

5.4 Identifying Measures

Surface water flooding is often highly localised and complex. There are few solutions which will provide benefits in all locations, and therefore, its management is largely dependent upon the characteristics of the CDA. This section outlines potential measures which have been considered for mitigating the surface water flood risk within the Royal Borough.

The SWMP Plan Technical Guidance (Defra 2010) identifies the concept of Source, Pathway and Receptor as an appropriate basis for understanding and managing flood risk. Figure 5-2 identifies the relationship between these different components, and how some components can be considered within more than one category.

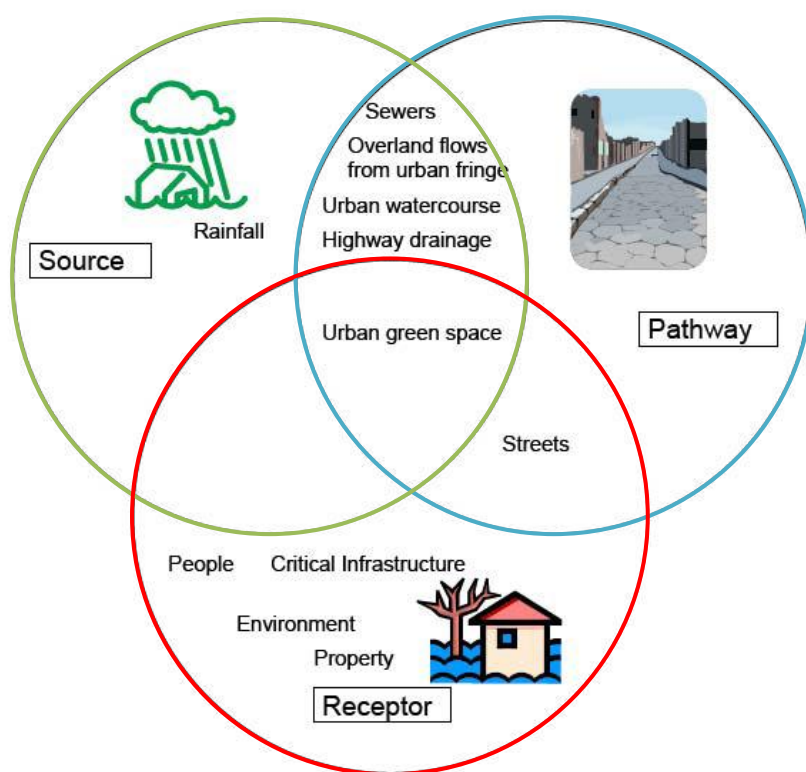


Figure 5-2 Illustration of Sources, Pathways & Receptors
(extracted from SWMP Technical Guidance, Defra 2010)

When identifying potential measures, it is useful to consider the source, pathway, receptor approach (refer to Figure 5-2 and Figure 5-3). Both structural and non-structural measures should be considered in the optioneering exercise undertaken for future CDAs. Structural measures can be considered as those which require fixed or permanent assets to mitigate flood risk (such as a detention basin or increased capacity pipe networks). Non-structural measures may not involve fixed or permanent facilities, and the benefits to flood risk reduction are likely to occur through influencing behaviour (education of flood risk and possible flood resilience measures, understanding the benefits of incorporating rainwater reuse within a property, planning policies etc).

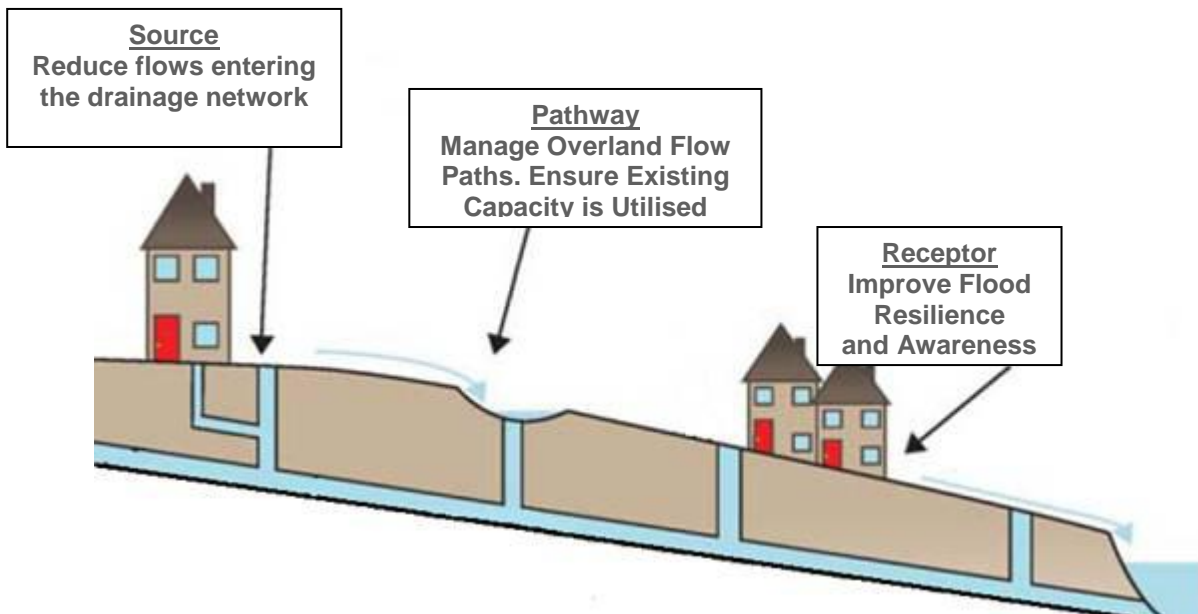


Figure 5-3 Source, Pathway and Receptor Model
(adapted from Defra SWMP Technical Guidance, 2010)

Methods for managing surface water flooding can be divided into methods which influence the Source, Pathway or Receptor, as described below, (refer to Table 5-1, overleaf.):

- **Source Control:** Source control measures aim to reduce the rate and volume of surface water runoff through increasing infiltration or storage, and hence reduce the impact on receiving drainage systems. Examples include retrofitting SuDS (e.g. bioretention basins, wetlands, green roofs etc) and other methods for reducing flow rates and volume.
- **Pathway Management:** These measures seek to manage the overland and underground flow pathways of water in the urban environment, and include: increasing capacity in drainage systems; separation of foul and surface water sewers etc.
- **Receptor Management:** This is considered to be changes to communities, property and the environment that are affected by flooding. Mitigation measures to reduce the impact of flood risk on receptors may include improved warning and education or flood resilience measures.

Table 5-1 Typical Surface Water Flood Risk Management Measures

	Generic measures	Site specific measures
	<ul style="list-style-type: none"> Do Nothing (do not continue maintenance) Do Minimum (continue current maintenance) 	
Source control	<ul style="list-style-type: none"> Bioretention carpark pods Soakaways, water butts and rainwater harvesting Green roofs Permeable paving Underground storage; Other 'source' measures 	<ul style="list-style-type: none"> Swales Detention basins Bioretention basins; Bioretention carpark pods; Bioretention street planting; Ponds and wetlands
Pathway Management	<ul style="list-style-type: none"> Improved maintenance regimes Increase gully assets 	<ul style="list-style-type: none"> Increase capacity in drainage system Separation of foul & surface water sewers Managing overland flows Land Management practices Other 'pathway' measures
Receptor Management	<ul style="list-style-type: none"> Improved weather warning Planning policies to influence development Social change, education and awareness Improved resilience and resistance measures Raising Doorway/Access Thresholds Other 'receptor' measures 	<ul style="list-style-type: none"> Temporary or demountable flood defences - collective measure

5.5 Options Assessment Guidance

A high-level scoring system for each of the options has been utilised to short-list preferred options. The approach to short-listing options is based on the guidance in FCERM and Defra's SWMP guidance. The scoring criteria are provided in Table 5-2 (overleaf).

Table 5-2: Options Assessment Short-Listing Criteria

Criteria	Description	Score
Technical	<ul style="list-style-type: none"> Is it technically possible and buildable? Will it be robust and reliable? Would it require the development of new techniques in order to be implemented? 	U: Unacceptable (measure eliminated from further consideration)
Economic	<ul style="list-style-type: none"> Will the benefits exceed the cost? Is the option within the available budget / funding? (This will depend on available funding, although it must be remembered that alternative routes of funding could be available) 	
Social	<ul style="list-style-type: none"> Will the community benefit from the option? Does the option have benefits for local amenity? Does the option result in any objection from local communities? 	-1: Moderate negative outcome
Environmental	<ul style="list-style-type: none"> Will the environment benefit from the option? Will the option provide benefits to water quality or biodiversity? 	0: Neutral
Objectives	<ul style="list-style-type: none"> Does it help achieve objectives of SWMP partnership? Does the option meet the overall objective of alleviating flood risk? 	+1: Moderate positive outcome +2: High positive Outcome

Any agreed short-listed options can be taken forward for further assessment, possibly detailed modelling if necessary, including an overview assessment of costs, benefits and feasibility. These include the ‘Do Nothing’ (no intervention and no maintenance) and ‘Do Minimum’ (continuation of current practice) options which, in line with the Project Appraisal Guidance (PAG), should be taken forward to the detailed assessment stage (even though they might not offer the desired results). Table 5-3 (overleaf) provides an example of applying the options scoring system.

Table 5-3: Example of a Conceptual Options Assessment

Area /CDA	Option Category	Option Description	Options Assessment							Take Forward?	Summary of Scheme
			Technical	Economic	Social	Environmental	Objectives	Overall			
RBKC (all areas 'at risk')	Do nothing	Do nothing	-	-	-	-	-	-	-	✓	Make no intervention or maintenance – no benefit to area
	Do minimum	Do minimum	-	-	-	-	-	-	-	✓	Continue existing maintenance regimes – minimal benefit and (currently) does not include increased maintenance for the predicted increase in rainfall as a result of climate change.
	Planning Policy	Adapt spatial planning policies	2	2	1	0	2	7	✓	Adapt spatial planning policy for all new developments, especially within areas identified at high risk of surface water flooding.	
	Improved Maintenance	Improved maintenance of drainage network	2	1	2	1	1	7	✓	Improved and targeted maintenance of the drainage network to avoid potential blockages which would reduce the drainage network capacity. Suggest list of targeted areas (i.e. areas at highest risk within the CDAs) to focus on.	
	Community Resilience	Improve community resilience to reduce damages from flooding	2	1	2	0	1	6	✓	Improve community resilience to flooding through establishing a flood warning system, reviewing emergency planning practices and encouraging the installation of individual property protection measures (such as flood-gates).	
	Source Control, Attenuation and SuDS	Install rainwater harvesting systems water-butts, and bioretention features	2	2	1	1	2	8	✓	Install rainwater harvesting systems, bioretention systems and water-butts in key risk areas in order to reduce the rate and volume of surface water runoff. Upstream attenuation via wetlands and ponds could also be considered.	
	Flood Storage / Permeability	Install permeable paving in key areas	2	2	1	1	2	8	✓	Install permeable paving systems in key areas and along key overland flow paths in order to reduce local runoff.	

