineation of Function Floodplain Zone 3b for Beverley Brook Catchment

SFRA Outcomes

Kingston upon Thames has been delineated into zones of low, medium and high probability of flooding, based upon existing available information provided by the Environment Agency. Detailed flood risk mapping for the River Thames, Hogsmill River and Beverley Brook and the latest Environment Agency Flood Zone Maps have been adopted as the basis for the SFRA for other watercourses.

Zone 3b (Functional Floodplain)

Areas subject to flooding up to (and including) the 5% once in every 20 years on average have been delineated. These areas have been sub-delineated on the basis of current land use, i.e. open space (i.e. 'Zone 3b Functional Floodplain') vs areas that are currently developed.

The latter are areas that are subject to relatively frequent flooding, and may be subject to fast flowing and/or deep water. However PPS25 recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight' areas of existing urban development. Whilst it may be impractical to refuse all future regeneration within these areas, careful consideration must be given to future sustainability, and a suite of planning policies have been developed accordingly. These areas have been designated as Zone 3b (Developed Land).

Zone 3a High Probability

Areas subject to flooding up to (and including) the 1%, once in every 100 years on average (i.e. Zone 3a High Probability) have been identified. Residential development should be avoided in these areas wherever possible. It is recognised

however that there may be strong planning arguments as to why housing may be required in these areas.

To meet the requirements of the Exception Test, it will be necessary for the Council to demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk. The Council must also demonstrate that the development is on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land.

The SFRA has outlined specific development management conditions that should be placed upon development within Zone 3a High Probability to minimise both the damage to property, and the risk to life in case of flooding. It is essential that the developer carries out a detailed Flood Risk Assessment (FRA) to consider the site-based constraints that flooding may place upon the proposed development.

Zone 2 Medium Probability

Areas subject to flooding in events exceeding the 100 year event, and up to (and including) once in every 1000 years on average (i.e. Zone 2 Medium Probability) have been identified. 'Highly vulnerable' development (e.g. essential community services and emergency services,) should be avoided in these areas. There are generally no other restrictions placed upon future development in these areas, however it is important to ensure that the developer takes account of possible climate change impacts to avoid a possible increase in the risk of flooding in future years (achieved through completion of a simple Flood Risk Assessment).

Zone 1 Low Probability

There are no restrictions placed on development within Zone 1 Low Probability by PPS25. Consideration must be given to the potential risk of flooding from other sources, ensuring that future development

is not advertently placed at risk. It is also essential to ensure that future development does not exacerbate the current risk posed to the existing built environment.

The Way Forward

A considerable proportion of the Borough is at risk of flooding, in particular Kingston Town Centre. The risk of flooding posed to properties within the Town Centre arises from a number of sources including river flooding, localised runoff, sewer and groundwater flooding.

A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for the Borough.

Where other planning considerations must guide the allocation of sites and the Sequential Test cannot be satisfied, specific recommendations have been provided to assist the Council and the developer to meet the Exception Test. These should be applied as development management conditions for all future development.

Council policy is essential to ensure that the recommended development management conditions can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management. Current policy has been reviewed in light of the findings and recommendations of this SFRA.

Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA.

A Living Document

This SFRA has been developed in accordance with PPS25. The SFRA has been developed by building heavily upon existing knowledge with respect to flood risk within the Town Centre and Borough-wide. The Environment Agency regularly review and update their Flood Zone Maps on a quarterly basis and has a rolling programme of detailed flood risk mapping. This will improve the current knowledge of flood risk within the Borough, and may marginally alter predicted flood extents. This may therefore influence future development management decisions within these areas. It is imperative that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives and an improving understanding of flood risk within the Borough.

Web Resources

Further information is available via the following links:

- Planning Policy Statement 25: Flood Risk and Development
<http://www.communities.gov.uk/publications/planningandbuilding/pps25floodrisk>
- Royal Borough of Kingston upon Thames - Planning and Flood Risk
<http://www.kingston.gov.uk>
- Environment Agency Standing Advice
<http://www.environment-agency.gov.uk/research/planning/default.aspx>
- Environment Agency Flood Warning Service
<http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx>

1 Introduction

1.1 Flooding represents a significant risk to both property and life and it is essential that planning decisions are informed, and take due consideration of the risk posed to (and by) future development by flooding. PPS25 requires that local planning authorities prepare a SFRA in consultation with the Environment Agency. The purpose of the SFRA is to:

- a. determine the variations in flood risk across the Borough taking account of all forms of flooding, and the impacts of climate change;
- b. inform and support the preparation of revised flood risk management policies in the Council's emerging Local Development Framework (LDF);
- c. inform the Sustainability Appraisal of Local Development Documents;
- d. provide the basis to apply the Sequential and Exception Tests in the site allocation and development control processes;
- e. Assist the the development control process by providing a more informed response to development proposals, influencing the design of future development
- f. assist emergency planning.

1.2 Previously Jacobs was commissioned by the Royal Borough of Kingston upon Thames to produce the Kingston Town Centre SFRA 2007 Level 2 to inform the K+20 Area Action Plan for Kingston Town Centre and to develop a Borough-wide SFRA 2008 Level 1.

1.3 This report and the supporting mapping represents Level 2 SFRA for Kingston Town Centre and Level 1 SFRA for the rest of the Borough. This SFRA should be used by the Council to inform the application of the Sequential Test.

2 Flood Risk in the Royal Borough of Kingston upon Thames

- 2.1** The northern and eastern boundaries of the Royal Borough of Kingston upon Thames are delineated by the River Thames and Beverley Brook respectively, and the Hogsmill River flows through the heart of the Borough. A review of potential flood risk from all sources has been carried out and is outlined below. Details about data collection and interpretation are located in the appendices of this SFRA.
- 2.2** There are 6764 properties (figures are based on Zone 2 medium probability) which are at risk of fluvial flooding in the Borough (RBK Multi Agency Flood Plan 2010/2011). Flooding from rivers within the Royal Borough of Kingston has historically been largely contained to Kingston upon Thames town centre, within which both the River Thames and the River Hogsmill have broken their banks, inundating property and disrupting livelihood. The approximate number of properties in Kingston Town Centre which are at risk of fluvial flood risk are 57 in zone 3b, 1144 only in zone 3a and 1103 only in Zone 2.
- 2.3** Figure 1 below shows the historic flood zone in Kingston Town Centre. Over time the river corridor has become increasingly constrained by urban development in Kingston Town Centre. Flooding has occurred within the Borough as recently as July 2007, during which a number of roads and rail connections were severely disrupted following a prolonged period of particularly heavy rain.

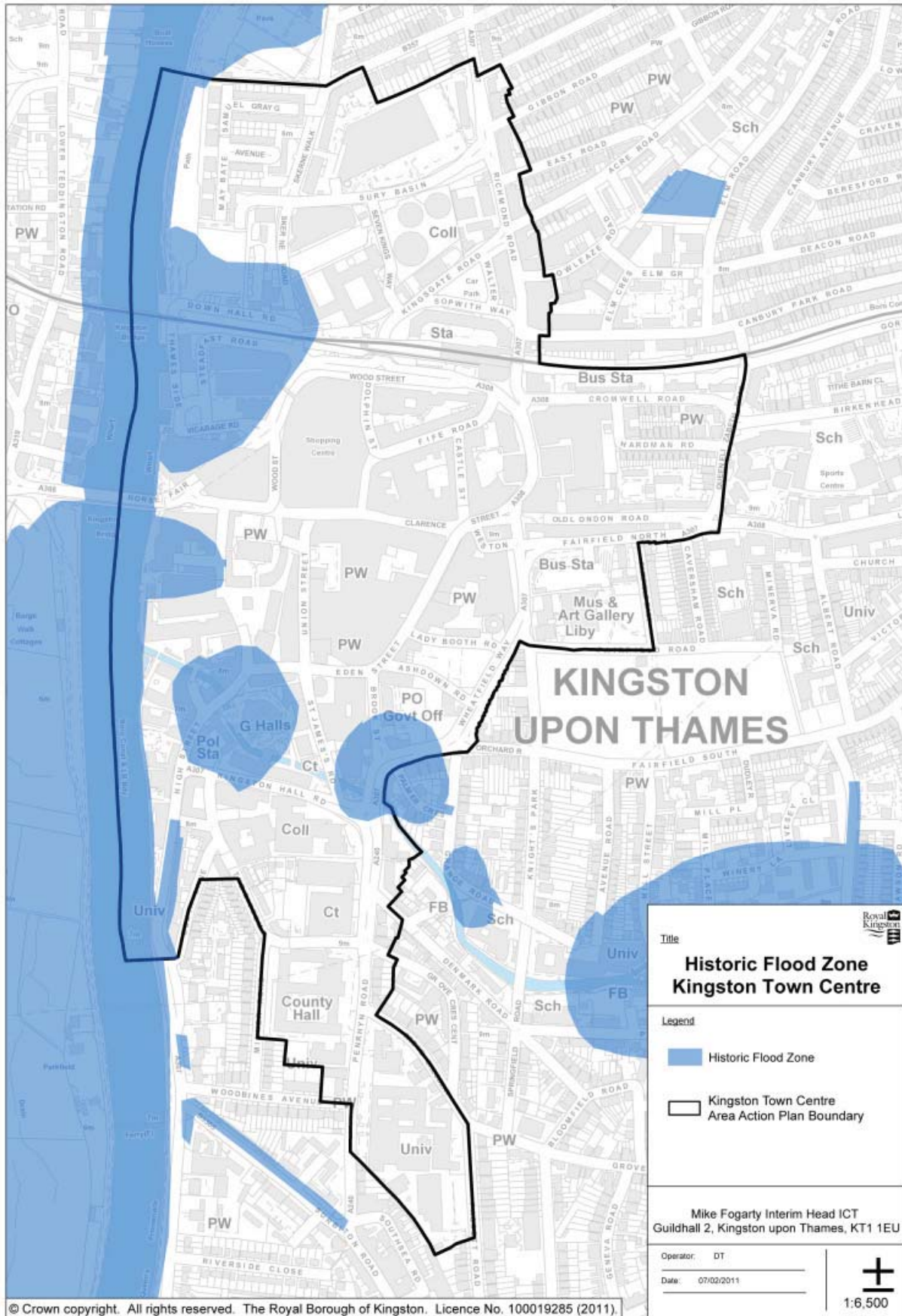
Other Sources of Flooding

- 2.4** It is essential to recognise that flood risk within the Borough is not limited solely to flooding of the main rivers. There is a risk to properties as a result of groundwater flooding, exacerbated by high river levels. Localised flooding as a result of local catchment runoff and/or sewer system failure following heavy rainfall is also a known risk to properties.
- 2.5** It is vitally important that planning decisions recognise the potential risk that these additional sources of flooding may pose to property, and that development is planned accordingly. In addition to property damage, flooding can affect lives and livelihoods. It is absolutely essential that future development (particularly residential development) is not placed within areas of the Borough within which the safety of residents cannot be assured in times of flood.

A Sustainable Approach

- 2.6** As highlighted throughout the SFRA, the potential risk of flooding is increasing due to pressure for future development and climate change. Future investment in flood defence cannot be assured, and for this reason, it is imperative that local government works to proactively deliver a reduction in flood risk through the planning process. PPS25, regional planning policy, and the Environment Agency require planners to guide vulnerable development away from areas that are most at risk. Sustainable design techniques are also very important to ensure that, where a degree of flood risk is inevitable, the risk to property and life is minimised. The core recommendations of this SFRA have been developed accordingly.

Figure 1 Historic Flood Zone Kingston Town Centre



2.1 Fluvial Flooding - Delineation of PPS25 Flood Zones

2.7 The risk of flooding to property from rivers within the wider Borough of Kingston is relatively low. The river valleys are relatively well defined, and effective planning controls have prevented development from encroaching heavily upon the waterway corridors of the River Hogsmill and Beverley Brook. Consequently, a large proportion of the delineated PPS25 flood zones are currently open space.

Delineation of the PPS25 Flood Zones

2.8 It is emphasised that the **risk** of an event (in this instance a flood event) is a function of both the **probability** that the flood will occur, and the **consequence** to the community as a direct result of the flood. PPS25 endeavours to assess the likelihood (or

probability) of flooding, categorising the Borough into zones of low, medium and high probability. PPS25 then provides recommendations to assist the Council to manage the consequence of flooding in a sustainable manner, for example through the restriction of vulnerable development in areas of highest flood risk.

2.9 To this end, a key outcome of the SFRA process is the establishment of flood maps that will inform the application of the Sequential Test in accordance with Annex D, Table D1 of PPS25. To inform the planning process, it is necessary to review flood risk across the area, categorising the area in terms of the likelihood (or probability) that flooding will occur.

2.10 The Borough has been delineated into the PPS25 fluvial flood zones summarised below and presented in Figures 8 to 17.

Table 2 : Delineated Flood Zone Descriptions

Delineated Flood Zone	Description
Zone 3b Functional Floodplain	Areas of the region susceptible to flooding within which “ <i>water has to flow or be stored in times of flood</i> ” (PPS25), or land which would flood with an annual probability of a 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood.
Zone 3a High Probability	Land assessed as having a 1 in 100 or greater annual probability (i.e. 1%) of fluvial flooding, or a 1 in 200 or greater annual probability (i.e. 0.5%) of tidal flooding, in any year.
Zone 2 Medium Probability	Land assessed as having between a 1 in 100 (i.e. 1% AEP) (fluvial), or 1 in 200 (0.5% AEP) (tidal), and 1 in 1000 (i.e. 0.1% AEP) annual probability of flooding in any year.
Zone 1 Low Probability	Land assessed as having a less than 1 in 1000 annual probability of flooding in any year (i.e. 0.1% AEP).

Delineation of Zone 3b Functional Floodplain

2.11 Zone 3b Functional Floodplain is defined as those areas in which “*water has to flow or be stored in times of flood*”. The definition of functional

floodplain remains somewhat open to subjective interpretation. PPS25 states that “*SFRAs should identify this Flood Zone (land which would flood with an annual 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 LPA and the Environment Agency, including water conveyance routes).*” For the purposes of the Kingston Borough SFRA, Zone 3b has been defined in the following manner:

- land where the flow of flood water is not prevented by flood defences or by permanent buildings or other solid barriers from inundation during times of flood;
- land which provides a function of flood conveyance (i.e. free flow) or flood storage, either through natural processes, or by design (e.g. washlands and flood storage areas);
- land subject to flooding in the 5% AEP (1 in 20) flood event (i.e. relatively frequent inundation expected, on average once every 20 years).

2.12 Detailed modelled flood has been provided by the Environment Agency for the River Thames, River Hogsmill and Beverley Brook, providing the basis for the delineation of Zone 3b Functional Floodplain.

Delineation of Zone 3a High Probability

2.13 Zone 3a High Probability is defined as those areas of the Borough with a 1% AEP (100 year) or greater chance of flooding. The detailed modelling outputs developed by the Environment Agency have been adopted for the delineation of Zone 3a High Probability.

Delineation of Zone 2 Medium Probability

2.14 Zone 2 Medium Probability is defined as those areas of the Borough that are situated between the 0.1% AEP (1 in 1000 year) and the 1% AEP (1 in 100 year) flood extents. In this instance, Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map.

Delineation of Zone 1 Low Probability

2.15 Zone 1 Low Probability is defined as those areas of the Borough that are situated above (or outside of) the 0.1% AEP (1000 year) flood extent. For SFRA purposes, this incorporates all land that is outside of the shaded Zone 2 and Zone 3 flood risk areas (as defined above).

2.2 Assessment of Risk to Life (Flood Hazard)

2.16 The speed and depth with which the River Thames and its tributaries flood into developed areas of the Royal Borough of Kingston is an important consideration. Deep, fast flowing water may potentially pose risk to life. This must be considered when planning future development, see Figure 2 Royal Borough of Kingston upon Thames Flood Hazard and Figure 3 Kingston Town Centre Flood Hazard (refer to Appendix B: Data Collection and Appendix C: Data Interpretation for further details on flood hazard modelling).

Flood Hazard due to overbank flooding

2.17 Detailed modelling indicates that the likelihood of a rapid river level rise within the River Thames system, resulting in the rapid inundation of urban areas that may pose a risk to life, is considered to be very small. This is primarily due to a relatively large catchment area, resulting in a generally extended response time. In simple

terms, the time between a rainfall event occurring and river levels rising to the point at which flooding occurs generally exceeds 18 hours at Kingston upon Thames.

- 2.18 However, in some parts of the Town Centre, there are areas in which the depth and velocity of overland flooding is high caused by the Hogsmill River which poses a potential risk to life. It is essential that development is restricted within these areas, and that the Kingston Borough emergency response plan (flooding) is developed with due consideration of these hazards.
- 2.19 Localised flash flooding, associated with surface water runoff from the local vicinity during heavy rainfall will clearly occur much more rapidly. Flooding of this nature will tend to disperse relatively quickly and is unlikely to result in deep, fast flowing floodwaters. The depth of flooding within overbank developed areas is typically relatively low, and is unlikely to pose a risk to life.
- 2.20 The River Hogsmill and Beverley Brook catchments are relatively small (in comparison to the River Thames) and will respond far more quickly, with river levels rising typically within 1 to 6 hours of a rainfall event. Within the Royal Borough of Kingston, outside of the town centre relatively few properties and/or roads are at risk of fluvial flooding. Furthermore, the extent, depth and velocity of the flow overland are generally low. For this reason, overbank flooding from the River Hogsmill and/or Beverley Brook is considered unlikely to pose an immediate risk to life.

Flood Hazard due to Reservoir Failure

- 2.21 There are no known water storage facilities within or adjacent to the Borough that may pose a potential risk of flooding to properties within the Borough.

Flood Hazard due to Flood Defence Failure

- 2.22 Two formal flood defence structures have been identified within the Environment Agency’s National Flood & Coastal Defence Database (NFCDD), situated at the Sewage Treatment Works (River Hogsmill) and MotspurPark (Beverley Brook) respectively. These appear to be situated at the periphery of the natural floodplain, and therefore during a flooding event, the depth of water behind the embankment will be very minimal. Consequently, the likelihood of these defences suffering a catastrophic collapse and potentially posing a risk to life is considered negligible.
- 2.23 There are a number of embankments situated throughout the Borough that alter the natural progression of floodwater as it flows overland (i.e. once breaking out of the river). These embankments are typically raised road or rail structures that clearly have not been constructed to hold water. As water levels rise however, these embankments will provide a barrier to the flow, altering the flooding regime. Ponding may occur behind the embankments, increasing the depth and width of the floodplain. Conversely however, areas on the ‘dry side’ of the embankments may be offered a degree of protection against flooding that they would not otherwise receive if the floodwaters were permitted to take their natural course.

2.24 The structures within the Borough that are recognised as 'informal flood defences' include (for example) Robin Hood Way at Kingston Vale, and the railway embankment at Motspur Park. These structures are typically substantial engineered embankments that are extremely unlikely to suffer

catastrophic failure as a result of flooding. For this reason, the risk of catastrophic failure resulting in a direct risk to life at these locations is considered negligible, and therefore the flood hazard associated with these structures has not been considered further in this instance.

Figure 2 Flood Hazard - Borough Overview

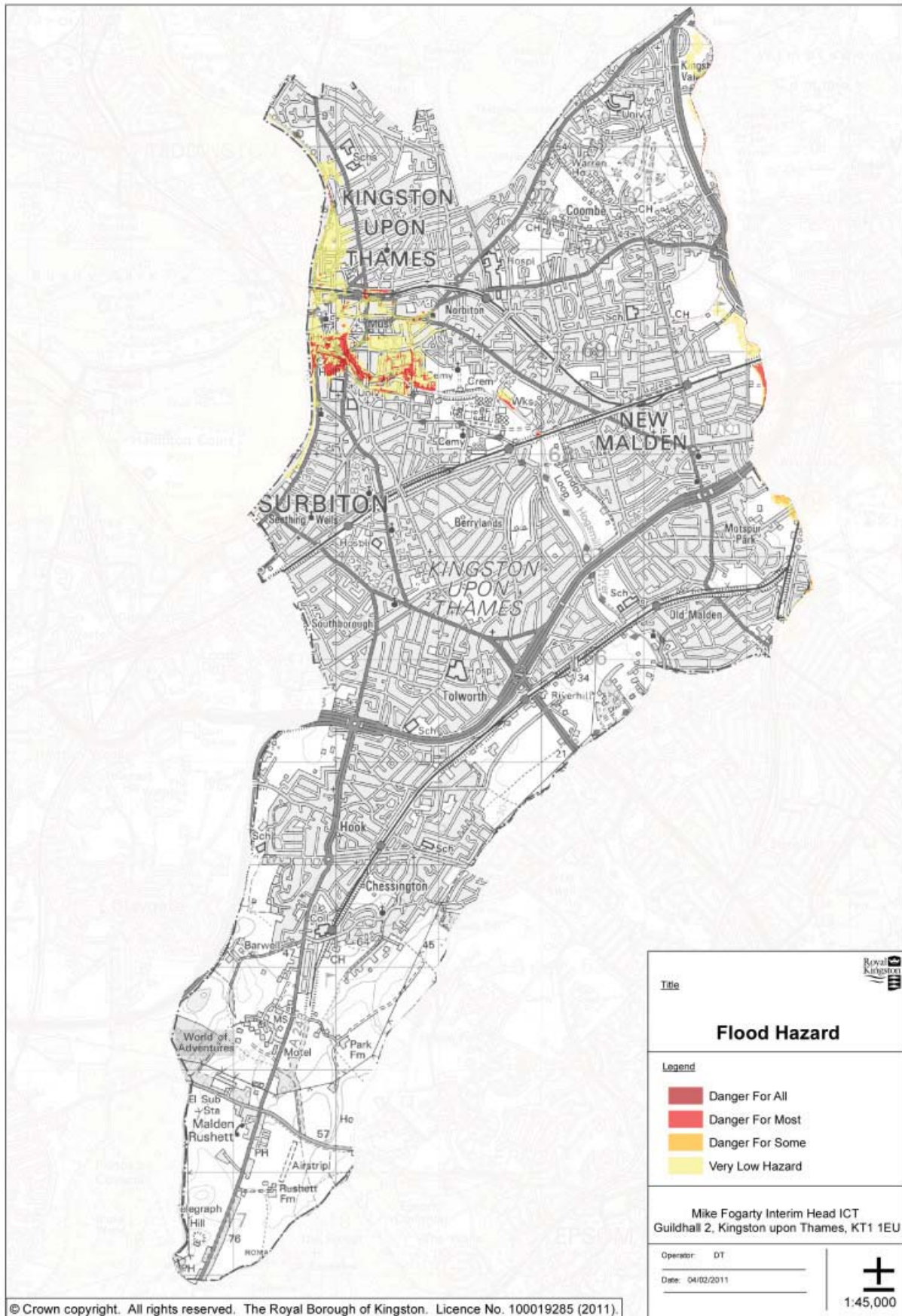
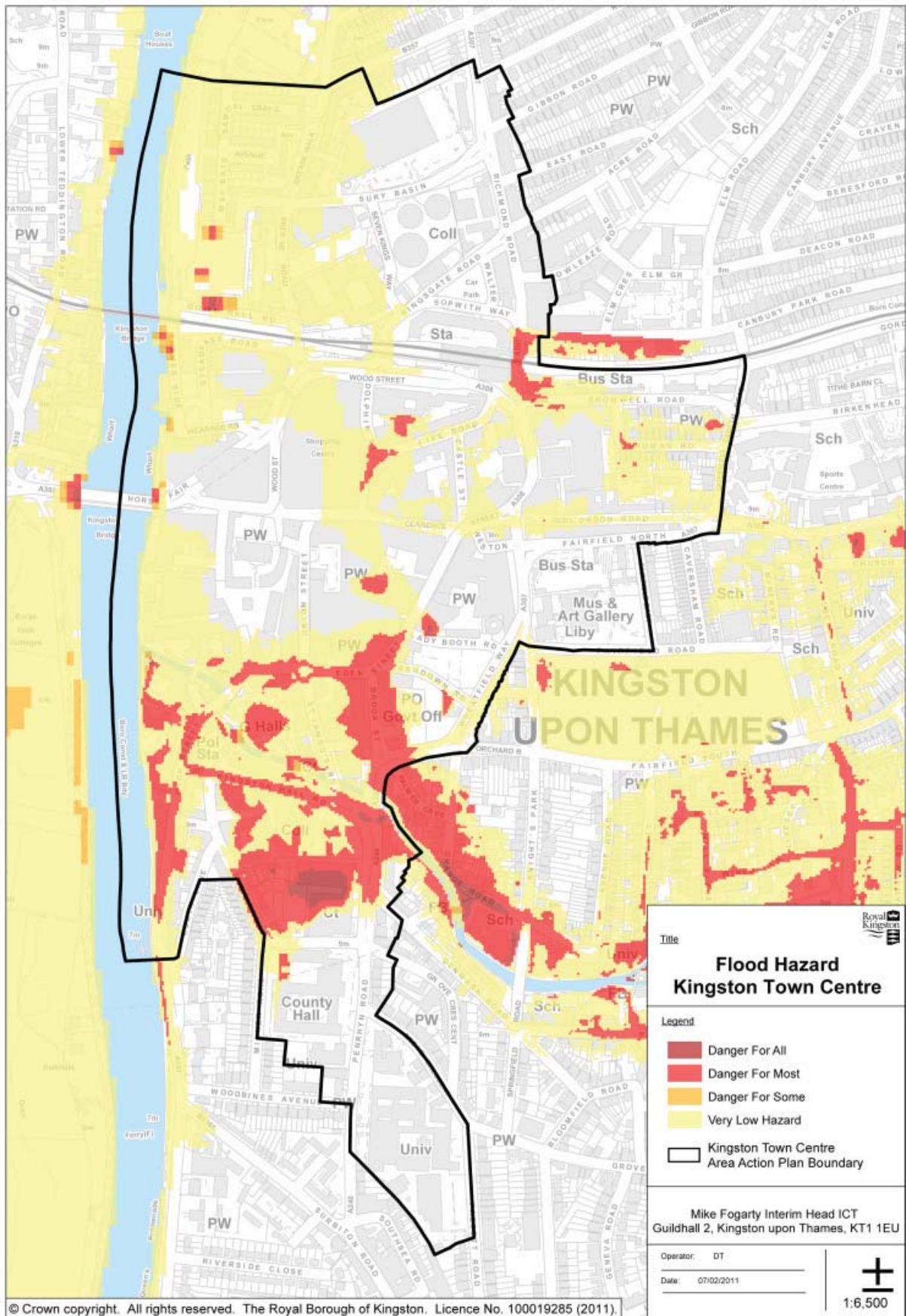


Figure 3 Flood Hazard - Kingston Town Centre



2.3 Surface Water Flooding

2.25 Flood Risk Regulations 2009 requires each LLFA (the Council) to produce a Preliminary Flood Risk Assessment (PFRA). The PFRA is a high level screening exercise to identify areas of significant flood risk within a given study area. It involves collecting information on past (historic) and future (potential) floods and identifying Flood Risk Areas. The Flood Risk Areas have been mapped by the Environment Agency and are based upon surface water maps and the National Receptors data set. The PFRA will be submitted to the Environment Agency this summer, then to European Union at the end of the year. The report will provide a useful reference point for all local flood risk management and inform local flood risk strategies.

