Hertfordshire County Council
Flood Investigation Report
Long Marston, Hertfordshire

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Revision schedule

Hertfordshire County Council
Flood Investigation Report

Friday 24 October 2014
Revision 2 - Draft

Rev	Date	Details	Author	Checked and Approved by
1	14/10/14	For internal consultation	Jack Shephard Project Officer Flood Risk Management	
2	20/10/14	Formatting and text revision	John Rumble Head of ERP	
3	24/10/14	For RMAs consultation	Jack Shephard Project Officer Flood Risk Management	John Rumble Head of Environmental Resource Planning
4	21/11/2014	Final Draft- Amended following comments from relevant risk management authorities	Jack Shephard Project Officer Flood Risk Management	John Rumble Head of Environmental Resource Planning
5	27/11/2014	Final Report	Jack Shephard Project Officer Flood Risk Management	John Rumble Head of Environmental Resource Planning

Explanation of acronyms

Acronym	Explanation
FDGiA	**Flood Defence Grant in Aid** – Government funding allocated to projects based on the number of households protected and other benefits achieved through flood and coastal erosion risk management.
FWMA 2010	**Flood and Water Management Act 2010** – Legislation that was developed and enacted as a result of the review in to the serious flooding in 2007. It brings new powers and duties to local authorities and other regulatory bodies.
HCC	**Hertfordshire County Council**
LDA 1991	**Land Drainage Act 1991 –** Legislation that sets out a range of roles and responsibilities relating to flood risk management. It is also the legislation that gives powers to local authorities to manage flood risk from watercourses and highlights the role of the landowner to manage watercourses on their land to maintain the flow of water.
LLFA	**Lead Local Flood Authority** – This is the role assigned to the unitary or county council for an area with a range of duties and powers to support the management of local flood risk.
RFCC	**Regional Flood & Coastal Committee –** established by the Environment Agency under the Flood and Water Management Act 2010. Members from Lead Local Flood Authorities and independent experts to address flooding related issues.
RMAs	**Risk Management Authorities** – Bodies identified in the FWMA 2010 with roles and powers to manage flood risk. This includes the county council, district councils, highway authorities, Environment Agency and water companies.

Glossary of terms

Term	Explanation
Culvert	A round or box shaped pipe of either concrete, plastic of brick construction which carries water.
Fluvial Flooding	The source of this type of flooding is from a watercourse. This occurs when the capacity of the watercourse is overwhelmed as water escapes into the floodplain, an area that usually floods.
Riparian Landowners	Person or persons who own land in which a watercourse flows through
Trash Screen	A screen which usually consists of vertical bars designed to catch debris carried by a flow of water. Usually installed at the entrance of a culvert to prevent blockage.

Executive summary

In the early hours of the morning of 7 February 2014, the village of Long Marston near Tring in Hertfordshire experienced flooding which caused internal damage to one commercial and at least five residential properties. The flooding also impacted on access to the village making the main road, Tring Road / Station Road, impassable. Chapel Lane was also impassable and the Fire Brigade attended to assist with pumping flood water away.

Due to the severity of the flooding and the number of properties impacted by this flood event, Hertfordshire County Council as Lead Local Flood Authority (LLFA) have investigated the flood incident under section 19 of the Flood and Water Management Act 2010 and published this report. The aim of this report is to establish the causes of the flooding; identify the relevant Risk Management Authorities (RMAs), highlight their role and responsibilities and confirm if those authorities intend use their relevant powers to help manage the flood risk to Long Marston.

There are accounts of flooding in Long Marston dating back to 1978 when reports suggest flooding was up to three foot deep in places. Each time similar locations have flooded along Tring Road, Station Road and Chapel Lane.

It has been concluded that the flooding that occurred on 7 February 2014 was primarily as a result of heavy rainfall over an extended period of time. This saturated the surrounding catchment, in which Long Marston sits, in the days prior to the flood event. Any additional rainfall was unable to soak into the ground resulting in surface water runoff. This runoff made its way towards the Tring Bourne and the unnamed watercourse running parallel along Tring Road.

Other factors which have been identified as contributing to the flooding on the 7 February 2014 including; inadequately sized culverts, some of which are associated with private crossovers, a lack of maintenance of culverts and poor maintenance of the open sections of the watercourses. Once the watercourse channels and culverts reach capacity there is no where else for the surface water runoff to go, other than taking the path of Tring Road in to the village.

As part of the Technical Assessment Report, produced by consultants appointed by Hertfordshire County Council, a list of recommendations that might help to manage flood risk to Long Marston has been put forward. This report looks at the feasibility of each of these recommendations and highlights which, if any, Risk Management Authorities would need to be involved.

The main recommendations explored are:

- Upgrade works or wholesale replacement of existing culverts
- A CCTV survey and structural assessment of all the key assets.
- The lowering of the road levels to the western end of Chapel Lane.