Area /CDA	Option Category	Option Description	Options Assessment							Summary of Scheme
			Technical	Economic	Social	Environmental	Objectives	Overall	Take Forward?	
	Improvement to Drainage Infrastructure	Improve drainage network capacity within key risk areas	2	1	0	0	2	5	✓	Work collaboratively with Thames Water to assess the possibility of increasing sewer network capacity in key areas (or those identified as having poor capacity).
	Preferential Overland Flow Routes	Increase kerb heights and/or lower road levels along key flow paths	2	1	2	1	1	7	✓	Investigate the potential of increasing footpath heights and/or lowering road levels along key flow paths in order to retain flood water within the roads and channel it away from properties at risk of flowing.
	Other	Hydrometric monitoring	2	2	0	1	2	7	✓	Install hydrometric monitoring equipment in order to gain a better understanding of rainfall patterns and mechanisms that lead to localised flooding across the study area.
	Other	Community Awareness	2	2	2	0	1	7	✓	Increase awareness of flooding within communities at risk through the use of newsletters, drop-in workshops, websites and social media.

5.6 Identifying Options

Following the identification of a number of measures (as described in Table 5-1), a series of Borough-wide options were defined based on this assessment. These options were based initially on a range of options (scheme categorisations) identified in Table 5-4. Each of the standard measures (from Table 5-1) have been categorised within an option.

Table 5-4 Potential options

Description		Standard Measures Considered
Do Nothing	Make no intervention / maintenance	<ul style="list-style-type: none"> • None
Do Minimum	Continue existing maintenance regime	<ul style="list-style-type: none"> • None
Improved Maintenance	Improve existing maintenance regimes e.g. target improved maintenance to critical points in the system.	<ul style="list-style-type: none"> • Improved Maintenance Regimes • Other 'Pathway' Measures
Planning Policy	Use forthcoming development management policies to direct development away from areas of surface water flood risk or implement flood risk reduction measures.	<ul style="list-style-type: none"> • Planning Policies to Influence Development
Source Control, Attenuation and SuDS	Source control methods aimed to reduce the rate and volume of surface water runoff through infiltration or storage, and therefore reduce the impact on receiving drainage systems.	<ul style="list-style-type: none"> • Green roofs • Soakaways • Swales • Permeable paving • Rainwater harvesting • Detention Basins • Ponds and Wetlands • Land Management Practices • Other 'Source' Measures
Flood Storage / Permeability	<p>Large-scale SuDS that have the potential to control the volume of surface water runoff entering the urban area, typically making use of large areas of green space.</p> <p>Upstream flood storage areas can reduce flows along major overland flow paths by attenuating excess water upstream, which reduce the demands on downstream networks.</p>	<ul style="list-style-type: none"> • Detention Basins • Ponds and Wetlands • Managing Overland Flows (Online Storage) • Land Management Practices • Other 'Source' Measures • Other 'Pathway' Measures
Separate Surface Water and Foul Water Sewer Systems	Where the settlement is served by a combined drainage network separation of the surface water from the combined system should be investigated. In growth areas separation creates capacity for new connections.	<ul style="list-style-type: none"> • Separation of Foul and Surface Water Sewers
De-culvert / Increase Conveyance	De-culverting of watercourses and improving in-stream conveyance of water.	<ul style="list-style-type: none"> • De-culverting Watercourse(s) • Other 'Pathway' measures
Preferential / Designated Overland Flow Routes	Managing overland flow routes through the urban environment to improve conveyance and routing water to watercourses or storage locations.	<ul style="list-style-type: none"> • Managing Overland Flows (Preferential Flowpaths) • Temporary or Demountable Flood Defences • Other 'Pathway' measures

Description		Standard Measures Considered
Community Resilience	Improve community resilience and resistance of existing and new buildings to reduce damages from flooding, through, predominantly, non-structural measures.	<ul style="list-style-type: none"> • Improved Weather Warning • Temporary or Demountable Flood Defences • Social Change, Education and Awareness • Improved Resilience and Resistance Measures • Other 'Receptor' Measures
Infrastructure Resilience	Improve resilience of critical infrastructure in the settlements that are likely to be impacted by surface water flooding e.g. electricity substations, pump houses.	<ul style="list-style-type: none"> • Improved Resilience and Resistance Measures • Other 'Receptor' Measures
Other - Improvement to Drainage Infrastructure	Add storage to, or increase the capacity of, underground sewers and drains and improving the efficiency or number of road gullies.	<ul style="list-style-type: none"> • Increasing Capacity in Drainage Systems • Other 'Pathway' measures
Other or Combination of Above	Any alternative options that do not fit into above categories and any combination of the above options where it is considered that multiple options would be required to address the surface water flooding issues.	

5.7 CDA Prioritisation

5.7.1 Methodology

To assist with prioritisation and programming of further work on all CDAs, a basic prioritisation methodology was applied to the CDAs identified in Section 4. At this stage of flood risk investigation and mitigation it is important to keep this method simple and transparent to ensure clear interpretation of the decision making process to prioritise one area over another. This will aid in demonstrating that future spending on surface water management is distributed equitably around the study area. The general method proposed is summarised below:

- Identify high priority CDAs based upon overall verified risk and potential synergy with other projects
- To prioritise further work in remaining medium and low priority CDAs, use risk assessment outputs to count the number of properties flooded within the following general categories:
 - Infrastructure
 - Essential (e.g. water treatment works, primary electricity substations and mass evacuation routes);
 - Highly Vulnerable (e.g. Police stations, fire stations and ambulance stations); and
 - More Vulnerable (e.g. Hospitals, retirement homes and schools)
 - Households; and
 - Commercial / Industrial
- For each category above determine the number of properties which are predicted to be flooded to a depth of:
 - 0.1m or more; and
 - 0.5m or more (highest confidence banding of depth)
- Assign a relative importance weighting associated with each of the above parameters
- Multiply and sum the parameters above to produce a 'total impacts' score

5.7.2 Prioritisation Outcomes

The outcomes of the above prioritisation process are detailed Appendix D and summarised within Table 5-5. Based on the final identified score the following range has been applied to these results:

- $\geq 6,001$ = High priority
- 3,001 – 6,000 = Medium priority
- $\leq 3,000$ = Low priority

Table 5-5 Results of Prioritisation Assessment

CDA No.	Total number of units flooded (100yr ARI)	Number of units flooded where depth >0.5m (100yr ARI)	Total Units Flooded	Impacts Score	Priority Rank
01	1,433	288	1,721	7,498	001
02	2,192	430	2,622	7,314	002
03	2,131	145	2,276	5,177	003
04	1,538	110	1,648	3,867	004

A graphical representation of these rankings can be located below within Figure 5-4.

It is recommended that any future assessments into flood alleviation within the CDAs is undertaken by reviewing the identified flood impact score against the cost / benefit of any proposed scheme.

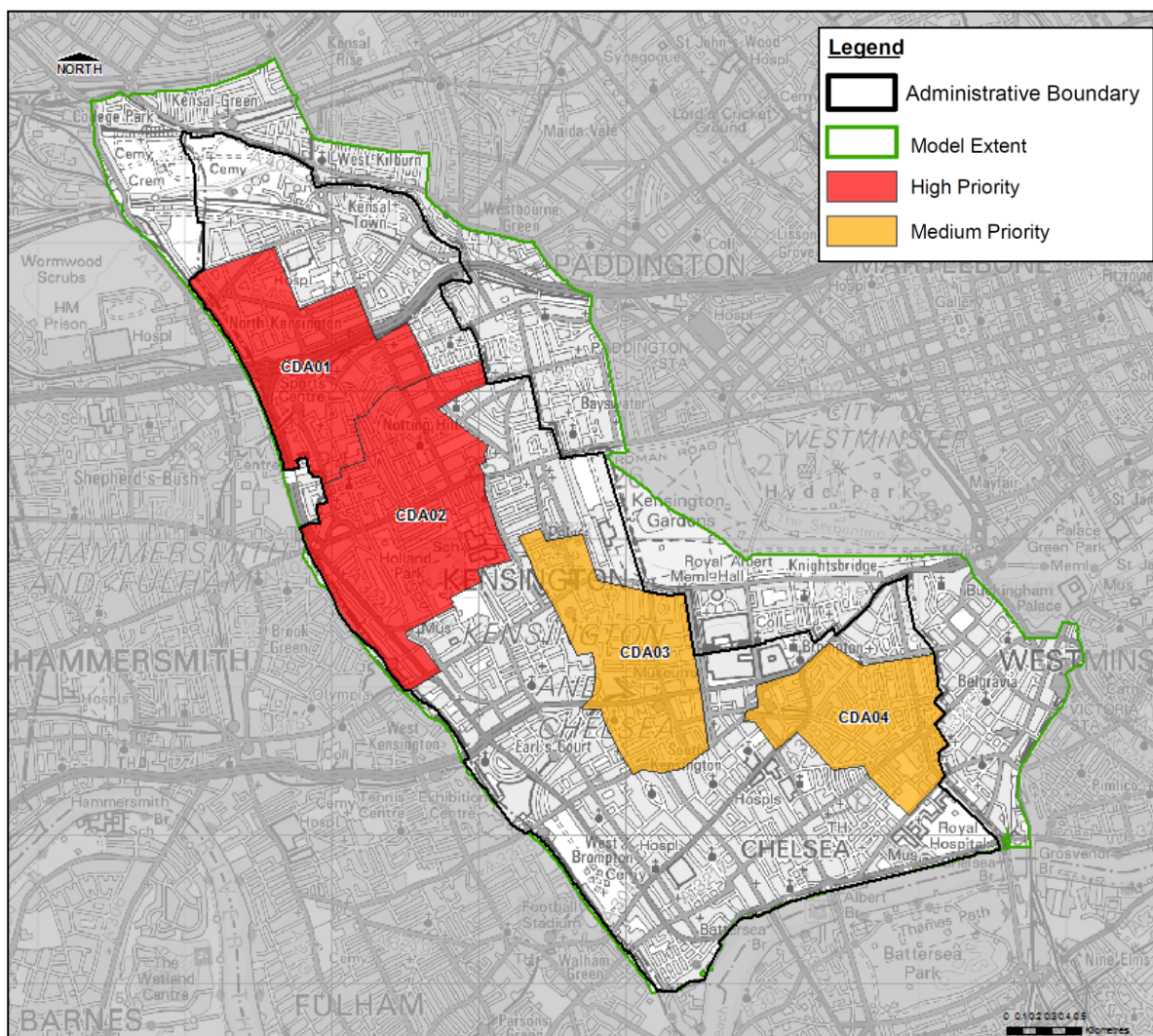


Figure 5-4 CDA Prioritisation

5.8 Preferred CDA Options

This section discusses the preferred option identified for each CDA based on the measures discussed earlier within this section. Conceptual option appraisal assessments were undertaken on a range of options for each CDA before the preferred option was chosen. Issues relating to feasibility, land ownership and conflicts with other service should be assessed before these conceptual options are progressed further.

