

## Appendix G Action plans for hotspot locations

Flexford		Map:
Actions		
1.	A partial CCTV survey was undertaken in November 2012 which indicated partial blockages of the culvert on Beech Lane. However the survey could not get beyond 4m which would suggest more significant blockage. A further CCTV survey should be undertaken to confirm the extent of blockages in the culvert.	<p><b>Hotspot 1 - Flexford</b></p> <p>The map displays the area around Wanborough Station and Christmas Lane. It features a detailed river network in blue, predicted flooding for a 30-year event in light blue, and proposed hotspots outlined in pink. Purple dots indicate GBC flood calls and sandbag requests. A pink line represents the SCC wetspot database. The map includes a north arrow, a scale bar (0 to 0.3 Kilometres), and a 1:4,230 scale. An inset map shows the location of Flexford within the UK.</p> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Proposed Hotspots</li> <li>Detailed river network</li> <li>Predicted flooding - 30 yr</li> <li>GBC flood calls and sandbag requests</li> <li>SCC wetspot database</li> </ul> <p><small>This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of Her Majesty's Stationary Office. © Crown Copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. 100023397, 2013.</small></p> <p><b>CH2MHILL</b></p> <p><small>Created by: Luke Webb (18/10/2013) Checked by: Ali Cotton (18/10/2013)</small></p>
2.	The current CCTV survey has indicated that the culverts under Beech Lane are in poor condition with notable blockages and cracks in the pipes. Structural maintenance of the culvert is needed to ensure the current culvert can convey flows up to its full capacity.	
3.	<p>It is estimated the culvert under Beech Lane can currently convey flows up to a 1 in 20 year rainfall probability event (based on a conservative estimate). To upsize the culvert to convey flows up to and including a 1 in 75 year rainfall probability event it is estimated the culvert would need to be upsized to a 600mm</p> <p>OR</p> <p>In combination (or instead of) improvements to the culvert under the railway it may be feasible to store additional flood water in storm cells under the highway. To enable this to work permeable asphalt would need to be installed on parts of Beech Lane as well as installing storm cells under the highway</p> <p>OR</p> <p>Should improvements to the culvert under the railway not be technically or economically feasible it is recommended that property level resistance and resilience measures are installed for 7 properties which experience internal flooding for a 1 in 30 year rainfall probability event</p>	
4.	Operation and maintenance of highway gullies on Orchard Close and Flexford Road seems to be the primary cause of flooding to properties. Additional maintenance and improvements to the highway drainage network are required in this location	
5.	Flood water is predicted to pond at the low spot of Orchard Close due to backing up against the railway. Further investigation is required to establish whether there is existing drainage (culvert or ditch) to drain water away from this location, as it poses a flood risk to properties. This investigation should also consider drainage at the top of Orchard Close	
6.	There is evidence of a 225mm culvert draining into a 150mm culvert which causes garden flooding to properties in the vicinity (Crossways). The entire length of the culvert needs upgrading to a 225mm culvert. In addition, it is reported that tree root ingress is affecting pipe capacity which needs to be resolved. Enforcement on the riparian owner may be required to mitigate flood risk.	
7.	During the course of the SWMP it has been difficult to ascertain the mechanism of flooding to properties on Westwood Lane. Further discussion with local residents should be undertaken to confirm the numbers of properties affected and the flooding mechanism. There is also evidence of a ditch to the eastern edge of the meadow on Beech Lane which should be investigated and cleared where necessary.	
8.	There is an informal trash screen (an iron gate) on the inlet to the culvert under Westwood Lane to the north of Flexford. A new trash screen should be designed and implemented at this location.	
9.	Work with local landowners to change farming practices to provide more natural attenuation of pluvial runoff. This would not prevent flooding but would mitigate the	

	impacts by reducing the flow rate of pluvial runoff.	
<b>Responsibility</b>		
Lead Organisation	Guildford Borough Council	
Partners	Surrey County Council, Thames Water, Network Rail, BT, local residents and parish council	
<b>Summary of costs and benefits</b>		
Total costs of proposed works are £180k Estimated benefits = £460k Partnership Funding Score (for FDGiA funding) = 46% (£96k required to secure FDGiA funding)		
<b>Funding strategy</b>		
Flood Defence Grant in Aid (FDGiA) funding has been secured to undertake further investigation and mitigation measures in Flexford. Whilst the SWMP has provided an enhanced understanding of flood risk in Flexford there remains uncertainty about some of the flooding mechanisms which should be further explored as part of the FDGiA funding available to confirm the exact scope and nature of mitigation measures. In particular further work is required to understand the location and condition of the highway drainage, which should be funded by Surrey County Council as the highways authority		

**Fairlands**

**Actions**

1. Undertake CCTV survey of the manhole to the south-east of the village hall car park (in vegetated area) to establish incoming pipes.
2. Reinststate historic ditch between watercourse that flows round the cricket pitch and the watercourse through the edge of the village (NB: some objections were raised by local residents during public consultation; these will be further considered as GBC investigate this further)
3. Remove man-made obstruction (bridges over watercourse) in the rear gardens of properties on Gumbell's Close to prevent blockage of the watercourse. Evidence from historic records indicate previous flooding to these properties may have been due to small bridges/culverts built over the watercourse in back gardens. Most have been removed already, but some remain.
4. Undertake an annual walkover of the watercourse required to check that homeowners have not put new culverts/bridges in without consent.

**Responsibility**

Lead Organisation	Guildford Borough Council
Partners	Local residents and parish council

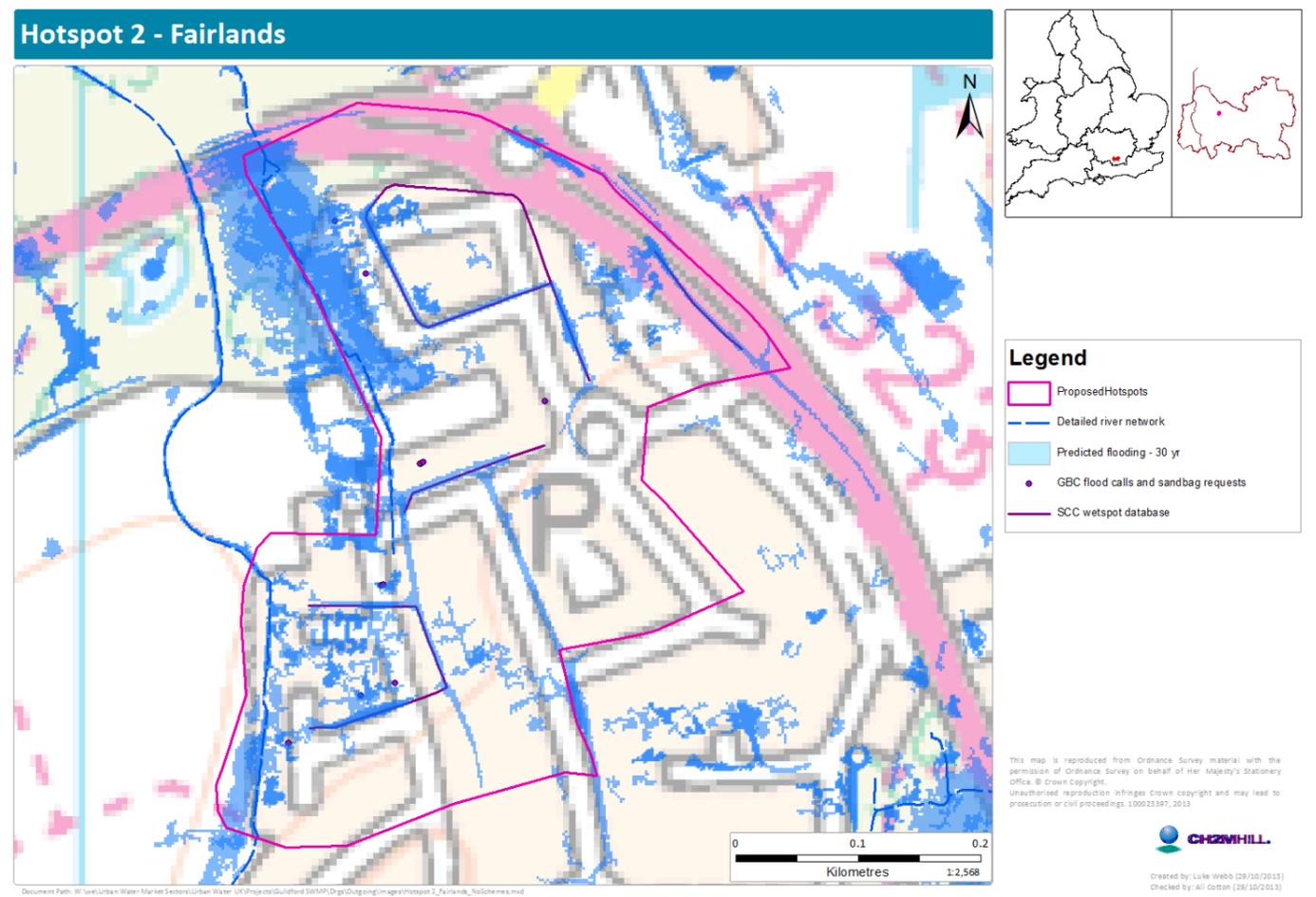
**Summary of costs and benefits**

Estimated costs = £21k  
 Estimated benefits = £800k (although likely to be over-estimated due to uncertainties in hydraulic modelling)

**Funding strategy**

The mix of capital and operational measures proposed in the SWMP should be funded directly by Guildford Borough Council through procurement of survey contractors or officer time. Should further evidence emerge of flood risk in this location due to incapacity in the watercourses more significant capital works (e.g. flood defences or channel improvements) would be required. It would be likely that these would qualify for Flood Defence Grant in Aid funding.