2.26 Recommendation 18 in the Pitt Review concluded that Surface Water Management Plans (SWMPs) should provide the basis for managing local flood risk. Richmond and Kingston Council have developed a joint first edition SWMP. The main aim of this study was to pilot Defra's draft SWMP Guidance.

2.27 Drain London is proposing to deliver a surface water management strategy for Greater London and establish an organisational framework that will support the implementation of the strategy at the local level. The aim of this is to implement the second edition of SWMPs across London in a more efficient, cost-effective and holistic manner than could be achieved if all London authorities were to act

independently. The Greater London Authority is currently in the process of using a hierarchical assessment to identify and prioritise surface water flood risk in London.

2.28 The second edition SWMPs are due to be produced this spring and until the Royal Borough of Kingston upon Thames has a full and adopted SWMP for its borough, the Council's planning policy and development management team is advised to use the Environment Agency's Surface Water Flood Maps and "Areas Susceptible to Surface Water Flooding" for information.

2.29 The Surface Water Flood Maps give an indication of the broad areas likely to be at risk of surface water flooding, see Figure 4 and 5 below. This is because the modelling only gives an indication of broad areas at risk, and because the Environment Agency do not hold information on floor levels, construction characteristics or designs of properties. It has been produced using a simplified approach to assess the way that underground sewerage and drainage systems, and smaller over ground drainage systems work, and uses simplified rainfall information. Therefore, it only provides a general indication of areas which are at risk from surface water flooding and is not appropriate for use at the individual property level. It shows areas that are likely to flood in storms with a 1 in 200 and 1 in 30 chance of occurring in any year. For each storm, the map shows areas which are likely to flood to a depth greater than 0.1m and areas which are likely to experience deeper flooding, greater than 0.3m.

Figure 4 Surface Water Flooding 1 in 30 Year Chance

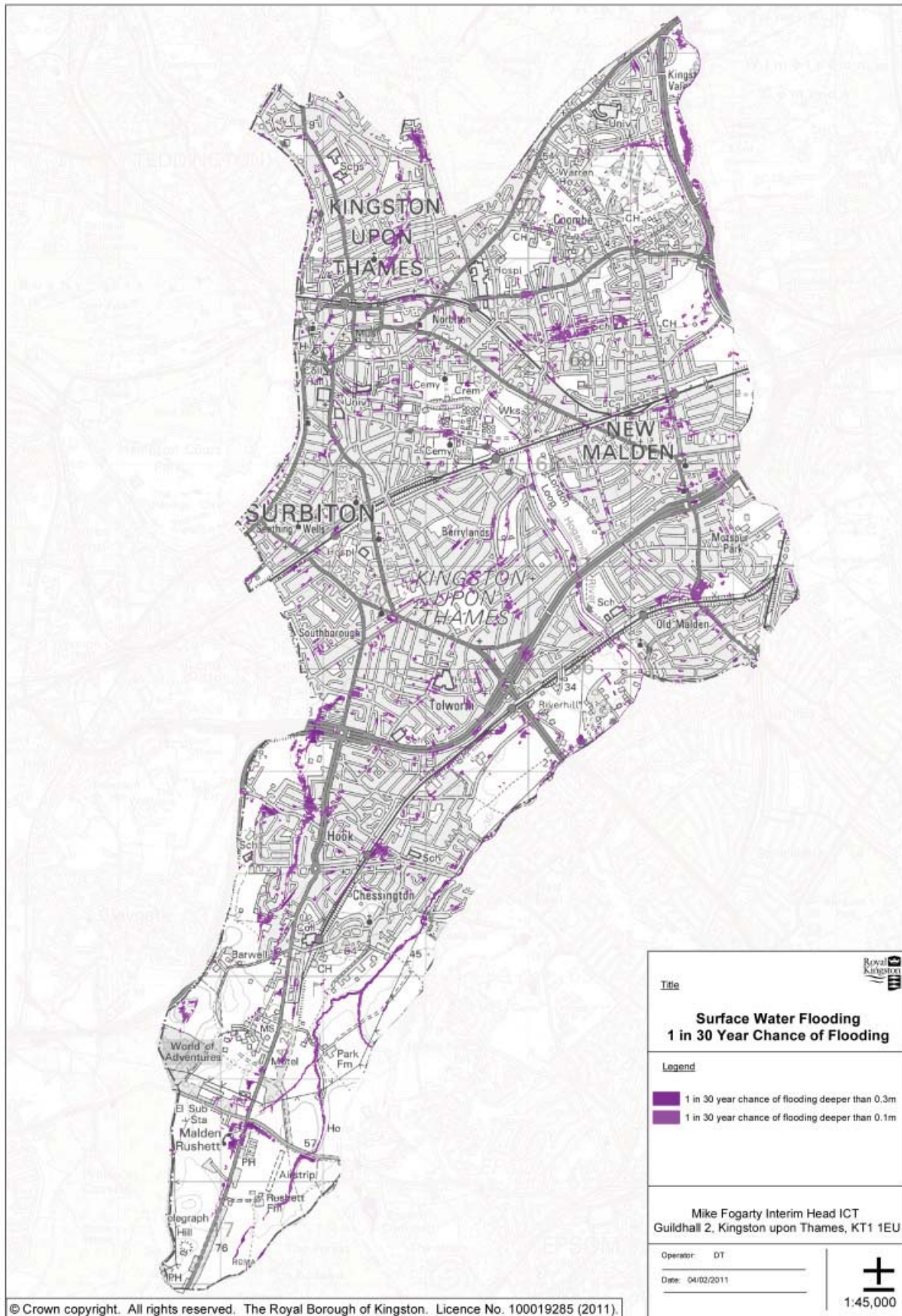
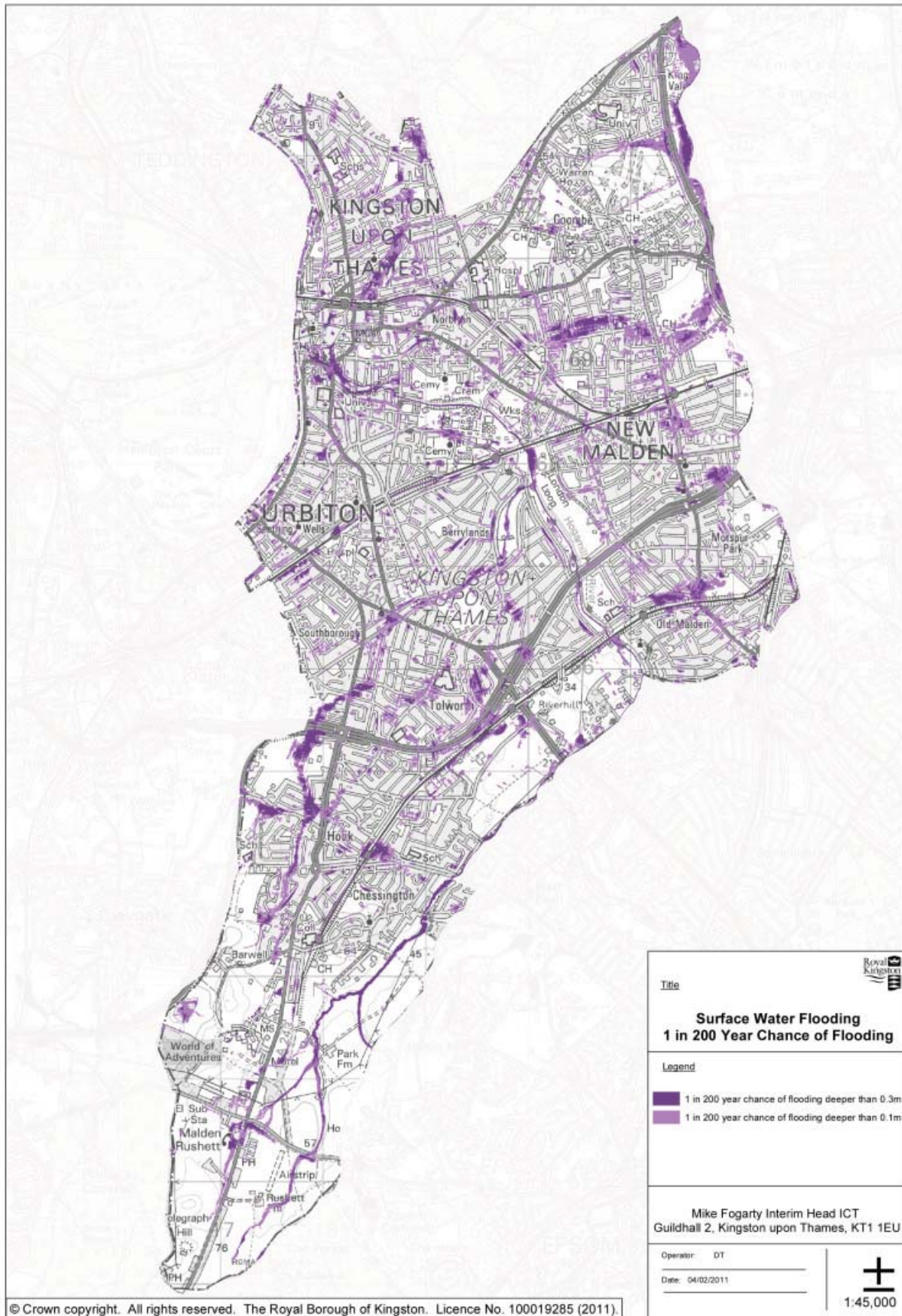


Figure 5 Surface Water Flooding 1 in 200 Year Chance



2.4 Local Drainage Issues

2.30 A number of observed incidents of flooding throughout the Royal Borough of Kingston have been collated through discussions with the Environment Agency and the Council as part of this investigation, and these are captured (and described) in the adjoining flood maps. Not surprisingly, many of these incidents are within relatively densely urbanised parts of the Borough, in particular Berrylands (adjoining Tolworth Brook/Surbiton Stream). The date and cause of flooding has been listed on the maps wherever possible. However it is important to recognise that this can often be somewhat subjective, i.e. due to the lack of detailed data.

2.31 On 20 July 2007, widespread localised flooding was experienced throughout the Greater London area, including within the Royal Borough of Kingston. An incident report prepared by the Council highlighted the following observations:

- Kingston Bypass (A3) has been closed due to flooding in the Hook and New Malden underpasses;
- All traffic is being diverted out of the Town Centre due to severe flooding;
- Wood Street, Richmond Road and London Road underpasses (Town Centre) have been flooded;
- Cambridge Road (A240) has been closed due to flooding;
- No trains are stopping at Kingston.

2.32 The capturing of historical incidents of flooding within the Borough as part of the SFRA is an important trigger to prospective developers to consider

what has happened in the past, developing a design that will seek to ensure that similar problems do not reoccur in the future. It is important to recognise however that historical flooding is not necessarily a measure of the potential risk of flooding in the future. Indeed, localised flooding (including surface water (flash) flooding, groundwater flooding, and/or surcharging of the sewer system) may occur anywhere within the Borough.

2.33 It is important to highlight that, throughout much of England, the drainage (sewer) network is typically designed to cater for no greater than a 1 in 30 year design storm. For this reason, any event that exceeds this probability can be expected to result in overland flow that may pose a risk of flooding to local properties. The modelling carried out as part of the Hogsmill Integrated Urban Drainage Pilot Study (Jacobs 2008) has highlighted that the densely populated areas of Berrylands and Southborough (adjoining the lower reaches of Surbiton Stream) are most susceptible to flooding of this nature, in addition to Kingston Town Centre.

2.34 The Hogsmill IUD Study estimated that approximately 80 properties within the Borough are potentially at risk from surface water (flash) flooding in a 1 in 100 year storm event. This is flooding from runoff that is conveyed overland before reaching a drain or gully. A further 200 properties are potentially at risk from surcharging of the sewer network in the 1 in 100 year event. This is flooding from clean and/or foul water that exceeds the capacity of the underground sewer system, and is therefore surcharged back onto the surface.

2.35 The risk of flooding from surface water and/or the sewer network is difficult to predict accurately, and is heavily dependant upon local conditions during the passing of a storm. For example, leaves and/or a parked car may be blocking a gully, water levels within the receiving watercourse may be elevated preventing free drainage from (or backing up of) the sewers. It is important therefore to ensure that the potential risk of localised flooding to a property is considered within a local context. This is most appropriate at the development application stage (i.e. as part of the detailed Flood Risk Assessment). Furthermore, the topography and geology maps have been provided to assist in this respect, see Figure 6 below and Figure 7 in the following sub section.

2.36 The topography of Kingston Borough is characterised to a large degree by its rivers. Whilst a large proportion of the Borough could be described as gently undulating, the escarpment that forms the western boundary of the Hogsmill catchment is a noticeable area of high ground separating the town centres of Kingston upon Thames and Surbiton. The river corridors throughout the Borough are generally well defined, however it is clear from the flood maps accompanying this report that there are areas adjoining the waterways that are susceptible to river flooding. A large proportion of these areas have not been developed, and indeed it is important that the planning process continues to protect these areas as natural floodplain corridors.

2.37 The Council is carrying out a number of actions to address local drainage issues with some of this work is being addressed through the Drain London project. The Infrastructure Delivery Plan which forms part of the LDF

evidence base has identified the utilities infrastructure which is needed to support the Core Strategy. The SWMP will set out mitigation options to address surface water flooding for the LLFA to take forward, such as partnership working with Thames Water to address these. Other actions are being driven by the requirements of the Flood and Water Management Act with new powers for LLFA to do works relating to groundwater/surface water flooding and a duty to maintain a register of assets relating to flood risk. Within the Council, a GIS based inventory and condition survey of land drainage has been commenced by the Highway Assets team.

Kingston Town Centre

2.38 A number of known localised problems have been identified throughout the Town Centre, highlighted as an outcome of flooding experienced by local residents or businesses.

2.39 Input has been sought from Thames Water to pinpoint known and/or perceived problem areas, however the information provided is very general.

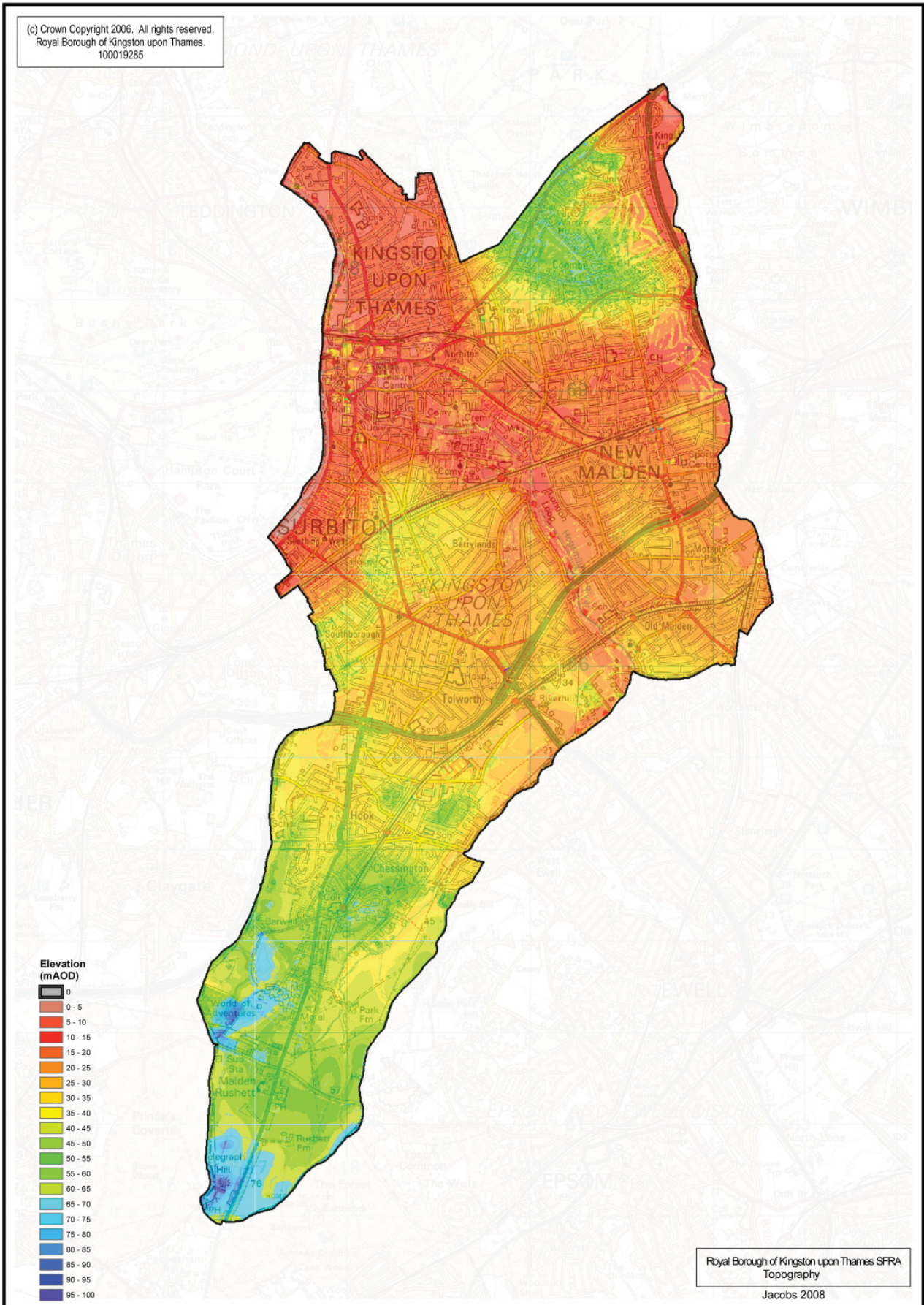
2.40 Issues of this nature however, in addition to those outlined above, are generally localised problems that can be addressed as part of the design process. The management of localised flooding will be an integral requirement of the detailed Flood Risk Assessment (to be completed by the developer). They should therefore not influence the allocation of land for future development. It is essential to ensure that future development does not exacerbate existing flooding problems. Strict planning conditions should be placed upon developers to ensure that best practice measures are

implemented to mitigate any potential increase in loading upon existing drainage system(s).

2.41 Wherever possible within brownfield areas, the developer should seek to reduce the rate of runoff from the site

to greenfield runoff rates (i.e. the rate of runoff generated from the site assuming an open grassed area), refer to Sustainable Drainage Systems (SUDS) in Planning and Development Management section for further details.

Figure 6 Topography



2.5 Groundwater Issues

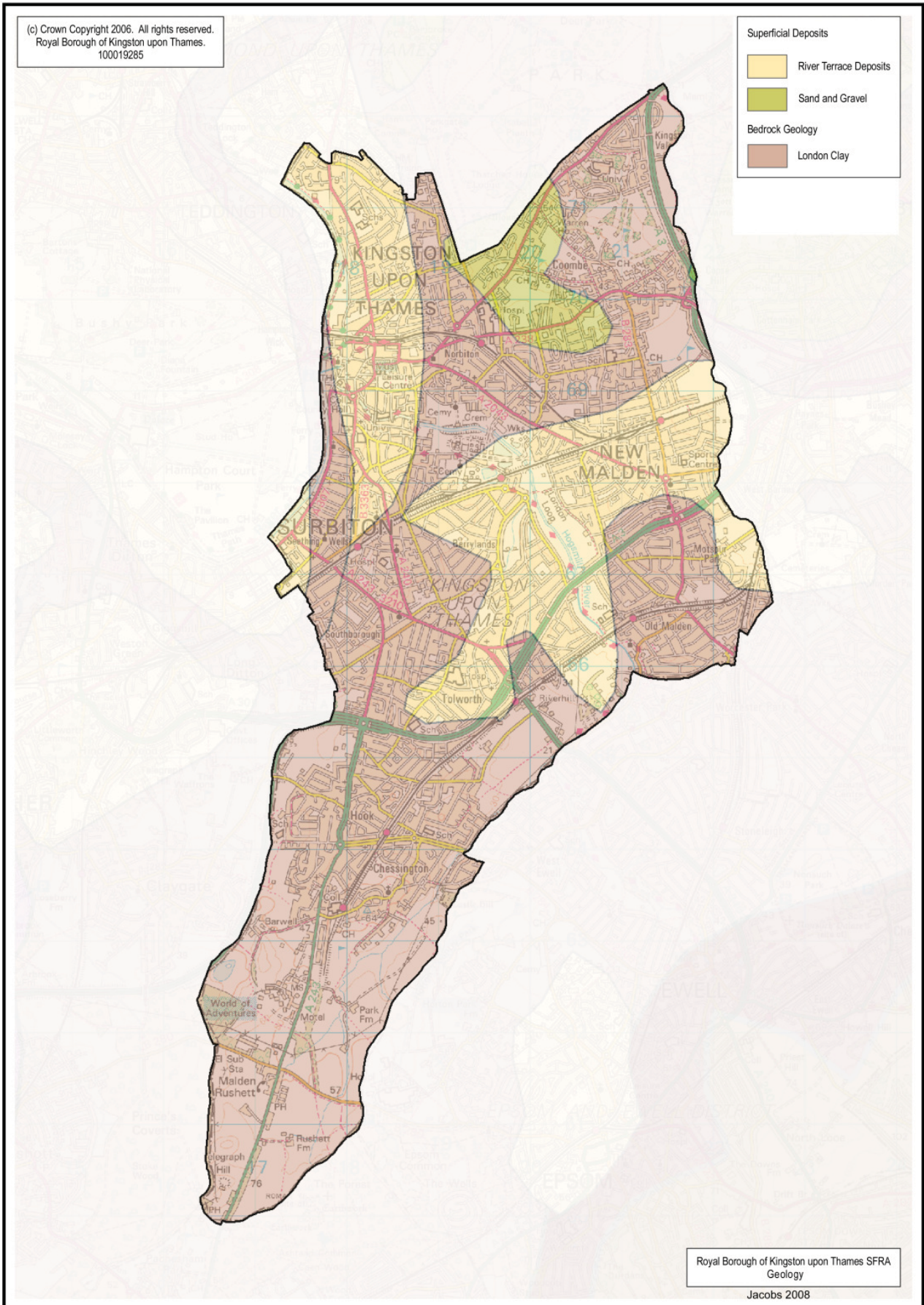
2.42 A large proportion of the Royal Borough of Kingston overlay London Clay, see Figure 7 therefore the risk of groundwater flooding will typically be very low. Immediately adjoining the River Thames, deposits of gravel overlay the London Clay and these are known as the 'Thames Gravels'. The impermeable nature of the soils can increase the susceptibility of the area to surface water (or flash) flooding following periods of heavy rainfall and this can lead to localised incidents of groundwater flooding. There is evidence within adjoining Boroughs of groundwater flooding occurring some distance from the river as a result of water finding a pathway through the gravels during high river levels.

2.43 Evidence of historical groundwater flooding within the Royal Borough of Kingston is relatively limited, but it is important to recognise that the risk of groundwater flooding is highly variable and heavily dependent upon local conditions at any particular time. It is not therefore possible to develop a

strategic map of 'groundwater risk' as part of the SFRA process. The risk of groundwater flooding was considered as an integral part of the River Hogsmill IUD Pilot Study, and 'groundwater envelopes' have been established on the basis of observed incidents of groundwater related flooding within the Borough. It is important to recognise however that historical flooding is *not* a robust measure of the risk of flooding in future years.

2.44 Due to the high degree of variability when considering groundwater flooding, it is important to ensure that the potential risk of groundwater flooding to a property is considered within a local context. This is most appropriate at the development application stage (i.e. as part of the detailed Flood Risk Assessment). The geology of the Borough will heavily influence the functionality of SUDS techniques, and should be carefully considered as part of the design process. This is discussed further in the Detailed Flood Risk Assessment section.

Figure 7 Geology



2.6 Sewer Flooding

2.45 Due to the complexities of the sewage and surface water networks and the uncertainty of development options at this point of the planning process, it is not possible to accurately assess areas which will be affected by sewer flooding as a result of future development. Areas where sewer flooding is known to occur should not necessarily be seen as areas to avoid development as new sewerage capacity may be able to be provided to alleviate the problem. The reverse is also true in that areas which currently do not encounter sewer flooding should not always be viewed as areas best placed to accommodate new development.

2.46 It is essential to ensure that infrastructure is in place ahead of development to avoid unacceptable impacts such as sewage flooding of residential and commercial properties. Consequently, development should only take place where the new demand upon existing infrastructure is taken into account. Therefore, developers should provide evidence in the form of written confirmation from the sewerage undertaker (in this instance Thames Water) that adequate capacity exists in the public sewerage network to serve their development.

2.47 The Hogsmill Valley Sewage Treatment Works has been identified in the Council's Infrastructure Delivery Plan for future expansion and improvements. This document forms part of the LDF evidence base.

2.7 Climate Change

2.48 A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. The UK

Climate Change Projections (2009) provides details on projected increases in sea level rise and precipitation for a range of seasonal and emission scenarios. These can be found at <http://ukclimatechangejections.defra.gov.uk>. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime. PPS25 (Annex B) states that a 10% increase in the 1% AEP (100 year) river flow can be expected within the next 20 years, increasing to 20% within the next 100 years.

2.49 Detailed modelling of the potential impacts of climate change upon fluvial flood risk within the Royal Borough of Kingston has been carried out by the Environment Agency for the Lower Thames, Hogsmill and Beverley Brook (as reflected in Figures 8 to 17).

2.50 For Kingston Town Centre, the impact of climate change will increase the extent of Zone 3a high probability. **However, climate change will not markedly increase the extent of river flooding within most areas of the Borough.** Consequently, few areas that are currently situated outside of Zone 3 High Probability will be at substantial risk of flooding in the foreseeable future. This is an important conclusion from a spatial planning perspective.

2.51 It is important to recognise that **those properties (and areas) that are currently at risk of flooding may be susceptible to more frequent, more severe flooding in future years.** The potential impacts of climate change could also exacerbate localised drainage problems. It is essential therefore that the development management process (influencing the design of future development within the

Borough) carefully mitigates against the potential impact that climate change may have upon the risk of flooding to the property.

2.52 It is essential that developers consider the possible change in flood risk over the lifetime of the development as a result of climate change. The likely increase in flow and/or tide level over the lifetime of the development should be assessed proportionally to government guidance as outlined above. PPS25 Practice Guide (2009) states that *“for practical reasons it is difficult to define the lifetime of development as each development will have different characteristics. For guidance, residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. For development other than residential, its lifetime will depend on the characteristics of that development. Planners should use their experience within their locality to assess how long they anticipate the development being present for. Developers should justify why they have adopted a given lifetime for the development when they are formulating their FRA.”* For design purposes, the Environment Agency suggests that the ‘lifetime of development’ is adopted as 60 years and 100 years for commercial and residential development respectively.