Modelling and observed data do not show distinctive and discrete areas of surface water ponding in RBKC which can lead to the easy identification of preferred capital investment options. The flat gradient and 'noisy' digital terrain data has resulted in a flood risk prediction which shows widespread pockets of flooding in basements and other topographic low points. The identification of capital schemes to alleviate specific flood problems has not been feasible in all of the CDAs. With the agreement of the Borough, a range of non-structural options have been promoted in each of the CDAs around source control and flood resilience.

Options were developed, assessed and selected in consultation with the Royal Borough of Kensington and Chelsea. The options identified within the SWMP are the preferred solution. The final selection will need to consider wider Council requirements and objectives (e.g. impacts on conservation areas, maintenance issues etc.) and how they can be managed whilst promoting the use of flood risk management measures and options (in particular SuDS devices). The incorporation of SuDS elements should not be restricted due to other Council priorities (e.g. excluding rain garden SuDS elements in preference of parking bays). Further studies and consultation with additional stakeholders should be undertaken before a decision is made on options to be taken forward. The SWMP study is only able to provide strategic level options selection with the final detailed selection being selected by the Steering Group in due course.

It is recommended that a community flood plan should be created for all CDA areas. This document should be developed by residents and site users, and could be supported by the Council. The plan should include the risk of flooding and appropriate techniques for flood risk management. Guidance on creating a community flood plan is provided by the EA at: <http://www.environment-agency.gov.uk/homeandleisure/floods/38329.aspx>.

The council should consider; retrofitting permeable surfacing and retrofitting bio-retention car park pods (and other street scale SuDS) throughout the CDA (where appropriate), and also consult the local community with respect to the benefits of including water butts and rainwater harvesting systems within businesses and private properties.

It is also recommended that maintenance practices are reviewed and increased where it is deemed appropriate and that additional gully pits are included within areas of ponding.

Owners of private open space should consider the benefits of lowering ground levels and receiving runoff from local roads to allow the temporary ponding of runoff before it is conveyed into the Thames Water sewer network.

All options identified will require further investigation through a feasibility study to establish which option will bring maximum benefit for managing surface water flood risk in the Royal Borough and to consider the implications for surcharging combined sewers.

It should be noted that the Counter's Creek sewerage alleviation scheme may assist with reducing the risk of sewer flooding – but only for low return period events. The direct benefit of this scheme on the CDAs has not been undertaken as part of this assessment.

CDA 01 – North Kensington Area

Preferred Option:

- Install Flooding Local Improvements Project (FLIP) or pumped devices within basement properties identified as being at risk. Review the need for incorporating resistance and resilience measures for properties predicted to be at risk of pluvial flooding. This could include protecting steps/access into basement gardens, air bricks and low thresholds. Properties should be selected through detailed survey, household questionnaires and further analysis during future extreme rainfall. It is not considered cost effective to recommend these measures for all properties currently predicted to be at risk.
- Promote the use of rainwater harvesting and water butts throughout the catchment.
- Open space (public and private) should be assessed to determine if road runoff can be temporarily stored in these locations during extreme events.
- It is also recommended that additional gulley pits are included within area of ponding, and that permeable surfacing and bio-retention carpark pods are retrofitted throughout the CDA (where appropriate).

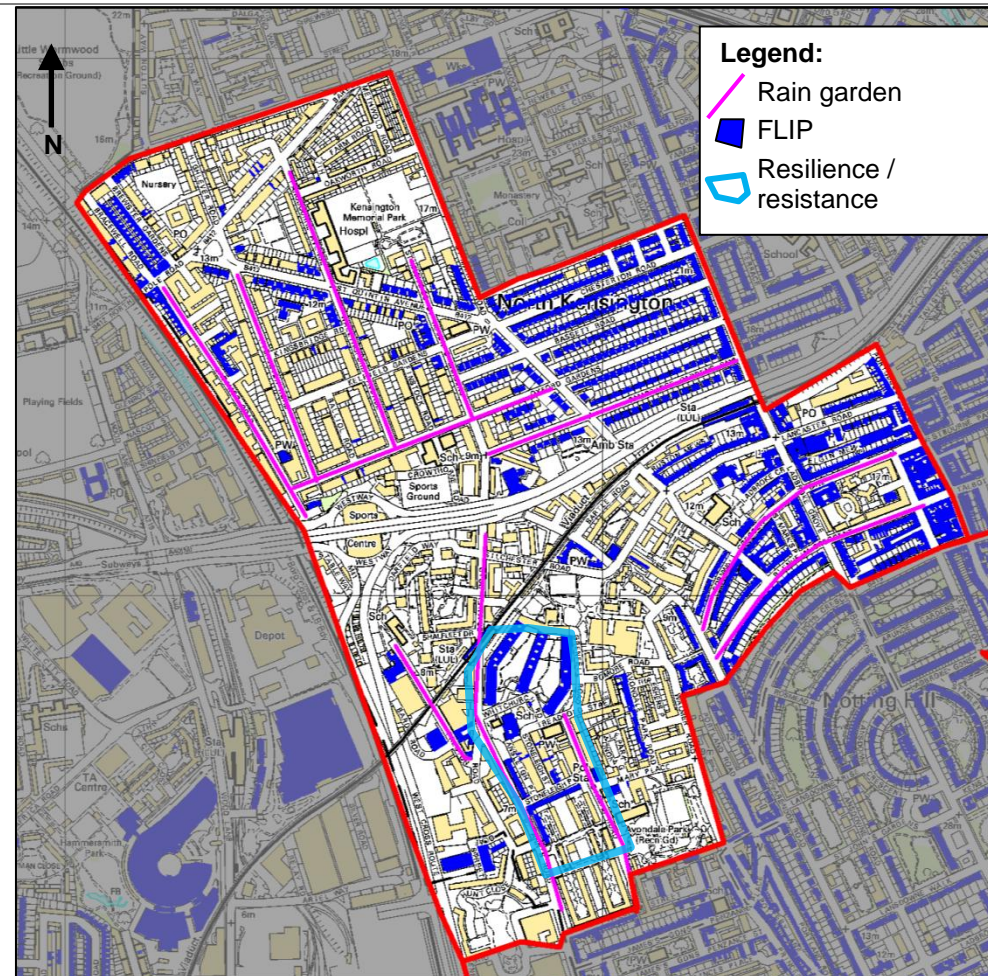


Figure 5-5 Preferred Options CDA 01 – North Kensington

CDA 02 – Holland Park Area

Preferred Option:

- Install Flooding Local Improvements Project (FLIP) measures or pumped devices within basement properties identified as being at risk.
- Review the need for incorporating resistance and resilience measures for properties predicted to be at risk of pluvial flooding. This could include protecting steps/access into basement gardens, air bricks and low thresholds. Properties should be selected through detailed survey, household questionnaires and further analysis during future extreme rainfall. It is not considered cost effective to recommend these measures for all properties currently predicted to be at risk.
- Promote the use of rainwater harvesting and water butts throughout the catchment.
- Open space (public and private) should be assessed to determine if road runoff can be temporarily stored in these locations during extreme events. Open space in the north-east of the CDA may be suitable for diverting flows into during times of flood.
- It is also recommended that additional gully pits are included within area of ponding, and that permeable surfacing and rain garden carpark pods are retrofitted throughout the CDA (where appropriate).

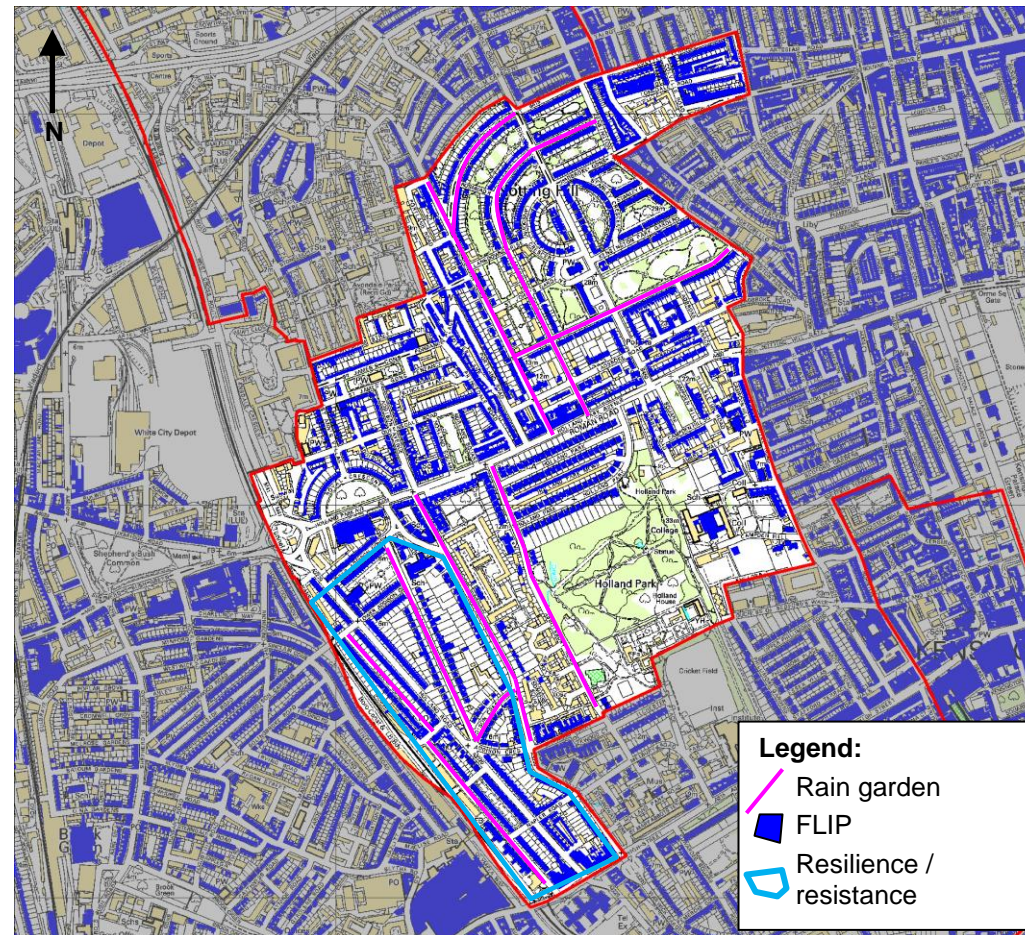


Figure 5-6 Preferred Options CDA 02 – Holland Park Area

CDA 03 – Kensington Area

Preferred Option:

- Install Flooding Local Improvements Project (FLIP) or pumped devices within basement properties identified as being at risk.
- Review the need for incorporating resistance and resilience measures for properties predicted to be at risk of pluvial flooding. This could include protecting steps/access into basement gardens, air bricks and low thresholds. Properties should be selected through detailed survey, household questionnaires and further analysis during future extreme rainfall. It is not considered cost effective to recommend these measures for all properties currently predicted to be at risk.
- Confirm standard of protection and predicted risk to the London Underground assets with TfL.
- Promote the use of rainwater harvesting and water butts throughout the catchment.
- Open space (public and private) should be assessed to determine if road runoff can be temporarily stored in these locations during extreme events. Determine if exceedance flows can be diverted into the Kensington Square and other private open space. The retrofitting of rain gardens within the boundaries of these areas of open space could screen the park and attenuate flows.
- It is also recommended that additional gully pits are included within area of ponding, and that permeable surfacing and rain garden carpark pods are retrofitted throughout the CDA (where appropriate).

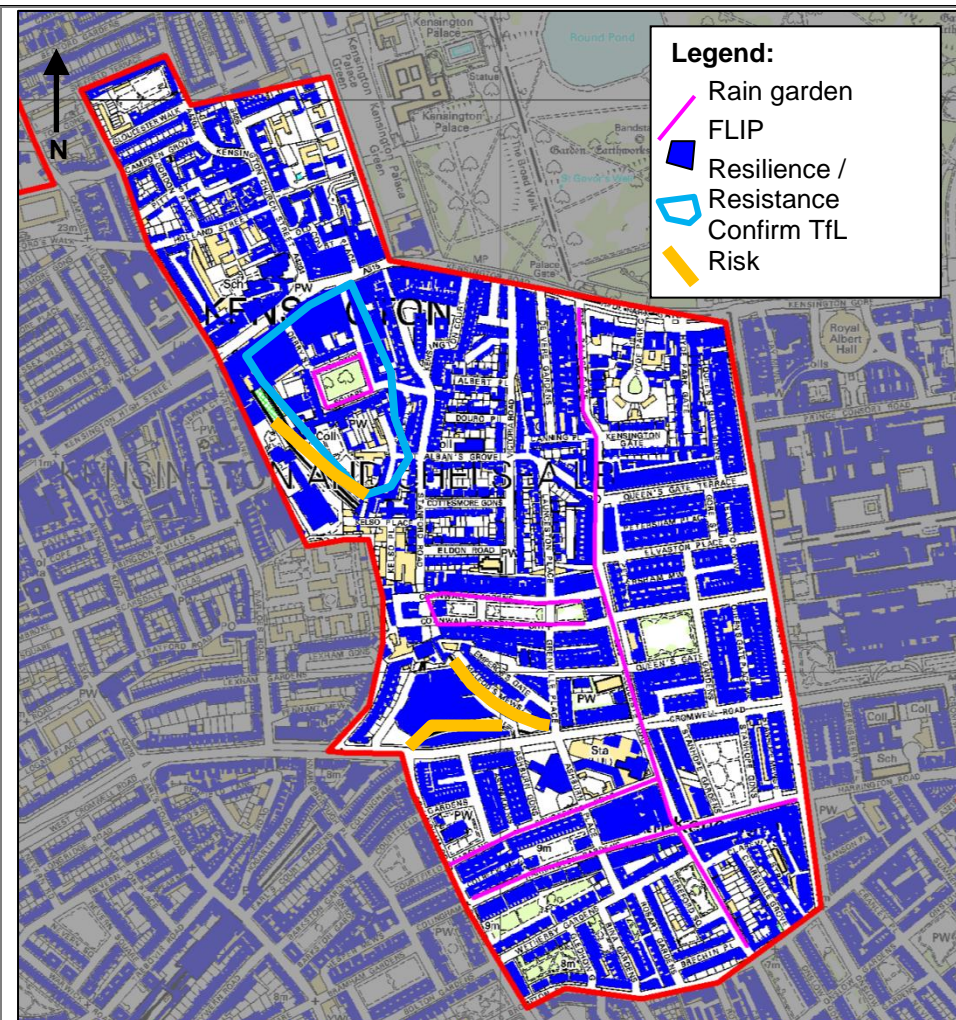


Figure 5-7 Preferred Options CDA 03 –Kensington Area

CDA 04 – Sloane Square Area

Preferred Option:

- Install Flooding Local Improvements Project (FLIP) or pumped devices within basement properties identified as being at risk.
- Review the need for incorporating resistance and resilience measures for properties predicted to be at risk of pluvial flooding. This could include protecting steps/access into basement gardens, air bricks and low thresholds. Properties should be selected through detailed survey, household questionnaires and further analysis during future extreme rainfall. It is not considered cost effective to recommend these measures for all properties currently predicted to be at risk.
- Confirm standard of protection and predicted risk to the London Underground assets with TfL.
- Promote the use of rainwater harvesting and water butts throughout the catchment.
- Open space (public and private) should be assessed to determine if road runoff can be temporarily stored in these locations during extreme events. Determine if exceedance flows can be diverted into Cadogan Square and other private open space. The retrofitting of rain gardens within the boundaries of these areas of open space could screen the park and attenuate flows.
- It is also recommended that additional gulley pits are included within area of ponding, and that permeable surfacing and rain garden carpark pods are retrofitted throughout the CDA (where appropriate).

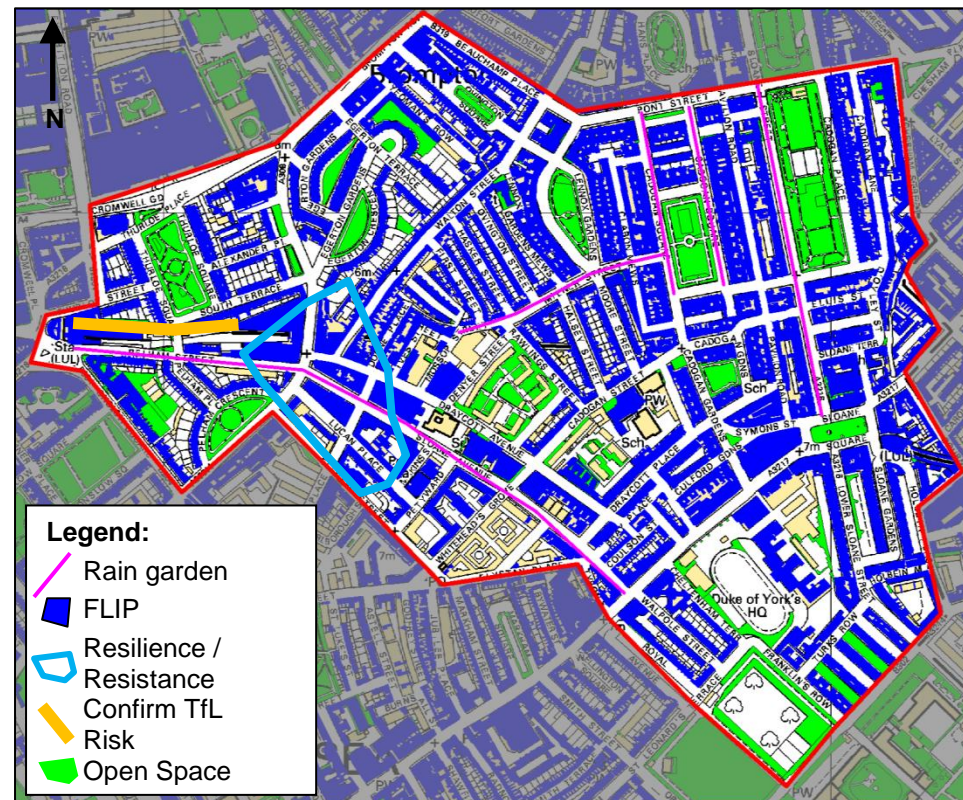


Figure 5-8 Preferred Options CDA 04 –Sloane Square Area

5.8.1 Recommendations for all CDAs

Before any works are undertaken in a CDA, it is recommended that a combination of actions are undertaken to further confirm the risk in the CDA, reduce costs of a preferred option / measure and establish the benefit of the proposed scheme. The following recommendations proposed:

- Reduce urban creep within the CDA. In particular the management of the encroachment of basement developments should be monitored and reduced where possible;
- Confirm with Thames Water which properties will benefit from the installation of FLIP measures and ensure that pumped devices are in place;
- Undertake a detailed feasibility study which includes:
 - Asset investigations (e.g. Inspection / CCTV of existing infrastructure to confirm condition, size and connectivity);
 - Initial underground service investigations (obtain and review relevant service plans);
 - Determine if Thames Water can undertake modelling scenarios for higher return events in order to provide additional evidence for areas at risk of sewer flooding;
 - Internal confirmation within RBKC to confirm the use of rain gardens (within open spaces, roundabouts, carpark bays, etc.) and permeable paving SuDS elements within the Royal Borough where areas are identified to be suitable. The benefits of these features should be included within any detailed modelling/assessment of the CDA;
 - Confirmation on land ownership issues and determination if private open space can be utilised to reduce the flood risk within the Royal Borough; and
 - Conceptual sizing and locating of proposed measures / options based on updated data and constraints.
- Initial consultation:
 - Discussions with the Flooding Steering Group and residents / land owners to confirm flooding history;
 - Internal discussions with the RBKC team; and
 - Discussions with EA and Thames Water to determine if any synergy can be provided within any proposed schemes and determine potential for funding (FDGiA funding, Local Levy Funding, AMP 5 / 6 etc⁷).