**Map:**



## Applegarth

### Actions

1. There is historical flooding on Hunts Close which appears to be related to highway and sewer flooding. The existing condition of the drainage network in the area should be assessed and maintenance enhanced where required.
2. There is significant evidence of debris and blockages in the watercourses to the west of Applegarth Avenue and north of Roman Farm Road. Annual clearance of these watercourses is required to reduce the risk of flooding.
3. Evidence from the site visits indicated a lack of highway gullies on the low spot on Hunts Close. Additional gullies should be added to provide increased drainage of flood water.
4. Evidence from the site visits indicate the culvert under Roman Farm Road was partially blocked. The blockages will need to be removed and a potential re-design of the culvert inlet is required to prevent future blockages.
5. Add a table top road hump between 28 and 39 School Meadow to divert water towards the watercourse and away from properties.
6. This involves constructing a flood embankment on the western edge of Kings College playing field to alleviate predicted flooding to 38-54 Pond Meadow. It would also help to alleviate potential flood risk to properties on Stoney Brook.
7. There is no anecdotal evidence of flooding on Hartshill, but it is in a natural depression so adequate maintenance of the existing highway drainage network is critical to ensure future flooding does not occur.

### Potential future action

8. Should there be a residual flood risk following improvements to the highway drainage network, property level protection would be suitable in Hunts Close.

### Responsibility

Lead Organisation: Guildford Borough Council and Surrey County Council

Partners: Environment Agency (to provide support for FDGiA funding)

Summary of costs and benefits

Estimated costs = £335k (£318k associated with embankment to east of Pond Meadow)

Estimated benefits = £1,500k (over £1,000k associated with embankment to east of Pond Meadow)

Partnership Funding Score (for FDGiA funding for Pond Meadow) = 73% (£78k required to secure FDGiA funding)

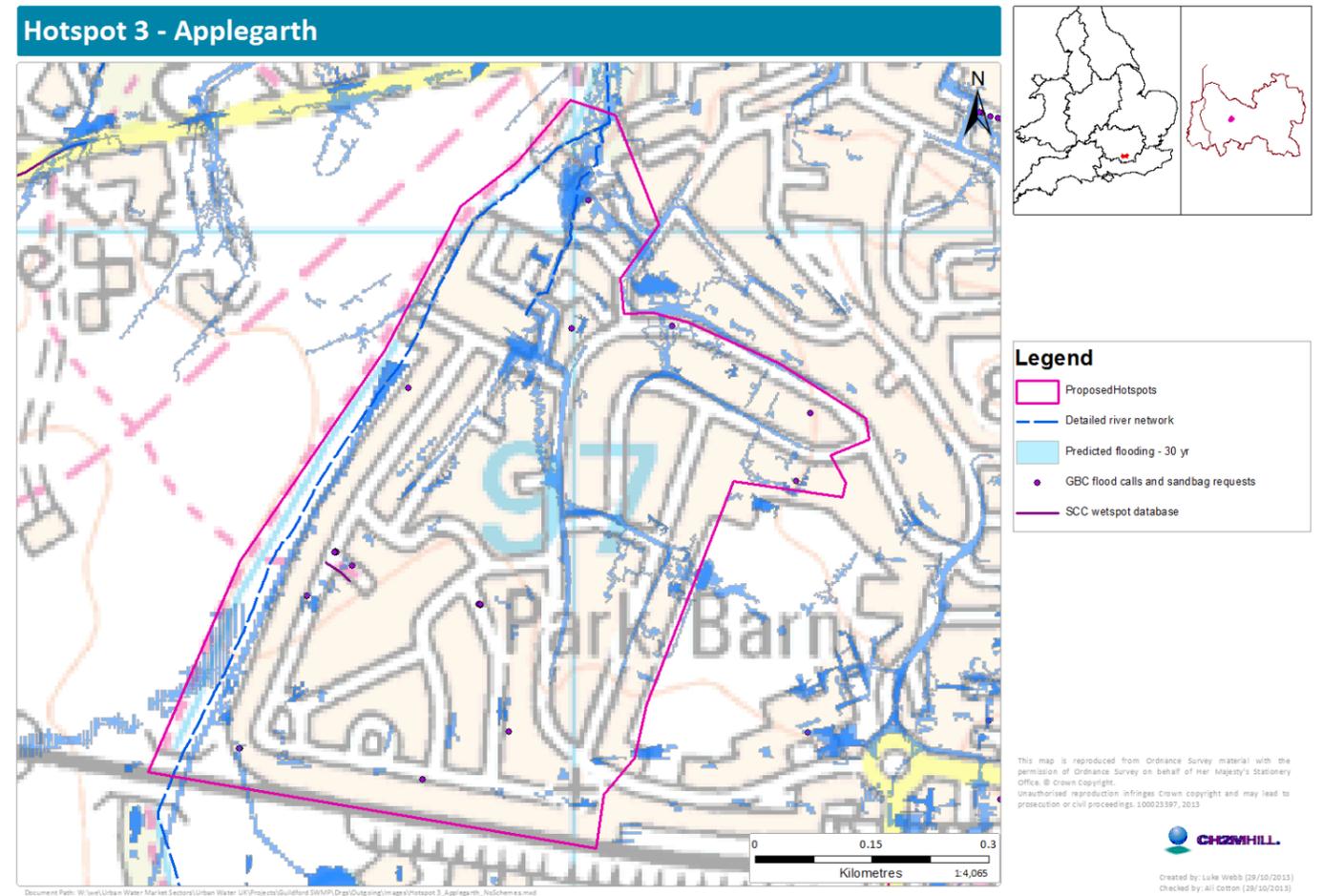
### Funding strategy

The proposed capital works on Hunts Close are related to highway drainage improvements and should be funded by Surrey County Council. In addition, the maintenance of highway gullies on Hartshill should be funded through Surrey County Council.

Works on Roman Farm Road, School Meadow and the general maintenance of the watercourses in this catchment should be funded by Guildford Borough Council.

It is recommended that a funding application for FDGiA be submitted for the flood embankment to the east of Pond Meadow, although some local contributions will be required.

### Map:



## Asheden Estate

### Actions

1. The route, condition and capacity of the watercourse in this area is unknown. A CCTV survey of the entire culverted section should be undertaken as a high priority.
2. To support the development of a business case for Central Government funding (FDGiA) it is recommended that detailed integrated modelling of the watercourse is undertaken. The modelling could be used to justify the current damages due to flooding and support the design of the mitigation measure (SC-6).
3. The analysis undertaken for the SWMP has suggested that a storage area of approximately 3,200 m<sup>3</sup> is required to store runoff up to and including the 1 in 75 year rainfall probability event, assuming a raised embankment storage is provided.
4. Should flood storage within the park area not be technically, socially or economically feasible, it is recommended that property-level protection be progressed.

### Responsibility

Lead Organisation	Guildford Borough Council
Partners	Environment Agency (to provide support for FDGiA funding), Tesco