- A review of the highway drainage infrastructure.
- Individual property level protection
- Removal or amendment of some of the existing structures
- Management of surface water runoff from the surrounding fields.

There is no one solution to resolve the flooding in Long Marston and there is no guarantee that flooding can be prevented particularly under the exceptional conditions similar to those that occurred on 7 February. A collaborative approach will be required between all Risk Management Authorities, landowners, Tring Rural Parish Council and the local community to manage flood risk in the future.

1. Introduction

1.1 Lead Local Flood Authority Investigation

Under Section 19 of the Flood and Water Management Act 2010 Hertfordshire County Council (HCC) as Lead Local Flood Authority (LLFA), on becoming aware of a flood in its area, must, to the extent that it considers it necessary or appropriate:

- investigate the incident;
- identify the Risk Management Authorities (RMAs) with relevant flood risk management functions;
- establish if the relevant risk management authorities have responded to the flood event or are proposing to respond;
- publish its findings in a Flood Investigation Report; and
- inform the relevant Risk Management Authorities of its findings.

As defined under section 6, subsection 13 of the Flood and Water Management Act, a risk management authority has certain powers to manage, regulate, assess and mitigate flood risk. We have identified the following Risk Management Authorities as part of this section 19 flood investigation for Long Marston:

- Hertfordshire County Council as Lead Local Flood Authority
- Dacorum Borough Council
- Hertfordshire County Council as Highway Authority
- Environment Agency
- Thames Water

Unlike the organisations listed above, the Canal and River Trust is not a Risk Management Authority as defined by Section 6 (13) of the Flood & Water Management Act 2010. The Trust is a navigation authority. It inspects, maintains and operates the water control structures within its ownership primarily to meet its statutory obligation to maintain navigation. Further information can be found on this link - https://canalrivertrust.org.uk/about-us/water/flood-and-water-management-act-2010

After 7 February 2014, HCC received reports that several residential properties and one commercial property had suffered internal flooding in the village of Long Marston. As a preparatory step to identify if a detailed flood investigation was to be carried out officers from the Environmental Resource Planning Team of Hertfordshire County Council attended Long Marston on 10 February 2014 and spoke to residents to ascertain the detail of what happened and who was affected.

Due to the severity of the flooding, it was determined that this flood incident met the criteria in Policy 2 of Hertfordshire County Council's Flood Risk Management Strategy (http://www.hertsdirect.org/services/envplan/water/floods/floodrisk/lfrmsherts/) and HCC subsequently commissioned this Flood Investigation.

1.2 Site location

The village of Long Marston is situated approximately three miles north-west of Tring, on the very western edge of Hertfordshire. This is illustrated in Figure 1.1, below.

Figure 1.1 Long Marston, Hertfordshire – Location Map

Red circle indicates location of Long Marston, Hertfordshire

The flooding that occurred on the 7 February 2014 caused road closures from the south-east entrance to the village, Tring Road and onto where it becomes Station Road closer to the centre of the village were closed to traffic. These roads are the only through routes in and out of Long Marston.

1.3 Catchment

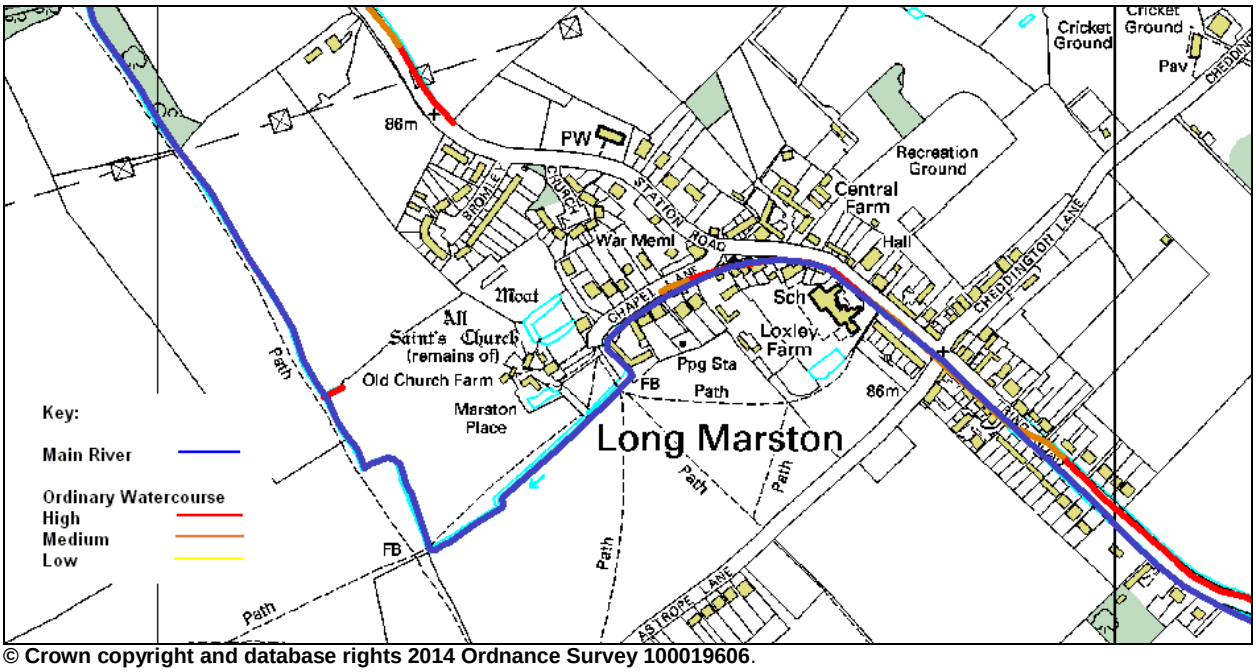
The Tring Bourne runs through Long Marston in a combination of open channels and culverts, before it outfalls to the west of Chapel Lane and then runs north away from the village. Further north-west of Long Marston, the Tring Bourne feeds the River Thame. Long Marston itself has a relatively small catchment as it is within the upper reaches of the wider River Thame catchment.