⁷ FDGiA Funding is central government funding allocated by the EA to manage flood and coastal erosion risk in England. Local Levy Funding is raised by Local Authorities. AMP 5 and AMP 6 refer to water companies' Asset Management Plans for the periods 2010-2015 and 2015-2020 respectively.

6 Proposed Surface Water Management Policy

6.1 Borough Wide Policy

CDAs delineate the areas where the impact of surface water flooding is expected to be greatest, it is acknowledged that the CDAs do not account for all the areas that could be affected by surface water flooding. It is therefore recommended that RBKC implement policies which will reduce the risk from surface water flooding throughout the whole Borough, so that they promote and apply Best Management Practises to the implementation of SuDS and the reduction of runoff volumes.

The SWMP Action Plan (discussed in Section 8.1), which is a major output of this project, recommends that the following policies are implemented within the boundaries of the catchment to reduce the flood risk therein:

Policy 1: *Proposed 'brownfield' redevelopments of more than one property or area greater than 0.1 hectare are required to reduce post-development runoff rates for events up to and including the 1 in 100 year return period event with an allowance for climate change (in line with NPPF and UKCIP guidance) to that of a Greenfield condition (calculated in accordance with IoH124⁸).*

Policy 2: *Developments located in Critical Drainage Areas (CDAs) and for redevelopments of more than one property or area greater than 0.1 hectare should seek betterment to a Greenfield runoff rate (calculated in accordance with IoH124). It is recommended that a SuDS treatment train is utilised to assist in this reduction.*

The Councils may also wish to consider the inclusion of the following policy to manage the pollutant loads generated from proposed development applications:

Policy 3: *Best Management Practices (BMP) are required for development applications greater than 0.1 hectare within the catchment. The following load-reduction targets must be achieved when assessing the post-developed sites SuDS treatment train (comparison of unmitigated developed scenario versus developed mitigated scenario):*

- 80% reduction in Total Suspended Sediment (TSS);
- 45% reduction in Total Nitrogen (TN);
- 60% reduction in Total Phosphorus (TP); and
- 90% reduction in litter (sized 5mm or greater).

The Council may also wish to consider specific policy relating to site based flood risk assessments for surface water that is similar to the current practice of the EA for fluvial flood risk. The flood risk maps produced as part of the SWMP can be used to trigger the need for a Flood Risk Assessment under the National Planning Policy Framework (NPPF). The level of assessment required could be implemented in a similar fashion to the EA Flood Zones:

- 100yr Surface Water Flood Depth >0.5m = Assessment similar to EA Flood Zone 3
- 100yr Surface Water Flood Depth between 0.1 and 0.5m = Assessment similar to EA Flood Zone 2

⁸ Defra/Environment Agency, September 2005, Flood and Coastal Defence R&D Programme: Preliminary Rainfall Runoff Management for Developments (R&D Technical Report W5-074/A/TR/1 Revision D)

Implementation of this policy is beyond the scope of this SWMP document and an action has been included in the Action Plan for RBKC to undertake internal consultation with their spatial planning and development compliance staff to determine how this type of policy could be implemented.

6.2 Policy Areas

This section provides an outline of planning policy tailored to specific areas within the study area that can be implemented to manage surface water flood risk. The purpose of this type of policy is to address the non-point source flooding that occurs in:

- Parts of CDAs that are not specifically addressed by a capital works solution;
- Areas not defined as CDAs; and
- Areas allocated for development which may have an impact on downstream flood risk.

The purpose of Policy Areas (PAs) is to influence development in RBKC that has the potential to impact local flood risk in the catchment.

Policy Area 1 – Counters Creek Catchment

Basement sewer flooding associated with the Counters Creek sewer in West London is the principal local flooding concern for residents, officials and elected members of the Royal Borough. Flooding occurs regularly (several times per year) and is due to insufficient capacity in the combined drainage network and the fact that many basements have low level connections to the sewer system. Basement flooding can occur when no flooding appears on the surface.

The proposed interventions are to be implemented both local to the flooding and across the wider contributing catchment which extends beyond RBKC to neighbouring Boroughs which are also connected to the same sewerage system.

The preferred option is already being implemented or planned by Thames Water. It has three elements:

1. Property resistance through FLIP (flooding local improvements project) devices which provide a one-way connection between the basement and the sewers. This 'quick win' intervention enables the discharge of wastewater from the property but prevents reverse flows from the sewer to the basement. FLIPS are financed by Thames Water and installed within properties.
2. SuDS Pilot Program is being implemented to assess the potential reduction in surface water to sewer in the long term due to the use of SuDS measures including driveway cut-off drains, drainpipe diversion, water butt/rainwater tanks and permeable paving.

The pilot schemes are proposed to assess:

- The reduction in surface water to sewer from each measure and how this varies with relevant parameters;
- Assessment of uptake and feasibility of install and development of practical solutions that are accessible for customers; and
- What is possible through legislation and incentivisation, for example design standards for SuDS measures, retrospective enforcement of legislation.

3. A new storm relief sewer across the catchment, associated pumping systems and enhancements to the existing network.

Proposed Policy CL7 – Entire RBKC Boundary

RBKC is undertaking a partial review of the Core Strategy. A bespoke basement policy (Policy CL7 currently under development) is part of this review and once adopted will become part of the Core Strategy.

The greatest benefit of this policy review will be to limit the size of basements being built underground. Policy CE2 (Flooding) of the Core Strategy requires surface water run-off to be managed as close to its source as possible.

A minimum of one metre of suitably drained permeable soil above any part of a basement within a garden reduces the amount and speed of water runoff to the drainage system and provides for the long term future of garden planting. Other SuDS measures may also be required. Given their nature, basements are more susceptible to flooding, both from surface water and sewage, than conventional extensions. Applicants are advised to see Policy CE2. Fitting basements with a pumped device (or equivalent reflecting technological advances) will ensure that they are protected from sewer flooding. Fitting only a 'non return valve' is not acceptable as this is not effective in directing the flow of sewage away from the building.

The full draft policy can be located at:

<http://www.rbkc.gov.uk/planningandconservation/planningpolicy/corestrategy/basements.aspx>.

The proposed draft Core Strategy Policy CL7 (September 2013) is reproduced below:

Proposed Policy CL7

Basements

All basements must be designed, constructed and completed to the highest standard and quality.

Basement development should:

- a) not exceed a maximum of 50% of each garden. The unaffected garden must be in a single area and where relevant should form a continuous area with other neighbouring gardens. Exceptions may be made on large comprehensively planned sites;
- b) not comprise more than one storey. Exceptions may be made on large comprehensively planned sites;
- c) not be built under an existing basement;
- d) not cause loss, damage or long term threat to trees of townscape or amenity value;
- e) not cause harm to the significance of heritage assets;
- f) not involve excavation underneath a listed building (including pavement vaults) or any garden of a listed building, except for gardens on large sites where the basement would not involve extensive modification to the foundation of the listed building by being substantially separate from the listed building;

- g) not introduce light wells and railings to the front or side of the property unless they are already an established and positive feature of the local streetscape;
- h) maintain and take opportunities to improve the character or appearance of the building, garden or wider area, with external elements such as light wells, roof lights, plant and means of escape being sensitively designed and discreetly sited;
- i) include a sustainable urban drainage scheme (SuDS), including a minimum of one metre of permeable soil above any part of the basement beneath a garden. Where the character of the gardens within an urban block is small paved courtyards SuDS may be provided in other ways;
- j) ensure that any new building which includes a basement, and any existing dwelling or commercial property related to a new basement, is adapted to a high level of performance in respect of energy, waste and water to be verified at pre-assessment stage and after construction has been completed;
- k) ensure that traffic and construction activity does not harm pedestrian, cycle, vehicular and road safety, affect bus or other transport operations (e.g. cycle hire), significantly increase traffic congestion, nor place unreasonable inconvenience on the day to day life of those living, working and visiting nearby;
- l) ensure that construction impacts such as noise, vibration and dust are kept to acceptable levels for the duration of the works;
- m) be designed to minimise damage to and safeguard the structural stability of the application building, nearby buildings and other infrastructure including London Underground tunnels and the highway;
- n) be protected from sewer flooding through the installation of a suitable pumped device.

A specific policy requirement for basements is also contained in Policy CE2, Flooding.

7 Preferred Options

Following consultation with the SWMP Steering Group and relevant stakeholders, a number of preferred options have been identified for the Royal Borough. These options will help to alleviate surface water flood risk alongside further investigations and studies that RBKC (as the LLFA) should look to take forward. These are all identified in the Action Plan and ranked as high, medium and low priority actions with a long, medium or short timescale for implementation.

7.1 Borough Wide Options

Adaptation of spatial planning policy: Spatial planning policies should be adapted, if necessary, to reflect the outputs and findings of the SWMP study. It is recommended that emphasis is placed on the requirement for appropriate measures to reduce surface water runoff, and the requirement for FRAs to inform the detailed design of new development, particularly within those areas that have been identified at high risk of surface water flooding. This may include mitigation measures, such as SuDS, where these are appropriate. This will ensure that any redevelopment or new development does not negatively contribute to the surface water flood risk of other properties and that appropriate measures are taken to ensure flood resilience in surface water flood risk areas.



Improve maintenance of the drainage network: Drainage maintenance schedules should be evaluated to reflect the findings of this study. The potential for blockages in the drainage network would exacerbate surface water flooding; this would be a particular issue in all the areas identified as being at risk of surface water flooding during an extreme event. It is recommended that a risk-based approach is applied so that drainage infrastructure in key areas is kept clear of blockages.

Despite overall funding cuts, by targeting key areas for more frequent and comprehensive maintenance while reducing maintenance in other areas, overall cost savings may be achieved in addition to reducing the chance of blockages in key areas.

Plans should be put in place to warn residents of when the gullies (and land drains/swales) are due to be cleaned and request that cars are parked elsewhere.

Improve drainage network capacity: A key recommendation of this study is to look at improving the drainage network capacity across the study, especially within areas that may have capacity issues. When undertaking pipe replacement works it is recommended that an assessment is undertaken to confirm if the area can benefit from an increase in pipe size rather than a like-for-like replacement. The benefits of the proposed storm relief sewer should be considered when determining the benefit of any pipe upgrade works.

It is recommended that work is carried out in collaboration with Thames Water to assess the possibility of upgrading the network capacity in these key areas, which would reduce the risk of surface water flooding.