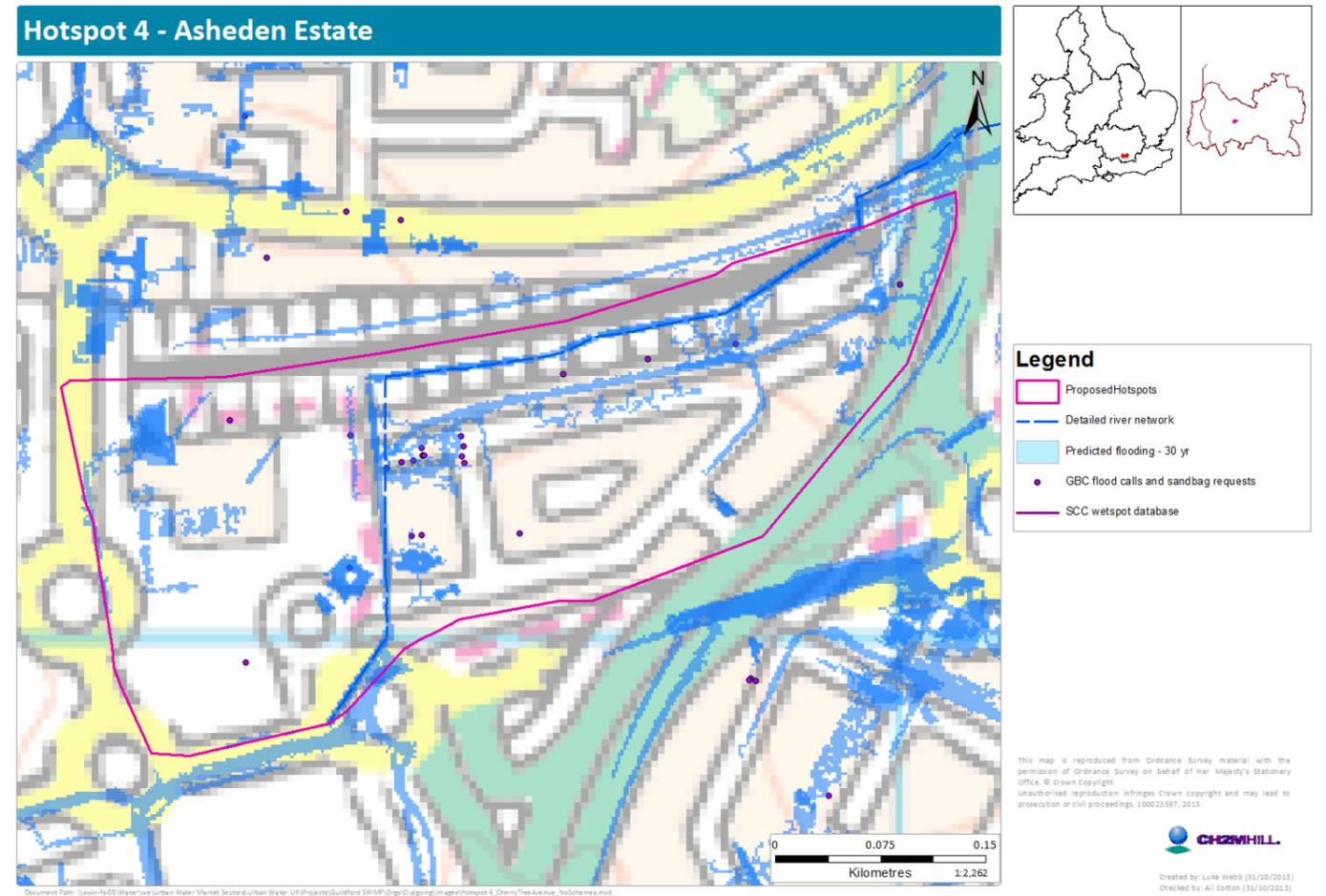
### Summary of costs and benefits

Costs = £420k  
 Benefits = £1,370k  
 Partnership Funding Score (for FDGiA funding) = 87% (£50k required to secure FDGiA funding)

### Funding strategy

It is understood that a funding application for FDGiA has already been submitted for this location. The evidence from the SWMP can be used to support enhancement of the funding bid. Given that there is historic evidence of flooding to the Tesco store and car park there is an opportunity to secure funding towards the scheme. This would significantly improve the potential to secure FDGiA funding.

### Map:



## Rydeshill

### Actions

1. One off maintenance clearance at natural channel at downstream end of the network (behind Bramble Close)
2. Future annual clearance at channel at downstream end of the network (behind Bramble Close)

### Responsibility

Lead Organisation: Guildford Borough Council

Partners:

### Summary of costs and benefits

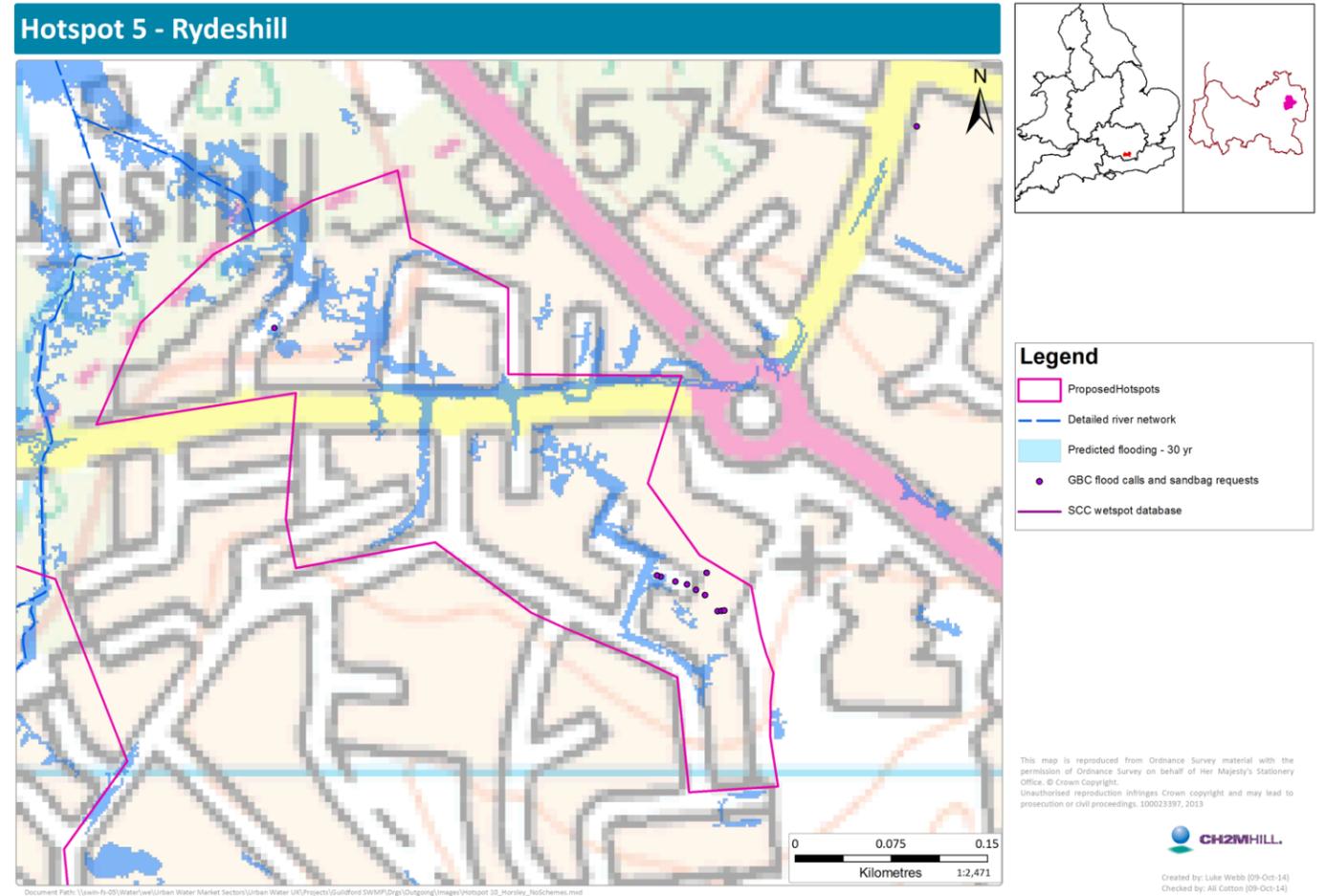
Costs = £6,000 initial cost to clear watercourse, followed by £2,000 per annum

Benefits = Not quantified as this is maintenance

### Funding strategy

Measures should be funded by Guildford Borough Council or Surrey County Council

### Map:



**Bellfields**

**Actions**

1. Clearance of highway gullies on Cypress Road to reduce risk of flooding to properties and infrastructure
2. CCTV Survey on Cypress Road of drainage network
3. Survey of pond/ thorough assessment of capacity of pond and detailed inflow/outflow volumes to determine potential for overtopping

**Responsibility**

Lead Organisation	Guildford Borough Council
Partners	Surrey County Council and Thames Water