The watercourses in the immediate vicinity of Long Marston are shown in Figure 1.2, below. The dark blue watercourse indicates a main river, the Tring Bourne and the red

lines indicates an un-named ordinary watercourse, which runs from the south-east parallel to the main river on the opposite side of Tring Road, before joining the main river via a culvert that passes under the road.

The red watercourse to the north of Long Marston flows north and away from the village.

Figure 1.2 Watercourse network in Long Marston



2. Background and history of flooding

2.1 Catchment characteristics

The catchment of the Tring Bourne is largely agricultural and relatively flat. This allows water to travel across a wide area before finding the low points in which it pools. The flat catchment also means that water takes time to pass through the village as there are no significant gradients that would speed up the flows.

2.2 Previous flood events

The earliest record available, at the time of writing this report, suggests that in 1978 Long Marston flooded to a depth of three feet on four separate occasions. More recently, flooding was recorded in January 2003; this event has been confirmed with Tring Rural Parish Council. Additional records also confirm that flooding occurred within Long Marston village in May 2007.

In 2013 and 2014, flooding has been recorded in Long Marston on 24 December 2013; this was then followed by widespread flooding in the village on 7 January 2014. It is also noted that flooding occurred four times between Boxing Day 2013 (26 December) and the 7 January 2014. It is not known how many properties, if any, flooded on any of these occasions.

These incidents were then followed by the most significant recent event on 7 February 2014. A summary of recent flood events is provided in table 2.1 and of recorded highway flooding in table 2.2

Table 2.1 Long Marston flood events summary

Date	Source	Summary
1978 (day unspecified)	longmarston.org	Village flooded 4 times, up to 3 feet in depth
2nd January 2003	HCC Scoping Document / longmarston.org / Tring Rural Parish Council	Widespread flooding, Marston Court under water
2003 (day unspecified)	Dacorum BC SFRA	Flooding in Long Marston
1st May 2007	Dacorum BC SFRA	Medium to heavy rainfall for 48 hours

Date	Source	Summary
24th December 2013	Tring Rural Parish Council	Flooding on 24/12/2013 and four times between this and 07/01/14
7th January 2014	HCC Scoping Document / The Bucks Herald / Tring Rural Parish Council	Widespread flooding
7th February 2014	HCC Scoping Document / The Bucks Herald / Tring Rural Parish Council	Emergency services

Table 2.2 Long Marston flooding highways records

Date - Time	Location	Summary
05/02/14 – 07:56	Chapel Lane, Long Marston	Road flooded at bend on Station Road
05/02/14 – 22:53	Astrope Lane, between Long Marston and Puttenham	Road flooded
07/02/14 – 08:44	Chapel Lane, Long Marston	Properties damaged by flooding, fire brigade in attendance
07/02/14 – 10:06	Tring Road, Long Marston	Stream overflowing and causing flooding of the road
07/02/14 – 11:41	Chapel Lane, Long Marston	Area of standing water of trafficked part of carriageway
14/02/14 – 10:29	Station Road, north of Long Marston	Road flooded

3. Assessment of 7 February 2014 flood event

3.1 Observations

In the early hours of the morning on 7 February 2014 residents of Long Marston observed surface water rushing down the main road (Tring Road) in to the village. This water then pooled in several locations throughout the village, the junction of Tring Road and Cheddington Lane, the junction of Station Road and Chapel Lane and the western end of Chapel Lane (see Technical Assessment Report for full description).