Improve community resilience: It is recommended that a general approach to improving community resilience is adopted across the study area, particularly in areas that have been identified as being at risk. This should include establishing a flood warning system and improving emergency planning procedures (described in more detail below) as well as encouraging property resilience through the installation of individual property protection measures, such as raising property thresholds or installing flood gates or air brick covers, FLIP and pumped devices.

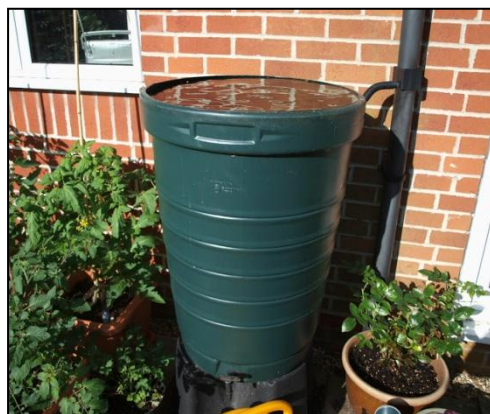
Options for funding of protection and mitigation measures should also be investigated, including the possibility of offering grants or subsidies for individual properties who are interested in installing such measures.

Improve flood warning systems: Installation of rainfall monitoring systems in key areas, in and around the study area, will provide an evidence base for flooding trigger levels and could provide data for a localised flood warning system. Providing a warning to key council operational departments and emergency services will enable the preparation and implementation of the Council’s flood incident management strategy. Relaying this information to households and businesses before a large rainfall event could be achieved through text messages or phone calls warning of potential flooding, as the Environment Agency currently do with their fluvial flood alert system. This, with prior education, will allow individuals to respond with appropriate actions and measures.

Emergency planning (flood incident management): Reviewing the emergency planning procedures in areas at risk from surface water flooding will help to ensure the safety of people and to develop additional planning where required.

Due to the rapid nature of surface water flooding following a rainfall event, resources will need to be in place for immediate implementation following a Flood Warning. Within flooded areas, actions such as the closure of roads and diversion of traffic may be required. A strategy for the safe evacuation of residents will also need to be revised based on the surface water modelling outputs contained within this document.

Permeable paving: Installing permeable paving in key risk areas and along key overland flow routes. These systems can assist in reducing the amount of runoff entering the drainage network, and assist in reducing the overall risk of flooding from an extreme rainfall event. Internal discussions between Highways and the Flood Risk team should aim to identify suitable materials and locations for their installation.



Rainwater harvesting and water-butts: Improving the resilience of local communities to flooding can be achieved through raising awareness of simple measures and systems that can be installed at their homes. Local residents and property owners may, for example, be encouraged to install simple systems such as water butts to capture roof runoff. Rainwater harvesting systems could be installed in new developments or schools or retrofitted into suitable areas.

The principle of rainwater harvesting is that rainfall from roof areas is passed through a filter and stored within large underground tanks. When 'grey water' is required, it is delivered from the storage tank to toilets, washing machines and garden taps for use. Any excess water can be discharged via an overflow to a soakaway or into the local drainage network.

One of the preferred options to reduce peak discharges and downstream flood risk is the implementation of water butts on all new development within the existing urban areas, and in addition, retrofitting these to existing properties where possible.

Water butts often have limited storage capacity given that when a catchment is in flood, water butts are often full and have no spare capacity for flood waters. However, it is still considered that they have an important role to play in the sustainable use of water. There is potential to use 'leaky' water butts that provide overflow devices to soakaways or landscaped areas to ensure that there is always some volume available for storage during heavy rainfall events.

Larger rainwater harvesting systems should also be implemented within suitable developments such as school facilities, commercial buildings or large residential buildings.

Retrofitting bioretention/rain garden carpark bays:

retrofitting bioretention features in key risk areas and along key overland flow routes will act as a source control measure to reduce the amount of runoff entering the drainage network, and reducing the overall risk of flooding from an extreme rainfall event. These devices can also enhance the aesthetics and biodiversity of an area due to their landscaping. These devices have been found to assist in reducing the total amount of phosphorus and nitrogen that discharge into downstream waterways as a result of adsorption and absorption processes within the filter media and vegetation and therefore improve the quality of the runoff discharging into the downstream network. They can be sized to utilise an entire car park bay, increase the road turn out width (reducing the crossing distance for pedestrian) or utilise a small portion of the footpath area (as illustrated in the image above from Brisbane, Australia⁹).



Hydrometric monitoring: It is recommended that installing a series of hydrometric monitoring systems across the Royal Borough would provide a stronger understanding of rainfall patterns and flows that lead to surface water flooding across the study area. Rain gauges should be installed in targeted areas so that a detailed understanding of the catchment hydrology can be established. This evidence base can be used to inform future studies and flood alleviation projects across RBKC.

RBKC should develop an integrated framework to support emergency response and flood incident management. In conjunction with this, it is recommended that rainfall gauging stations can be used to assist with this aim, as well as to assist with the Council's responsibility of investigating flood incidents as required under the FWMA 2010.

⁹ Source: <http://www.peakstopoints.com.au/brisbane-city-council-investing-in-new-ways-to-protect-brisbane-catchments/>

Preferential overland flowpaths (Urban Blue Corridors): Surface water can be managed through the designation of existing highways as Urban Blue Corridors. This concept aims to manage the conveyance of surface water across an area of the catchment through the redesign of the urban landscape to create specific channels to convey surface water. This can be achieved through increasing kerb heights and property thresholds to retain water on the roads. This option could be combined with existing highways maintenance and improvement projects and funding which would make it more cost-effective.

Raising community awareness: Communicating the risk of flooding and raising awareness within local communities across the Borough can be implemented in the short-term and provides a 'quick win' measure to surface water management. This will mean residents are more aware of the flood risk across the Borough and can encourage people to become more proactive within their community. Awareness has already been increased by the creation of the Flooding Steering Group, Flood Fair events and dedicated webpages. Dialogue between the Council and residents should be nurtured and monitored.

It is also important that modern technology is fully utilised in order to communicate with the local community as best as possible. The Environment Agency have produced an iPhone and Blackberry App which delivers data from their online flood warning service straight to people's phones; this is an excellent example of how innovative thinking and technology can be applied to the communication of flood risk. In the first instance,

it is recommended that social media platforms such as Google+, MySpace, Facebook or Twitter are utilised as a way of communicating with local residents and providing information on the council's flood and water management activities; this can be an easy 'quick win' action.



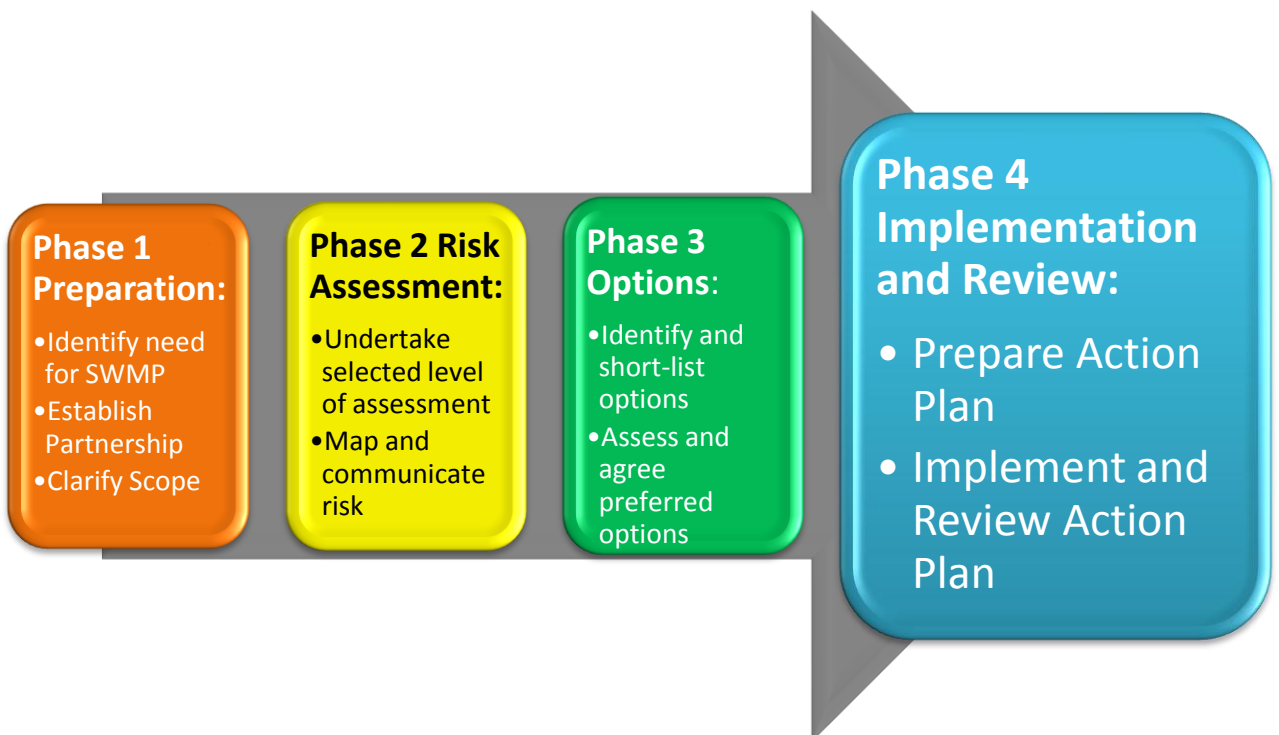
7.2 Short – Medium Term Recommendations

Accounting for the nature of the surface water flooding in the Royal Borough, it is considered that:

- Kerb raising and ramping could be installed to protect below-ground infrastructure (e.g. tube station entrances and large below-ground car parks or storage/loading areas);
- Community flood plans should enlist community support in the implementation of receptor measures (especially measures to increase basement property flood resilience). These plans have already been discussed with the Flooding Steering Group;
- Gulley maintenance should be improved. This has its limitations as the capacity within the existing sewer network is the greater cause of flooding in the area. The inclusion of improved maintenance will ensure that smaller rainfall events are not ponding for prolonged periods and do not add to the total runoff volume generated during an extreme event.
- In consultation with Thames Water, RBKC should review the areas at risk and confirm if the storm relief sewer will assist in reducing the flood risk to these area, and keep working in partnership with Thames Water to address flooding;
- RBKC should undertake a feasibility study for providing source control and flow path management measures in relevant open space areas within RBKC. This will require consultation with land owners to private open space areas within the Royal Borough;

-
- A feasibility study should be undertaken to determine benefits of including water butts and rainwater harvesting measures throughout the study area;
 - RBKC should confirm the flood risk of all TfL assets and agree if any contingency measures should be put in place for key routes through the Royal Borough;
 - RBKC should undertake a borough-wide study to determine which roads may be retrofitted to include bioretention carpark pods and other street scale SuDS;
 - Maintenance regimes should be improved and target those areas identified as having blocked gullies;
 - RBKC should identify and record surface water assets which are likely to have a significant effect on flood risk as part of the LLFAs Asset Register, prioritising those areas that are known to regularly flood and are therefore likely to require maintenance / upgrading in the short-term;
 - RBKC should produce a Communication Plan to raise awareness of surface water flood risk to different audiences using a clearly defined process for internal and external communication with stakeholders and the public; and
 - The 'Information Portal' on the RBKC website should be kept up to date, for local flood risk information and measures that can be taken by residents to mitigate surface water flooding to / around their property. This could include:
 - A list of appropriate property-level flood risk resilience measures that could be installed in a property;
 - Link to websites/information sources providing further information;
 - An update on work being undertaken in the Royal Borough of Kensington and Chelsea by the Council and/or the stakeholders to address surface water flood risk; and
 - A calendar showing when gullies are to be cleaned in given areas, to encourage residents to ensure that cars are not parked over gullies / access is not blocked during these times.