2.8 Residual Risk of Flooding

2.53 It is essential that the risk of flooding is minimised over the lifetime of the development in all instances. It is important to recognise however that flood risk can never be fully mitigated, and there will always be a residual risk of flooding.

2.54 This residual risk is associated with a number of potential risk factors including:

- a flooding event that exceeds that for which the local drainage system has been designed;
- the residual danger posed to property and life as a result of flood defence failure;
- general uncertainties inherent in the prediction of flooding.

2.55 The modelling of flood flows and flood levels is not an exact science, therefore there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. The adopted flood zones underpinning the Royal Borough of Kingston are largely based upon the detailed flood mapping within the area. Whilst these provide a robust depiction of flood risk for specific modelled conditions, all detailed modelling requires the making of core assumptions and the use of empirical estimations relating to (for example) rainfall distribution and catchment response.

2.56 Taking a conservative approach for planning purposes, the Environment Agency advises that finished floor levels are raised to 300mm above the peak design flood level (including 20% allowance for climate change) when advising developers.

3 Planning & Development Management

3.1 Planning Solutions to Flood Risk Management

The Sequential Test

3.1 Historically, urbanisation has evolved along river corridors due to the rivers providing a critical source of water, food and energy. This leaves many areas of England with a legacy of urban centres that, because of their close proximity to rivers, are at risk of flooding.

Applying the Sequential Test at the local planning level

3.2 The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer urban development away from areas that are susceptible to flooding. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. **Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated.** This sequential approach is referred to as The Sequential Test, and the application of the this at the local level for LDF preparation is summarised in Figure 4.1 of the PPS25 Practice Guide (2009).

Box 1

It is absolutely imperative to highlight that the SFRA does not attempt, and indeed cannot, fully address the requirements of the PPS25 Sequential Test. As highlighted in this section and Figure 4.1 of the PPS25 Practice Guide, it is necessary for the Council to demonstrate that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding (i.e. Zone 2, and finally Zone 3).

Applying the Sequential Test for individual planning applications

3.3 PPS25 stipulates permissible development types and this considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur. The Council must restrict development to the permissible land uses summarised in PPS25 Annex D (Table D2). This may involve seeking opportunities to 'swap' more vulnerable allocations at risk of flooding with areas of lesser vulnerability that are situated on higher ground.

3.4 It is important to recognise that the principles of the sequential approach are applicable throughout the planning and development cycle, and refer equally to the forward planning process (delivered by Council as part of the LDF), to the determination of applications for development, to the assessment of windfall sites and to locating development within a site. The

Council will assist where possible with supporting information. The detailed FRA will be required to demonstrate the careful and measured consideration of whether indeed there is an alternative site available within an area of lesser flood risk, in accordance with the PPS25 Sequential Test.

The Exception Test

3.5 A proportion of Kingston is situated within Zone 3a High Probability, including urban and retail centres. Prohibiting future development within these areas may have a detrimental impact upon the economic and social welfare of the existing community. It is essential that a sequential approach is taken to underpin all planning decisions as stipulated above. It may be however that pressing planning arguments (that outweigh flood risk) remain, putting into place a requirement to investigate further the possibility of regeneration and/or future development within areas at risk of flooding.

3.6 Should this be the case, the Council and potential future developers are required to work through the **Exception Test** (PPS25 Annex D) where applicable. It is important to remember that the Sequential Test should always be carried out prior to the Exception Test. For the Exception Test to be passed:

- *“It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the ‘submission’ stage, the benefits of the development should contribute to*

the Development Plan Document’s Sustainability Appraisal;

- *the development should be on developable, previously development land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land; and*

3.7 The first two points set out in the Exception Test are planning considerations. A planning solution to removing flood risk must be sought at each specific location in the initial instance, seeking to relocate the proposed allocation to an area of lower flood risk (i.e. Zone 1 Low Probability or Zone 2 Medium Probability) wherever feasible.

3.8 This SFRA has been developed to inform the Sequential Test. It will be the responsibility of the Council to carry out the Sequential Test on the basis of this information, allocating potential sites for future development accordingly. Equally developers proposing sites in Zone 3 or Zone 2 will be required to demonstrate within the detailed FRA that the Sequential Test has been applied, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.

- *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall;*

3.9 The management of flood risk throughout the Borough must be assured should development be permitted to proceed, addressing the third critical element of the Exception Test. The SFRA has provided specific recommendations that ultimately should be adopted as design features, with

evidence provided of how they will be fulfilled prior to permission being granted for all future development. It is the responsibility of the prospective developer to build upon these recommendations as part of a detailed FRA to ensure that the specific requirements of PPS25 can be met.

3.10 An overview of flood risk throughout the borough has been provided in section 4 Strategic Flood Risk Assessment Interpretation. **Future planning decisions should consider the spatial variation in flood risk across the district, as defined by the delineated flood zone that applies at the specified site location, and apply the recommendations provided below accordingly.** It is reiterated that PPS25 applies to allocated sites identified within the emerging LDF and to future windfall sites.

3.2 A Proactive Approach - Positive Reduction of Flood Risk through Development

3.11 PPS25 does not only consider the risk of flooding posed to new development, it also seeks to positively reduce the risk of flooding posed to existing properties within the Borough. This principle should be adopted as the underlying 'goal' for all planning and development management decisions.

3.12 Developers should be encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk, whether that be by reducing the frequency or severity of flooding (by implementing SUDS), or by reducing the impact that flooding may have on the community. This should not be seen as an onerous requirement, and indeed if integrated into the design at the conceptual stage, will place no added demands upon the development and/or planning application process.

3.13 Possible risk reduction measures for consideration may include the following:

- The integration of SUDS to reduce the runoff rate from the site;
- A change in land use to reduce the vulnerability of the proposed development;
- A reduction in the building footprint;
- The raising of internal floor levels and flood proofing (within existing buildings) to reduce potential flood damage;
- The rearrangement of buildings within the site to remove obstructions to overland flow paths;
- The placement of buildings to higher areas within the site to limit the risk of flood damage.

3.14 It is recommended that each FRA summarises how a reduction in flood risk has been achieved within the proposed (re)development. This may be specified as (for example) a reduction in flow from the site, a reduction in water levels within (or adjacent to) the site, or a reduction in the consequences of flooding (i.e. Reducing the vulnerability and number of people at risk).

3.3 Localised Flood Risk within the Planning Process

3.15 PPS25 advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems identified within the SFRA relate to historical incidents, the source of which is often somewhat uncertain. It is important to recognise therefore that these are not necessarily a measure of 'risk', but rather problems that have occurred due to a particular set of local circumstances in the past

(for example, the blockage of a local gully inlet). These may or may not reoccur in future years.

3.16 It is unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past that were the result of circumstances unlikely to reoccur. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified in this SFRA will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development management recommendations have been provided in Table 3 in the following section.

3.4 Spatial Planning & Development Management Recommendations

Table 3 : Spatial Planning & Development Management Recommendations

PPS25 Requirement	Zone 3b Functional Floodplain	Zone 3a High Probability	Zone 2 Medium Probability	Zone 1 Low Probability
Spatial Planning Recommendations				
Important Considerations	It should be recognised that property situated within zone 3b Functional Floodplain will be subject to frequent flooding, on average, no less than once in every 20 years. There are clear sustainability implications to be considered in this regard, and it is highly questionable whether insurance against flooding related damages will be available in the longer term. Future development within zone 3b Functional Floodplain can only be considered following application of the Sequential Test.	Future development within zone 3a High Probability can only be considered following application of the Sequential Test.	Future development within zone 2 Medium Probability can only be considered following application of the Sequential Test.	It is important to recognise that sites within Zone 1 may be susceptible to flooding from other sources. Development may contribute to an increase in flood risk elsewhere if not carefully mitigated.
Land Use (refer Table D2 of PP25)	Water Compatible Development and/or Essential Infrastructure	Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development may only be considered if	Land use should be restricted to Water Compatible, Less Vulnerable or More Vulnerable development. Highly Vulnerable development may only be considered	No restrictions

PPS25 Requirement	Zone 3b Functional Floodplain	Zone 3a High Probability	Zone 2 Medium Probability	Zone 1 Low Probability
		Exception Test can be passed.	if Exception Test can be passed.	
Permitted Development & Property Subdivision	Not Applicable	Building extensions (including out-buildings) should be discouraged to avoid raising flood levels elsewhere. Property subdivision may increase the intensity of development, and the population at risk, and should be discouraged.	No restrictions	No restrictions
Development Management Recommendations				
Detailed Flood Risk Assessment (FRA)	Required	Required	Required	Required for all sites greater than 1ha in area. Recommend that all sites carry out an assessment of localised flood risks, including surface water flooding (where sewer system is exceeded) and groundwater flooding, where an incident of localised flooding has been observed.

PPS25 Requirement	Zone 3b Functional Floodplain	Zone 3a High Probability	Zone 2 Medium Probability	Zone 1 Low Probability
Floor Level	To be situated a minimum of 300mm above the 1 in 100 year river flood level, including climate change.			No minimum level stipulated by PPS25
Site Runoff	Complete Drainage Impact Assessment and implement SUDS to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SUDS design must take due account of groundwater and geological conditions.			
Buffer Zone	A minimum 8m buffer zone must be provided to 'top of bank' within sites immediately adjoining a river corridor. This relates to both open waterways and culverted waterway corridors. Reference should be made to the Environment Agency's "Living on the Edge" guide (www.environment-agency.co.uk) that discusses any development situated in, over, under or adjacent to rivers and/or streams.			
Other	<ul style="list-style-type: none"> Ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased, that overland flow routes are not truncated by buildings and/or infrastructure, or hydraulically linked compensatory flood storage is provided within the site (or upstream). As an integral part of the government's "Making Space for Water" agenda, the Environment Agency is actively seeking the renaturalisation of culverted watercourses as part of future development. Realistic opportunities to reinstate the natural open waterway within existing culverted reaches of the river(s) should be promoted. Require Planning Obligations/Community Infrastructure Levy in the future to help fund infrastructure to reduce flood risk as necessary. 			

3.5 Domestic and Non-Domestic Building Extensions

3.17 Planning applications for minor domestic extensions and commercial extensions with a footprint of less than 250sqm, are not required to submit a FRA unless there are concerns about the potential cumulative impact from minor extensions. Further information is provided for planning applicants on Environment Agency's standing advice web page

<http://www.environment-agency.gov.uk/research/planning/default.aspx>.

However, such applicants are encouraged to introduce SUDS and other risk reduction techniques wherever possible. Similarly applicants for development less than 1 hectare in Flood Zone 1 are not required to submit a FRA but are encouraged to install SUDS and other risk reduction measures as well. The production of a Sustainable Design and Construction Supplementary Planning Document will provide further details on the implementation of SUDS.

3.18 Part H of Building Regulations requires rainwater to be collected from roof surfaces (and some limited paved areas) to be disposed of via ground infiltration systems (soakaways) whenever this is practicable. Other relevant Building Regulations include Part C which requires sites where there is a high water table (within 0.25m of lowest floor level) to be drained and for existing land drains to be diverted where interrupted by development.

3.19 The progressive loss of valuable floodplain areas to extensions and/or outbuildings some of which do not require planning permission is an issue. Whilst each individual extension may not result in a measurable impact upon

localised flood levels, the cumulative impact of building extensions can significantly increase the risk of flooding.

3.20 Councils can use the provisions of Article 4 of the Town and Country Planning General Permitted Development Order 1995 to make a direction to remove specific development rights for property in specific geographical areas and take back control where this is necessary. This would require the householder to seek planning permission for development, and allow the Council to assess the possible impacts of the works, and decide whether to grant permission, if necessary subject to conditions (such as ensuring the use of permeable materials), or refuse it. Extending planning controls in this way in Flood Zones 3b, 3a and 2 in particular may be considered appropriate.

4 Strategic Flood Risk Assessment Interpretation

Interpretation of the Kingston Borough SFRA (Maps)

4.1 The spatial variation in flood risk across the Borough is depicted on the adjoining maps, and described below. The Kingston Borough SFRA should be used by both the Council and prospective developers to meet their obligations under PPS25 throughout the planning cycle. Instructions for use are provided below.

Forward Planning

4.2 Figures 8 to 17 provide an overview of the spatial variation in flood risk throughout the Borough. It is necessary to adopt a sequential approach when considering where land should be allocated for future development, and these figures should be used to inform this sequential approach. Furthermore, PPS25 provides clear guidance on permissible land use within areas potentially at risk from flooding (for more details, see Table 3 Spatial Planning and Development Management Recommendations).

4.3 Whilst there is no particular constraint placed upon land use within areas of Zone 1 Low Probability, it is necessary for the Council in identifying sites for future development to take due consideration of flooding from other sources (i.e. surface water). Future investment in the sewage infrastructure is in the Council's Infrastructure Delivery Plan and further work will deliver new guidance on SUDS in the Sustainable Construction and Design Supplementary Planning Guidance.

4.4 Observed incidents of localised flooding are also depicted in Figures 8 to 17, and these should be used to inform design to ensure that future development does not exacerbate these existing problems, and indeed reduces flood risk. Many of these localised sources of flooding can be effectively managed through the design process. However it is recommended that advice is taken from the Environment Agency to ensure that the severity of any local issue that may affect (or be exacerbated by) the proposed allocation is fully understood.

Development Management & Developers

4.5 It is important that the potential risk of flooding is considered as an integral part of all proposed development. Figures 8 to 17 provide a measure of the severity of flooding within the proposed development site. These should be used to trigger a more detailed assessment of flood risk related issues within the site, as set out in a Flood Risk Assessment (see Detailed Flood Risk Assessment Section 5).

4.1 K+20 Area Action Plan - Kingston Town Centre Character Areas

4.6 A Level 2 SFRA is required to inform Area Action Plans requiring the Exception Test, therefore an assessment of K+20 Area Action Plan Kingston Town Centre 'Character Areas' has been carried out. These character areas have been delineated to encompass zones of common land use, activity and historic environment.

4.7 Each Character Area as shown in Figure 8 below, should be read in conjunction with the accompanying

map and further information can be found in Section 4.2 Kingston Town Centre K+20 AAP Proposal Sites.

- 4.8** Any future development will require a site based FRA in accordance with Kingston Town Centre FRA requirements set out in this SFRA. Further details on the raising of floor levels and SUDS are also located within this section.

C1 - Prime Shopping

- 4.9** Character Area 1 is situated centrally within Kingston Town Centre, and encompasses the retail 'heart' of the commercial precinct. It is characterised by relatively modern buildings housing primarily shops and cafes. With the exception of the southernmost boundary of the area, the majority of C1 is situated within **Zone 2 Medium Probability**.

- 4.10** Within **Zone 2 Medium Probability**, future regeneration must seek to raise floor levels above the adopted maximum flood level plus freeboard. Safe access to/from the site must be ensured during times of flooding, even within those areas where buildings are not directly affected. This will ensure residents can return safely to their homes and/or have access to food and shelter during extended periods of flooding.

- 4.11** SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. With due consideration to the existing land use and general character of the area, appropriate SUDS may include permeable pavements (e.g. within pedestrian zones), landscaped areas encompassing planted infiltration zones and/or green roofs.

- 4.12** Within **Zone 3a High Probability**, future regeneration must be carried out in accordance with the specific recommendations outlined in Proposal Site P1 Clarence St North in the following section.

C2 - South East

- 4.13** Character Area 2 is situated within the south east corner of Kingston Town Centre, and encompasses primarily office based and retail land uses. It is characterised by relatively modern buildings with little heritage value. With the exception of the western boundary of the area, C2 is situated within **Zone 2 Medium Probability**. A large proportion of the character area is dominated by Proposal Sites 3 and 4, these sites lie partially within **Zone 3b Functional Floodplain** and **Zone 3a High Probability** and specific recommendations are made for these sites in the following section.

- 4.14** As described above, future regeneration within **Zone 2 Medium Probability** must seek to raise floor levels above the adopted maximum flood level plus freeboard. SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. Appropriate forms of SUDS may include permeable pavements (e.g. within pedestrian zones), landscaped areas encompassing planted infiltration zones, soakaways and/or green roofs.

- 4.15** Safe access to/from the site must be ensured during times of flooding, even within those areas where buildings are not directly affected. This will ensure residents can return safely to their homes and/or have access to food and shelter during extended periods of flooding.

C3 - Eastern Approach

4.16 Character Area 3, Eastern Approach is situated to the east of Kingston Town Centre, and is largely characterised by older style residential development. The large proportion of the area is situated within **Zone 2 Medium Probability**, however a distinct flow path exists through C3 that will be susceptible to inundation from River Hogsmill during the 1% (100 year) event, i.e. **Zone 3a High Probability**.

4.17 Within **Zone 2 Medium Probability**, future regeneration must seek to raise floor levels above the adopted maximum flood level plus freeboard. SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. Due to the residential nature of the area, the application of SUDS becomes more difficult on a site-by-site basis. Appropriate SUDS may include permeable paving within garden areas.

4.18 Within **Zone 3a High Probability**, future regeneration of the residential areas must seek to raise habitable floor levels above the maximum flood level plus freeboard. It will be necessary to ensure that any localised land raising to increase floor levels does not increase existing flood levels. The use of basement areas for habitable uses (i.e. that may sustain damage to household possessions and/or pose a risk to life in times of flooding) must be avoided. Safe access must be provided to ensure evacuation in times of flooding. As a minimum, community based flood risk mitigation measures such as flood proofing shall be required.

C4 - Kingston Station and its approaches

4.19 Character Area 4 encompasses the train station and the surrounding retail and entertainment precinct (including the recently completed Rotunda complex). A large proportion of the character area is incorporated within Proposal Sites 8, 9, 10 and 11 specific recommendations for these sites are made in the following section. With the exception the Cromwell Road, C4 is predominantly situated within **Zone 2 Medium Probability**.

4.20 Within **Zone 2 Medium Probability**, future regeneration must seek to raise floor levels above the adopted maximum flood level plus freeboard. SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. With due consideration to the existing land use and general character of the area, appropriate SUDS may include permeable pavements (e.g. within pedestrian zones), landscaped areas encompassing planted infiltration zones and/or green roofs.

C5 - Riverside North

4.21 Character Area 5 encompasses the river frontage area to the south of the railway. A large proportion of the character area is incorporated within Proposal Site 12, specific recommendations for this site are made in the following section. The primary requirement at this location includes the raising of floor levels above maximum flood level plus freeboard.

4.22 Whilst the rear of the site is on relatively elevated ground and within **Zone 2 Medium Probability**, the river frontage is susceptible to relatively frequent flooding and is situated within **Zone 3b Functional Floodplain**.

C6 - Old Town Conservation Area Historic Core

4.23 Character Area 6 is the historic 'heart' of Kingston Town Centre and is characterised by a largely retail precinct housed within buildings of particular heritage value. The northern half of the area falls within **Zone 2 Medium Probability** whereas the southern half is affected by River Hogsmill during the 1% (100 year) event, and is therefore **Zone 3a High Probability**.

4.24 It is recognised that the historical nature of the existing buildings may result in strict limitations being placed upon the works undertaken. However some redevelopment opportunities may occur in this area and these should have regard to the recommendations set out for character areas 1 to 5.

4.25 Within **Zone 2 Medium Probability**, safe access to/from the site must be ensured during times of flooding, even within those areas where buildings are not directly affected. SUDS must be implemented wherever possible, and with due consideration to the character of the area, these may include permeable pavements (e.g. within pedestrian zones).

4.26 Within **Zone 3a High Probability**, the raising of floor levels above flood level, flood proofing of buildings and safe access for evacuation will be required.

C7 - Old Town Conservation Area - Riverside South

4.27 Character Area 7 fronts the River Thames and is characterised largely by modern residential development and entertainment uses (cafes and bars). C7 falls almost fully within **Zone 3a High Probability**.

4.28 Currently an elevated boardwalk provides a recreational corridor between the river and the river frontage development. It is understood by the EA that other planning constraints place considerable demand upon river frontage for housing, however future regeneration may consider retreat to encourage re-naturalisation of the river corridor.

4.29 The raising of floor levels above flood level plus freeboard will be required for all development. Residential land uses must be restricted to upper floors. The use of basement areas for storage and/or carparking should be discouraged, however as a minimum flood proofing will be required and all access/egress points must be situated above flood level. Safe access for evacuation will be required.

C8 - Old Town Conservation Area - High Street

4.30 Character Area 8 is the original retail centre of Kingston and largely retains its heritage value with many buildings dating from the Victorian and Georgian eras. The large proportion of this area falls within **Zone 3a High Probability**.

4.31 Once again, it is recognised that the historical nature of the existing buildings may hinder the works undertaken to 'flood proof' future regeneration of existing buildings. The recommendations provided endeavour to address this potential constraint.

4.32 Within **Zone 3a High Probability**, the raising of floor levels above flood level, flood proofing of buildings and safe access for evacuation will be required.

4.33 It is noted that the Kingston Town Centre Police Station is situated adjacent to River Hogsmill within **Zone 3a High Probability**. The police station is considered a critical (highly

vulnerable) land use, and it is essential that this remains operational during flooding conditions. It is recommended that opportunities to relocate the police station to higher ground are sought.

C9 - Civic & Education Quarter

4.34 Character Area 9 is situated to the south of the study area, and encompasses the civic and educational areas of the town centre. With the exception of the southernmost boundary of the area (situated within **Zone 2 Medium Probability**), the majority of C9 is situated within **Zone 3a High Probability**.

4.35 Longer term, regeneration must encourage built development away from the River Hogsmill corridor within the civic precinct, providing a buffer zone of up to 8m. It is understood that currently basement areas within the civic buildings are actively used for storage purposes. The use of basements should be discouraged, however as a minimum floodproofing will be required and all access/egress points must be situated above flood level.

4.36 Within **Zone 3a High Probability**, the raising of floor levels above flood level must be sought and safe access for evacuation will be required.

4.37 SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. With due consideration to the existing land use and general character of the area, appropriate SUDS may include permeable pavements (e.g. within pedestrian zones), landscaped areas encompassing planted infiltration zones and/or green roofs.

C10 - North Kingston

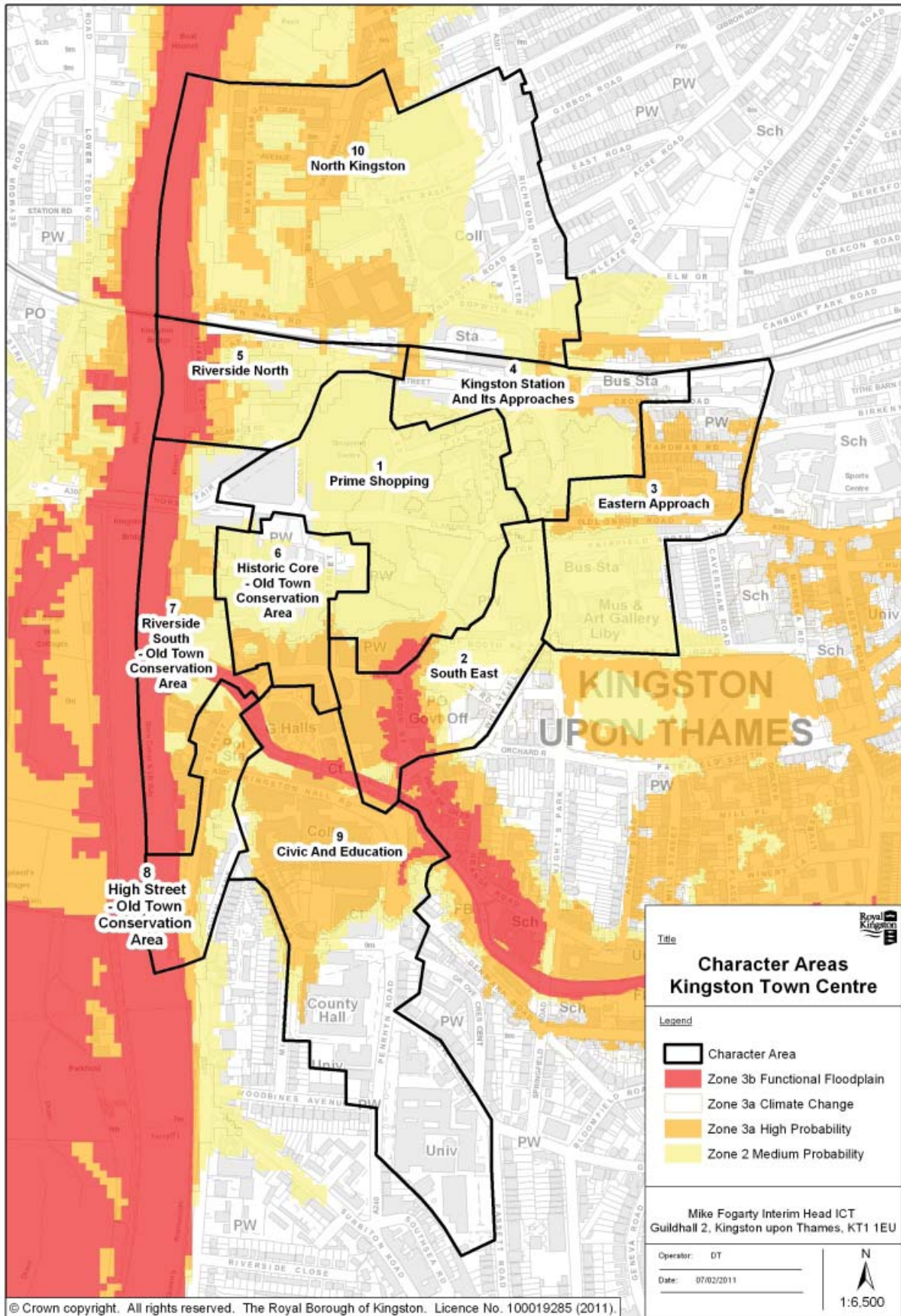
4.38 Character Area 10 encompasses the emerging residential area to the north of the railway line. A large proportion of the character area is incorporated within Proposal Sites 17, 18, 19 and 20, and specific recommendations relating to future flood risk management at these locations are made in the following section.

4.39 The north-west corner of C10 is characterised by recent residential development between the River Thames and Skerne Road. A review of flood risk has identified that this area is situated within **Zone 3a High Probability**. Access to the site via Skerne Road is situated within **Zone 3a High Probability**.

4.40 Future regeneration of this area must ensure that all floor levels are situated above maximum flood level plus freeboard. Safe access to/from the site must be provided. Currently the basement areas are used for car parking, and future regeneration must discourage this. Broader regeneration within C10 must seek to raise floor levels above the adopted maximum flood level plus freeboard. Safe access to/from the site must be ensured during times of flooding.