It was also reported that water entered the Tring Road and Cheddington Lane junction from Astrope Lane and this water pooled to cause flooding to a nearby garage area.

Hertfordshire Fire and Rescue and Buckinghamshire Fire and Rescue both attended the scene to try and alleviate the flooding and were in attendance for over 16 hours. Residents reported seeing no decline in water levels for the majority of time that the fire brigades were in attendance.

It was reported that the flood water to the west of Chapel Lane was unable to take a natural path back to the watercourse due to the watercourse at this point being in culvert and the raised road level. This exacerbated the amount of water that pooled and then caused flooding on Chapel Lane.

Once the rainfall ceased, residents stated that the water levels dropped quite quickly but serious flood damage had already been done to over five properties within the village.

3.2 Ground conditions

Following a long period of heavy rainfall and the wettest winter on record since Met Office records began in 1910; the ground in the catchment surrounding Long Marston would have been saturated and had no capacity to allow for the infiltration of surface water.

3.3 Sources of flooding

3.3.1 Rivers (fluvial)

There are two sources of fluvial flooding contributing to the flood event in Long Marston:

- At the junction of Wingrave Road and Lukes Lane the main river (Tring Bourne) is split via a sluice with part of the flow entering Ashen Brook. The remainder of the main river runs through Long Marston in a mixture of open channel, culverted crossovers and via an extended culvert which outfalls to the west of Chapel Lane.

- An un-named ordinary watercourse runs parallel to the Tring Bourne from Gubblecote towards Long Marston, before it joins the main river via a culvert under Tring Road.

3.3.2 Surface water (pluvial)

Lands in Long Marston and its immediate hinterland lie at shallow surface gradients, with the catchment shedding generally from north-east to south-west. Lands south-east of Cheddington Lane / north-east of Tring Road locally drain at a steeper gradient toward Tring Road, with typical gradients of 1 in 26 (c. 4%). The natural drainage path for any overland flow irrespective of its source from lands to the west is towards the Tring Bourne to the east, and must pass through Long Marston in all instances. Therefore, in the event of flooding to the west of Long Marston due to runoff from saturated ground or local drainage system failure, surface water is likely to be directed towards and through the developed area on its natural path to the west.

Figure 3.1 Long Marston surface water catchments

The surface water catchments of the two main areas affected by historical flooding coincide with localised depressions that would essentially form “pinch points” for overland flooding from any source. These have been identified and are shown in figure 3.1. The pinch point locations identified are as follows:

- SW Catchment 1 – Junction of Station Road and Chapel Lane

- SW Catchment 2 – Village Crossroads (Junction of Station Road, Cheddington Lane, Tring Road and Astrope Lane)

It is noted that the third area identified as being at risk of flooding, the western end of Chapel Lane, is situated adjacent to the open channel of the main watercourse and is therefore not considered to be at risk from surface flooding only, i.e. flooding at that location is likely to be surface water in combination with fluvial influences.

Surface water from both catchments would tend to drain toward the watercourses on the site, flowing either directly into the channel or entering via an engineered drainage network (highway drains or sewer network). There is no evidence of any surface water drainage infrastructure in the village; therefore the majority of runoff would tend to flow overland. Such a scenario would be exacerbated where the receiving watercourse was flowing full or in flood, or where the highway drainage network (where it exists) was rendered ineffective by back water effects from downstream incapacity.

Figure 3.3 Tring Bourne main culvert route through Long Marston

Surface water runoff from nearby fields and paved areas, which is unable to enter the main river system as it is in culvert (see figure 3.2) in the centre of the village, will run overland to the low points in the catchment.

When the river channels are full and once water overflows the banks of the channel upstream of the culvert system, it takes the flow path of the road (Tring Road) and cannot get back in to the channel. These overland flows will also congregate at the low points in the surface water catchment.

3.4 Tring reservoirs and canal infrastructure

There is no evidence that the Grand Union Canal or Aylesbury Arm Canal has over-spilled in areas where outflows would enter the Tring Bourne catchment. It is therefore not considered that this had a direct impact on flooding in Long Marston. Excess water over-spilling from Wilstone Reservoir did cause flooding of farmland and the highway along Astrope Lane. It is worth noting that this is not a controlled release as the overspill weir is used to maintain safe top water levels in the reservoir. It is similarly worth noting that Wilstone Reservoir weir continued to convey flow to Gudgeon Stream until mid-June 2014 without further reported flooding incidents.

3.5 Structures and features

The main structure located in Long Marston is the culvert that takes the main river (Tring Bourne) through the village from Tring Road and outfalls in to open channel again in Chapel Lane (see figure 3.3). This structure was last inspected by CCTV in September 2010 and defects identified were recorded. To date no remedial works have taken place on this culvert and any identified defects have not been rectified. Responsibility for the maintenance of this culvert lies with the relevant riparian owners of the main river along its course. However it is unclear as to whether the riparian owners are aware that they have these responsibilities or whether they even know that a main river passes through their land.