PHASE 4: IMPLEMENTATION AND REVIEW



8 Purpose of an Action Plan

The Action Plan outlines a wide range of recommended measures that should be undertaken to manage surface water within RBKC more effectively. The Action Plan has been developed to outline the responsibilities and implications of both structural and non-structural preferred options discussed in Phase 3 of the SWMP. The Action Plan details the methods, timescale and responsibility of each proposed action.

Within the Action Plan there are details of general measures that could be implemented across the Royal Borough. The general actions are non-structural and encourage improved surface water management through planning policy and public education and awareness. The general actions also include the development of a flood response strategy and surface water flood warning system, which would be beneficial in ensuring successful response, with minimal harmful consequences, in the event of extreme surface water flooding.

Recent guidance and policy has led to the requirement for a Local Flood Risk Management Strategy (as required by the Flood and Water Management Act). RBKC must ensure the SWMP is aligned as closely as possible to their local strategy; this Action Plan will provide the early stages of these documents and can be used to support and inform future studies.

The Action Plan should be read in conjunction with details of the preferred options. The Action Plan is included in Appendix A of this report.

8.1 Action Plan Details

This Action Plan is a simple summary spreadsheet that has been formulated by reviewing the previous phases of the SWMP in order to create a useful set of actions relating to the management and investigation of surface water flooding going forward. It is the intention that the Action Plan is a live document, maintained and regularly updated by RBKC (the LLFA) as actions are progressed and investigated.

New actions may be identified by the RBKC, or may be required by changing legislation and guidance over time.

The Action Plan identifies:

- General flood risk management actions to integrate outcomes and new information from this study into the practices of other RBKC services and external partner organisations;
- Policy actions to assist RBKC to manage future developments in the context of local flood risk management;
- Maintenance actions to prompt review of current schedules in the context of new information presented in this study;
- General CDA actions to be implemented across all CDAs identified within this study;
- High priority CDA actions to be implemented to better understand flood risk in specific areas and proactively manage operational risks; and
- Underpass, road and rail risk assessment actions to understand and highlight the risk to TfL assets, highways assets and pedestrian underpasses.

9 Implementation and Review

9.1 Overview

Following the completion of the SWMP, the actions detailed in the Action Plan will need to be implemented. This will require continued work within the Council and the Flooding Steering Group to ensure all partners are involved in the implementation and ongoing maintenance and performance measures.

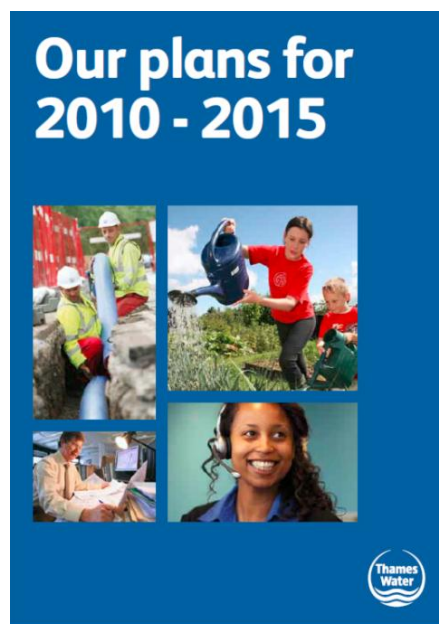
RBKC should coordinate with relevant internal and external partners in order to ensure a holistic approach to the implementation of outputs and actions from the SWMP. Key internal Council partners include contingency planners, the highways department, planning policy and the environmental section. Key external partners include Thames Water, TfL and the Environment Agency.

The outputs of the SWMP should be used, where appropriate, to update and adjust policies and actions. The implications of the SWMP for these partners are described below.

9.2 Thames Water

Ofwat, the water company regulator, has also outlined their intention for water companies to work with other key partners to deliver SWMPs. In addition, the Flood Risk Regulations (2009) outline a duty for water companies to provide information and co-operate with such studies. Thames Water has been extremely helpful throughout the SWMP process and it is important that this partnership continues into the future.

One example of how the partnership can be developed upon completion of this study is to look at how the outputs from this SWMP could be used to influence Thames Water's investment and funding schedule for drainage improvements and maintenance programmes across the Royal Borough. It would be extremely beneficial if their investments plans can be influenced by this study to target areas which have been identified as being at significant risk of surface water flooding due to drainage capacity issues.



Thames Water is currently in the AMP5 period of work (set out between 2010 and 2015), and therefore it is recommended that the outputs of the SWMP should be incorporated into the next planning period (AMP6). Thames Water's Business Plan outlines future investment strategy within the water company. The outputs and recommendations from the SWMP should feed into the decisions made about drainage and sewer flooding in key locations.

The overall aim is for the SWMP outputs to encourage a more holistic approach to future funding arrangements and schemes for drainage improvements within the Royal Borough. For example, the SWMP model outputs can feed into the investments plans for areas with an identified flood risk.

9.3 Spatial Planning

Implications and actions arising for Local Planning Authorities

The Defra SWMP Technical Guidance (March 2010) states that a SWMP should establish a long-term action plan to manage surface water in an area and should influence land-use planning.

The National Planning Policy Framework (NPPF) replaced Planning Policy Statement 25 *Development and Flood Risk* in March 2012 and sets out national planning policy for development in relation to flood risk. Planning Authorities have a duty to ensure that any new development does not add to the causes or sources of flood risk. NPPF takes a risk based approach and categorises land uses into different vulnerabilities, which are appropriate to different flood zones.

Although NPPF applies to all forms of flood risk, surface water, groundwater and ordinary watercourse flood risks are generally less understood than fluvial or coastal flood risk. This is due in part to the much faster response times of surface water flooding, a perception that the impacts are relatively minor and the highly variable nature of influences, e.g. storm patterns, local drainage blockages, interactions with the sewer system. In addition, until production of this report, detailed information on surface water flooding has not generally been available to local authorities.

However, climate change models are predicting more frequent heavy storms and there is emerging evidence that this is already happening. It is also clear from the flooding that occurred in several parts of England in the summer of 2007 that surface water flooding can have major impacts. The detailed modelling and historical research that has been undertaken to prepare this SWMP has identified that in some parts of the modelled settlements, the risks are significant and it is important that appropriate consideration is given to these risks when new development is proposed. The planning system is a key tool in reducing flood risk and with new and more accurate information, it can be applied to surface water flood risk as well as fluvial and tidal flood risk.

The interrelationship between SWMPs and planning was highlighted by Recommendation 18 of the Pitt Review (Cabinet Office, 2008) which states that SWMPs should:

“build on Strategic Flood Risk Assessments (SFRAs) and provide the vehicle for local organisations to develop a shared understanding of local flood risk, including setting out priorities for action, maintenance needs and links into local development frameworks and emergency plans”.

The following section identifies important implications for land use planning arising from the findings of the detailed SWMP modelling. It recommends actions for implementing the Surface Water Management Action Plan that fall within the responsibility of the statutory local planning authority which is responsible for the development and implementation of land use and spatial planning policy.

There are three key avenues by which the findings of this Surface Water Management Plan (SWMP) are recommended to be taken forward through the planning system:

1. The SWMP maps which identify potential areas that are more vulnerable to surface water flooding should be used to update information in SFRAs;

2. The SWMP maps which identify potential areas that are more vulnerable to surface water flooding should be used to update/prepare policies in Development Plan Documents (Development Management Policies and Sites Allocations DPDs); and
3. The SWMP maps which identify potential areas that are more vulnerable to surface water flooding should be used to inform development decisions for sites or areas by either:
 - Resulting in modifications to strategies, guidance, or policies for major development locations (e.g. through Area Action Plans and Supplementary Planning Guidance); or
 - Influencing planning decisions in relation to the principle, layout or design of particular development proposals.

It is recommended that the Environment Agency utilise the findings of this SWMP within any future planning response.

Using the SWMP to update SFRA

Defra's SWMP guidance (March 2010) suggests that local authority planning departments use the map outputs from a SWMP to help update SFRA where surface water flooding has not been addressed in detail. In accordance with the Defra guidance, it has been identified that the existing SFRA do not address flooding from surface water, groundwater or ordinary watercourses in any detail.

The mapping within this SWMP shows some areas that are vulnerable to extensive deep accumulations of water (>0.5m). These areas have a high certainty of flooding during extreme storms and the damage occurring is likely to be significant. The mapping also shows some small areas of potentially deep accumulations of water (>0.5m). These areas may have particular risks associated with them, but may also occur due to irregularities in mapping and modelling. Even relatively shallow water flowing at high velocities can be a threat to life and can cause damage.

For RBKC, the production of this SWMP will be a significant addition of new/updated data. Therefore, in due course, this new information should trigger a review of the Level 1 SFRA. The SFRA should consider these newly identified risks in the following ways:

- Large areas of deep (>0.5m) flooding (excluding basement areas) should be shown as Local Flood Risk Zones and Critical Drainage Areas, unless there is evidence to suggest that the risk has been mitigated, for example by high capacity drainage or pumping infrastructure.
- Small, isolated areas of deep (>0.5m) flooding should be investigated to determine how likely they are to be at flood risk, but do not need to be shown if there is no significant risk.
- Large areas of shallower flooding should be identified as Local Flood Risk Zones if they pose a significant risk, but do not need to be shown if the risks are relatively minor.
- Smaller isolated areas of shallower flooding should generally not be identified as Local Flood Risk Zones, unless there is a particular significant risk associated with that area, as it must be expected that most areas will be affected to some extent by rainwater.
- Routes of fast flowing water may be considered as Local Flood Risk Zones if they pose a significant risk.