4.41 SUDS must be implemented to reduce runoff rates from the area wherever possible, or as a minimum ensure that future redevelopment does not increase runoff. With due consideration to the existing land use and general character of the area, appropriate SUDS may include permeable paving (e.g. within garden patio areas), landscaped areas encompassing planted infiltration zones and/or green roofs.

Figure 8 Kingston Town Centre K+20 Character Areas



4.2 K+20 Area Action Plan - Kingston Town Centre Proposal Sites

4.42 A review of the proposal sites in K+20 Area Action Plan, as presented in Figure 9 has been carried out. Some of these sites are affected by a degree of flood risk. In some instances, it may be appropriate to apply the Exception Test, seeking a design solution that will mitigate the risk posed by flooding to the site (and surrounding area). **It is reiterated that the Exception Test can only be satisfied if a strong planning argument can be provided that conclusively demonstrates that the development provides wider sustainability benefits to the community that outweigh the flood risk.**

4.43 In accordance with PPS25, it is necessary for a local authority to adopt a sequential approach when allocating sites for future development. However in simple terms it must be demonstrated that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding. The SFRA does not endeavour to address this aspect of the Sequential Test. It can however review emerging allocations, and in light of the delineated PPS25 flood zones, provide clear recommendations for permissible land uses (as defined by PPS25).

4.44 The risk of flooding posed to each site has been assessed in Table 4 below (i.e. based upon the delineated flood zone within which the site falls), and PPS25 applied to identify the planning constraints posed as a result of flood

risk. A 'traffic light' system has been adopted to summarise the preferred land use for each site (i.e. in strict accordance with the Sequential Test), restricted land uses (i.e. those not permitted under PPS25), and permissible land uses that may be considered if the Exception Test can be satisfied. The table summarises:

- the locality of each nominated site;
- the flood zone within which that site falls; and
- the restrictions that flood risk places upon the future development of the site.

4.45 It is highlighted that, in some instances, sites are only partially affected by flooding. In these instances, the 'traffic lights' within the attached matrix reflect the most significant risk of flooding within the site. At these locations, future development may be permitted to proceed, however this should be restricted to the lowest risk areas of the site if at all possible. Two amendments have been made to Proposal Site 10: Kingston Station and Proposal Site 14: Guildhall 1, County Court and Bath Passage/St. James Road corner, since the Kingston Town Centre SFRA 2007.

4.46 *NOTE:* Where a site is only partially affected by flooding, the 'worst' (most constrained) flood zone has been highlighted in the matrix. Future development should be restricted to the area within the site that is least affected by flooding.

4.47 The table should be interpreted in accordance with the following legend.

Table 4

	Development type is permissible under PPS25 and a site based FRA must meet
--	--

	the requirements set out in this SFRA.
	Development type is permissible under PPS25, only if the Exception Test is passed. It must be demonstrated that the development provides wider

	sustainability benefits to the community that outweigh flood risk. A site based FRA must meet the requirements set out in this SFRA.
	Development type is not permitted by PPS25.

Figure 9 Kingston Town Centre K+20 Proposal Sites

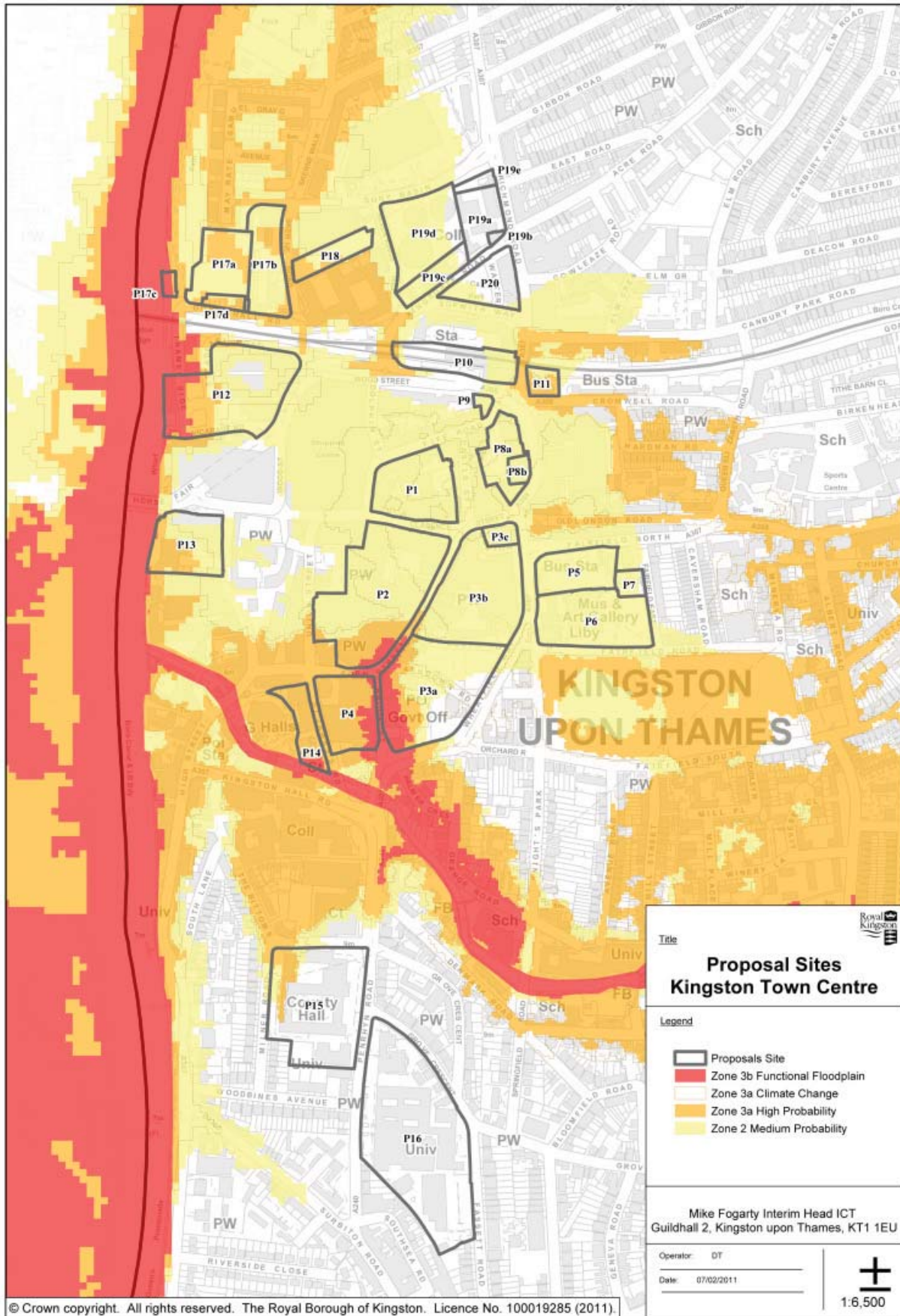


Table 5 : Kingston Town Centre AAP K+20 Proposal Sites

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)				
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
P1: Clarence Street North	High quality comparison retail facilities with residential, including affordable housing, replacement offices, studio workshops or community facilities above, through selective redevelopment and refurbishment	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.	Green	Orange	Green	Green	Green
P2: South of Clarence Street, Eden Quarter	High quality new comparison shopping facilities in an open street format with a mix of shop sizes, to the rear of the Clarence Street frontage, including the partial redevelopment of the Eden Walk Shopping Centre. Residential, including affordable housing, offices and community uses, above the retail.	3a	Only a small proportion of site P2 is situated within High Probability Zone 3. Development within that proportion of the site within Zone 3 should be conditioned in accordance with Kingston Town Centre Planning Recommendations for Zone 3b and Zone 3a. The remaining proportion of the site falls within Zone 2, refer to Kingston Town Centre Planning	Orange	Red	Orange	Green	Green

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)				
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
P3: East of Eden Street and the Ashdown Road Sites: The Eden Quarter	The extension of the Primary Shopping Area onto the Ashdown Road sites P3a by the provision of high quality new comparison shopping facilities in an open street format, with a mix of shop sizes. A new bus station on P3a on the Wheatfield Way frontage with high quality waiting facilities for bus passengers. A multi-storey car park on P3a. Redevelopment and intensification in area P3b to provide high quality buildings, new retail facilities, with residential, offices, a hotel or community uses above and improved pedestrian links from Wheatfield Way to Eden Street. Redevelopment of area P3c, fronting Clarence Street to improve the quality of the retail facilities with	3a	Recommendations for this zone. Only a small proportion of site P2 is situated within High Probability Zone 3. Development within that proportion of the site within Zone 3 should be conditioned in accordance with Kingston Town Centre Planning Recommendations for Zone 3b and Zone 3a. The remaining proportion of the site falls within Zone 2, refer to Kingston Town Centre Planning Recommendations for this zone.					

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
	offices above to provide a focal point in this gateway location								
P4: St James Area	Enhanced retail uses	3a	A small proportion of the site falls within Zone 3b, however it is a developed area. Refer to Kingston Town Centre Planning Recommendations for Zone 3b & 3a.						
P5: Cattle Market Car Park and Fairfield Bus Station	Improvements to the Fairfield bus station & improved car parking	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.						
P6: Kingfisher Leisure Centre, Open Space and Kingston Library and Museum	Upgrading or replacement of the Kingfisher Leisure Centre for leisure, recreation or community use. Retention and enhancement of the local open space and an improved play area. Enhancing Kingston Library, Museum and Art Gallery, and the setting of the listed buildings by the	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.						

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
	demolition of the Children's Library building. Residential including affordable housing								
P7: Former Fairfield Nursery Site	Education or community use	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.						
P8: 107-163 Clarence Street including the Rear Yard and Former Empire Theatre Building and Station Buildings, Fife Road	Retention and enhancement of the former Empire Theatre building (8b) for retail, retail related or A3/A4 uses on the ground floor with A3/A4 and D2 leisure uses above, residential is not an appropriate use of this building or site. Redevelopment of the Station Buildings for retail and related uses. Redevelopment of the rear service yard and parking area (8a) to include servicing, parking and managed student housing with pedestrian access from Clarence Street and Fife Road and	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.						

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
	vehicle access from Fife Road.									
P9: Corner of Fife Road and Wood Street	Redevelopment for retail and retail related uses with residential or B1 offices/studio workspace above	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.							
P10: Kingston Station	The Council will pursue the upgrading of Kingston Station with partners. In the longer term there is potential for mixed use redevelopment to provide a new station, retail, and A2/A3 uses at ground level with B1 offices/workspace above and managed student housing to create high quality landmark development.	3a	A very small proportion of site 10 is situated within Zone 3a and a small proportion is located with Zone 2. Development within the Zone 3a should refer to Kingston Town Centre planning recommendations for Zone 3. Development within the proportion of the site within Zone 2 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 2. The remaining proportion of the site falls within							

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
			Zone 1, refer to Kingston Town Centre Planning Recommendations for Zone 1.							
P11: Quebec House	Ground floor A1 retail, A2 financial and professional services, A3 restaurant/café uses with active frontages. Use of the upper floors for B1a offices, residential (including affordable housing and managed student accommodation) or D1 uses, including a nonresidential education or training centre.	3a	A proportion of site P11 is situated within High Probability Zone 3. Development within that proportion of the site within Zone 3 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 3. The remaining proportion of the site, falls within Zone 2, refer to Kingston Town Centre Planning Recommendations for Zone 2.							
P12: Northern Riverfront -Bentalls Car Parks, Vicarage Road and Turks Sites	A quality, full service hotel with conference and banqueting facilities; residential including affordable housing; ground floor A1, A3 and A4 uses	3a	A small proportion of site 10 is situated within Zone 3. Development within that proportion of the							

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
	with active frontages; a new public space on the riverside, a high quality pedestrian route from Wood Street to the riverside; and public car parking		site within Zone 3 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 3. The remaining proportion of the site falls within Zone 2 and 1, refer to Kingston Town Centre Planning Recommendations for Zone 2 and 1.						
P13: Bishops Palace House and 11-31 Thames Street	Retail, housing, including affordable housing, B1 offices, A3 café / restaurant uses and replacement A4 public house	3a	A proportion of site P11 is situated within High Probability Zone 3. Development within that proportion of the site within Zone 3 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 3. The remaining proportion of the site, falls within Zone 2, refer to						

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
			Kingston Town Centre Planning Recommendations for Zone 2.							
P14: Guildhall 1, County Court and Bath Passage/St James's Road corner	The Council will work with Her Majesty's Courts Service to provide new and upgraded Courts and associated support facilities. Consider the comprehensive redevelopment of P14 for retail, A3, offices, courts, civic and community uses.	3a	A very small proportion of site P14 is located within Zone 3b however the majority of site lies within Zone 3a. Refer to Kingston Town Centre Planning Recommendations for Zone 3a and 3b.							
P15: Surrey County Hall	In the event that Surrey County Council move out of County Hall, the Council will promote the use of the building for Higher Education Use by Kingston University	1	Refer to Kingston Town Centre Planning Recommendations for Zone 1.							
P16: Kingston University	High quality redevelopment of outmoded buildings to accommodate University expansion and enhance its facilities, including landmark development of the	1	Refer to Kingston Town Centre Planning Recommendations for Zone 1.							

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)				
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
P17: Former Power Station; EDF Sub Station; The Barge Dock and Thames Water Pumping Station, Skerne Road and Down Hall Road	Town House on the Penryhn Road frontage Housing on 17a and 17b, including affordable housing, quality full service hotel with conference and banqueting facilities on 17a or 17b, a community use such as a nursery, landscaped amenity and play space on 17a and 17b, and a landmark building on 17a which respects its sensitive riverside setting.	3a	A very small proportion of site P17 (P17c) is situated within High Probability Zone 3b. It is suggested that areas delineated as Zone 3b should be treated as Zone 3a for planning purposes as there is no direct flow path between the site and the river (removing the functionality of the floodplain). The site is also partially situated Zone 3a. Development within that proportion of the site within Zone 3 should be conditioned in accordance with Kingston Town Centre Planning Recommendations for Zone 3. The remaining					

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
			proportion of the site falls within Zone 2, refer to Kingston Town Centre Planning Recommendations for Zone 2.						
P18: Lok'n Stor Site, 12 Skerne Road	Housing including affordable housing, an NHS GP healthcare facility, landscaped amenity and play space, and basement car parking	2	Refer to Kingston Town Centre Planning Recommendations for Zone 2.						
P19: Kingston College and adjoining sites, Kingsgate Business Centre and Printing Works, and Kingston Gas Holder Station	The provision of new and upgraded facilities for Kingston College on their Richmond Road site 19a, retaining the old school frontage building and the Penny Gallery. The redevelopment of the small site to the north of the College 19e for mixed A1 retail/A2/A3 uses with residential above or education use. The upgrading of the appearance of the property to the south of the College 19b or its redevelopment for education, retail or	2	A small proportion of site 19 is situated within Medium Probability Zone 2. Development within that proportion of the site within Zone 2 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 2. The remaining proportion of the site falls within Zone 1, refer to Kingston Town Centre Planning						

K+20 Proposal Site	Proposed Land Use	PPS25	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
	office use. The retention of the Kingsgate Business Centre and printing works 19c for employment use or their redevelopment for B1 business use or ground floor B1 use with managed student accommodation above.		Recommendations for Zone 1.						
P20: Kingsgate Car Park and Richmond Road Frontage	Ground floor retail (A1) and retail related uses (A2/A3) on the Richmond Road frontage, retail or showroom uses on the ground floor on the car park site. Residential, including affordable and student housing, offices or community uses on the upper floors.	2	A small proportion of site 20 is situated within Medium Probability Zone 2. Development within that proportion of the site within Zone 2 should be conditioned in accordance to Kingston Town Centre Planning Recommendations for Zone 2. The remaining proportion of the site falls within Zone 1, refer to Kingston Town Centre Planning Recommendations for Zone 1.						

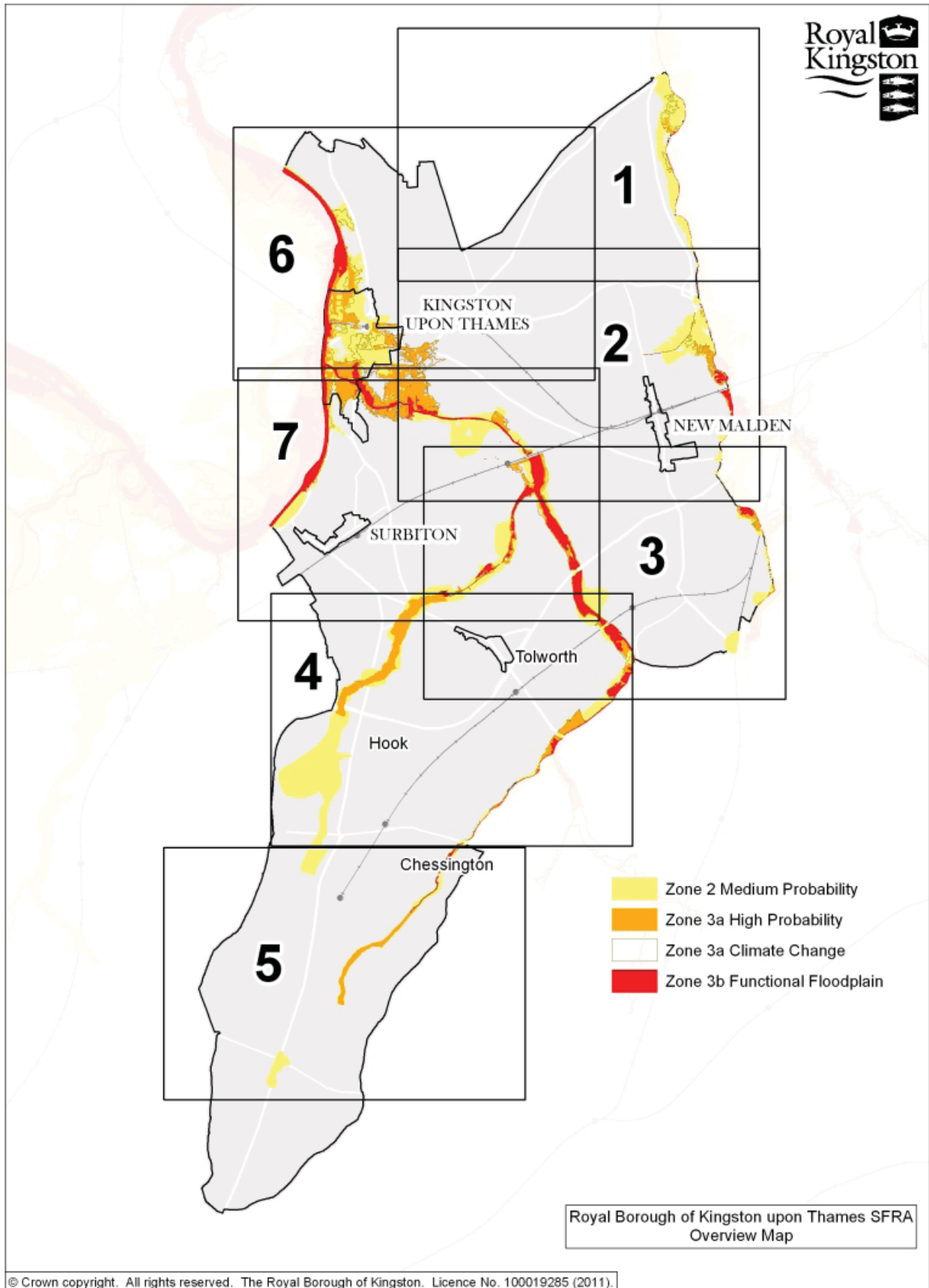
4.3 Borough Character Areas

4.48 SFRA level 1 within the Borough has been considered on the basis of 'Character Areas,' (see Figure 10). The Borough Character Areas have been delineated largely on the basis of geographical location and specific recommendations have been provided. The following recommendations are applicable to all Borough Character Areas:

- Future planning horizons should ensure that the open space areas adjoining the River Thames, Beverley Brook and River Hogsmill waterway corridor, delineated as Zone 3a High Probability, are protected against future development.
- It is important to recognise that the River Hogsmill poses a marked risk of flooding to Kingston Town Centre. All future development must be carefully planned to avoid any possible exacerbation of flood risk downstream.
- Localised flooding that has been observed historically is provided for each character area. PPS25 (Annex F) states that *“Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account”*. To this end, development should (as far as is practicable) be designed so that flows generated by the development are safely contained within the site up to and including the 1% (1 in 100) design event, including an allowance for climate

change. Surface water flows that exceed this event should be managed so that they do not pose an unacceptable risk to people or property.

Figure 10 Borough Character Areas Overview

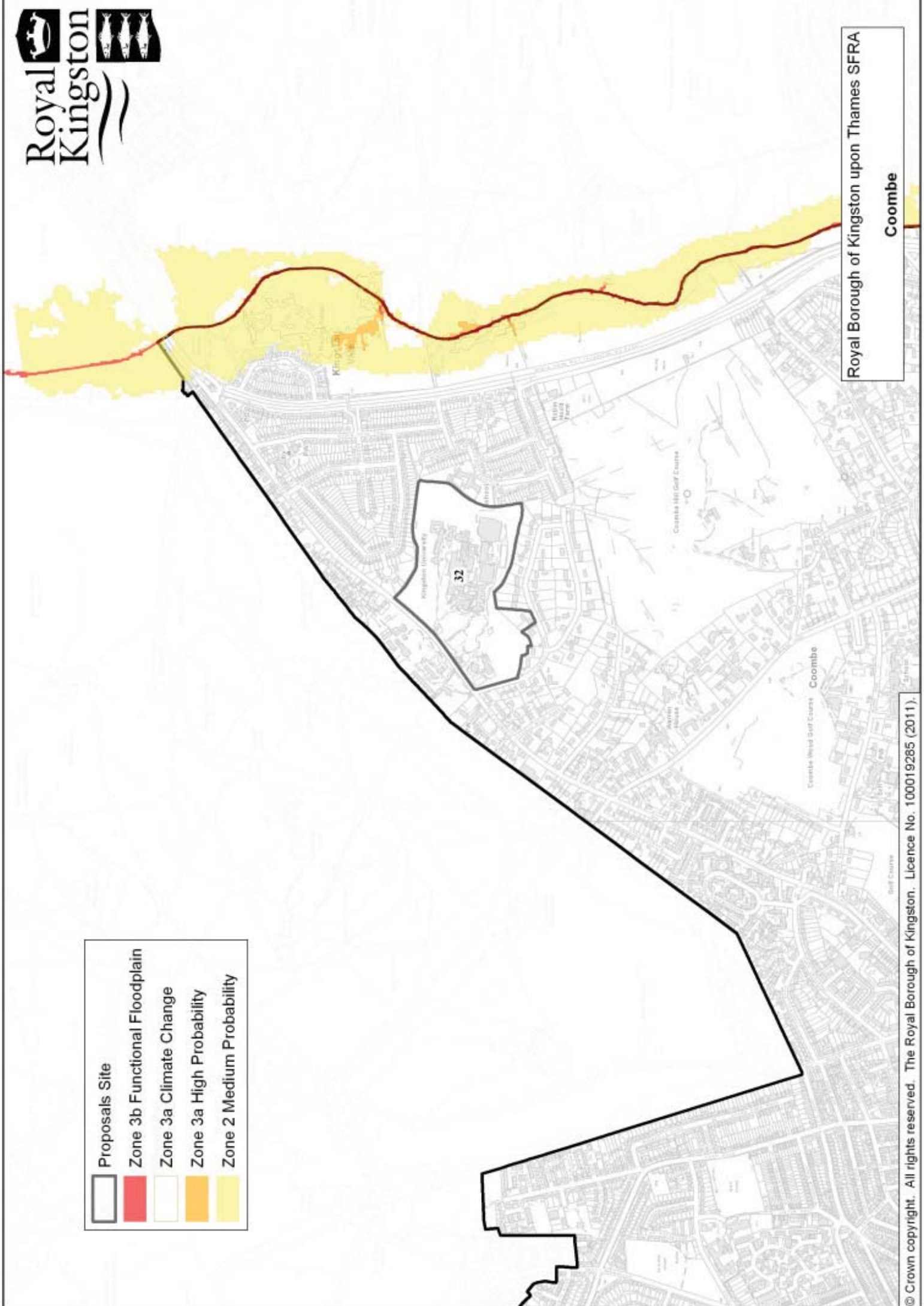
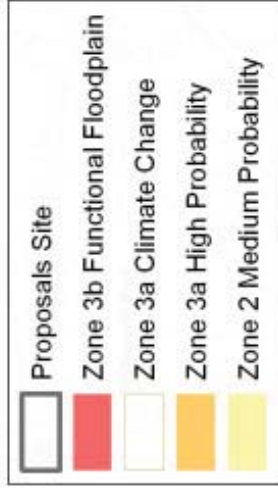


4.4 Character Area KB1 - Coombe

4.49 Character Area KB1, Coombe is bounded to the east by Beverley Brook. A large proportion of Character Area KB1 is elevated and situated within **zone 1 low probability**, see Figure 11. The Environment Agency flood zone map indicates that open space areas adjoining the brook (i.e. to the east of Robin Hood Way) are subject to flooding, with the majority falling within **zone 2 medium probability** however a small proportion falls within **zone 3a high probability**. These open spaces have been retained as playing fields, and therefore there is no existing and/or potential future development at risk within current planning horizons.

4.50 In addition to the fluvial flooding from the Beverley Brook, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Coombe Ridings (2000) - water in brickwork at back of house
- Gibbon Road (2003) - water in the cellar



Royal Borough of Kingston upon Thames SFRA
Coombe

4.5 Character Area KB2 - New Malden and Norbiton

4.51 Character Area KB2, New Malden and Norbiton is bounded to the east and west by Beverley Brook and River Hogsmill respectively, see Figure 12. A large proportion of the area is unaffected by fluvial flooding, situated within **zone 1 low probability**.