There is also a sluice located at the south-eastern edge of the village at the junction of Wingrave Road and Lukes Lane. This sluice serves to split the flow on Tring Bourne into two with part of the flow going south-westerly via Ashen Brook and into Gudgeon Stream. The opening size of the sluice gate relative to the channel indicates that more flow would be passed to Ashen Brook than onto Tring Bourne. At the time of inspection this sluice appears to be in relatively poor repair and it was not possible to identify who is responsible for its maintenance and operation.

3.4 Condition of watercourses

The watercourses in Long Marston and surrounding area have not been subject to any maintenance in the past ten years. A lack of watercourse maintenance is considered likely to have contributed to an increase in flood risk to the village. The significant build up of silt; debris and growth of channel and bankside vegetation will lead to a decrease

in the capacity of the channel and therefore increase the potential for flooding from the watercourses.

3.5 Possible causes of flooding

The following are the key findings of the fluvial / pluvial analysis and other flooding mechanisms that have been determined as part of this investigation:

- Winter 2013/2014 was one of the wettest on record for the region; and heavy (while not extreme) rainfall falling on already highly saturated ground with an elevated groundwater table has caused flood flows likely to have overwhelmed the capacity of the main river and ordinary watercourse channels affecting the site. The consequence of this was overland flooding into Tring Road, Station Road and Chapel Lane. Tring Road and Station Road form a preferential flow route through the village.
- Rainfall onto already highly saturated ground drains directly towards the village and is likely to have caused direct surface water flooding on lands to the rear of properties on Tring Road and would have exacerbated fluvial flooding in the same vicinity.
- The existing river network capacity, and in particular the main culvert capacity, is likely to be insufficient to convey the rate/volume of floodwater caused by the events immediately preceding and on 7 February 2014, this situation will have been exacerbated by the lack of maintenance.
- The lack of culvert capacity (due to culvert size and efficiency) is likely to have had a number of consequences including; out of channel flooding at its inlet; direct flooding due to surcharge of manholes and the failure of surface drainage networks (where present) to cater for direct runoff to due to surcharge / incapacity in the system.
- Inflows to the river catchment from CRT infrastructure (canal and reservoirs) are discounted in terms of causing or significantly contributing to flooding in Long Marston.
- The effect of failure of the foul pumping station is likely to have caused surcharge of the upstream sewer network and exacerbated surface water flooding in areas where surface drainage cross connections discharge to the foul network. Failure of the pumping station would feasibly have caused direct flooding of low lying properties on Chapel Lane in the immediate vicinity of the plant.

Primary flood mechanisms and flood routing for the three main areas previously affected by flooding, whereby each is a localised depression on the main flow route through the village is considered as follows:

'Area 1' - Junction of Station Road and Chapel Lane

- Overland flooding from Tring Bourne (emerging from culvert manholes and flooding from the open channel upstream) and surface water flooding draining

from lands north/west would accumulate in this area where highway drainage reliant on discharge to the main culvert failed.

- Water would accumulate until overtopping a localised high point on Chapel Lane to the south-west.

'Area 2' - Junction of Station Road, Cheddington Lane, Tring Road and Astrope Lane

- Overland flooding from Tring Bourne (emerging from the culvert inlet to the south-east at Ravens Court) would tend to accumulate in this vicinity.
- Direct runoff from lands west of Tring Road would, in the absence of any surface drainage network, tend to accumulate to the rear of properties facing onto Tring Road and would be impounded locally by built structures before overtopping onto Tring Road.
- Flooding would accumulate until reaching an overtopping level before flowing north-west onto Station Road toward Chapel Lane.

'Area 3' - Western end of Chapel Lane

- Out of bank floodwater from the Tring Bourne channel would accumulate at the west of Chapel Lane and would be prevented from returning to the watercourse to the south by a locally raised road level. Water would tend to spread toward properties to the north.
- Low lying surface water connections to the sewerage network would tend to back up due to downstream surcharge, and cause surface flooding in this vicinity.

4. Responsible authorities and landowners

HCC as the LLFA have investigated the flooding at Long Marston to establish the relevant RMAs that have Flood Risk Management Functions in accordance with the FWMA 2010 as part of this study. Those RMAs and their relevant powers and functions are set out below.

4.1 Hertfordshire County Council Lead Local Flood Authority

HCC as the LLFA for its area has fulfilled its legal responsibility to carry out a Flood Investigation under Section 19 of the FWMA 2010, to;

1. Identify the relevant RMAs and;
2. Establish if those authorities intend to utilise their own powers and to what extent.