**Summary of costs and benefits**

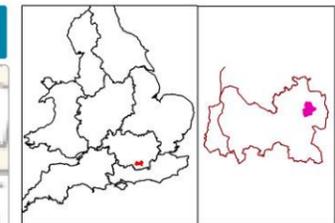
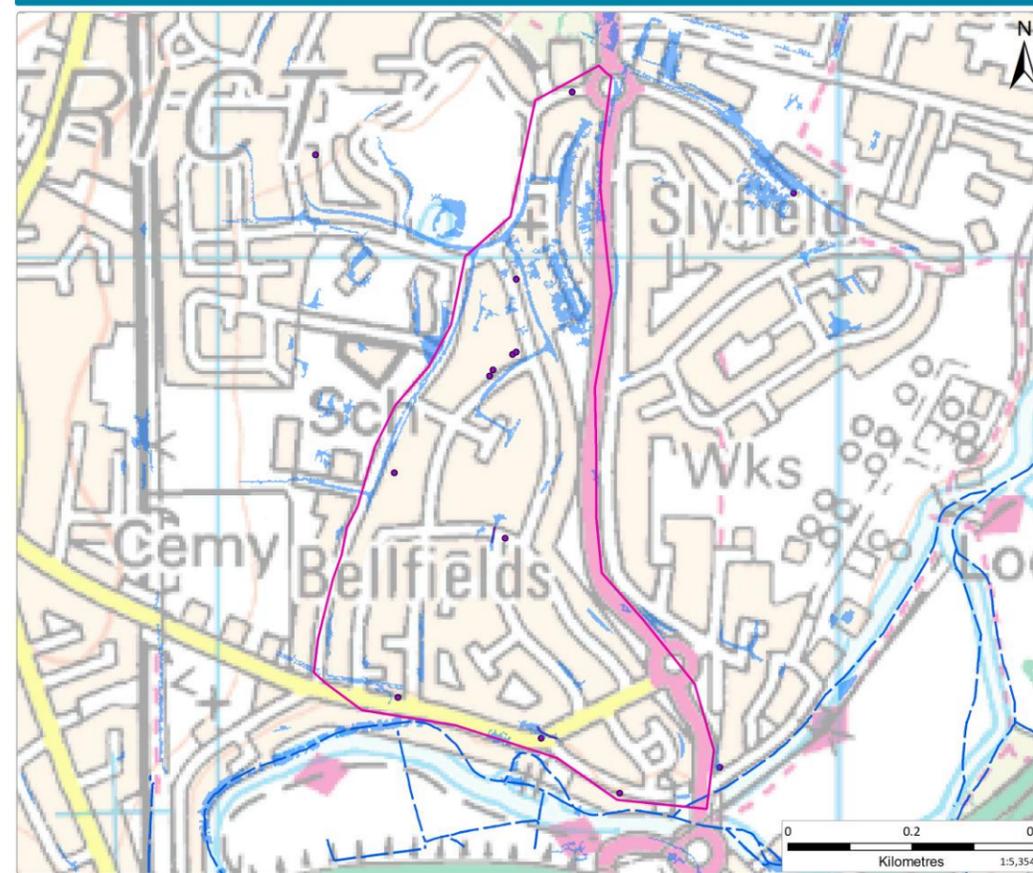
Costs = £2,000 for CCTV survey, and £2,000 per day for highway gully clearance. Investigation of balancing pond estimated to cost £10,000  
 Benefits = Up to £550,000 although modelling does seem to over-estimate flood risk based on limited historical evidence

**Funding strategy**

It is recommended that the works at Bellfields are funded by Guildford Borough Council and Surrey County Council, with the Borough focussing funding on the embankment on Cypress Road and the investigation of the balancing pond, and the County Council investigating highway maintenance issues on Cypress Road.

**Map:**

**Hotspot 6 - Bellfields**



**Legend**

- ProposedHotspots
- Detailed river network
- Predicted flooding - 30 yr
- GBC flood calls and sandbag requests
- SCC wetspot database

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## Jacobswell

Actions	
1.	The left bank of the watercourse contains a 900mm high embankment and appears to be designed to protect Oak Tree Close residences from high water levels; however a 10m long gap was found opposite 9 Oak Tree Close. This measure will re-instate the embankment.
2.	Check condition of gullies along roads on Brookside to ensure there are enough and that they are adequately maintained. Resolve any issues.
3.	The trash screen on the culvert inlet under Jacobswell road is cleaned up to 3 times a day by the parish council during heavy rainfall. To ease the burden on this culvert inlet an additional trash screen could be installed on the watercourse near Oak Tree Close to capture debris.
4.	Between the A320 and the Oak Tree Close there is a meadow area that could be used as a natural storage area. However, further analysis of the ground levels indicates that the meadow and Oak Tree Close are at similar levels so creating a storage area would require raised embankments, which would not be economically viable.

## Responsibility

Lead Organisation	Guildford Borough Council
Partners	Surrey County Council, parish council and Worplesdon Flood Forum