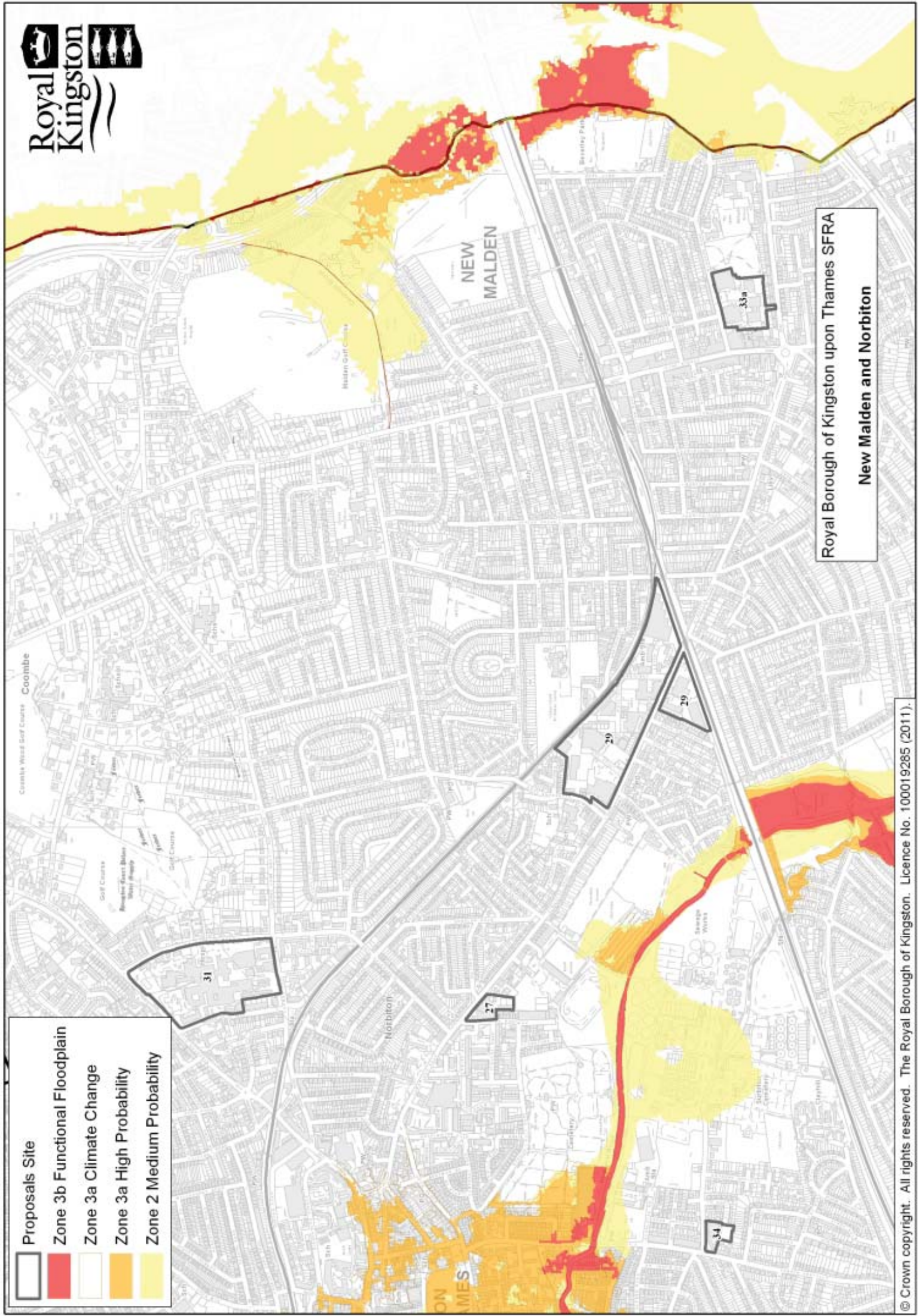
4.52 A potential risk of flooding associated with River Hogsmill is highlighted in Figure 12. Currently no property appears to be at risk of flooding in Norbiton, the flood affected zone limited largely to open space areas adjoining the waterway corridor and the Sewerage Works. It is important to recognise however that River Hogsmill poses a marked risk of flooding to Kingston Town Centre, situated immediately downstream. All future development must be carefully planned to avoid any possible exacerbation of flood risk downstream.

4.53 A potential risk of flooding has also been identified associated with Beverley Brook, affecting properties within New Malden. Properties situated between Malden Golf Course and Beverley Way are situated within **zone 2 medium probability**.

4.54 In addition to the fluvial flooding from the Hogsmill River and Beverley Brook, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Beverley Road (2003) - water below floorboards
- Darley Drive (2003) - overflowing manhole in school grounds, probably due to leaking main, rainfall makes the situation worse.
- Gibbon Road (2003) - water in Cellar

- Galsworthy Road (2002) - water entering block of flats in basement
- Raeburn Avenue (1) (2002) - damp garden



**Royal Borough of Kingston upon Thames SFRA
New Malden and Norbiton**

- Proposals Site
- Zone 3a High Probability
- Zone 3a Medium Probability
- Zone 3b Functional Floodplain
- Zone 2 Medium Probability

4.6 Character Area KB3 - Old Malden & Motspur Park

4.55 Character Area KB3, Old Malden and Motspur Park is bounded by River Hogsmill to the west and Beverley Brook to the east. A large proportion of the area falls within **zone 1 low probability**, however properties immediately adjoining the River Hogsmill and Beverley Brook waterway corridors are identified by the Environment Agency flood zone maps as potentially at risk of flooding, see Figure 13.

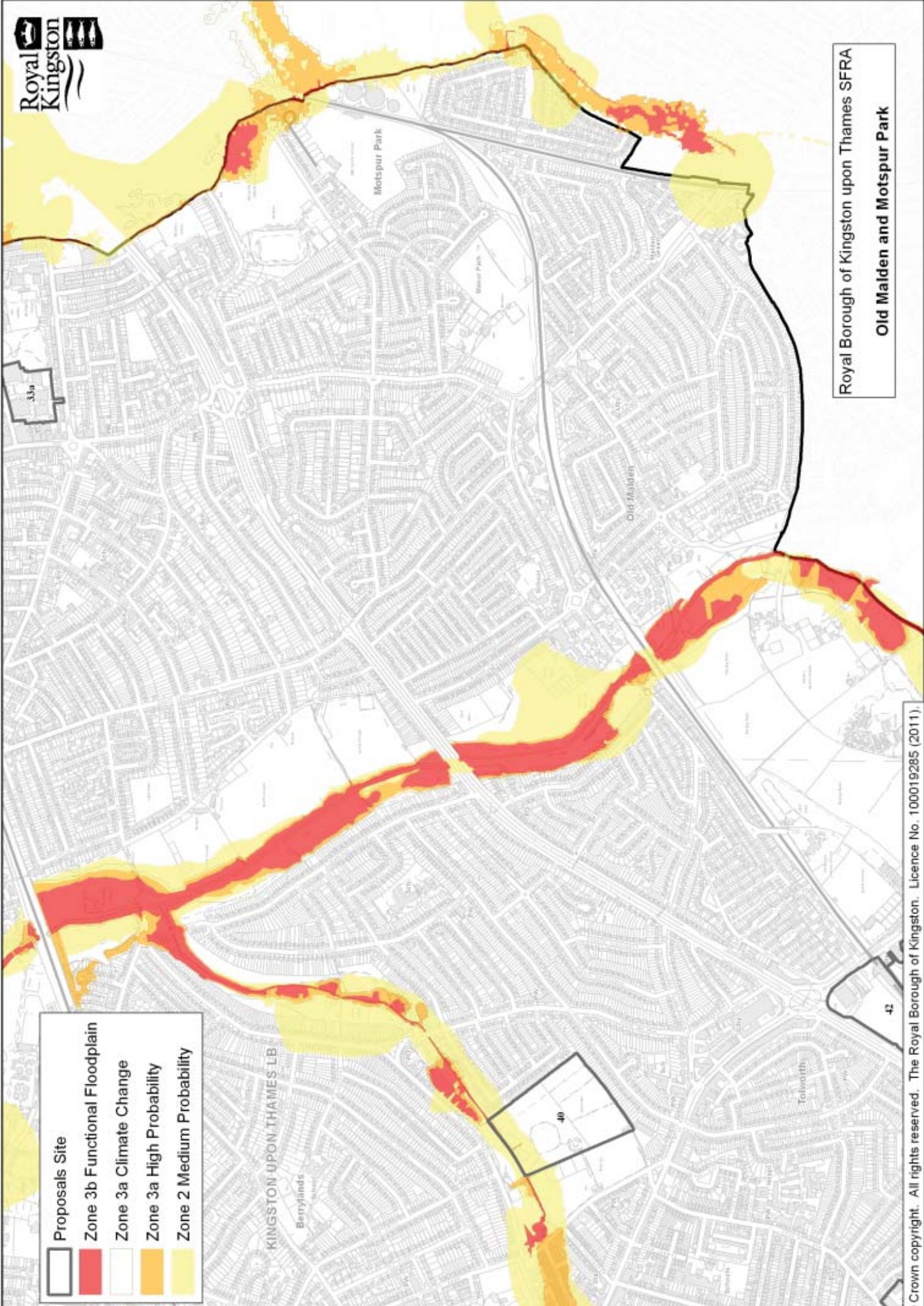
4.56 A small number of homes adjoining the River Hogsmill (i.e. properties in Southwood Drive) and its tributary (properties in Raeburn Avenue and Northcote Avenue) fall within **zone 2 medium probability**. Localised flooding has also been experienced in the vicinity of the River Hogsmill tributary, highlighting the susceptibility of properties to flooding in this locality. Most of the area affected by flooding in the River Hogsmill corridor is currently designated open space.

4.57 Properties in Pembury Avenue and surrounding Worcester Park train station are delineated as **zone 2 medium probability**. There are no known observations of historical flooding at this location.

4.58 The interim findings of the River Hogsmill IUD Pilot Study confirms a particular susceptibility to surface water flooding and surcharging of the underground drainage system within this vicinity.

4.59 In addition to the fluvial flooding from the Hogsmill River and Beverley Brook, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Raeburn Open Space- Lagoon site suffers from flooding from time to time - cause unknown
- Alexandra Drive - combination of ground flows combined with sewer surcharge causes road to "flood" and affects two properties. There was also a groundwater issue at the rear of these two properties.
- Beverley Road (2003) - Water below floorboard
- Hazel Bank (2000) - Groundwater flooding of garden
- The Crest (2000) - Basement flooded
- Pune Gardens (2001) - Waterlogged Garden
- Purbeck Avenue (2001) - Groundwater issues
- Raeburn Avenue (1) (2002) - Damp garden
- Greenfield Avenue (2002) - Void under house filling up due to heavy rainfall
- Raeburn Avenue (2) (2003) - Waterlogged garden



	Proposals Site
	Zone 3b Functional Floodplain
	Zone 3a Climate Change
	Zone 3a High Probability
	Zone 2 Medium Probability

4.7 Character Area KB4 - Tolworth and Hook

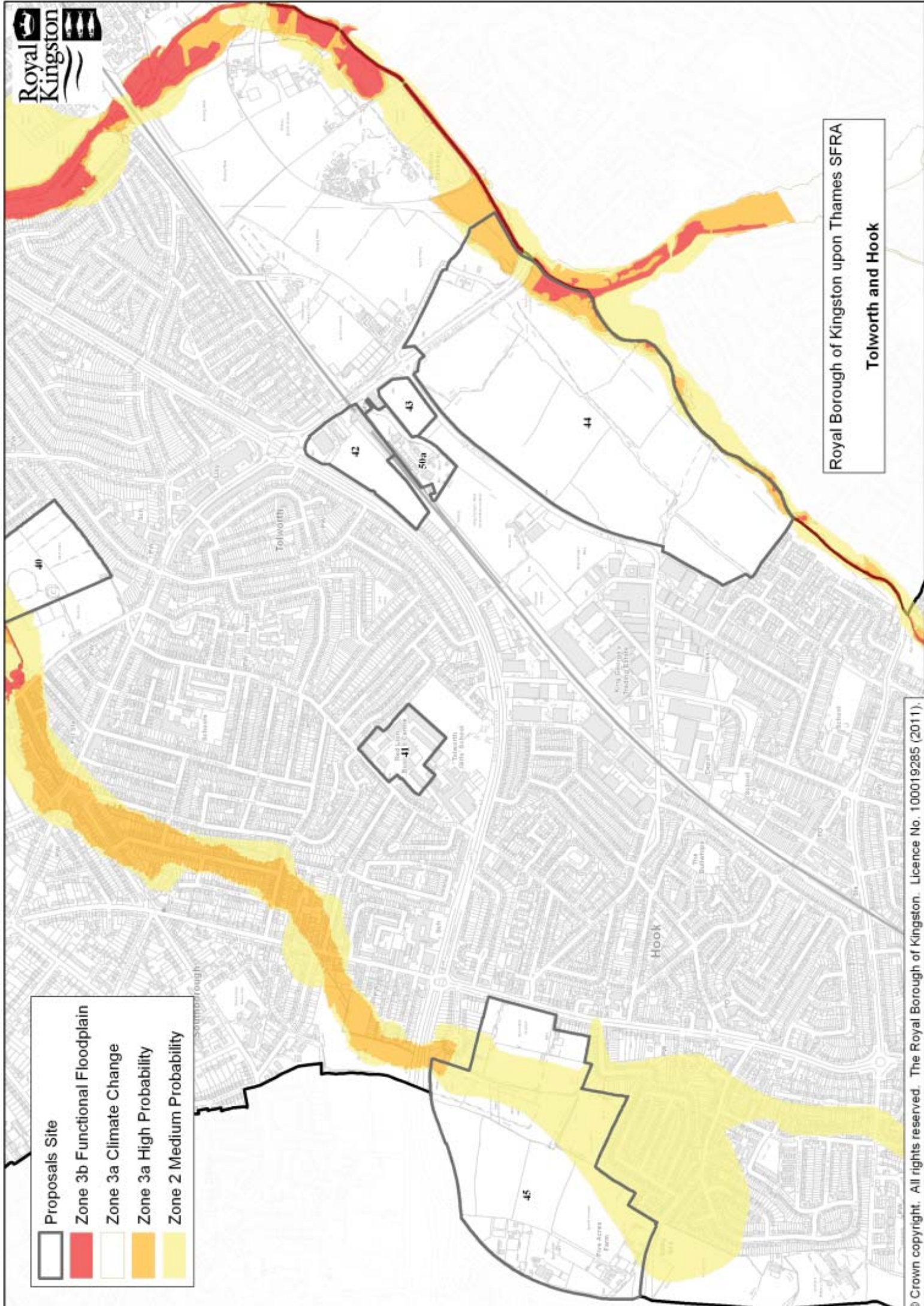
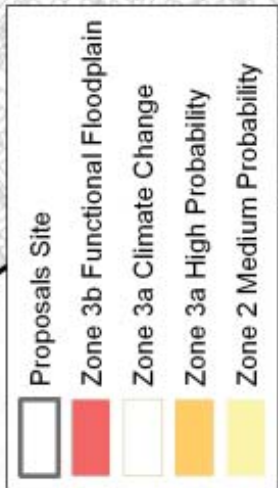
4.60 A large proportion of Character Area KB4, Tolworth and Hook is situated within **zone 1 low probability**, refer to Figure 14. The area is bounded to the south east and north west by the River Hogsmill and its tributary respectively. The land adjoining the River Hogsmill corridor is largely open space. These areas are designated **zone 3a high probability** for planning purposes.

4.61 In contrast, Tolworth Brook also known as Surbiton Stream (a tributary of Hogsmill River) is heavily constrained by urban development, and a number of residential properties adjoining the waterway corridor are situated with **zone 3a high probability**.

4.62 A large number of properties situated within the uppermost reaches of the River Hogsmill tributary (i.e. Hook) are within the **zone 2 medium probability**. There is no obvious overland flow path at this location, indicating a culverted system.

4.63 In addition to the fluvial flooding from the tributaries of the Hogsmill River, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Hazel Bank (2000) - Groundwater flooding of garden
- Ellerton Road (2000) - Flooded garden
- Clayton Road (2002) - Water in foundations



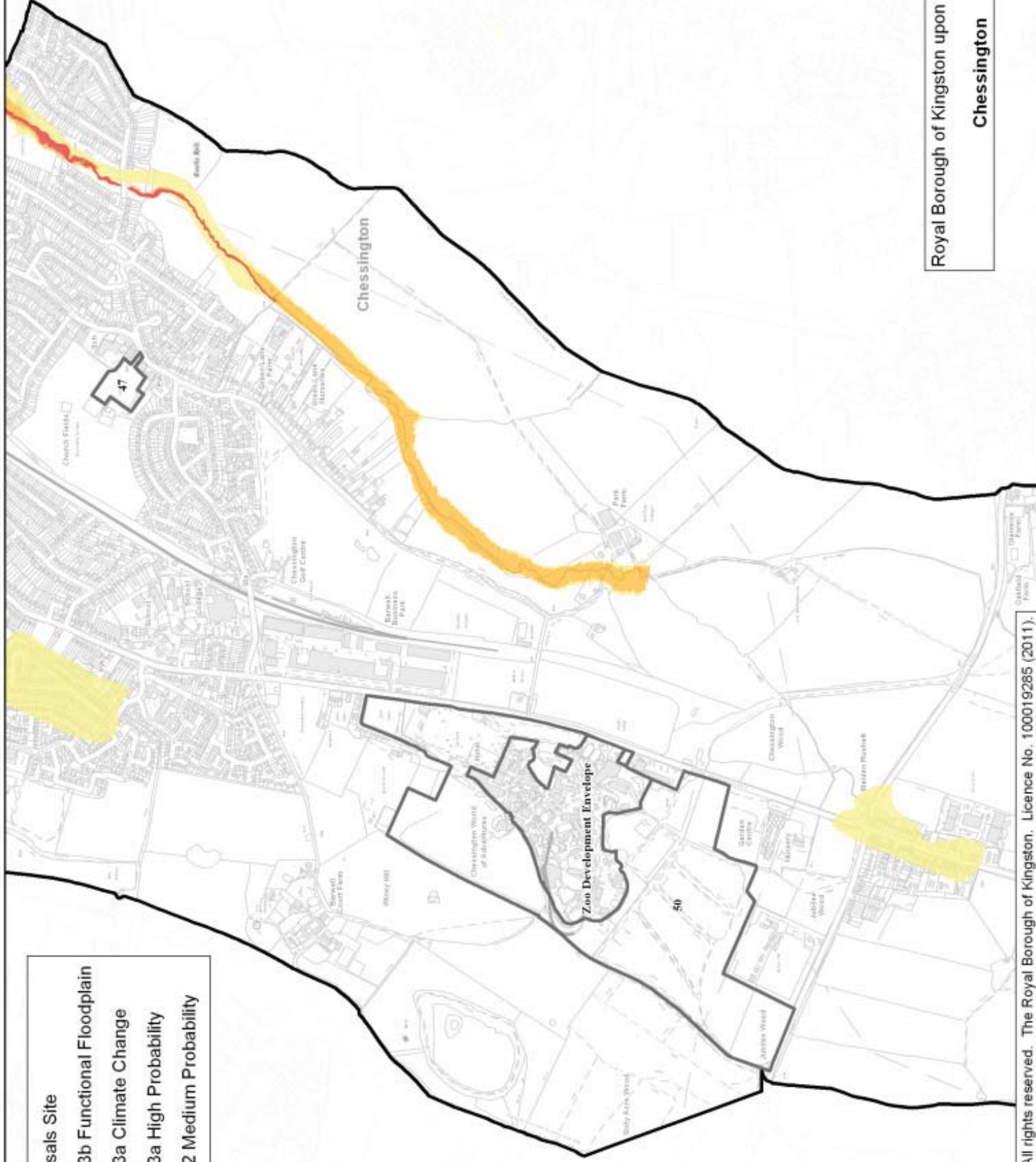
4.8 Character Area KB5 - Chessington

4.64 Character Area KB5, Chessington is situated within the upper most reaches of the River Hogsmill. With the exception of a narrow corridor of open space adjoining the waterway corridor, most of this area falls within **zone 1 low probability** so the majority of properties within the Chessington area do not appear to be at risk of flooding directly, see Figure 15.

4.65 The village of Malden Rushett is categorised as **zone 2 medium probability**. Historical flooding has been observed at this location, however the source (and scale) of the flooding is unknown.

4.66 In addition to the fluvial flooding from the River Hogsmill, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- A243 (1) (2005) - waterlogged garden for 5 months
- Filby Road (2001) - water draining into garden from neighbours
- A243 (2) (2003) - regular flow from garden down driveway, other houses affected opposite



- Proposals Site
- Zone 3b Functional Floodplain
- Zone 3a High Probability
- Zone 2 Medium Probability

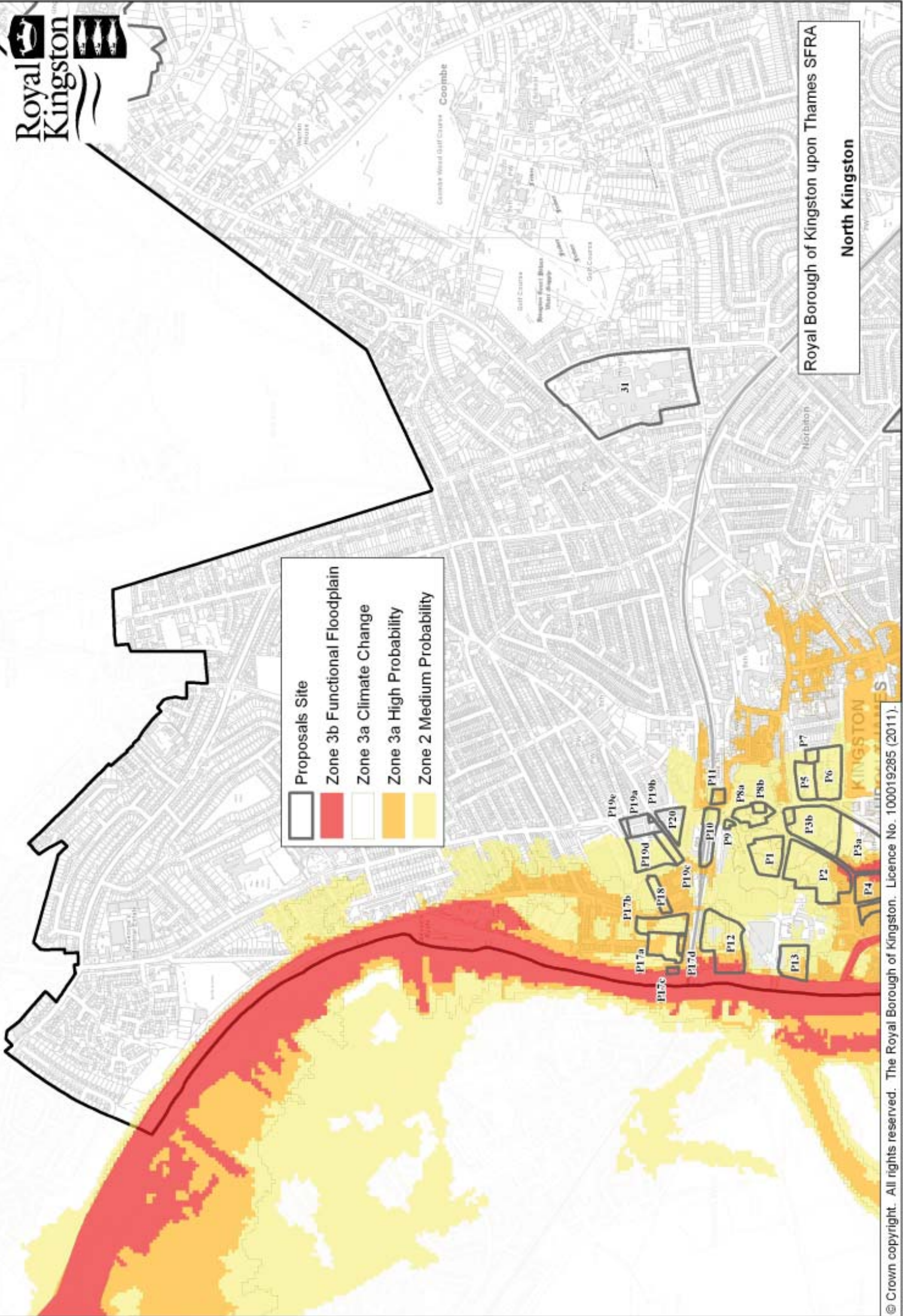
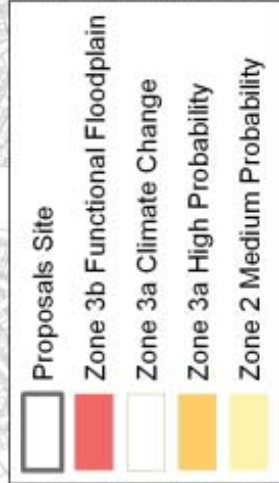
4.9 Character Area KB6 - North Kingston

4.67 The vast majority of Character Area KB6 North Kingston is situated in **zone 1 low probability**, see Figure 16. The largely residential area situated between Richmond Road and the River Thames is affected by fluvial flooding from the Thames, and a small number of properties situated on the eastern side of Skerne Road fall within the 1% (100 year) flood extent, designated **zone 3a high probability**. Properties adjoining Albany Mews are located within zone 2 medium probability however detailed flood risk mapping indicates that climate change may increase the extent of flooding in future years.

4.68 Skerne Road is an identified flow path during River Thames flooding and is located within **zone 3a high probability**. As a road corridor, this will not unduly influence future development within the region. Emergency planning should carefully consider the potential risk to residents during flooding events, ensuring that an alternative evacuation route is available.

4.69 In addition to the fluvial flooding from the River Thames, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Skerne Road (2000) - damp cellar
- Coombe Ridings (2000) - water in brickwork at back of house
- Galsworthy Road (2002) - water entering block of flats in basement
- Gibbon Road (2003) - water in cellar



4.10 Character Area KB7 - Surbiton & Berrylands

4.70 The area of Surbiton and Berrylands, Character Area KB7, is bounded by the River Thames to the west and the River Hogsmill to the east. The majority of the area falls within **zone 1 low probability**, and therefore future development is generally not restricted under flood risk grounds, see Figure 17.