In order to achieve the responsibilities under Section 19, HCC as LLFA must first establish the cause and impacts of the flooding and identify where possible, potential solutions as discussed in this report.

The LLFA has powers to carry out flood risk management works for flooding from surface runoff and ground water in accordance with the Local Flood Risk Management Strategy for Hertfordshire.

The unnamed watercourse to the north of Tring Road is designated as an Ordinary watercourse. This is a legal designation which means Hertfordshire County Council is the regulatory authority for all ordinary watercourses in Hertfordshire under the Land Drainage Act 1991.

The relevant sections of the Act are as follows:

- Section 23 of the LDA 1991 requires any works within the channel of an Ordinary Watercourse that could affect the flow to apply for written consent from HCC.
- Section 24 of the LDA 1991 gives powers to HCC to enforce any contravention of Section 23 where works have been carried out without prior written consent.
- Section 25 of the LDA 1991 gives enforcement powers to HCC to ensure riparian landowners of ordinary watercourses keep clear from obstruction from vegetation, debris, failing assets and blocked assets to ensure there is no impedance of flows.

4.2 Dacorum Borough Council

The District Council have powers to carry out flood improvement works on ordinary watercourses under Section 14A of the Land Drainage Act 1991 as amended by the Flood and Water Management Act 2010. These powers are discretionary and works

are subject to consultation with Hertfordshire County Council and the Environment Agency.

Dacorum Borough Council are the local planning authority for the Long Marston area and their role is to determine planning applications for new development, approve and assess any impacts from all sources of flooding and any associated proposed drainage.

4.3 Hertfordshire County Council Highways Authority

Both Tring Road and Station Road are Hertfordshire County Council adopted highways. HCC Highways are the responsible authority to maintain and manage HCC adopted highways. This includes associated drainage infrastructure such as gullies drainage pipes and any assets that lie within the highway boundary within their ownership (culverted and open sections of watercourses and trash screens). Where there are sections of open watercourse outside of their ownership, the relevant landowner is responsible for its maintenance.

HCC Highways have powers to manage water on an adopted road under the Highways Act 1981, however where this water originates from third party land and not from runoff from the highway, these powers are limited.

4.4 Environment Agency

The Environment Agency is the regulatory body for watercourses designated as Main River under the Water Resources Act 1991. In the Long Marston area, this includes the Tring Bourne, Ashen Brook and Gudgeon Stream. The Environment Agency has permissive powers to carry out maintenance works in relation to managing flood risk.

Although the Environment Agency has permissive powers for carrying out maintenance on Main Rivers, this does not mean that they are responsible for carrying out works and maintenance on main rivers. The responsibility to maintain main rivers rests with the riparian owner of the watercourse, who should act to keep the channel free from obstruction and maintain the flow of water. The Environment Agency has provided a written statement on their position in respect of the maintenance of the watercourses in the Long Marston area and this is included in appendix 1.

4.5 Thames Water

Thames Water has responsibility for the safe and clean disposal of the foul water sewerage and has a Pumping Station situated on Chapel Lane, Long Marston that serves the foul water system from properties in Chapel Lane, Station Road and Tring Road. This element is governed by the Water Industry Act 1991.

4.6 Canal & River Trust

The Canal and River Trust are responsible for the operation of the canal infrastructure within the area. In the vicinity of Long Marston and Tring this includes the Grand Union Canal, the Aylesbury Arm Canal and Wilstone, Tringford, Marsworth and Startopsend Reservoirs. The Canal and River Trust are not a Risk Management Authority; they are a Navigation Authority. They have stated that they would be happy to participate in a Community Group or Flood Action Group for Long Marston.

4.7 Landowners

Landowners are responsible for the management of their land, including any associated drainage. This will encompass drainage ditches, land management practices and surface water runoff.

4.8 Riparian Land Owners

Riparian Owners refers to landowners where an open watercourse or a culvert that carries a watercourse flows either through or adjacent to the land for which they hold the title. There are numerous riparian landowners within Long Marston that are responsible for the maintenance of sections the Tring Bourne and the un-named ordinary watercourse as it passes through the village.

Each of these landowners are responsible for maintaining their section of watercourse to ensure the flow within the channel is maintained and kept free from obstruction. This will include the maintenance and repair of any associated structures such as trash screens, culverts, residential crossovers, bridges etc.

The riparian owners along the course of the Tring Bourne and the un-named ordinary watercourse have not yet been identified.

4.9 Buckinghamshire County Council

As neighbouring Lead Local Flood Authority within the catchment, Buckinghamshire County Council has been consulted on this investigation but there are no actions or recommendations for them.

5. Conclusions and recommendations

5.1 Conclusions

One major factor contributing to the flooding was the amount, longevity and intensity of the rainfall during the preceding days of the flood event on 7 February 2014. The winter of 2013/14 has been confirmed to be the wettest winter on record for the UK.