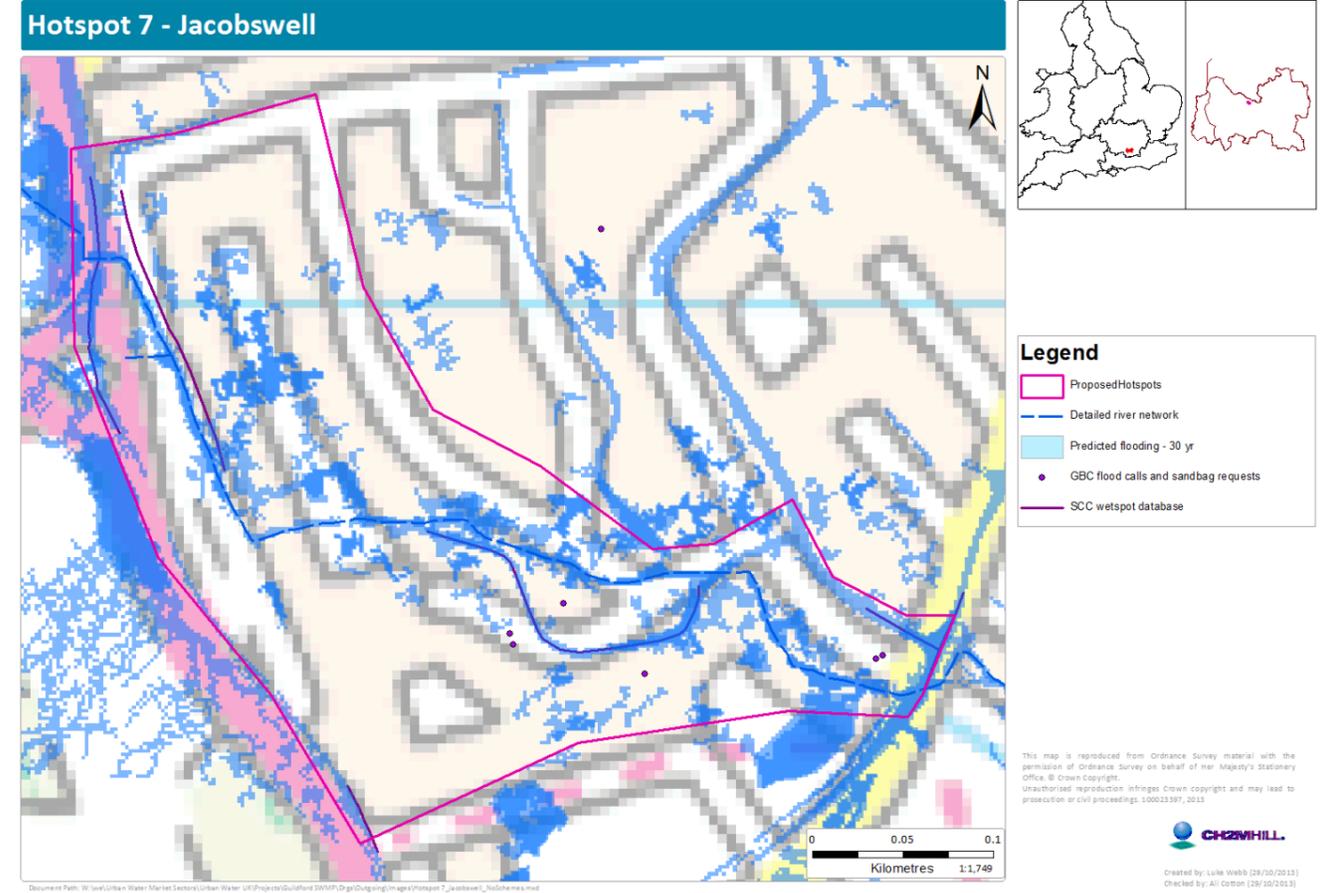
## Summary of costs and benefits

Costs = £22k
Benefits = £380k

## Funding strategy

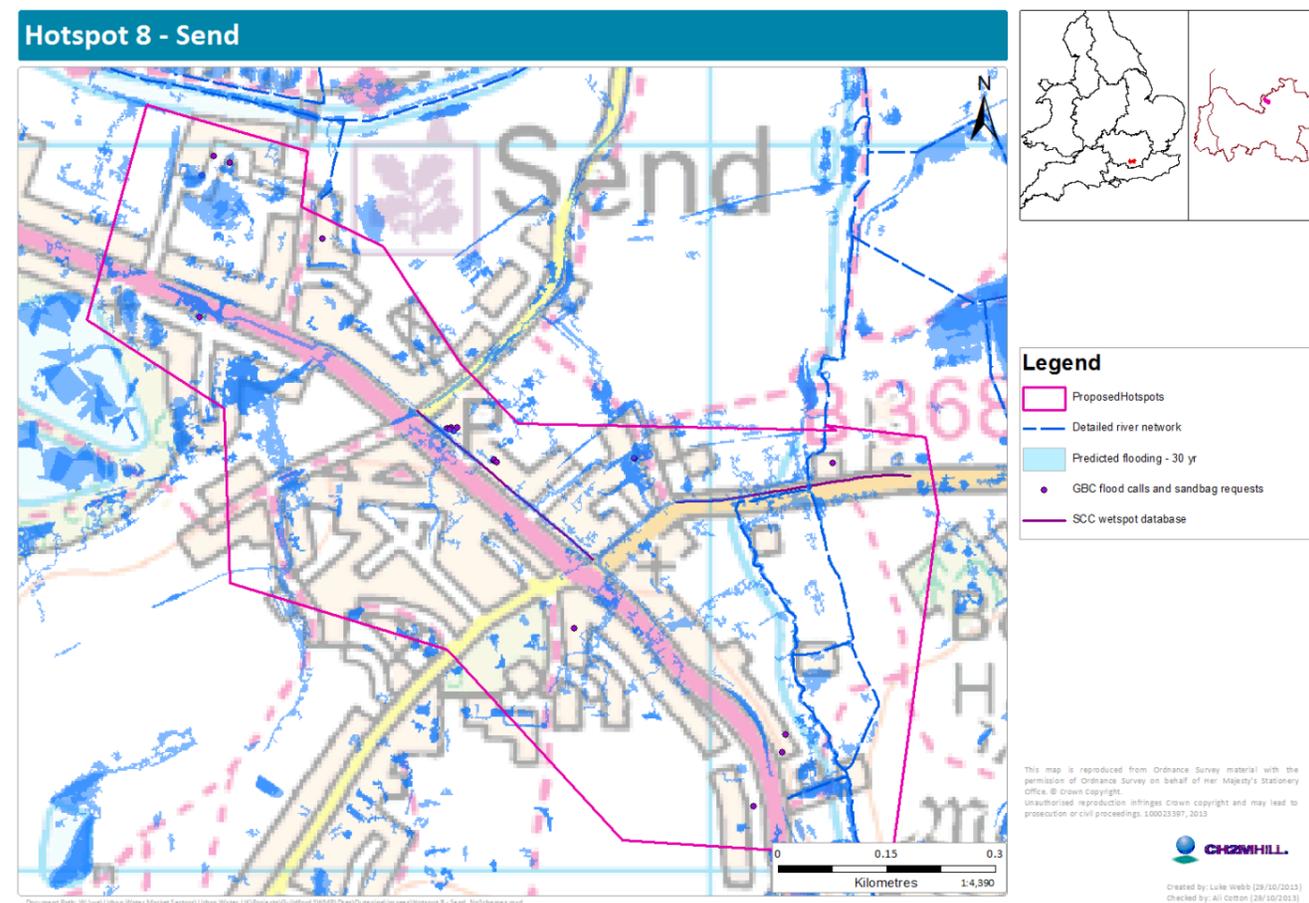
It is recommended that the works at Jacobswell are funded by Guildford Borough Council and Surrey County Council. The Borough should focus funding on the embankment on Oak Tree Close and the potential for an additional trash screen, whilst the County Council should investigate highway flooding issues in Brookside. It is recognised that there is an active flood forum in Jacobswell who contribute to the management and maintenance of the watercourse. The Borough Council and flood forum should continue to work in partnership to manage flood risk from the watercourse, as blockages or obstructions could result in flooding to residential properties.

## Map:



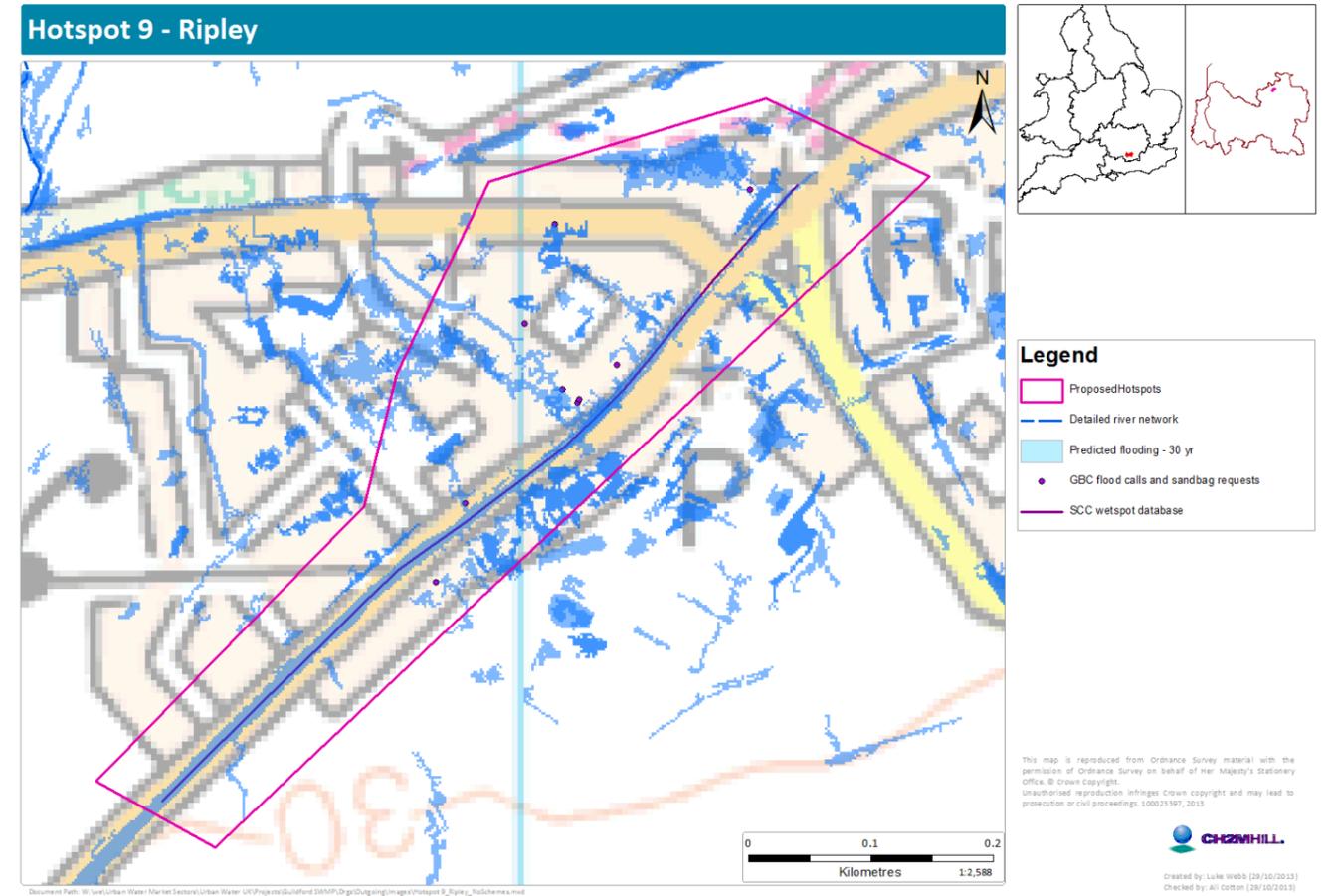
Send	
Actions	
1.	Properties on Send Road appear to be vulnerable to flooding because they are lower than the highway and there is no highway drainage outside the properties. It is recommended that additional highway gullies (or an aco drain) be installed to prevent internal flooding to these properties. In addition, Send Marsh Road is also vulnerable to flooding because the highway gullies appear insufficient to drain water away. Further investigation and mitigation is required.
2.	There is no evidence of the watercourses overtopping in this area, but regular maintenance and inspections of culverts will be required to minimise risks of blockages that could result in flood risk to properties and infrastructure.
Potential future action	
3.	Should there be a residual flood risk following improvements to the highway drainage network, property level protection would be suitable for properties on Send Road.
Responsibility	
Lead Organisation	Surrey County Council
Partners	
Summary of costs and benefits	
Costs = £20k (for highway works)	
Benefits = £120k (for highway works)	
Funding strategy	
The flood risk issues in Send appear to be localised and related to the condition and location of highway drainage within the area. Therefore it is recommended that Surrey County Council act as the lead organisation for further investigation and funding of the proposed mitigation measures. Should property level protection be progressed in this area, an FDGiA application could be submitted to secure funding for the scheme, although local contributions would be needed to secure FDGiA.	