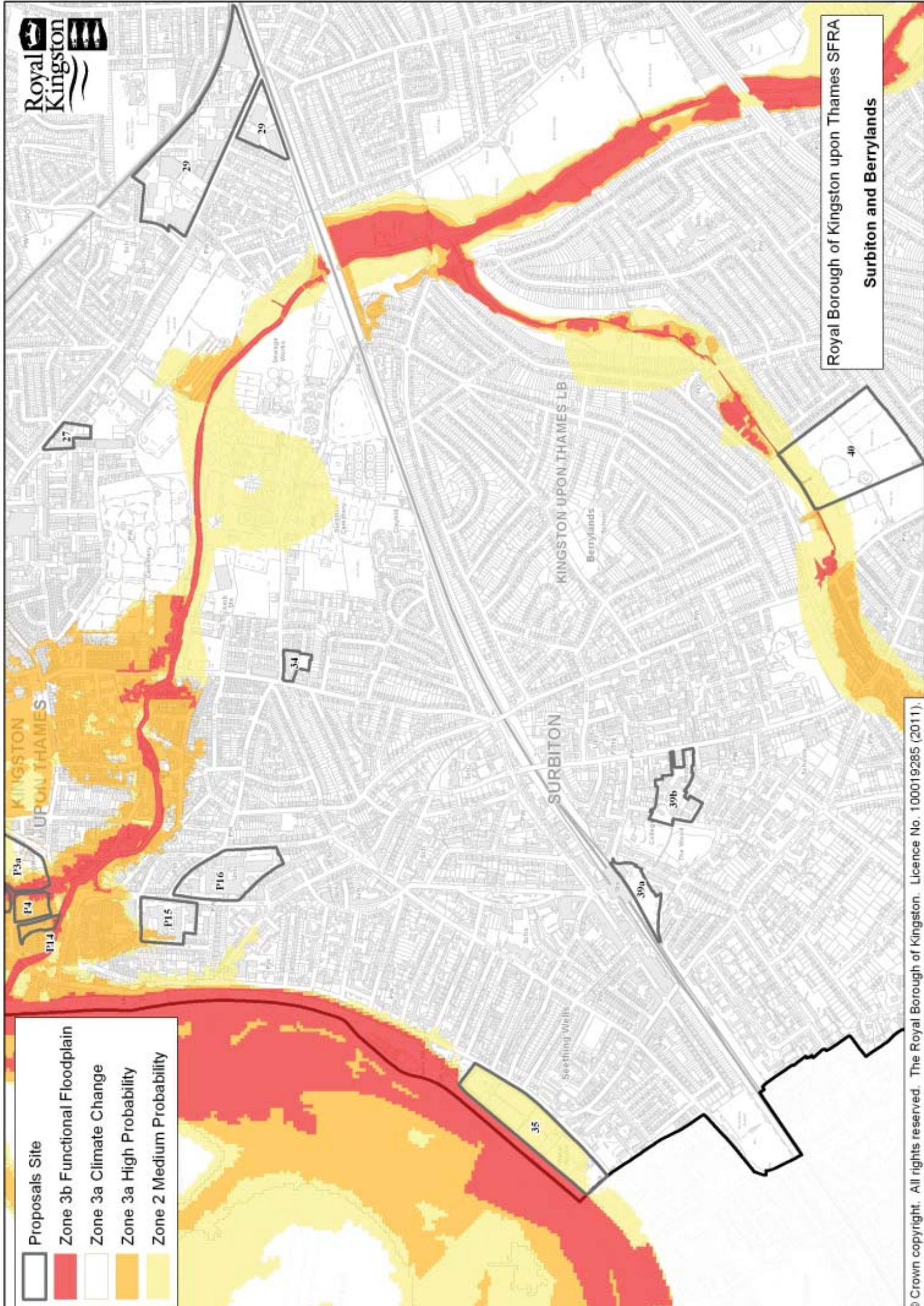
4.71 Detailed modelling indicates that a small number of properties immediately adjoining the River Thames (along A307) are situated within **zone 2 medium probability**.

4.72 The area immediately to the east of the town centre however is affected by flooding associated with the River Hogsmill, impacting upon a number of properties in the vicinity of Mill Street and Villiers Road. This area is designated **zone 3a high probability** accordingly, and careful planning is required within this area to minimise the potential risk to property and life.

4.73 It is noted that this area is situated immediately downstream of the Sewerage Works (also contained within **zone 3a high probability**). It is understood that releases from the Sewerage Works results in a rapid increase in water levels within the River Hogsmill downstream. Discussions have been held with Thames Water in this regard, and it was confirmed that releases occur only in accordance with strict licence conditions that are in place to ensure that there is no impact upon flood risk downstream.

4.74 In addition to the fluvial flooding from the River Thames and River Hogsmill, the previous SFRA (2008) highlighted localised flooding that had been observed historically at the following:

- Raeburn Open Space - lagoon site suffers from flooding from time to time
- Alexandra Drive - combination of overground flows combined with sewer surcharge that caused road to "flood" and overflow two properties. There was also a ground water issue at the rear of the two properties
- Browns Road/King Charles Crescent - flooding affects houses in this area. Thames Water have proposed a scheme to reduce this by utilising the fishponds.
- Avenue South (2000) - water in cellars, waterlogged pitches
- Fishponds (2000) - water in basement
- The Crest (2000) - basement flooded
- Pune Gardens (2001) - waterlogged garden
- Cranes Park (2002) - damp garden
- Raeburn Avenue (1) (2002) - damp garden
- Greenfield Avenue (2002) - void under house filling up due to heavy rainfall
- Raeburn Avenue (2) (2003) - waterlogged garden



	Proposals Site
	Zone 3b Functional Floodplain
	Zone 3a Climate Change
	Zone 3a High Probability
	Zone 2 Medium Probability

4.11 Unitary Development Plan Proposal Sites

4.75 An assessment of flood risk relating to the Proposal Sites identified in the Adopted Unitary Development Plan (UDP) (August 2005) is presented below (see Figures 8 to 17 for locations of UDP proposal sites). The risk of flooding posed to (and by) the proposed development has been considered. Where possible at this stage, a cross check has been carried out between the proposed land use, and the vulnerability criteria provided by PPS25. This provides an indication of whether or not the sites are likely to meet the requirements of the Exceptions Test. Please note that the Exceptions Test should not be considered until such time as the Sequential Test has been applied.

4.76 In accordance with PPS25, it is necessary for a local authority to adopt a sequential approach when allocating sites for future development. This is outlined in Planning and Development Management section of the SFRA, however it must be demonstrated that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding. The SFRA does not endeavour to address this aspect of the Sequential Test. It can however review emerging allocations, and in light of the delineated PPS25 flood zones, provide clear recommendations for permissible land uses (as defined by PPS25).

4.77 All of the proposal sites in the Council’s adopted UDP (August 2005), with the exception of PS29b: Territorial Army Depot and the open space/recreation sites are situated within Zone 1 Low Probability. One amendment has been made since the SFRA (Jacobs, 2008) for PS35: Thames Water Plc.

4.78 In the future, the UDP will be superseded by the LDF and the Proposal Sites in the UDP will not be taken forward. However, the broad strategic locations for potential new housing in the Borough will be sequentially tested by the Council and form part of the LDF evidence base.

4.79 The table below has adopted a ‘traffic light’ system to mirror the decision matrix provided within PPS25 Annex D. In some instances, sites are only partially affected by flooding, and the ‘traffic lights’ within the attached matrix reflect the most significant risk of flooding within the site. At these locations, future development may be permitted to proceed, however this should be restricted to the lowest risk areas of the site if at all possible. The attached table summarises:

- the locality of each site;
- the flood zone within which that site falls; and
- the restrictions that flood risk places upon the future development of the site.

4.80 The table should be interpreted in accordance with the following legend.

Table 6

	Development type is permissible under PPS25 and a site based FRA must meet the requirements set out in this SFRA.
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	Development type is permissible under PPS25, only if the Exception Test is passed. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk. A site based FRA must meet the requirements set out in this SFRA.
	Development type is not permitted by PPS25.

4.81 NOTE: Where a site is only partially affected by flooding, the 'worst' (most constrained) flood zone has been highlighted in the matrix. Future development should be restricted to the area within the site that is least affected by flooding.

Table 7 : Unitary Development Plan Proposal Sites

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)				
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
PS44: Tolworth Court Farm	Open Recreation	3a	<p>This site is situated partially within Zone 3a High Probability. Following the application of the Sequential Test, future development within this zone must be restricted to water compatible, less or more vulnerable uses and essential infrastructure. More vulnerable uses and essential infrastructure may only be permitted if the Exception Test is passed. All Development should be guided towards areas of lowest risk within the site, and development should be designed in strict accordance with the development control recommendations set out in the SFRA. A very small proportion of the site is situated within Zone 3b Functional Floodplain, and development should be avoided within this area.</p>					

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)				
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
PS35: Thames Water Plc	Recreation	2	This site is situated mainly within Zone 2 Medium Probability. Following the application of the Sequential Test, all future uses are appropriate. Highly vulnerable uses may only be permitted if the Exception Test is passed. All development should be guided towards areas of lowest risk within the site, and development should be designed in strict accordance with the development control recommendations set out in the SFRA.	Green	Orange	Green	Green	Green
PS40: Tolworth Main Allotments	Open Space Uses	2	This site is situated partially within Zone 2 Medium Probability. Following the application of the Sequential Test, all future uses are appropriate. Highly vulnerable uses may only be permitted if the Exception Test is passed. All development should be guided towards areas of lowest risk within the	Green	Orange	Green	Green	Green

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
			site, and development should be designed in strict accordance with the development control recommendations set out in the SFRA.							
PS45: King Edward's Playing Field	Open Recreation	2	This site is situated partially within Zone 2 Medium Probability. Following the application of the Sequential Test, all future uses are appropriate. Highly vulnerable uses may only be permitted if the Exception Test is passed. All development should be guided towards areas of lowest risk within the site, and development should be designed in strict accordance with the development control recommendations set out in the SFRA.							
PS29b: Territorial Army Depot	Residential	2	This site is situated partially within Zone 2 Medium Probability. Following the application of the Sequential Test, all future uses are							

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
			appropriate. Highly vulnerable uses may only be permitted if the Exception Test is passed. All development should be guided towards areas of lowest risk within the site, and development should be designed in strict accordance with the development control recommendations set out in the SFRA.							
PS32	Kingston University	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.							
PS29: St. John's Industrial Area	General Industry	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints							

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
			placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS31	Kingston Hospital	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS34: Unigate Milk Depot	Residential	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential						

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)						
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible		
			that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.							
PS27: Rex Motors	General Industry	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.							
PS33a: Cocks Crescent	Community Uses	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and							

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
PS39a: Surbiton Car Park	Residential	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS39b: Surbiton Hospital	Surbiton Hospital	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
PS41: Red Lion Road	Industry	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS42: Former Government Offices	Residential	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS43: Land at Kingston Road	Commercial	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing						

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
			planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS47: Churchfield Allotments	Recreation/Community Uses	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS50: Chessington World of Adventures	Recreation	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk,						

UDP Proposal Sites	Proposed Land Use	PPS25 Zone	Comments	Permissible Land Use (PPS25 Sequential Test)					
				Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible	
			however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						
PS50a	Rail (Industry)	1	This site is situated wholly within Zone 1 Low Probability. There are no pressing planning constraints placed on this site by PPS25 as a result of fluvial flood risk, however it is essential that the potential risk of flooding from other sources is thoroughly understood, and mitigated as an integral part of the design process.						

5 Detailed Flood Risk Assessment

5.1 The SFRA is a strategic document that provides an overview of flood risk throughout the district. Once the Sequential Test has been applied in accordance with Planning and Development Management section to determine the allocation of sites for future development, it is imperative that a site-based Flood Risk Assessment (FRA) is carried out by the developer for all proposed developments. This should be submitted as an integral part of the planning application. **It is emphasised that, for windfall sites, it will be necessary for the developer to demonstrate that the Sequential Test has been applied (in accordance with PPS25) within the detailed FRA.**

5.2 The FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding to the site is negligible (e.g. Zone 1 Low Probability), there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower in the catchment. The particular requirements for FRAs within each delineated flood zone are outlined below.

5.3 This section has been split into two parts and sets out the detailed requirements for Flood Risk Assessments (FRA) located within the Kingston Town Centre and Borough wide planning. The information is to be used by planning applicants.

Box 2

It is highlighted that the description of flood risk provided in the Kingston Town Centre and Borough Character Areas above place emphasis on the primary source of flood risk (i.e. river flooding). In all areas, a localised risk of flooding may also occur, typically associated with local catchment runoff following intense rainfall passing directly over the Borough. This localised risk of flooding must also be considered as an integral part of the detailed Flood Risk Assessment.

Scope of Detailed Flood Risk Assessment

Proposed Development within Zone 3a High Probability and Zone 3b Functional Floodplain (Developed Areas)

All Flood Risk Assessments (FRA) supporting proposed development within Zone 3b Functional Floodplain and Zone 3a High Probability should include an assessment of the following.

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage and/or groundwater) as well as from river flooding. In addition to the use of information provided within the SFRA, this will involve discussion with the Council and the Environment Agency to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change) **for all sources of flooding**, i.e. maximum water levels, flow paths and flood extents within the property and surrounding area. The Environment Agency may have carried out detailed flood risk mapping (with respect to

fluvial flooding) within localised areas that could be used to underpin this assessment. Where available, this will be provided at a cost to the developer. Where detailed modelling is not available, hydraulic modelling by suitably qualified engineers may be required to determine the risk of flooding to the site. The propensity of culverted systems to block, increasing the risk of flooding, should be considered.

- The presence of both formal and de-facto (including, for example, local road and/or rail embankments) flood defences within the proximity of the site must be considered. Flood defences may alter the risk of flooding within the site, and it is imperative that any change in the flooding regime as a result of a flood defence is thoroughly understood. The integrity of the defence must be assessed to ensure that the defence will be structurally sound throughout the lifetime of the proposed development. The potential impact of a defence failure must be considered.
- The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment, to be carried out by a suitably qualified engineer. It is emphasised that the detailed assessment of potential impacts elsewhere should not be limited (in a geographical sense) to within the borough. Future development within the Borough may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood

defences, flood resistant and resilient design, provision for escape/evacuation, effective flood warning and emergency planning.

- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum.
- Details of proposed SUDS that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of topographical, groundwater and geological conditions (refer to Section 2 Flood Risk in the Royal Borough of Kingston).
- The developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the borough.

Proposed Development within Zone 2 Medium Probability

- For all sites within Zone 2 Medium Probability, a high level FRA commensurate with the level of risk posed to the site should be prepared based upon readily available existing flooding information, sourced from the EA. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed through, for example, the provision of raised floor levels and the provision of a planned evacuation route.
- The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered, and SUDS must be employed to ensure no worsening to existing flooding problems elsewhere within the area. Once again, it is reiterated that future development within the district may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.
- As part of the high level FRA, the developer must provide a clear and

concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the borough.

- Details of proposed SUDS that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of topographical, groundwater and geological conditions (refer to Flood Risk in the Royal Borough of Kingston section).

Proposed Development within Zone 1 Low Probability

For all sites greater than 1 hectare in area, a simple FRA must be prepared:

90

- The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered, and sustainable drainage techniques must be employed to ensure no worsening to existing flooding problems elsewhere within the area. Once again, it is reiterated that future development within the borough may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.
- As part of the FRA, the developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the borough.
- Details of proposed SUDS that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of topographical, groundwater and geological conditions (refer to Flood Risk in the Royal Borough of Kingston section).

The table below summarises the FRA requirements for each flood zone.

Table 8 : FRA Requirements Summary

FRA Requirements			
	Zones 3b and 3a	Zone 2	Zone 1 (>1ha)
The vulnerability of the development to flooding from all sources as well as from river flooding	√	√	√
Essential to discuss with the Council and the Environment Agency to confirm whether a localised risk of flooding exists at the proposed site	√		
Vulnerability of the development to flooding over the lifetime of the development for all sources of flooding	√		
Consideration of the propensity of culverted systems to block	√		
Presence of both formal and de-facto flood defences, their integrity and failure consequences	√		
Potential of the development to increase flood risk elsewhere due to surface water runoff	√	√	√
Demonstration that residual risks of flooding are acceptable	√	√	
Site levels	√		
Proposed SUDS	√	√	√
Statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the Borough	√	√	√

5.1 Flood Warning and Evacuation Plans

5.4 In line with PPS25, Flood Warning and Evacuation Plans should be in place for those areas at an identified risk of flooding. Developers should ensure that appropriate evacuation and flood response procedures are in place to

manage the residual risk associated with an extreme flood event, and include how such plans will be implemented. Therefore, it is recommended that development proposals submit a Flood Warning and Evacuation Plan. Further information on what a Flood Warning and

Evacuation Plan should cover can be found in Figure 7.2 of PPS25 Practice Guidance (2009).

5.2 Liason with the Environment Agency

5.5 To assist local planning authorities, the Environment Agency has produced standing advice to inform them on their requirements regarding the consultation process for planning applications on flood risk matters. Full details of their Flood Risk Standing Advice for England can be found at <http://www.environment-agency.gov.uk/research/planning/82584.aspx>.

5.6 The Environment Agency is an excellent source of information for the preparation of the detailed FRA. The external relations team should be contacted as early as possible to source information relating to (for example) historical flooding, hydraulic modelling and topography (LiDAR). The information provided within this SFRA is the best available at the time of writing. More up to date information may be available, and contact should be made with the EA at an early stage to ensure that the detailed site based FRA is using the most current datasets, avoiding unnecessary re-work.

5.7 It is recommended that a draft of the detailed FRA is provided to the EA for review and comment before submission with the Planning Application, thereby reducing potentially costly delays to the planning process. The Council and the EA will liaise on the suitability of the FRA as submitted, with the EA providing technical assistance to the Council.

5.8 Developers and applicants can get advice from the Environment Agency free of charge relating to a specific plot

of land before submitting a planning application to a Local Planning Authority. The form is available on: <http://www.environment-agency.gov.uk/research/planning/33580.aspx>

5.3 Raised Floor Levels & Basements

5.9 The raising of floor levels above the 1% AEP (100 year) fluvial flood level will ensure that the damage to property is minimised. Given the anticipated increase in flood levels due to climate change, the adopted floor level should be raised above the 1% AEP (100 year) predicted flood level assuming a 20% increase in flow over the next 100 years.

5.10 Wherever possible, floor levels should be situated a minimum of 300mm above the 1% AEP (100 year) plus climate change flood level, determined as an outcome of the site based FRA. A minimum of 750mm above the 1% AEP (100 year) flood level should be adopted if no climate change data is available. The height that the floor level is raised above flood level is referred to as the 'freeboard', and is determined as a measure of the residual risks.

5.11 The use of basements within flood affected areas should be discouraged. Where basement uses are permitted however, it is necessary to ensure that the basement access points are situated 300mm above the 1% AEP (100 year) flood level plus climate change. The basement must be of a waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within flood affected areas should not be permitted. It must be demonstrated that any below ground construction

does not adversely increase the risk of groundwater flooding to adjoining properties.

5.4 Sustainable Drainage Systems

5.12 Sustainable Drainage Systems (SUDS) are engineering approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both a site and its surroundings. Reducing the rate of discharge from urban sites to greenfield runoff rates is one of the most effective ways of reducing and managing flood risk. The integration of sustainable drainage systems into a site design can also provide broader benefits. These include an improvement in the quality of runoff discharged from the site, the capture and re-use of site runoff for irrigation and/or non potable uses, and the provision of green-space areas offering recreation and/or aesthetic benefits.

5.13 The National SUDS Working Group states that SUDS can improve the sustainable management of water for a site by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Reducing potable water demand through rainwater harvesting;

- Improving amenity through the provision of public open space and wildlife habitat;
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

5.14 In catchment terms, any reduction in the amount of water that originates from any given site is likely to be small. But if applied across the catchment in a consistent way, the cumulative effect from multiple sites could be significant.

5.15 The Regional Flood Risk Appraisal for London recommends that 'developments all across London should reduce surface water discharge in line with the Sustainable Drainage Hierarchy set out in policy 5.13 of the draft replacement London Plan.'

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a Watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer

5.16 In addition, the Flood and Water Management Act 2010 introduces powers for local authorities to manage flood risk and allows water companies to restrict water use during shortages. When fully in force, it will encourage the development of SUDS. More can be read about this at <http://www.legislation.gov.uk/ukpga/2010/29/contents>

5.17 There are numerous ways that SUDS can be incorporated into a development and the most commonly found components of a SUDS system are described in the following table. The appropriate application of a SUDS scheme to a specific development is heavily dependent upon the topography and geology of the site and its surrounds. For example, infiltration techniques are unlikely to function effectively in areas of impermeable soils (including London Clay, as is characteristic of so much of the Borough). Careful consideration of the site characteristics is needed to ensure the future sustainability of the adopted drainage system. On-going maintenance needs to be easy to manage and enforce, and should be secured through a planning condition.

Table 9 : SUDS Techniques

SUDS technique	Description
Permeable surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground.

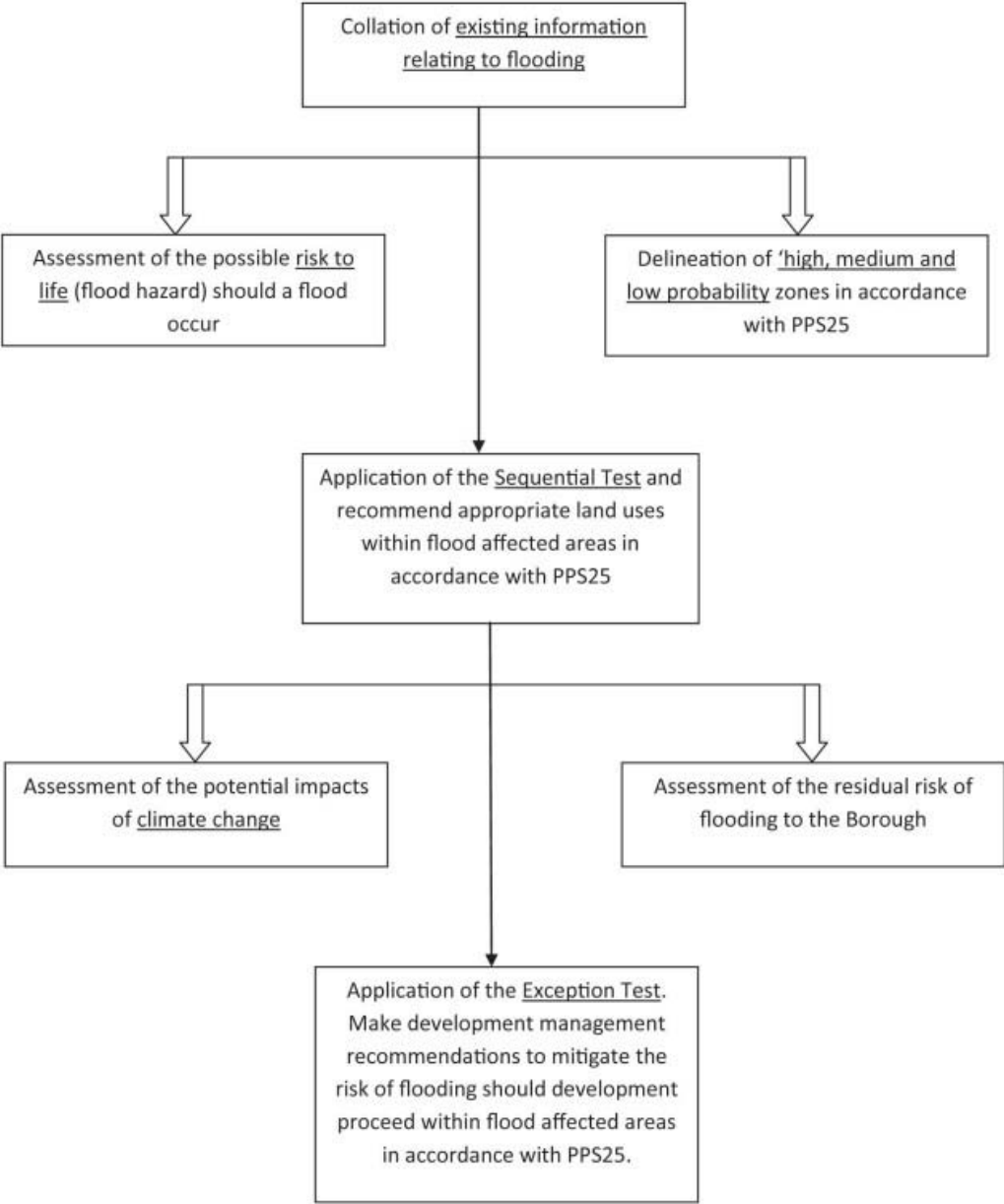
5.18 Information on the implementation of SUDS into developments in Kingston is available online in the Royal Borough of Kingston upon Thames Council Planning and Flood Risk web page at <http://www.kingston.gov.uk>.

Links to Environment Agency and CIRIA information and guidance can be found on this website.

1 SFRA Approach

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- 1.1** The primary objectives of the Kingston Borough SFRA are to inform the revision of flooding policies and the allocation of land for future development within the emerging Local Development Framework (LDF). More specifically, the SFRA seeks to inform planning application decisions and the identification of sustainability objectives, test policy options and allocate land for housing and employment.
 - 1.2** The Government does not provide a specific methodology for the SFRA process. Therefore, to meet these broader objectives, the SFRA has been developed in a pragmatic manner in close consultation with both the Council and the Environment Agency.
 - 1.3** A considerable amount of knowledge exists with respect to flood risk within the Borough, including information relating both to historical flooding, and the predicted extent of flooding under extreme weather conditions (i.e. as an outcome of detailed flood risk modelling carried out by the Environment Agency). The Kingston Borough SFRA has used this existing knowledge, underpinning the delineation of zones of 'high', 'medium' and 'low' probability of flooding, in accordance with PPS25. These zones constitute a robust and transparent evidence base for the development of flood risk management policy, and the allocation of sites for future development.
 - 1.4** It is important to recognise that all of the rivers that affect the Borough flow into, or from, adjoining authorities within the ThamesValley. Future development within the Borough, if not carefully managed, can influence the risk of flooding posed to residents within neighbouring areas. Conversely, inappropriate planning decisions within adjacent districts can also impact adversely upon flooding within the Borough.
 - 1.5** A number of authorities within the ThamesValley are carrying out similar strategic flood risk investigations at the current time. Whilst the delivery teams and programmes underpinning these studies vary from one district to the next, all are being developed in close liaison with the Environment Agency. Consistency in adopted approach and decision making with respect to the effective management of flood risk throughout the Thames system is imperative. Regular discussions with the Environment Agency have been carried out throughout the SFRA process, seeking clarity and consistency where needed.
 - 1.6** A summary of the adopted SFRA process is provided in the figure below, outlining the specific tasks undertaken and the corresponding structure of the SFRA report.

Figure 18 SFRA Approach



2 Legal and Policy Requirements

- 2.1** This section provides an overview of the policy context relevant to flood risk in the Royal Borough of Kingston upon Thames.
- 2.2** The success of the SFRA is heavily dependent upon the Council's ability to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning decisions and development control conditions. A framework of national and regional policy directive is in place, providing guidance and direction to local planning authorities. Ultimately however, it is the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk.

2.1 Flood and Water Management Act

- 2.3** The Flood and Water Management Act (2010) arose from the recommendations of the Pitt report in the aftermath of the 2007 floods. The majority of the act will commence in August 2011. The act classifies all London borough councils as Lead Local Flood Authorities (LLFAs). LLFAs will gain new responsibilities of investigating flood events, registration and designation of assets and structures, overseeing sustainable drainage and coordinating partnerships and communication with other risk management authorities.

2.2 Flood Risk Regulations

- 2.4** The Flood Risk Regulations were compiled to bring the UK into accordance with the EU Floods Directive 2007/60/EC. The Regulations require the following to be produced;-

- Preliminary assessment reports leading to the identification of flood risk areas by 22 December 2011. This will be completed within the ongoing Drain London Project.
- Flood hazard maps and flood risk maps for flood risk areas by 22 December 2013.
- Flood risk management plans for flood risk areas by 22 December 2015.