This resulted in saturated soils throughout the catchment and with extensive lengths of culverted watercourse throughout the village the rain water had no where to go and could not enter the natural drainage system. The number, size and condition of culverts and crossovers on the watercourses that form the drainage system in and around Long Marston meant that there was insufficient capacity to cope with the amount of rain and its intensity. Lack of maintenance on these watercourses and associated culverts and crossovers also means that the available capacity would be diminished and undermined by silt and obstructions.

In order to develop and provide a suitable resolution to the flooding, there needs to be a collaborative approach between the LLFA, relevant landowners and all the identified relevant Risk Management Authorities.

5.2 Recommendations

The following are the recommendations of the county council, in its capacity as Lead Local Flood Authority and follow from the main findings from the Section 19 flood investigation carried out into the flood event in Long Marston on 7 February 2014.

No.	Recommendations	Comments	RMAs and other parties to be involved
1.	Investigation of Property level protection	Individual properties have flood risk assessments with a view to retro-fitting protection to properties to increase resilience to flooding. This is for individual property owners to organise and fund, although there is a Repair & Renew Grant available for people that suffered internal flooding in February 2014. Advice is available from Dacorum Borough Council.	• Dacorum Borough Council
2.	Carry out maintenance works to watercourse	Review what should be undertaken in relation to the watercourses throughout Long Marston. Riparian owners to satisfy their riparian owner responsibilities in relation to both Main River (regulated by the Environment Agency) and ordinary watercourse (regulated by Hertfordshire County Council). The Environment Agency commissioned a CCTV survey of the culverted main river in September 2010. Following this relevant riparian owners were notified of the actions falling to them from this investigation. It is recommended that the actions assigned to relevant riparian owners are reviewed with a view to securing their completion as a priority. Works would need to be done with the relevant regulatory body's approval, the Environment Agency and Hertfordshire County Council.	• Environment Agency • Hertfordshire County Council – Lead Local Flood Authority • Riparian land owners

No.	Recommendations	Comments	RMAs and other parties to be involved
		If further survey investigations are required in the future, the Environment Agency will notify the relevant riparian owners of the findings. Guidance on riparian ownership can be found within the Environment Agency's 'Living on the Edge' document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297423/LIT_7114_c70612.pdf	
3.	Investigate the Tring Bourne culvert upgrade	Carry out a feasibility study as to the upgrade / replacement works necessary on the main river culvert through Long Marston. Any scheme would need EA agreement/consent. Any proposal for works would need to be beneficial and not increase flooding elsewhere. A feasibility study would require an assessment to ensure there would not be an increase to flood risk downstream. If culvert capacity is increased, additional attenuation may be required in combination with the culvert upgrade. May require FDGiA funding subject to a successful bid being submitted and partnership funding.	• Environment Agency • Hertfordshire County Council – Lead Local Flood Authority
4.	Investigate diversion of the Tring Bourne	Undertake a feasibility study for the diversion of the main river and ordinary watercourse around Long Marston. This will be dependent on approval / consent from the Environment Agency and will require a full flood risk assessment and interaction report with other	• Environment Agency • Hertfordshire County Council – Lead Local Flood Authority • Dacorum Borough Council

No.	Recommendations	Comments	RMAs and other parties to be involved
		local rivers and watercourses. This will likely require funding from FDGiA and therefore will be subject to a successful bid being submitted.	
5.	Investigation of modifications to the surface water capture and drainage system in and around Long Marston.	Develop a hydraulic model to replicate surface water flows within the area and interpret whether modifications would help alleviate the risk of surface water flooding. Highways drainage needs to be assessed and improved where feasible. This element will need input from the Highways Authority and the Local Planning Authority. Costs of study to be met via a RFCC funded study.	• Hertfordshire County Council – Lead Local Flood Authority • Hertfordshire County Council – Highway Authority • Dacorum Borough Council
6.	Investigate the modification of road levels south of Chapel Lane.	Investigation of the feasibility of modifying road levels south of Chapel Lane to allow flow of surface water back into the main river. Investigation and consultation would need to be led by Hertfordshire County Council in its role of Highways Authority.	• Hertfordshire County Council – Highway Authority
7.	Improvements to the foul sewerage infrastructure	Explore possible improvements and changes to the current foul sewerage infrastructure in Long Marston. This to include investigation of misconnections to ensure there is no contamination of the foul sewer system with surface water drainage. This would need to be led by Thames Water.	• Thames Water
8.	Explore changes to Land Management east of Tring Road and Station Road.	This will be dependent on landowners' agreement to change land use / practices. Hydrological study will be required to test for feasibility and determine whether possible land management changes would help flood risk.	• Hertfordshire County Council – Lead Local Flood Authority • Landowners