Map:



Ripley	
Actions	
1.	Evidence from the site visits indicated that the highway gullies along the High Street were in poor condition and needed additional maintenance. In addition the presence of highway gullies along the pavement indicates a historic problem in this area, which should be further investigated by Surrey County Council. Ripley Parish Council have also identified a range of other highway ditches and pipe network which requires enhancement and maintenance. These have been passed onto SCC as the highways authority for consideration.
2.	There is a localised ditch that runs alongside Grove Heath North (to the west of Ripley) and into a culvert under Portsmouth Road. The inlet to the culvert is completely blocked and needs to be cleared to prevent flooding onto the main road through Ripley, although this does not cause property flooding.
3.	The natural wet area behind properties to the south of the High Street could be converted into an attenuation area. It is estimated that up to 5,300 m <sup>3</sup> of storage is feasible at this location, assuming a maximum embankment height of 2m (no excavation). It is estimated that it could accommodate flows up to and including the 1 in 75 year rainfall probability event.
4.	Work with local landowners to change farming practices to provide more natural attenuation of pluvial runoff. This would not prevent flooding but would mitigate the impacts by reducing the flow rate of pluvial runoff.
Potential future action	
5.	Should flood storage behind the High Street area not be technically, socially or economically feasible it is recommended that property-level protection be progressed.
Responsibility	
Lead Organisation	Surrey County Council and Guildford Borough Council
Partners	Environment Agency (to provide support for FDGiA funding)
Summary of costs and benefits	
Costs = £355k (including highways works and design, construction and maintenance of storage areas)	
Benefits = £650k	
PF Score = 41% (£190k needed to secure FDGiA funding)	
Funding strategy	
Improvements to the existing highway drainage on High Street and the ditch network adjacent to Grove Heath North should be progressed and funded by Surrey County Council as the highways authority. Officers from Guildford Borough Council should take the lead on working with local landowners to improve the management of land to reduce runoff rates.	
The most feasible funding opportunity for the flood storage area to the south of the High Street would be FDGiA. However, initial analysis of the Partnership Funding Score indicates that significant cost savings or external contributions would be needed to fund the scheme. Further work will be required to seek cost savings, as it is considered unlikely that £190k can be raised locally to support the scheme, in the absence of a recent flood history in the area.	

Map:



## The Horsleys

### Actions

1. Improve maintenance of gullies in Kingston Avenue (at low spot) where flooding has occurred before and increase number if there are too few.
2. Undertake CCTV of the culverts under the railway, in the back gardens of 44-49 Kingston Ave and at the roundabout nr 16 Kingston Avenue.
3. Investigate condition and maintenance of highway network on East Lane and The Street
4. Surface water mapping indicates potentially significant flood risk to properties in Horsley due to the watercourse which runs south to north. There is no anecdotal evidence of flooding along the watercourse, so no immediate mitigation measures are recommended. Rather, further liaison with local residents should be undertaken to establish if there is any flooding history from the watercourse. If there is any current (or future) evidence of flood risk due to the watercourse, further detailed hydraulic modelling of the watercourse would be necessary.

### Potential future action

5. Should improvements to the highway drainage network not resolve the flooding on Kingston Avenue, property level protection should be offered to properties which have flooded in the past.

### Responsibility

- |                   |   |
|-------------------|---|
| Lead Organisation | Surrey County Council and Guildford Borough Council                           |
| Partners          | Environment Agency (to provide support for FDGiA funding) and local residents |

### Summary of costs and benefits

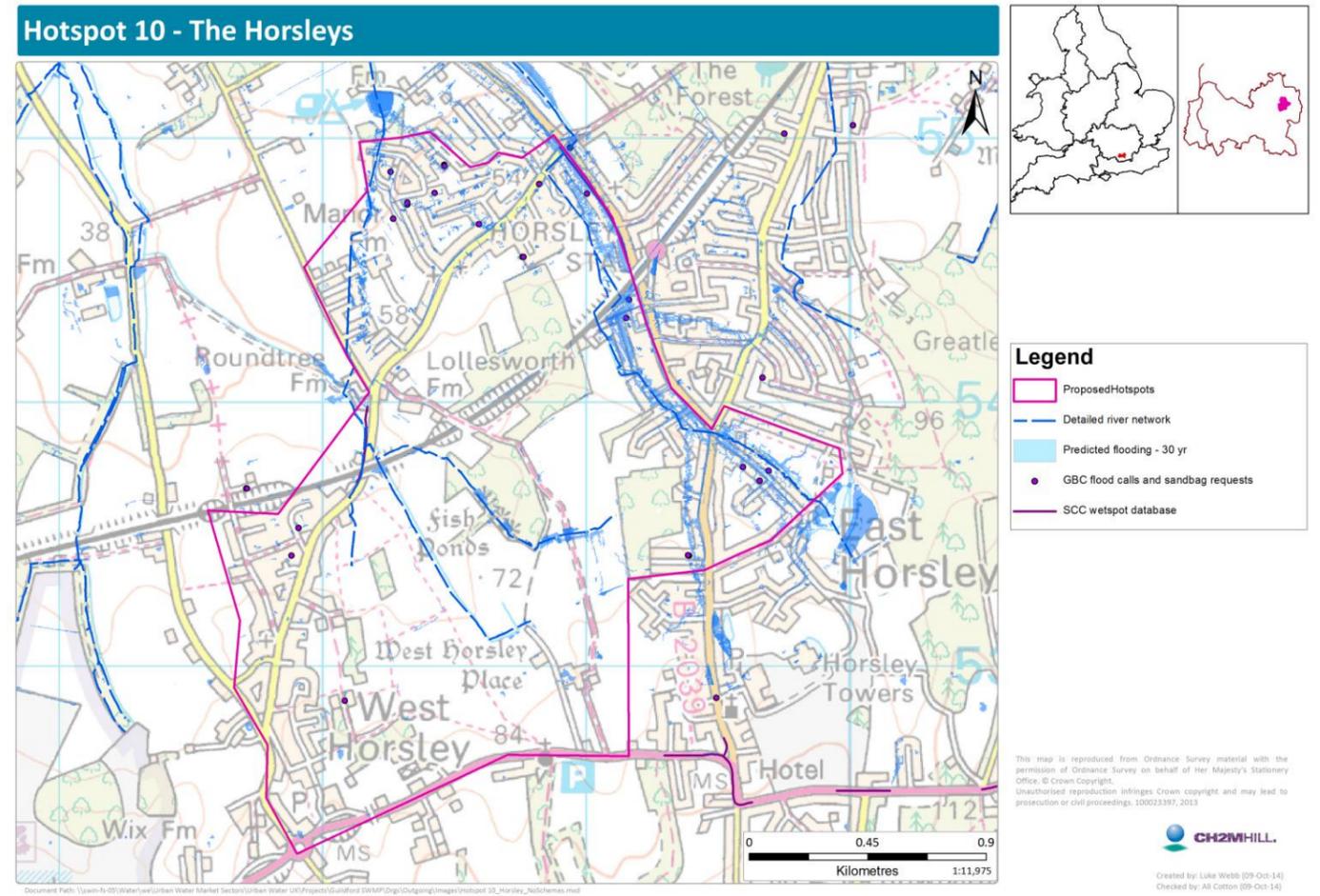
- Costs for highway works = £10k
- Benefits of highway works = £240k
- Estimated costs for future hydraulic modelling = £75k

### Funding strategy

It is recommended that highway drainage improvements on Kingston Avenue are funded and delivered by Surrey County Council as the highways authority. A CCTV survey of the watercourse to the rear of Kingston Avenue should be undertaken by Guildford Borough Council.

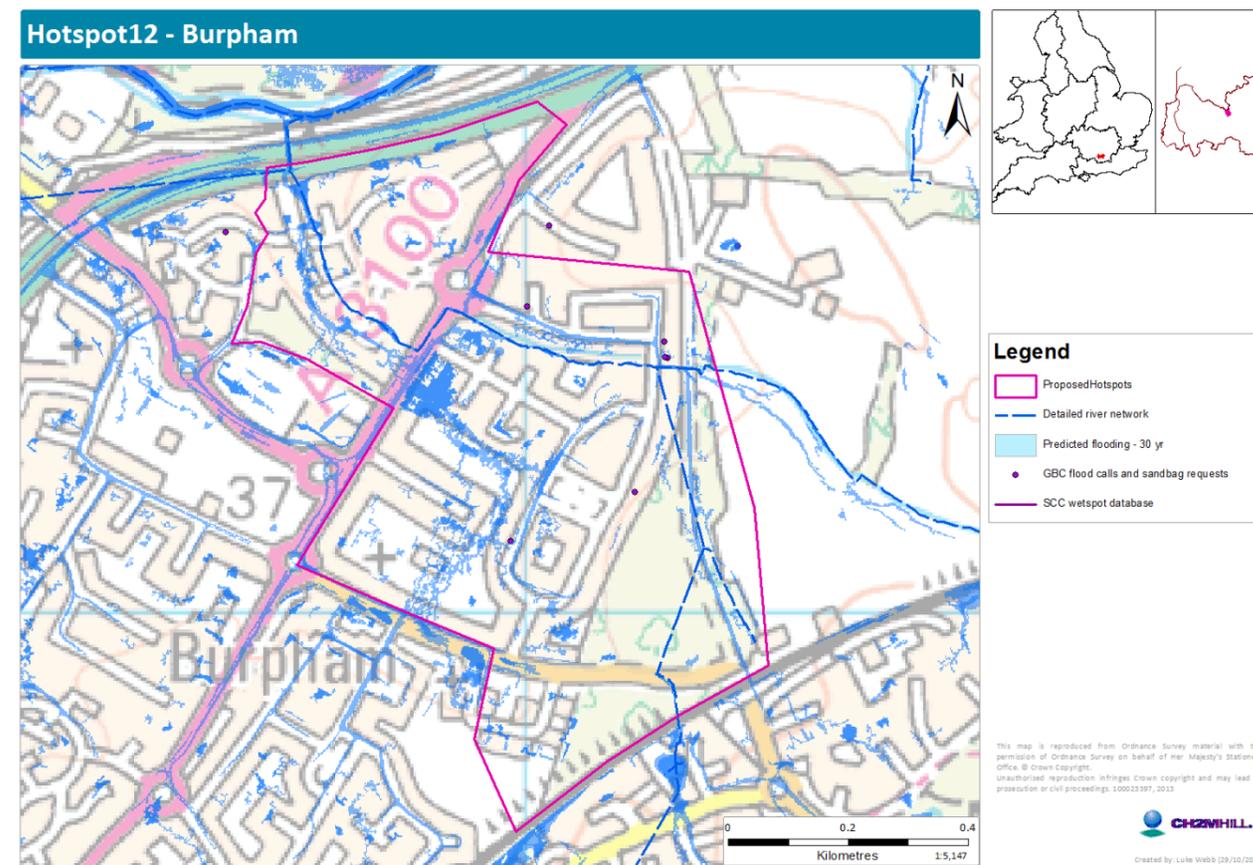
Further investigation and detailed hydraulic modelling of the watercourse through East Horsley is recommended. Initially, Guildford Borough Council should undertake engagement and consultation with local residents to better understand historic flooding in the catchment. Subsequently, it is recommended that an application for FDGiA funding is submitted to undertake detailed hydraulic modelling of the watercourse and drainage network in East Horsley to improve understanding of flood risk and potential mitigation measures. A CCTV survey of the culverted watercourses may be required and should be funded by Guildford Borough Council.