2.3 National Policy

Planning Policy Statement 25: Development and Flood Risk

- 2.5** Planning Policy Statement 25 (PPS25) was first published in December 2006. An amended version superseded the original in March 2010. PPS25 sets out the planning objectives for flood risk management in the UK. It states that all forms of flooding and their impacts are material planning considerations. The aim of PPS25 is to ensure that flood risk is taken into account at all stages of the planning process in order to prevent inappropriate development in 'at risk' areas.
- 2.6** The three key objectives for planning are appraising, managing and reducing flood risk. To appraise the risk it is stated that flood risk areas need to be identified, and that the level of risk needs to be defined. To facilitate this, PPS25 indicates that Regional Flood Risk Appraisals and Strategic Flood Risk Assessments should be prepared.
- 2.7** To manage the risk, Local Planning Authorities (LPAs) need to develop policies which "avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change". LPAs should also only permit

development in flood risk areas if there are no feasible alternatives located in areas of lower flood risk.

- 2.8 To reduce the risk, PPS25 indicates that land needed for current or future flood management should be safeguarded; new development should have an appropriate location, layout and design and incorporate sustainable drainage systems (SUDS); and that new development should be seen as an opportunity to reduce the causes and impacts of flooding by measures such as provision of flood storage, use of SUDS, and re-creating the functional flood plain.
- 2.9 A partnership approach is stressed in PPS25 to ensure that LPAs work with partners such as the Environment Agency. The Environment Agency can provide both information and advice relating to flood risk, and should always be consulted when preparing policy or making decisions which will have an impact on flood risk.
- 2.10 The future impacts of climate change are highlighted, as climate change will lead to increased flood risk in many places in the years ahead. When developing planning policy, LPAs need to consider if it is necessary to encourage the relocation of existing development to locations at less of a risk from flooding in order to prevent future impacts of flooding.
- 2.11 PPS25 also gives specific advice for determining planning applications, which needs to be considered when developing policy. LPAs should ensure that flood risk assessments (FRAs) are submitted with planning applications where this is appropriate; they should apply the sequential approach, (defined in the PPS) which ensures that lower risk areas are considered preferable to higher risk areas; priority should be

given to the use of SUDS; and new development should be designed to be resilient to flooding as appropriate.

- 2.12 The amended version of PPS25 sought to make clear how and when certain important infrastructure units, such as wind turbines, can be located in flood prone areas. Further guidance was also given on flood risk assessments, the sequential and exception tests and surface water management
- 2.13 The PPS25 Practice Guide was first published by Communities and Local Government in June 2008 and was updated in December 2009. The document provides additional guidance on the principles set out in PPS25. The guide is primarily aimed at planning policy makers, development control officers, developers and their advisors.

Supplement to Planning Policy Statement 1: Planning and Climate Change

- 2.14 The statement supplements the existing PPS1: Delivering Sustainable Development. The document highlights the issue of climate change, and sets out ways that planning should prepare for its inevitable effects, which includes managing flood risk. Additionally, the supplement advises on how Carbon emissions can be reduced, thus minimising climate change into the future, as far as is possible and practical.

2.4 Regional Planning Policy

The London Plan

- 2.15 The London Plan is the adopted regional spatial strategy relevant to the Royal Borough of Kingston upon Thames. This document includes a number of policies relevant to flood risk. Three key policies relate to flooding; flood risk management; and sustainable drainage.

2.16 Policy 4A.12 “Flooding” states that boroughs should identify areas at risk from flooding and highlights the need to refer to PPS25. This SFRA document identifies areas at risk from flooding and covers many of the issues highlighted in PPS25. The policy also indicates that boroughs should avoid permitting built development in functional flood plains (referred to as zone 3b in this document).

2.17 Policy 4A.13 “Flood Risk Management” states “Where development in areas at risk from flooding is permitted, (taking into account the provisions of PPS25), the Mayor will, and boroughs and other agencies should, manage the existing risk of flooding, and the future increased risk and consequences of flooding as a result of climate change, by

- Protecting the integrity of existing flood defences;
- Setting permanent built development back from existing flood defences to allow for the management, maintenance and upgrading of those defences to be undertaken in a sustainable and cost effective way;
- Incorporating flood resilient design;
- Establishing flood warning and emergency procedures.

2.18 Opportunities should also be taken to identify and utilise areas for flood risk management, including the creation of new floodplain or the restoration of all or part of the natural floodplain to its original function, as well as using open space in the flood plain for the attenuation of flood water.

2.19 The Mayor will, and boroughs and other agencies should, take fully into account the emerging findings of the Thames

Estuary 2100 Study, the Regional Flood Risk Appraisal and the Thames Catchment Flood Management Plan.”

2.20 Policy 4A.14 “Sustainable Drainage” seeks to ensure that surface water run-off is managed as close to its source as possible in line with the drainage hierarchy:

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release to a watercourse;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse;
- Discharge rainwater direct to a watercourse;
- Discharge rainwater to a surface water drain;
- Discharge rainwater to the combined sewer.

2.21 Developers are encouraged to achieve greenfield run off from their sites through incorporating rainwater harvesting and sustainable drainage. Boroughs should encourage the retention of soft landscaping in front gardens and other means of reducing, or at least not increasing, the amount of hard standing associated with existing homes.

2.22 The London Plan (2008) also includes the revised Borough level housing targets, which in Kingston's case are to provide an additional 3,850 homes over the period 2007/8 to 2016/17.

2.23 The policies mentioned above will need to be considered when the Royal Borough of Kingston upon Thames is considering how to allocate land to meet housing targets and other land use requirements.

Consultation Draft Replacement London Plan (2009)

2.24 A draft replacement for the London plan was put to public consultation in January 2010. It is expected to be published in late 2011. The replacement maintains a focus on flood mitigation through planning but increases its focus on sustainable systems. Policy 5.11 “Green roofs and development site environs” ensures green roofs will increase in abundance and policy 5.13 “Sustainable drainage” will lead to a greater incorporation of other SUDS into developments proposals.

Regional Flood Risk Appraisal (2009)

2.25 The regional flood risk appraisal (RFRA) for London was produced as a sister document to the London plan draft replacement. The RFRA looks at flood risk in more detail and aims to determine areas of greatest risk, responsible parties and how flood risk can be reduced. All types of flooding are investigated. The joint use of the London plan and RFRA will ensure London has both detailed overarching flood risk policies and strategic focuses for improvement.

2.26 The RFRA sets out recommendations aimed at varying scales from London-wide to individual utility companies. A number of recommendations are aimed at borough councils. The following recommendations are relevant to the Royal Borough of Kingston upon Thames.

2.27 Recommendation 1: All Thames-side planning authorities should consider in their SFRAs and put in place DPD policies to promote the setting back of development from the edge of the Thames and tidal tributaries to enable

sustainable and cost effective upgrade of river walls/embankments, in line with Policy 5.12, CFMPs and TE2100.

2.28 Recommendation 2: Boroughs including the Royal Borough of Kingston upon Thames should put in place policies to avoid development that would prejudice the implementation of increased channel capacity between Teddington Lock and Hammersmith Bridge in line with TE2100 findings.

2.29 Recommendation 4: Boroughs at confluences of tributary rivers with the River Thames should pay particular attention to the interaction of fluvial and tidal flood risks. This includes Kingston.

2.30 Recommendation 5: Developments all across London should reduce surface water discharge in line with the Sustainable Drainage Hierarchy set out in Policy 5.13 of the draft replacement London Plan.

2.31 Recommendation 6: Regeneration and redevelopment of London’s fluvial river corridors offer a crucial opportunity to reduce flood risk. SFRAs and policies should focus on making the most of this opportunity through appropriate location, layout and design of development as set out in PPS25 and the Thames CFMP. In particular opportunities should be sought to:

- Set back of development from the river edge to enable sustainable and cost effective flood risk management options
- Ensure that the buildings with residual flood risk are designed to be flood compatible or flood resilient
- Use open spaces within developments which have a residual flood risk to act as flood storage areas

2.32 Recommendation 8: Organisations responsible for development with large roof areas should investigate providing additional surface water run-off storage.

Sustainable Design and Construction Supplementary Planning Document

2.33 The London Plan Sustainable Design and Construction Supplementary Planning Document (SPD) (2006) sets out guidance in section 2.4.4 Water and Pollution on approaches to SUDS and flood resistant design. The Essential Standards require the use of Sustainable Drainage Systems (SDS) measures, wherever practical and the achievement of 50% attenuation of the undeveloped site's surface water run off at peak times. Whilst the Mayor's Preferred Standard is to achieve 100% attenuation of the undeveloped site's surface water run off at peak times.

2.5 Local Planning Policy

Royal Borough of Kingston upon Thames UDP (Adopted 2005)

2.34 The Royal Borough of Kingston upon Thames UDP was adopted in August 2005, and contains policies that address flooding.

2.35 Policy STR7b (Water Resource Management) states: "The Council places importance on sustainable and positive management of the Borough's water resources, through:

- Protecting watercourses and riverside areas from inappropriate development and seeking enhancements, including riverside access, and promotion of natural riverside vegetation where practicable
- Promoting good riverside design of development, especially alongside the River Thames;

- Promoting recreational and transportation uses of watercourses and water features which do not adversely affect local amenity or nature conservation value;
- Prioritising flood protection and taking due account of water conservation, water quality and drainage issues."

2.36 The supporting guidance (Paragraph 7.14) states: "Government advice in PPG25 (Development and Flood Risk) sets out a sequential test to be used for allocating land and development control decisions. The sequential test uses a risk-based search sequence to locate developments in areas which avoid flood risk or, otherwise, manage the risk effectively, whilst recognising the uncertainties that are inherent in the prediction of flooding. The Council considers that, based on current information, its land-use allocations are consistent with the sequential approach in PPG25. There are no major built development allocations proposed on functional flood plain land or undeveloped/sparsely developed areas of high flood risk. Where proposals come forward for new development in existing developed areas of high flood risk, the Council will use Policy OL18 to refuse development which increases the risk of flooding, and require appropriate mitigation measures to ensure new development does not exacerbate existing risks. At the same time, the Council will, in partnership with the Environment Agency, continue working towards reducing the risk of flooding in all parts of the Borough.

2.37 Policy OL18 (Flooding) states: "In areas at risk from flooding, the Council will resist development which will increase the risk of flooding. Where any development is permitted, the Council

may require appropriate flood protection measures in conjunction with the Environment Agency.”

2.38 The adopted policy is based upon PPG25, the predecessor to the current policy guidance. It broadly encapsulates the key underlying principles set out in PPS25, however it is recommended that future revisions to the policy are sought, providing specific reference to the sequential approach set out in PPS25 (mirroring the policy established for the Kingston Town Centre AAP).

2.39 Finally, a suite of development management recommendations have been identified and agreed in close consultation with the Environment Agency and the Council (refer to Spatial Planning and Development Management Recommendations section). They represent the minimum design measures that will be expected by the Environment Agency should development be permitted to proceed. It is essential to ensure that the development management recommendations can be imposed consistently at the planning application stage. Therefore it is recommended that the development management recommendations presented in the SFRA are incorporated into the LDF.

K+20 Kingston Town Centre Area Action Plan

2.40 The K+20 Kingston Town Centre Area Action Plan (adopted 2008) is a part of Kingston’s Local Development Framework. The plan directs development in Kingston town centre. Policy K24 relates to flood risk management. The policy states: “Within Zone 3b, functional floodplain, only water compatible uses and essential

infrastructure will be permitted, unless the site specific recommendations in the SFRA state otherwise.”

2.41 “Within High Risk Zone 3a, development proposals should include the flood mitigation measures set out below as an integral part of the design process:

- Land use on the ground floor must be limited to non-residential uses
- Floor levels must be situated above the 1% predicted maximum flood level plus climate change, incorporating an allowance for freeboard.
- Safe escape routes must be provided for evacuation in times of flood
- Access to basement areas must be situated above the predicted maximum flood level plus freeboard and all basements must be of waterproof construction
- Development must not result in an increase in maximum flood levels within adjoining properties”

2.42 “Within medium probability zone 2 development proposals must have:

- Flood levels situated above the 1% (100 year) predicted maximum level plus climate change.
- Safe escape routes must be provided for evacuation in times of flood, even within areas where buildings are not directly affected”

2.43 “Within all areas in the town centre, development proposals should, where appropriate, include SUDS to reduce surface water runoff rates, or as a minimum ensure that future redevelopment does not increase runoff.”

2.44 For development proposals in low probability zone 1, a flood risk assessment is required if the development is over 1ha in area.

Local Development Framework

2.45 The Core Strategy is scheduled to replace the UDP in May 2012. The Council has been preparing the Core Strategy since 2007 as part of the series of documents known as the Local Development Framework (LDF). The LDF will guide borough development for fifteen years. Policy DM 4 within the Core Strategy states the Council's policy approach on flood risk, and focuses on PPS25, utilisation of related studies and SUDS.

2.46 The Core Strategy pre-submission version was published in January 2011, the next steps are the submission of Core Strategy in May and the examination in September.

3 Sustainable Management of Flood Risk

- 3.1** An ability to demonstrate ‘sustainability’ is a primary government objective for future development within the UK. The definition of ‘sustainability’ encompasses a number of important issues ranging broadly from the environment (i.e. minimising the impact upon the natural environment) to energy consumption (i.e. seeking alternative sources of energy to avoid the depletion of natural resources). Of particular importance however, is sustainable development within flood affected areas.
- 3.2** Recent history has shown the devastating impacts that flooding can have on lives, homes and businesses. A considerable number of people live and work within areas that are susceptible to flooding, and ideally development should be moved away from these areas over time. It is recognised however that this is often not a practicable solution. For this reason, careful consideration must be taken of the measures that can be put into place to minimise the risk to property and life posed by flooding. These should address the flood risk not only in the short term, but throughout the lifetime of the proposed development. This is a requirement of PPS25.
- 3.3** The primary purpose of the SFRA is to inform decision making as part of the planning and development control process, taking due consideration of the scale and nature of flood risk affecting the Borough (as discussed in the previous chapters of this report). Responsibility for flood risk management resides with all tiers of government, and indeed individual landowners, as outlined below.

Responsibility for Flood Risk Management

3.4 There is no statutory requirement for the Government to protect property against the risk of flooding. Notwithstanding this however, the Government recognise the importance of safeguarding the wider community, and in doing so the economic and social well being of the nation. An overview of key responsibilities with respect to flood risk management is provided below.

- The Regional Assembly for London i.e. the Mayor of London should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure. The London Plan and Regional Flood Risk Appraisal documents do this.
- The Environment Agency (EA) has a strategic overview role for all flood risk in England. The Environment Agency is required to develop a national strategy for the management of coastal erosion and all sources of flood risk for England. It also assists the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues.
- Lead Local Flood Authorities (LLFAs) include all London Boroughs. This is a new lead role for local authorities in managing local flood risk (from surface water, ground water and non main river watercourses). This change was introduced by the Flood and Water Management Act (2010), drawing on the recommendations from the Pitt report.

- The Local Planning Authority is responsible for carrying out an SFRA. The SFRA should consider the risk of flooding throughout the district and should inform the allocation of land for future development, development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions.
- Landowners & Developers have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties.

3.5 The Environment Agency has developed a guide entitled “Living on the Edge” that provides specific advice regarding the rights and responsibilities of riparian owners, the Environment Agency and other bodies. The guide is targeted at owners of land situated alongside rivers or other watercourses, and is a useful reference point outlining who is responsible for flood defence, and what this means in practical terms. It also discusses how stakeholders can work collaboratively to protect and enhance the natural environment of our rivers and streams. This guide can be found on the Environment Agency’s website at

<http://publications.environment-agency.gov.uk/pdf/GEHO0407BMFL-e-e.pdf>.

3.1 Strategic Flood Risk Management - The Environment Agency

3.6 The Environment Agency takes a strategic approach to flood risk management and promotes a proactive

approach for other flood risk management authorities. The assessment and management of flood risk is carried out on a ‘whole of catchment’ basis. This enables the Environment Agency to review the impact that proposed defence works at a particular location may have upon flooding at other locations throughout the catchment.

3.7 A number of flood risk management strategies are underway within the region, encompassing many of the large river systems that influence flood risk within the Royal Borough of Kingston upon Thames. A brief overview of these investigations is provided below.

3.2 Thames Catchment Flood Management Plan

3.8 Catchment Flood Management Plans (CFMPs) are planning tools through which the Environment Agency works in partnership with other key decision-makers within a river catchment. The plans aim to explore and define long term sustainable policies for flood risk management. The Thames CFMP, published in July 2008, is one of 77 CFMPs for England and Wales. It gives an overview of the flood risk in the Thames catchment and sets out a preferred plan for sustainable flood risk management over the next 50 to 100 years. The River Thames CFMP was completed in July 2008, and the published summary report can be found at <http://publications.environment-agency.gov.uk/pdf/GETH1209BQYL-e-e.pdf>

3.9 The flood risk regime within the Royal Borough of Kingston upon Thames is heavily influenced by the River Thames and its tributaries. The Thames system is under careful consideration by the Environment Agency. Resources are

currently being targeted at a strategic level to ensure that the nature and severity of flood risk throughout the wider greater London area is broadly understood. This will enable the Environment Agency, which is responsible for the future management of flood risk within the area, to target future activities in a cost effective and sustainable manner.

3.10 The following key messages have been extracted from the published CFMP, of direct relevance to the Kingston Borough SFRA:

3.11 *Lower Thames Policy Unit (areas in close proximity to the River Thames- It will be important to identify which aspects of PPS25 (location, layout or design) will be the focus for managing flood risk when considered alongside the finalised option for the Lower Thames Flood Risk Management Strategy.*

- *Where we can, we will progress options to reduce flood risk that are most effective and sustainable in the long-term*
- *It is vital that there is a shared vision for land use so that we can focus on the most effective way of managing flood risk. In some places it will be through adaptation of the urban environment to make it more resilient to flooding and in others it will be about locating new development in areas of lowest risk*
- *These areas are located on large rivers where it is not generally possible to increase the capacity of the river to convey more flow. Within the urban floodplains we are seeking long-term adaptation to increase the resilience of what is at risk. In some cases*

re-locating areas of development may become an option

- *Managing the consequences of flooding will be very important, particularly those areas where redevelopment rates are low and flood defences are not viable*

3.12 *Hogsmill Policy Unit and Beverly Brook Policy Unit*

- *We need long-term adaptation of the urban environment. There are massive opportunities to reduce flood risk through redevelopment. In most areas we need to change the character of the urban area in the floodplain through re-development. It must be resilient and resistant to flooding and result in a layout that re-creates river corridors*
- *We are seeking to re-create river corridors through redevelopment so that there is space for the river to flow more naturally and space in the floodplain where water can be attenuated*
- *We will be seeking to build flood defences as redevelopment occurs and as part of an overall catchment plan. This is because more attenuation and more space in the river corridors are needed for defences to be sustainable. This is more complex but represents better value for society in the long-run even if it is more costly for the Environment Agency today*
- *These areas are very susceptible to rapid flooding from thunderstorms. Emergency response and flood awareness are particularly important*

3.13 The CFMP classes Kingston Borough in sub area 5- 'urbanised with some flood defences'. The preferred policies for this area type are to maintain flows,

manage run off, and retain open spaces. It is also noted that whilst the Hogsmill and Beverley Brook catchments are not high risk and are generally well protected, work must be ongoing to ensure flood risk does not increase with climate change.

3.3 Lower Thames Strategy

3.14 The Environment Agency's draft Lower Thames Strategy (LTS) completed its consultation period in December 2009. The strategy was triggered as an outcome of the widespread flooding experienced within the catchment in 2003. The strategy proposes measures to reduce the risk of flooding to the 15,000 properties which are currently at risk from a 1% flood event in the area from Datchet to Teddington. These measures include the construction of three flood diversion channels in the Reach 3 area, the widening of Desborough Cut and improvements to Sunbury weir, Molesey weir and Teddington Lock. It also includes community based measures for improving resistance and resilience to flooding for smaller groups of properties and improving mapping information for emergency evacuation plans.

3.15 The Royal Borough of Kingston upon Thames is located in Reach 4. The LTS proposes both floodplain management and engineering works for various locations in reach 3 and 4. Floodplain management is core to the strategy. The following areas of work are planned:

- Increasing public awareness of flooding
- Continuing the partnership between Environment Agency with local authorities and other public bodies to improve flood mapping, develop emergency plans, local

flood action plans and apply the best means available to make individual properties resistant to floods

- Working through policy and planning, and encouraging increased flood storage in upstream tributaries
- Community based measures, which may include providing financial support for individual and community based flood prevention initiatives. These would include the use of demountable, temporary defences and flood resistance schemes for individual and groups of properties. It is a priority to protect small groups of properties, particularly between Walton Bridge and Teddington (Reach 4). This is less relevant in Reach 3 due to the wider floodplain.
- Production of interactive flood mapping tools, new procedures to guide and promote sustainable development, and effective community evacuation plans
- Safeguarding of flood flow routes
- Using the Thames Barrier to mitigate flood impacts in the downstream parts of Reach 4. However, because the Thames Barrier's legal purpose is to protect against tidal flooding, it is likely that the availability of the Thames Barrier to alleviate for fluvial flooding will get will decline over the next 25 years, as the sea level continues to rise.

3.16 The proposed engineering works for Reach 4 aim to ensure flows are not increased due to work in Reach 3. The works are:

- Modifying weirs - this would involve increasing the capacity of Sunbury, Molesey and Teddington weirs to convey water during a flood.

- Desborough Cut - widening of the Desborough Cut by 3 to 4m on the southern bank between the river and the road to improve the flow of water.
- Local defences - would protect localised areas such as those around Teddington Studios and on the river frontage at Kingston.

3.17 It is important to emphasise that the intention of the study is not to reduce flood risk in order to make way for future development. It is also unlikely that the physical management measures identified will be in operation within foreseeable planning time frames. For this reason, the SFRA has not taken the potential flood risk reduction measures into account. Within future planning horizons however, the revision of the SFRA should review the status of schemes recommended as an outcome of the Lower Thames Strategy, and consider the potential impact that these may have had upon flood risk within the Borough.

3.4 River Hogsmill Integrated Urban Drainage Pilot Study

3.18 The Hogsmill Integrated Urban Drainage (IUD) Pilot Study was commissioned and funded by DEFRA under project HA2 of the Government's "Making space for water strategy", and was completed in June 2008. The Environment Agency acted as the project leader. The findings of the study are presented in the published report provided on the DEFRA website at <http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/hogsmillreport.pdf>.

3.19 The Hogsmill IUD Pilot covers the whole of the Hogsmill catchment, encompassing the northern most extents of the Borough of Reigate &

Banstead, the Borough of Epsom & Ewell, and a large proportion of the Royal Borough of Kingston upon Thames. The four main partners involved in the delivery of the project included the local authorities of Kingston and Epsom & Ewell, Thames Water and the Environment Agency who are the lead organisation for the study. The technical delivery of the study was carried out by Jacobs.

3.20 The primary objective of the Hogsmill IUD Study was "to better understand the level of flood risk from all sources in the catchment, identify its causes, and potential ways of reducing the risk". The study identified that, across the catchment, over 1300 homes are at risk from surface water flooding. A further 3900 homes are at risk of flooding from rivers. Within the borough of Kingston, the study determined that approximately 4% of the damages sustained by flooding are as a result of surface water flooding. Rather, the primary risk to property is as a result of river flooding.

3.21 A summary of the key findings in relation to the mechanisms of flooding within the catchment is presented below, providing an overview of the critical physical characteristics that should be carefully considered when assessing the risk of flooding locally (i.e. as part of a detailed FRA).

Table 10 : Summary of Findings

Issue	Findings
Impact of river flooding on surface water flooding	Surface water flooding is generally not affected by river flooding, other than within 50m of the river
Impact of transport infrastructure	There are several railway lines across the catchment that represent a barrier or diversion to natural overland flow paths
Importance of geology	The upper catchment is chalk, which means there is no need for a pipe drainage system in these upper most reaches (i.e. Reigate & Banstead)
Flooding of low lying ground	The area of low lying ground adjacent to the River Hogsmill is modest, and limited to old quarries. There are no flood defences that would be vulnerable to breach at times of flooding
Flooding mechanisms due to surface water flooding in 1% (1 in 100) event	Surface water flooding is typically around 0.2m in depth, except where ponding occurs upstream as a result of barriers to the flow. The velocity of overland flow is variable, up to approximately 1.5m/s

3.22 A suite of comprehensive flood risk maps, indicating the risk of flooding from all sources within the Hogsmill catchment, is provided in Appendix A of the study. This can be accessed at <http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/hogsmilla.pdf>.

flood mapping has been carried out in 2009 and is incorporated into this SFRA.

3.23 The Council is actively encouraged to reference these maps to provide an appreciation of the nature and severity of the risks posed by flooding within the area that they are considering for future development.

3.5 Beverley Brook Flood Risk Management Strategy

3.24 The Beverley Brook Flood Risk Management (FRM) Strategy was carried out by the Environment Agency. The Strategy focuses on reducing damages to property situated within the Beverley Brook catchment. Detailed

4 Local Community Actions to Reduce Flood Damage

4.1 There are 6764 properties which are at risk of fluvial flooding in the Borough (RBK Multi Agency Flood Plan 2010/2011). It is essential therefore to ensure a broad awareness with respect to flood risk, providing the community with the knowledge and tools that will enable them to help themselves should a flood event occur.

4.2 The following 'community based measures' are cost effective solutions that local communities could introduce to minimise the damage sustained to their own homes from flooding. Further guidance is provided by the EA, Defra, the National Flood Forum www.floodforum.org.uk and CLG 'Improving the Flood Performance of New Buildings - Flood Resilient Construction (2007).

4.3 It is recommended that the Borough seek to proactively raise awareness within the community with respect to flooding (and indeed 'self help' flood risk reduction opportunities) through, for example, the circulation of a targeted newsletter to affected residents to coincide with the release of the Kingston Borough SFRA.

4.1 Designing for Flood Risk

4.4 There are four main approaches to designing for flood risk:

- Flood Avoidance: Constructing a building and its surroundings (at site level) in such a way to avoid being flooded.
- Flood Resistance: Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.
- Flood Resilience: Constructing a building in such a way that

although flood water may enter the building its impact is reduced.

- Flood Repairable: Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced. This is also a form of flood resilience.

Flood Avoidance:

4.5 These measures include applying the sequential approach at the site level by locating more vulnerable development in lower flood risk areas, whilst using areas at higher risk of flooding for amenity area and other water-compatible or less vulnerable uses. The raising of floor levels above the anticipated maximum flood level including climate change ensures that the interior of the property is not directly affected by flooding, avoiding damage to furnishings, wiring and interior walls. It is highlighted that plumbing may still be impacted as a result of mains sewer failure. Also the raising land to create higher ground, without increasing the risk of flooding elsewhere.