6. Next steps and actions

6.1 Lead Local Flood Authority

The following are agreed actions to be undertaken by Hertfordshire County Council in its capacity as Lead Local Flood Authority;

1. To seek a meeting with the Environment Agency to discuss the maintenance issues in relation to the identified watercourses within the area of Long Marston.
2. To identify all riparian land owners in the area of Long Marston to establish a dialogue on the future maintenance of the watercourses within the area of Long Marston.
3. To seek discussions with the Highway Authority to look at the feasibility of modifications to the road levels south of Chapel Lane.
4. Subject to funding being identified to carry out an investigative study to determine the feasibility of the following:

    - Improvements to the main culvert of the Tring Bourne running through the centre of the village.
    - Implementing a diversion of the Tring Bourne around Long Marston.
    - Investigate possible modifications to the surface water capture and drainage system in and around Long Marston. This to include the exploration possible changes to land management practice to better support surface water management.

6.2 Highway Authority

The following are suggested actions to be undertaken by Hertfordshire County Council in its capacity as the Highways Authority;

5. To look at the feasibility of modifications to the road levels south of Chapel Lane.
6. To participate in an investigative study to explore possible changes to the management of highways drainage in the Long Marston Area.

Highways have said they can assess the current highway drainage in the area and check the system is fully operational and any defects are repaired accordingly. These were exceptionally wet conditions that led to the flooding so any detailed investigation works or level survey would have to compete against the priorities of the highway service subject to the budget availability.

6.3 Environment Agency

The following are suggested actions to be undertaken by the Environment Agency;

7. To collaborate in a meeting to discuss the maintenance issues in relation to the identified watercourses within the area of Long Marston.
8. To assist in the identification of all riparian land owners in the area of Long Marston and help to establish a dialogue on the future maintenance of the watercourses within the area of Long Marston.
9. To participate in an investigative study to determine the feasibility of the following:

    - Improvements to the main culvert of the Tring Bourne running through the centre of the village.
    - Implementing a diversion of the Tring Bourne around Long Marston.

The Environment Agency has stated that they welcome the opportunity to work in partnership with the Lead Local Flood Authority to examine ways to reduce and manage flood risk in Long Marston. They would also encourage a meeting to discuss roles and responsibilities and set up a partnership for working to understand how this can progress.

6.4 Dacorum Borough Council

The following are suggested actions to be undertaken by Dacorum Borough Council;

10. To assist affected residents in securing nationally funded Repair and Renew Grant for the installation of appropriate property flood protection measures.

6.5 Thames Water

The following are suggested actions to be undertaken by Thames Water;

11. To investigate and remedy any misconnections of the foul sewerage system in the Long Marston area.

7. Disclaimer

This report has been prepared as part of Hertfordshire County Council's responsibilities under the Flood and Water Management Act 2010. It is intended to provide context and information to support the delivery of the local flood risk management strategy and should not be used for any other purpose.

The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event. McCloy Consulting and Hertfordshire County Council expressly disclaim responsibility for any error in, or omission from, this report and the supporting technical assessment Report arising from or in connection with any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation and McCloy Consulting and Hertfordshire County Council expressly disclaim responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and any recommendations.

Hertfordshire County Council does not accept any liability for the use of this report or its contents by any third party.

Appendix 1 Environment Agency position statement

Long Marston

01 October 2014

Hertfordshire County Council (HCC) has completed their Technical Assessment Report to support the Section 19 Flood Investigation for Long Marston. The Report has highlighted a number of recommendations for all Risk Management Authorities. We will be working closely with HCC and Dacorum District Council to action the recommendations, to better understand the mechanisms of flooding in the area and how we can reduce flood risk.

We have a strategic overview of all sources of flooding. We have powers to maintain main rivers, under provisions of the Water Resources Act 1991 and the Flood and Water Management Act 2010. However, we have no duty to maintain them and legal responsibility for maintenance remains with the riparian owners (owner of land or property adjacent to a river).

The Long Marston Brook/ Tring Bourn is not on our maintenance programme. We use a risk-based approach to assess the need and justification for our work. We can only invest in activities that are economically and environmentally justifiable and technically feasible. We will undertake a review of our maintenance programme for the Long Marston Brook/ Tring Bourn.

We will work with HCC to promote riparian responsibilities to land owners, to provide advice and guidance on the clearance and maintenance of river channels. We have a document named 'Living on the edge', which sets out riparian responsibilities. This can be found on our website http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx

We would encourage residents to set up a community action group and to prepare for flooding by carrying out individual flood plans. For guidance on preparing for a flood and get help during and after please see https://www.gov.uk/prepare-for-a-flood/find-out-if-youre-at-risk

www.gov.uk/environment-agency

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