### Map:



Burpham	
Actions	
1.	The culvert and headwall to the rear of 92/94 Gosden Hill Road is showing imminent signs of collapse and urgent work is required to rectify this.
2.	Ongoing maintenance of the culvert under New Inn Lane is required because the culvert is prone to blockage and causing flooding.
3.	Investigate condition of balancing pond south of railway near Fitzjohn Close
4.	There remains significant uncertainty about the watercourses which drain to Merrow Lane. Several outlets were observed during the site visit but it was not possible to follow the route of each watercourse/ditch as part of the SWMP. It is recommended that a detailed watercourse walkover survey is undertaken to establish the source and pathway of each of the watercourses/ditches which drain towards Merrow Lane. Cross sections (of open sections and culvert inlets/outlets) should be taken at various points of the survey and the watercourses should be mapped to enable further hydraulic modelling work to be progressed.
5.	The route of the watercourse downstream of New Inn Lane is uncertain due to historic development in the area. A CCTV survey (and review of adopted surface water sewer maps) should be undertaken to confirm the route and size of the network.
6.	Downstream of London Road there is evidence of bank erosion, scour and deposition of sediment within the watercourse. Maintenance is required to remove vegetation and accumulated sediment, as well as to manage bank erosion and scour.
7.	Along watercourses downstream of London Road there is evidence of mis-connections which need to be assessed.
8.	Once the watercourse survey has been undertaken it is recommended that a detailed integrated hydraulic model of the catchment is produced to better understand flooding mechanisms. The model will help to justify the business case for further funding. The model would represent the entire hotspot area.
9.	Subject to the watercourse survey and detailed integrated hydraulic modelling, it is recommended that upstream storage to the east of Merrow Lane be provided. It is estimated that 8,300m <sup>3</sup> of storage can be provided at this location which would offer flood storage between a 1 in 50 year and 1 in 75 year rainfall probability event.
10.	Investigate the condition, connectivity and pumping arrangements of the sewer network on New Inn Lane and Raynham Close
Potential future action	
10.	Should flood storage upstream of Merrow Lane area not be technically, socially or economically feasible it is recommended that property-level protection be progressed.
Responsibility	
Lead Organisation	Guildford Borough Council
Partners	Surrey County Council, Environment Agency (to provide support for FDGiA funding), Thames Water, and local residents
Summary of costs and benefits	
Costs = £20k for structural repairs to culvert near Gosden Hill Road	
Costs = £12k per annum for maintenance of watercourse downstream of London Road, and £4k per annum for maintenance of culvert under New Inn Lane	
Costs = £530k for flood storage to the east of Merrow Lane	
Benefits (only benefits of flood storage quantified) = £1,000k	

Map:



PF Score = 53% (£290k needed to secure FDGiA funding)

#### Funding strategy

It is recommended that the following proposed mitigation measures are progressed and funded by Guildford Borough Council:

- works to repair the culvert and headwall to the rear of Gosden Hill Road;
- walkover survey (including taking cross sections) of all watercourses within the area;
- undertake works to alleviate bank erosion, bed scour and deposition of sediment on the watercourse downstream of London Road;
- undertake pro-active maintenance of the culvert near New Inn Lane which is prone to blockage and causes property flooding, and;
- commission a CCTV survey of the watercourse to trace the route of the culvert downstream of New Inn Lane.

A funding application for FDGiA should be submitted to develop the flood storage area to the east of Merrow Lane. Detailed hydraulic modelling should be undertaken of the study area to support the economic appraisal and design of the proposed flood storage area. This would include a more detailed hydrological analysis to improve confidence and certainty of flows arriving at Merrow Lane.

**York Road area**

**Actions**

1. Consider condition and enhanced maintenance of gullies in key locations, e.g. Cooper Road, Cline Road, York Road,
2. Undertake detailed study of the drainage in this area, to confirm capacity of current network and options to alleviate flooding. Possible options include:
  - Upsizing the drainage network
  - Disconnecting surface water into localised above ground storage areas
  - Property level protection

**Responsibility**

Lead Organisation: Guildford Borough Council

Partners: Surrey County Council and Thames Water

**Summary of costs and benefits**

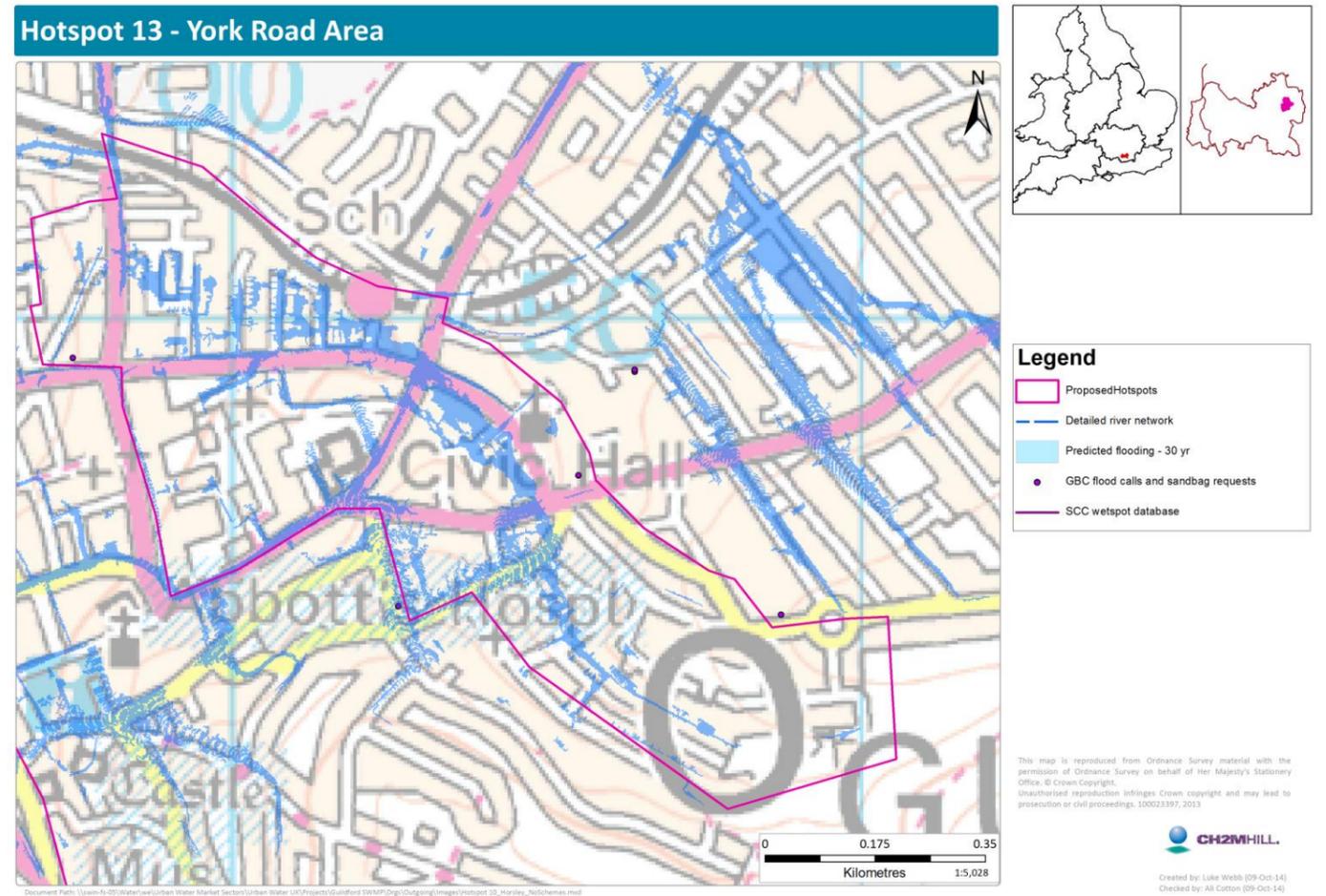
Costs = For improve maintenance and detailed investigation are in the region of £60,000

Benefits = Cannot be quantified at this stage

**Funding strategy**

As the highways authority Surrey County Council should take act as the lead organisation in improving maintenance of the highway network. The detailed investigation of flooding will require collaboration of Guildford Borough Council, Surrey County Council and Thames Water.