Flood resistance

4.6 Flood resistance comprises of measures designed for stopping water entering a property. Such measures must be installed as a complete package, and advice should be sought from a specialist. Every entry point for flood water must be stopped i.e. doors, air-bricks, gaps round pipes, sinks and toilets. There are two types of resistance measures, permanent and temporary measures. Permanent measures include the use of low permeability materials such as plastics and water resistant sealants. Temporary measures include for

example the installation of flood resistant door guards, skirts, fences and gates.

- 4.7** When constructing new properties, permanent flood resistance measures are always preferable to temporary measures as they do not require intervention by the property occupants (e.g. a flood gate needs to be securely shut and remain so, flood skirts need to be slid across the door etc.).
- 4.8** For existing homes, the use of flood boards/gates can be a successful measure as well as the placement of a temporary watertight seal across doors, windows and air bricks to avoid inundation of the building interior. This may be suitable for relatively short periods of flooding, however the porosity of brickwork may result in damage being sustained should water levels remain elevated for an extended period of time. This may lessen the effectiveness of flood proofing to existing properties affected by flooding from larger river systems such as the Thames.
- 4.9** Flood resistance is not recommended for floods deeper than 600mm because they obstruct the natural flow of water. This has the potential to place hydrostatic and/or hydrodynamic pressure on the structure of the building, placing occupants at risk. It also has the potential to cause sudden inundation of the building if the level of resistance to flood waters is breached by the water depth or velocity. Therefore, flood resistance measures are generally less desirable than flood resilience measures (see below) when flood waters are deeper.

Resilient design is favoured where the flood water levels are likely to be greater than 0.6m in height. Unlike resistance measures, improvements can be made separately and can yield individual benefits. Many of the measures can be done while redecorating, for little or no extra cost.

- 4.11** Developers are strongly recommended to have regard to Communities Local Government 'Improving the Flood Performance of New Buildings' (2007) when identifying the materials to be used in any new development proposal located in an area at risk of flooding.
- 4.12** Flood resilience also encompasses many other practical and design based initiatives, such as raising of electrical wiring and sockets within flood affected buildings and chasing electricity through ceilings rather than beneath the floor, as this reduces the risks to health and safety, and also reduces the time required after a flood to rectify the damages sustained. Flood resilience can also include locating electrical appliances and heating systems above the predicted height of flood water, fitting one-way valves on water pipes to prevent drainage systems from backing up, choosing interior fittings such as kitchen units and floor coverings with flood risk in mind and ensure they are more flood resilient.
- 4.13** Flood repairable in many ways is the same as flood resilience, however this considers measures that result in the least harm in the event of damage occurring.

Flood Resilience and Repairable

- 4.10** Flood resilience measures comprise of measures designed to reduce flood damage costs and recovery time.

4.2 Environment Agency Flood Warning Service

4.14 In England and Wales the Environment Agency operates a flood warning service in areas at risk of flooding from rivers or the sea. This can be accessed at <http://www.environment-agency.gov.uk/homeandleisure/floods/124554.aspx>. Using the latest available technology, Agency staff monitor rainfall, river levels and sea conditions 24 hours a day and use this information to forecast the possibility of flooding. If flooding is forecast, warnings are issued using a set of four easily recognisable codes.

- A Flood Alert would be issued when water levels can potentially overtop the banks.
- A Flood Warning is issued when the Environment Agency anticipates flooding to property.
- The trigger for issue of a Severe Flood Warning is dependent on a number of factors, but is essentially used when there is thought to be extreme danger to life.

4.15 Nationally, the Agency aims to give a two-hour warning in advance of any flooding taking place. However in certain cases this may not always be possible.

4.16 All warnings are highly dependent on our ability to forecast. There are two basic meteorological systems that concern us. Frontal rain bringing heavy and prolonged rainfall over a catchment or convective storms which produce very high intensity rainfall for shorter periods directly over part of a catchment. Both are regularly experienced in Thames Region and the Kingston Borough. Both types of rainfall event brings risk of severe flooding, however, it is the unpredictable nature

of the convective storm cells which present the most significant risk to delivery of an effective warning service.

4.17 We have a comprehensive rain gauge network and have direct access to Met Office radar products which show rainfall intensities and amounts. For the Kingston upon Thames Catchments (Hogsmill and Beverley Brook) a 2 hour warning lead-time is impractical in many of the urban areas and upper catchments within Thames Region as low-to-peak flow can occur over just half an hour. In these instances, the provision of warnings based on Met Office forecasts is often required. The difficulty in detection and unpredictable nature of convective storms make providing reliable meteorological forecasts the most difficult. In these cases we are dependent on meteorological forecasts from the Met Office and not flood forecasts to issue warnings.

5 Emergency Planning

5.1 Emergency planning is a critical element of any sustainable flood risk management solution. Liaison with both the Environment Agency and emergency services is imperative.

5.2 The Environment Agency monitor river levels within the main rivers affecting the Borough, and based upon weather predictions provided by The Met Office, make an assessment of the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in the inundation of populated areas (restricted to those urban areas situated within Environment Agency flood warning zones) the Environment Agency will issue a series of flood warnings within defined flood warning areas, encouraging residents to take action to avoid damage to property in the first instance. These warning codes, as well as other Kingston borough specific flood emergency information can be found at

<http://www.kingston.gov.uk/>

5.3 Areas susceptible to 'flashier' flooding, associated with storm cells that pass over the district resulting in high intensity, often relatively localised, rainfall. It is anticipated that events of this nature will occur more often as a result of possible climate change over the coming decades. Events of this nature are difficult to predict accurately, and the rapid runoff that follows will often result in flooding that cannot be sensibly forewarned.

5.4 All urbanised areas are potentially at some degree risk of localised flooding due to heavy rainfall. The blockage of gullies and culverts as a result of litter

and/or leaves is commonplace, and this will inevitably lead to localised problems that can only realistically be addressed by reactive maintenance.

5.5 Widespread flooding throughout the region is a recognised risk associated with rising water levels from fluvial and pluvial sources. This event will occur due to long duration rainfall depressions situated over southern England, and considerable forewarning will be provided to encourage preparation in an effort to minimise property damage and risk to life.

5.6 As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the Council to coordinate the evacuation of residents. This evacuation will be supported and facilitated by the emergency services. It is essential that a robust plan is in place that clearly sets out (as a minimum):

- roles and responsibilities;
- paths of communication;
- to provide immediate welfare to evacuated residents;
- contingency plans in case of loss of power and/or communication.

5.7 Coordination with the emergency services and the Environment Agency is imperative to ensure the safety of residents in time of flood. As outlined in Local Community Actions to Reduce Flood Damage section, forewarning will be provided where possible to encourage preparation in an effort to minimise property damage and risk to life. Residents can sign up to the Environment Agency's Flood Warning Service at

<http://www.environment-agency.gov.uk/homeandleisure/>

[floods/124554.aspx](https://www.gov.uk/government/news/floods/124554.aspx). It is worth noting that the Environment Agency has designed a new opt-out flood warning system for British Telecom customers within their designated flood risk areas.

- 5.8** Residents in areas located with Zone 3b functional floodplain are likely to be the most vulnerable as water levels rise. These areas will flood more frequently and are likely to be the first cut off from safe evacuation routes. It is very important to recognise that the river flooding depicted in the flood risk maps in this SFRA are unlikely to occur in isolation. Flooding of this nature will typically occur during heavy, prolonged rainfall across the Borough, and is likely to coincide with other emergency incidents, for example localised flooding due to sewer failure. Whilst it is essential that a safe route of escape (above the maximum river flood level) is provided as part of the design process, it should be emphasised that the safety this escape route may be hindered at the time of evacuation. For this reason, it is imperative that full control is provided to the emergency services during a flooding situation to determine the timing and route of any evacuation. Therefore SFRA (Jacobs, 2007) proposed evacuation routes map has been removed from this SFRA as a result of the recommendation made by emergency planning.
- 5.9** It is recommended that the Council's Borough Emergency Plan is reviewed in light of the findings and recommendations of the SFRA to ensure that safe access can be provided during a major flooding event. The Council advises the Borough Contingency Planning Forum of the risks raised in light of the Royal Borough of Kingston upon Thames SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

6 Insurance

6.1 Many residents and business owners perceive insurance to be a final safeguard should damages be sustained as a result of a natural disaster such as flooding. Considerable media interest followed the widespread flooding of 2000 when it became clear that the insurance industry were rigorously reviewing their approach to providing insurance protection to homes and businesses situated within flood affected areas. Not surprisingly, the recent widespread flooding of July 2007 has further exacerbated the discussion surrounding the future of insurance for householders and business owners situated within flood affected areas.

6.2 The Government has negotiated an agreement with the insurance industry, called the Statement of Principles and this is due to expire in June 2013. The agreement contains a number of conditions, the most important of which is for the government to maintain and improve flood defences. Whilst the Association of British Insurers (ABI) members commit to:

- Continue to make flood insurance for domestic properties and small businesses available as a feature of standard household and small business policies if the flood risk is not significant (this is generally defined as no worse than a 1.3% or 1 in 75 annual probability of flooding).
- Continue to offer flood cover to existing domestic property and small business customers at significant flood risk providing the Environment Agency has announced plans and notified the ABI of its intention to reduce the risk for those customers below significant within five years. The

commitment to offer cover will extend to the new owner of any applicable property subject to satisfactory information about the new owner.

6.3 The commitment does not apply to any new property built after 1 January 2009. The ABI encourages developers and customers purchasing a property in a new development to ensure that it is insurable for flooding, and this commitment is subject to annual review. The statement from the ABI of principles on the provision of flood insurance is available at <http://www.abi.org.uk/>.

6.4 This agreement between the government and ABI is due to expire in June 2013. The future availability of flood insurance within the UK will be heavily dependant upon the commitment from the government to reduce the risk of flooding over time, particularly given the anticipated impacts of climate change. However the Department Environment Food and Rural Affairs (Defra) recent consultation paper on future funding of flood and coastal erosion risk management proposes potential reforms to the way in which capital grant-in-aid is allocated to projects in England.

6.5 As flood insurance for development at a greater than 1 in 75 risk of flooding is unlikely, it is essential to ensure that spatial planning decisions do not place property within areas at risk of flooding.

7 Conclusion and Recommendations

- 7.1** Planning policy needs to be informed regarding the risk posed by flooding. A collation of potential sources of flood risk has been carried out in accordance with PPS25, developed in close consultation with both the Council and the Environment Agency. Zones of 'high', 'medium' and 'low' probability of flooding have been identified in accordance with PPS25, providing the basis for the application of the PPS25 Sequential Test. Other (non river related) sources of flooding have also been identified, and together these should inform the development management process.
- 7.2** A planned solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. It is also vitally important to recognise the significant potential to reduce flood risk through redevelopment, and this should be actively sought as an integral part of the planning process. Specific planning recommendations have been provided to guide decision making and design in relation to both future development and redevelopment within the Borough (refer to Spatial Planning and Development Management Recommendations section).
- 7.3** Where other planning considerations must guide the allocation of sites and the Sequential Test has been applied, specific recommendations have been provided to assist the Council and the developer to address the requirements of the Exception Test. These should be applied as development management recommendations for all future development (refer to Spatial

Planning and Development Management Recommendations section).

- 7.4** Council Policy is essential to ensure that the development management recommendations presented in the SFRA should be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management. Flood policy in the Core Strategy (to be adopted in 2012) has been developed in light of the suggested development management recommendations in this SFRA.
- 7.5** Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the Kingston Borough SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

A Living Document

- 7.6** The SFRA has been developed building upon existing knowledge on flood risk and upon detailed mapping within the Thames Region carried out by the Environment Agency, who will continue their rolling programme of flood risk mapping. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the Borough and may marginally alter predicted flood extents. Furthermore, a review of national planning policy is currently under way with a view to consolidate policy statements, circulars and guidance documents into a single consolidated National Planning Policy Framework. Given that policy documents and flood risk information

is continually being improved and updated, a periodic review of the Kingston Borough SFRA is imperative.

7.7 It is recommended that the Kingston Borough SFRA is reviewed on a regular basis. The following key questions should be addressed as part of the SFRA review process:

Question 1

7.8 Has any flooding been observed within the Borough since the previous review? If so, the following information should be captured as an addendum to the SFRA:

- What was the mapped extent of the flooding?
- On what date did the flooding occur?
- What was the perceived cause of the flooding?
- If possible, what was the indicative statistical probability of the observed flooding event? (i.e. how often, on average, would an event of that magnitude be observed within the Borough?)
- If the flooding was caused by overtopping of the riverbanks, are the observed flood extents situated outside of the current Zone 3a? If it is estimated that the frequency of flooding does not exceed, on average, once in every 100 years then the flooded areas (from the river) should be incorporated into Zone 3a to inform future planning decision making.

Question 2

7.9 Have any amendments to PPS25 or the Practice Companion Guide been released since the previous review? If so, the following key questions should be tested:

- Does the revision to the policy guidance alter the definition of the PPS25 Flood Zones presented within the SFRA?
- Does the revision to the policy guidance alter the decision making process required to satisfy the Sequential Test? (refer to Planning and Development Management section)
- Does the revision to the policy guidance alter the application of the Exception Test? (refer to Planning and Development Management section)
- Does the revision to the policy guidance alter the categorisation of land use vulnerability, presented within Table D2 of PPS25 (2010)?

7.10 If the answer to any of these questions is 'yes' then a review of the SFRA recommendations in light of the identified policy change should be carried out.

Question 3

7.11 Has the Environment Agency issued any amendments to their flood risk mapping and/or standing guidance since the previous policy review? If so:

- Has any further detailed flood risk mapping been completed within the Borough, resulting in a change to the 20 year, 100 year or 1000 year flood outline? If yes, then the Zone 3b and Zone 3a flood outlines should be updated accordingly.
- Has the assessment of the impacts that climate change may have upon rainfall and/or river flows over time altered? If yes, then a review of the impacts that climate change may have upon the Borough is required.
- Do the development management recommendations provided in

Planning and Development Management section of the SFRA in any way contradict emerging EA advice with respect to (for example) the provision of emergency access, the setting of floor levels and the integration of sustainable drainage techniques? If yes, then a discussion with the EA is required to ensure an agreed suite of development control requirements are in place.

- Have any new/updated surface water or other sources of flooding maps been produced and published?

7.12 The Environment Agency Flood Zone Map is reviewed on a quarterly basis. If this has been revised within the Borough, the updated Flood Zones will be automatically forwarded to the Council for their reference. *It is recommended that only those areas that have been amended by the Environment Agency since the previous SFRA review are reflected in Zone 3 and Zone 2 of the SFRA flood maps.* This ensures that the more rigorous analyses carried out as part of the SFRA process are not inadvertently lost by a simple global replacement of the SFRA flood maps with the Flood Zone Maps.

Question 4

7.13 Has the implementation of the SFRA within the spatial planning and/or development management functions of the Council raised any particular issues or concerns that need to be reviewed as part of the SFRA process?

Appendix A: Glossary

Table 11

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years).
DCLG	Department of Communities and Local Government
DEFRA	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework which sets out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.
Flood Zone Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.
Fluvial Flooding	Flooding caused by rivers
FRA	Flood Risk Assessment
Freeboard	The difference between the flood defence level and the design flood level; it is also an allowance for uncertainty in estimating flood levels, and for potential wave action as a result of for example vehicles driving through flood water.
Greenfield land	Land that has not been previously developed (also see Previously Developed land definition).
Habitable Room	The rooms within a dwelling that are used as living accommodation. Includes living rooms, bedrooms, dining rooms, studies. Kitchens larger than 13 square metres are also included. Bathrooms, toilets and kitchens smaller than 13 square metres are not included. Living rooms greater than 19 square metres and capable of sub-division count as two habitable rooms.
Informal Flood Defence	A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
LiDAR	Light Detection and Ranging - This is a term used for a method of distance measurement using laser light. (Just as RADAR is 'Radio Detection and Ranging').

LPA	Local Planning Authority
Planning Policy Guidance (PPG) & Planning Policy Statement (PPS)	PPGs are a series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by PPSs.
Pluvial	Flooding caused by excess rain on ground surface
Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land.
Proposal Sites	An area identified in the Council's UDP that may offer future development potential. The adopted UDP includes a total of 55 Proposal Sites.
Residual Risk	The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.
Resilience	Constructing the building in such a way that although flood water may enter the building, its impact is minimised, structural integrity is maintained and repair, drying and cleaning are facilitated.
Resistance	Construction the building in such a way as to prevent flood water entering the building or damaging its fabric. This has the same meaning as flood proof.
Riparian Zone	The area immediately surrounding a watercourse.
SA	Sustainability Appraisal (SA) is an appraisal of plans, strategies and proposals to test them against the four broad objectives set out in the Government's sustainable development strategy.
SEA	Strategic Environmental Assessment (SEA) is a generic term used internationally to describe environmental assessment as applied to policies, plans and programmes. The European 'SEA Directive' (2001/42/EC) does not in fact use the term strategic environmental assessment. It requires a formal 'environmental assessment' of certain plans and programmes, including those in the field of planning and land use.
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).
Zone 3b Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Defined in PPS25 as areas at risk of flooding in the 5% AEP (1 in 20 chance) design event

Zone 3a High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year
Zone 2 Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year
Zone 1 Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)

Appendix B: Data Collection

A considerable amount of knowledge exists with respect to flood risk within the Royal Borough of Kingston up Thames, including:

- Historical river flooding information;
- Detailed flood risk mapping and Environment Agency Flood Map;
- Local flooding information (including: ordinary watercourses, surface water and groundwater flooding)
- Topography - Light Detection and Ranging (LiDAR)

This data has been sourced from the organisations highlighted below. The data has been used to determine flood zones 1, 2, 3a and 3b. The data has also been used to identify the potential impacts of climate change.

The Surface Water Management Plan and Preliminary Flood Risk Assessment for the Royal Borough of Kingston upon Thames will deliver improved information on local flood risk.

There is no risk of tidal or coastal flooding in Kingston upon Thames as the tidal influence does not go further upstream than Teddington weir.

Data Sources

Data has been collected from a range of organisations listed below and licensed for use by the Royal Borough of Kingston upon Thames.

Royal Borough of Kingston upon Thames

- Proposal sites (Including K+20 Proposal Sites (2007) and UDP Proposal Sites (2005));
- Areas potentially at risk from river flooding and /or areas with urban drainage issues; and
- Information on emergency response to flooding

Environment Agency

- Detailed flood risk mapping of the River Thames, Hogsmill and Beverley Brook;
- Flood Map including Flood Zones 2 and 3, flood defences, areas benefiting from defences, main river line and flood storage areas;
- Areas Susceptible to Surface Water Flooding;
- Flood Map for Surface Water;
- Detailed River Network;

The table below outlines the dates and source of the datasets provided by the Environment Agency:

Table 12 : Environment Agency Datasets

Dataset	Date	Description	Used for
Lower Thames (Reach 4) detailed flood risk mapping	December 2010	Based on a flood risk model calibrated to historic floods (used ISIS-Tuflow software). The model assumes all structures operate as expected and there are no blockages in the channel. Reach 4 of the Lower Thames model covers from Sunbury to downstream of Teddington Lock.	Flood Zones 2 and 3 as shown on the Environment Agency Flood Map. Outputs used as extent of Strategic Flood Risk Assessment flood zones 2, 3a, 3b and flood zone 3a with climate change.

Dataset	Date	Description	Used for
			Model also used to generate flood hazard maps (Hazard maps created using FD2320 supplementary note method)
Beverley Brook detailed flood risk mapping	2009	Based on a flood risk model calibrated to historic floods (used ISIS-Tuflow software). The model assumes all structures operate as expected and there are no blockages in the channel.	(see Lower Thames detailed flood risk mapping)
Hogsmill detailed flood risk mapping	2006	Based on a flood risk model calibrated to historic floods (used ISIS-Tuflow software). The model assumes all structures operate as expected and there are no blockages in the channel.	(see Lower Thames detailed flood risk mapping)
Flood Map including Flood Zones, Flood Defences and Areas Benefiting from Defences.	Updated every 3 months following changes to detailed flood risk mapping or historic flood outlines	<p>Show the natural floodplain ignoring the presence of flood defences (The Flood Map only ignores the effect of formal raised flood defences, such as flood walls and embankments). River bank protection, weirs, locks, diversion channels and railway embankments do not count as flood defences. Flood Zone 2 shows the area with a 0.1% (1 in 1,000) annual probability of flooding. Flood Zone 3 shows the area with a 1% (1 in 100) annual probability of flooding.</p> <p>There are no flood defences present in Kingston upon Thames. This means that the detailed flood risk mapping flood outlines can be used for Flood Zones.</p>	<p>Flood Zone 2 is directly transposed to the SFRA Flood Zone 2.</p> <p>Flood Zone 3 is used as the SFRA Flood Zone 3a.</p>
Areas Susceptible to Surface Water Flooding	September 2008	Data sent to Local Resilience Forums for emergency planning use in response to the Pitt Review in September 2008. Following updates to the ground level data in July	(see Flood Map for Surface Water)

Dataset	Date	Description	Used for
		2009, the data was made available for use by Local Planning Authorities.	
Flood Map for Surface Water	2010	<p>Developed as an improvement to the Areas Susceptible to Surface Water Flooding.</p> <p>Based on more up-to-date data and more advanced modelling to predict surface water flood outlines.</p> <p>Improvements include:</p> <p>a) simulates 2 storm events,</p> <p>B) considers buildings</p> <p>c) considers sewer system,</p> <p>d) uses better ground level data.</p> <p>The Flood Map for Surface Water compares well to historic records of surface water flooding.</p>	<p>Not suitable for defining Flood Zones. Can however be used to inform suitable planning policies or recommend the need for site specific assessment.</p> <p>The Flood Map for Surface Water should be used alongside more detailed local records of flooding or detailed models.</p> <p>The Flood Map for Surface Water should be reviewed against:</p> <ul style="list-style-type: none"> ● Areas Susceptible to Surface Water Flooding; ● local modelled data; ● local historic data; ● local knowledge.

Thames Water is responsible for the management of urban drainage (surface water) and sewerage within the Borough. Thames Water was consulted to discuss the risk of localised flooding associated with the existing drainage/sewer system.

Uncertainty

Flood risk mapping is not precise. The detailed flood risk mapping represents the best available information on flood risk at a catchment scale. This is suitable for use in the Strategic Flood Risk Assessment. In many cases it may be possible to improve using more locally specific ground levels and surveys of structures in the river and

floodplain. Where appropriate and proportional to the potential consequences of a new development, site specific flood risk assessments should look to refine the understanding of flood risk.

Appendix C: Data Interpretation

Strategic Flood Risk Assessment of Flood Zones

Flood **risk** is the description of both the **probability** that the flood will occur, and the **consequence** to the community as a direct result of the flood. PPS25 requires the probability of flooding to be quantified into flood zones. The flood zone a site lies within determines the planning policy that needs to be applied and the requirements for flood risk assessment.

Flood Zone 3b – functional flood plain

- Land assessed as having a 5% (1 in 20) or greater annual probability of flooding in any year; and/or
- Areas susceptible to flooding within which “water has to flow or be stored in times of flood”.

Flood Zone 3a – high probability

- Land assessed as having a 1% (1 in 100) or greater annual probability of flooding in any year.

Flood Zone 2 – medium probability

- Land assessed as having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding in any year.

Flood Zone 1 – low probability

- Land assessed as having a less than 0.1% (1 in 1000) annual probability of river flooding in any year.

Surface Water Flooding

In July 2009 the Areas Susceptible to Surface Water Flooding was made available for use by Local Planning Authorities.

During 2009/10 the Environment Agency developed the Flood Map for Surface Water which should be used as the primary source of information on risk from surface water flooding.

Although the new Flood Map for Surface Water uses better data and more realistic representation of conditions affecting flooding, it does have some limitations, the principal one being the map has used a national average drainage capacity (as local data on actual drainage capacity was not available). Therefore, in some areas (particularly where drainage capacity is much less than the national average) the old Areas Susceptible to Surface Water Flooding map may show a more realistic flood extent.

It is important that the Royal Borough of Kingston upon Thames together with their partners, review, discuss, agree and record what surface water flood data best represents local conditions. This will happen during work on the Surface Water Management Plan and Preliminary Flood Risk Assessment.

The Flood Map for Surface Water should be reviewed against:

1. Areas Susceptible to Surface Water Flooding;
2. local modelled data;
3. local historic data;
4. and local knowledge.

As the maps are indicative, they are not appropriate to act as the sole evidence for any specific planning decision without further supporting studies or evidence, for example historic surface water records.

Future development could alter surface water flood risk if runoff and drainage from new developments (or the cumulative impact of many developments) is not appropriately managed.

Climate Change

Consideration must be given to the probable change in flood risk over the lifetime of development as a result of climate change. PPS25 (Annex B) states that a 20% increase in the 1% (1 in 100) annual probability flood flow can be expected within the next 100 years.

The Lower Thames, Hogsmill and Beverley Brook detailed mapping studies all include a model run that takes account of the expected 20% increase in flood flows.

Climate change will also alter the risk of surface water flooding. The Flood Map for Surface Water takes no account of climate change.

As more detailed climate models are developed it may be appropriate to review the likely impact of climate change to flooding in Kingston.

Flood Hazard

The Flood Zones show the flood outlines of floods with different likelihoods of occurring. Within each zone the severity of flooding will vary. Flood Hazard maps represent the risk to life from flooding within the Flood Zone. Flood Hazard has been mapped for Flood Zone 3a with climate change to show areas where there is a greater risk to life.

The method used to produce the Flood Hazard maps is in accordance with Defra guidance provided in the form of 'Flood Risk to People' (FD2320 and FD2321, refer www.defra.gov.uk). High flood hazard is found in locations with either deep flood depths, fast flood flow velocity or both. The method includes an assessment of the danger posed by floating debris such as trees or cars. The Flood Hazard categories are based on the danger to vulnerable people or all people including emergency services.

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- کرینگے مدد کو آپ ہم تو ہیں ناقابل سے وجہ کسی پڑھنے کو دستاویز اس آپ اگر فون 020 8547 5757 ۰۲۰۸۵۴۷۵۷۵۷ لائن ہیلپ کاونسل کنگسٹن مہربانی برائے 020 8547 5757 سے کسی یا کیجنے کروائے۔

Haddii aadan awoodin akhrinta dokumentigan sabab naafada ama luqadda ah, waan ku caawin karnaa. Fadlan soo wac Khadka caawimada ee Kawnsalka Kingston 020 8547 5757 ama qof ku matalaya ka codso inuu na soo waco

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If you would like to discuss any aspect of this document or the Local Development Framework generally, please ring the LDF Team on 0208 547 5312 or email us at ldf@rbk.kingston.gov.uk



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