- Areas susceptible to groundwater flooding should be shown where they are likely to pose a significant risk of flooding or where they are likely to affect the nature of future development, especially for the design and use of sub-surface spaces.

Identifying an area as a Local Flood Risk Zone should mean that it is then treated in a similar way to Environment Agency Flood Zone 3, in that development proposals will require a Flood Risk Assessment which demonstrates that measures have been implemented to reduce the likelihood and impact of any flooding.

Where a Critical Drainage Area identified by future studies contributes significant amounts of surface water to a Local Flood Risk Zone, the SFRA should identify this and suggest strict application of sustainable drainage measures in this area.

Mapping Checklist

The table below indicates the SWMP maps which are of potential use to spatial planning, and indicates which maps may be suitable for replacing existing SFRA maps:

Table 9-1: SWMP maps which are of potential use to spatial planners

Issue	SWMP map reference	Consider replacing existing SFRA maps?
Surface water flood risk	Figures 9 to 12 (Appendix C)	Yes – more detailed methodology to that used for the SFRA.
Susceptibility to Groundwater Flooding	Figure 5 (Appendix C)	Yes – more detailed methodology to that used for the SFRA.
Recorded incidents of flooding	Figure7 (Appendix C)	May include more recent records.

Using the SWMP to update/modify policies in Development Plan Documents

Ideally the review and update of the SFRAs should be a pre-cursor to any significant change to local Development Plan Documents. Therefore, reference to the SFRA within any local Development Plan Documents should lead to an update in the approach to local flood risks.

The production of the SWMP should act as a catalyst for a review of the proposed sites being put forward through the Sites Allocations Development Plan Documents which are being prepared for RBKC. Identification of CDAs which have similar levels of hazard significance as the areas identified by the Environmental Agency as Flood Zone 3 should be reflected in the site selection and screening process.

Using the SWMP to influence areas of major growth and development

The SWMP should inform consideration of how proposed new development will drain to areas of existing surface water flood risk, and therefore the runoff requirements from those development sites.

Where major development proposals are brought forward within the RBKC, these should be examined for:

- Local Flood Risk Zones and CDAs that affect the area;
- Increased Potential for Elevated Groundwater; and
- Contribution of run-off to Local Flood Risk Zones and CDAs beyond the actual redevelopment area.

Local flood risk should not necessarily prevent development from taking place, but it may affect the location, uses, design and resilience of the proposals. Therefore, a Flood Risk Assessment should be undertaken to consider:

- the location of different types of land use within the site(s);
- application of the sequential approach to development layout and design;
- the layout and design of buildings and spaces to take account of flood risk, for example by dedicating particular flow routes or flood storage areas;
- measures to reduce the impact of any flood, through flood resistance /resilience measures/materials;
- incorporating sustainable drainage and rainwater storage to reduce run-off to adjacent areas; and
- linkages or joint approaches for groups of sites, possibly including those in surrounding areas.

These requirements can be set out in Development Management policies or as site specific policies in the Site Allocations DPD.

Using the SWMP to influence specific development proposals

Where development is proposed in an area covered wholly or partially by a Local Flood Risk Zone, this should trigger a Flood Risk Assessment, as already required under NPPF.

Whilst some small scale developments may not be appropriate in high risk areas, in most cases it will be a matter of ensuring that the Flood Risk Assessment considers those items listed above and also considers some or all of the following site specific issues:

- Are the flow paths and areas of ponding correct, and will these be altered by the proposed development?
- Has the site been planned sequentially to keep major surface water flow paths clear?
- Has exceedance of the site's drainage capacity been adequately dealt with? Where will exceedance flows run off the site?
- Could there be benefits to existing properties at risk downstream of the site if additional storage could be provided on the site?
- In the event of surface water flooding to the site, have safe access to / egress from the site been adequately considered?
- Have the site levels been altered, or will they be altered during development? Consider how this will impact surface water flood risk on the site and to adjacent areas.

- Have inter-dependencies between utilities and the development been considered (for example, the electricity supply for building lifts or water pumps)?

9.4 Emergency Planning

Presently, surface water flooding is not as clearly understood as other sources of flooding (such as fluvial or coastal). Therefore, this SWMP study offers an opportunity to communicate up to date information about locations at risk from surface water flooding to those with an interest. Emergency responses will be informed by known surface water flooding locations, especially near public buildings and major routes through the area.

The purpose of this section is to assist in communicating surface water flood risk to Local Resilience Forums and Emergency Planners to enable them to ensure that incident management plans are updated based on the improved understanding of surface water flooding.

The Kensington and Chelsea Borough Resilience Forum have produced the Kensington and Chelsea Multi-Agency Flood Plan for Surface Water Flooding (2013), which outlines a variety of emergency response and recovery measures for both specific and general major incident risks. The need for specific plans is identified through the Community Risk Register. The key overarching plan for the Royal Borough is the Multi Agency Flood Plan which sets out how the agencies involved with the response and recovery to major incidents will work together (the NERRS is a public document and is available at the following link to the RBKC website <http://www.rbkc.gov.uk/planningandconservation/planningpolicy/floodingissues.aspx>). In relation to flooding the resilience forum has a strategic flood plan which deals with the overall borough-wide response to flooding.

SWMP mapping outputs and knowledge should be used to inform contingency planning decisions and ensure emergency responses to surface water flood events can be improved through identification of likely flow paths and locations of surface water ponding. In particular the following documents should be reviewed and updated following the understanding gained from the SWMP:

- Community Risk Registers (CRR); and
- Multi-Agency Flood Plan (MAFP).

9.5 Highways

Transport for London is responsible for managing key routes through the Royal Borough, whilst the RBKC Highways team is responsible to managing and maintaining the road drainage network within the Royal Borough. Both stakeholders have a variety of responsibilities ranging from repairing potholes to salting the roads during cold and icy weather. It is also responsible for ensuring that drains and gullies are kept clear from debris such as soil, dead leaves and rubbish.

This type of debris often builds up in drains preventing the flow of water into the surface water or combined sewers and requires frequent maintenance. If drains become blocked during a heavy rainfall event it can exacerbate the severity of flooding that occurs locally.

It is important that the outputs from this SWMP are used effectively in order to support and inform the future management practices of the road infrastructure within the Royal Borough. In particular, consideration should be given to the key recommendations which are discussed in the following section.

The main recommendations and actions that the highways department should take from the SWMP process include the following key points:

- The existing schedule of drain and gully maintenance is recommended to be re-evaluated in order to give particular attention to areas considered to be at the highest risk of surface water flooding. Drains and gullies in these areas should be kept clear throughout the year to maximise the capacity of the drainage network and reduce the risk of blockages; this should be reflected in the highways maintenance schedule.
- Opportunities for joint funding on improvement work within RBKC should be considered. Highway maintenance and improvement projects could be combined with drainage improvement or flood alleviation projects through a more holistic approach within the Council. For example, highways drainage programmes may offer opportunities to incorporate useful changes to overland flow paths or increase drainage capacity within a surface water flood risk hot spot with little extra cost. This would provide a time and cost effective way to manage the resources of the Council and ensure different departments are involved in working together to reduce the flood risk across the Royal Borough.

9.6 Review Timeframe and Responsibilities

Proposed actions have been classified into the following categories:

- Short term: Actions to be undertaken within the next one to three years;
- Medium term: Actions to be undertaken within the next one to five years; and
- Long term: Actions to be undertaken beyond five years.

The Action Plan identifies the relevant internal departments and external partnerships that should be consulted and asked to participate when addressing an action. After an action has been addressed, it is recommended that the department responsible for completing the action should review the Action Plan and update it to reflect any issues (communication or stakeholder participation) which arose during the completion of an action and whether or not additional actions are required.

It is recommended that the Action Plan is regularly reviewed and updated to reflect any necessary amendments. In order to capture the works undertaken by the RBKC and other stakeholders, it is recommended that the Action Plan review should be on a not greater than annual basis.

For clarity, it is noted that the FWMA 2010 places immediate or in some cases imminent new responsibilities on LLFAs. The main actions required are summarised below:

- Develop, maintain, apply and monitor a Strategy for local flood risk management of the area.
- Duty to maintain a local flood risk asset register.
- Investigate flood incidents and record in a consistent manner.
- Establish a SuDS Approval Body (SAB).
- Contribute towards achievement of sustainable development.
- On-going responsibility to co-operate with other authorities through sharing of data and expertise.

9.7 Ongoing Monitoring

It is intended that the partnership arrangements established as part of the SWMP process, will continue beyond the completion of the SWMP in order to discuss the implementation of the proposed actions, review opportunities for operational efficiency and to review any legislative changes.

The SWMP Action Plan should be reviewed and updated annually, but there may be circumstances which might trigger an earlier review and/or an update of the Action Plan. In fact, Action Plan updates may be as frequent as every few months. Examples of something which would be likely to trigger an Action Plan review include:

- Occurrence of a surface water flood event;
- Additional data or modelling becoming available, **which may alter the understanding of risk within the study area**;
- Outcome of investment decisions by partners is different to the preferred option, which may require a revision to the action plan, and;
- Additional (**major**) development or other changes in the catchment which may affect the surface water flood risk.

It is in the interest of RBKC and the residents of the Royal Borough that the SWMP Action Plan remains current and up-to-date. To help facilitate this, the RBKC will liaise with other flood risk management authorities and monitor progress.

9.8 Incorporating new datasets

The following tasks should be undertaken when including new datasets in the SWMP:

- Identify new dataset;
- Save new dataset/information; and
- Record new information in log so that next update can review this information.

9.9 Updating SWMP Reports and Figures

In recognition that the SWMP will be updated in the future, the report has been structured in chapters according to the SWMP guidance provided by Defra. By structuring the report in this way, it is possible to undertake further analyses on a particular source of flooding and supersede the relevant chapter, whilst retaining the original versions of other chapters.

In keeping with this principle, the following tasks should be undertaken when updating SWMP reports and figures:

- Undertake further analyses as required after SWMP review;
- Document all new technical analyses by rewriting and replacing relevant chapter(s) and appendices;
- Amend and replace relevant SWMP maps;
- Update options and action plan; and
- Reissue to departments within the RBKC and other stakeholders.

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Appendix A: SWMP Action Plan

Appendix B: Modelling Details

Appendix C: Maps and Figures

Appendix D: CDA Prioritisation

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