**Map:**



## Tormead and Collingwood Crescent

### Actions

1. Check existing maintenance of key network through Collingwood Crescent
2. Consider upsizing 375mm network on Boxgrove Road

### Responsibility

Lead Organisation: Surrey County Council

Partners: Thames Water

### Summary of costs and benefits

Costs = For improved maintenance of the culvert under Collingwood Crescent the costs have been estimated at £4k per annum. The costs of upsizing the 375mm culvert on Boxgrove Road has not been costed

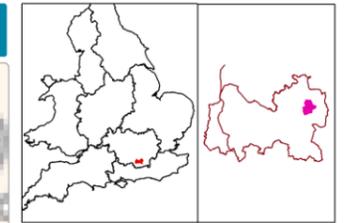
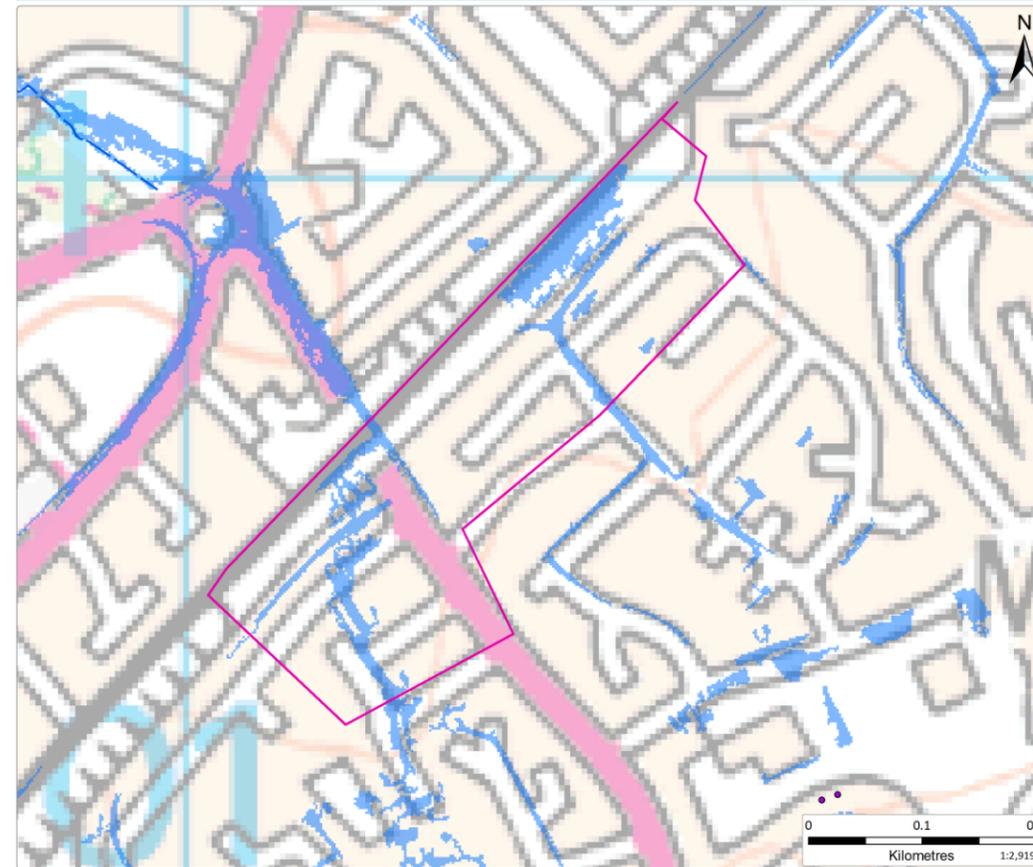
Benefits = Cannot be quantified at this stage

### Funding strategy

The measures will need to be funded for by Thames Water and/or Surrey County Council

### Map:

#### Hotspot 14 - Tormead



#### Legend

- ProposedHotspots
- Detailed river network
- Predicted flooding - 30 yr
- GBC flood calls and sandbag requests
- SCC wetspot database

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## Effingham

### Actions

1. Improve maintenance of ditches, culverts and drains running adjacent to, or underneath Effingham Common Road
2. Work with sub-station asset owner to improve resilience of electricity sub-station on Orestan Lane

### Responsibility

Lead Organisation Guildford Borough Council

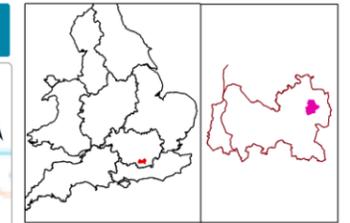
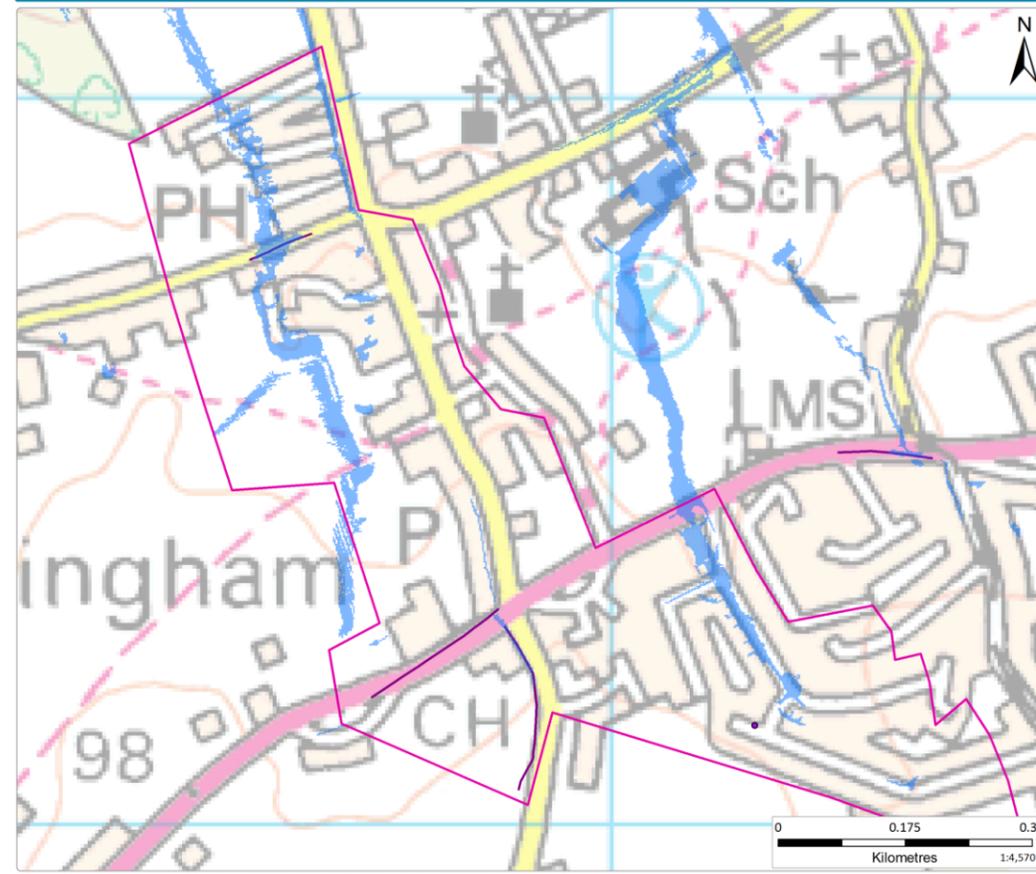
Partners Surrey County Council, Effingham Parish Council and riparian owners

### Summary of costs and benefits

At this stage no costs or benefits have been ascribed to the two measures outlined above. It is unknown at this stage what additional resilience is needed at the electricity sub-station, and it is anticipated that the costs of clearing ditches, culverts and drains will be borne by riparian owners (or possibly Surrey County Council as the highways authority).

### Map:

#### Hotspot 17 - Effingham



#### Legend

- ProposedHotspots
- Detailed river network
- Predicted flooding - 30 yr
- GBC flood calls and sandbag requests
- SCC wetspot database

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