Harlow Surface Water Flooding

sustainable drainage – seizing the opportunity in Rye Meads, Harlow

by Will Neal, Lindsay Fulton and Neil Marples

Optimise were tasked by Thames Water to resolve frequent flooding of 4 properties in Rye Meads, Harlow. These properties are relatively near to the head of the system. Reports indicated that flooding occurred from a range of sources, including the surface water system being overloaded, as well as runoff from the common land to the south and east. A verified hydraulic model of the sewer system was built to understand the problem and its location. Subsequently, the above ground system was represented to channel flooding from upstream manholes towards the flooding properties. This model included a representation of the greenfield runoff and was validated with actual flooding events.

Geocellular modular storage being constructed at Rye Meads - Courtesy of Optimise

Understanding the flooding problem

A critical issue was to understand the interaction between the greenfield and impermeable surface runoff, causing different surcharging within the sewer network. The results from the hydraulic modelling, clearly indicated two separate peaks from these elements, occurring at different times.

The detailed knowledge combined with anecdotal evidence enabled the project needs to be understood. The modelling confirmed the flooding was from the surface water system only. Figure 1 (see next page) shows the flooding locations, source, and impacted properties.

Identifying opportunities for SuDS

An online storage solution with a 1,200mm diameter sewer constructed along the centre of a busy local road would have resolved the problem, it could have been designed and construction within the budget and programme.

However, as the surface water could be managed close to the surface Optimise recognised an opportunity to retrofit SuDS. A major concern was getting the buy-in from stakeholders, particularly Harlow District Council, Thames Water and its customers. When looking for industry examples of when and where this type of solution had been developed as an integral part of the public sewer system, rhetoric about why it would work and how these solutions were needed was abundant, but there were very few examples in the UK of where projects such as this had actually been constructed.

Harlow DC are driven by their responsibility under the Water, Flood and Management Act 2010 and are supportive of sustainable solutions. Where Harlow DC was struggling, was the lack of funding to build SuDS and limitations in their expertise and knowledge.

Following the CIRIA guidance set out in C713, Retrofitting to Manage Surface Water *(Digman et al, 2012)*, Optimise visited the site and identified potential locations for retrofitting. This included

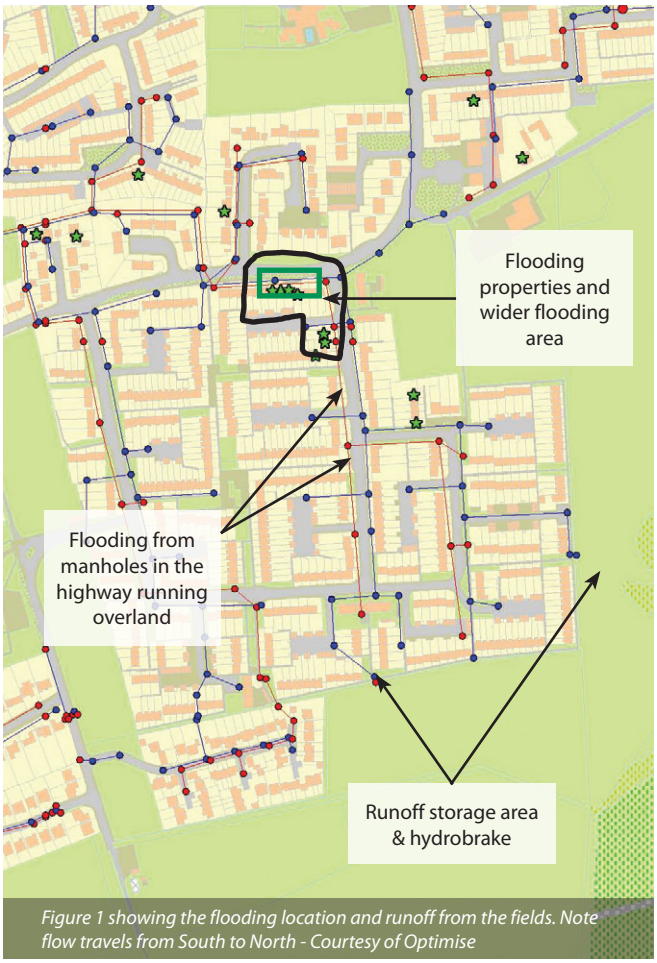

Figure 1 showing the flooding location and runoff from the fields. Note flow travels from South to North - Courtesy of Optimise

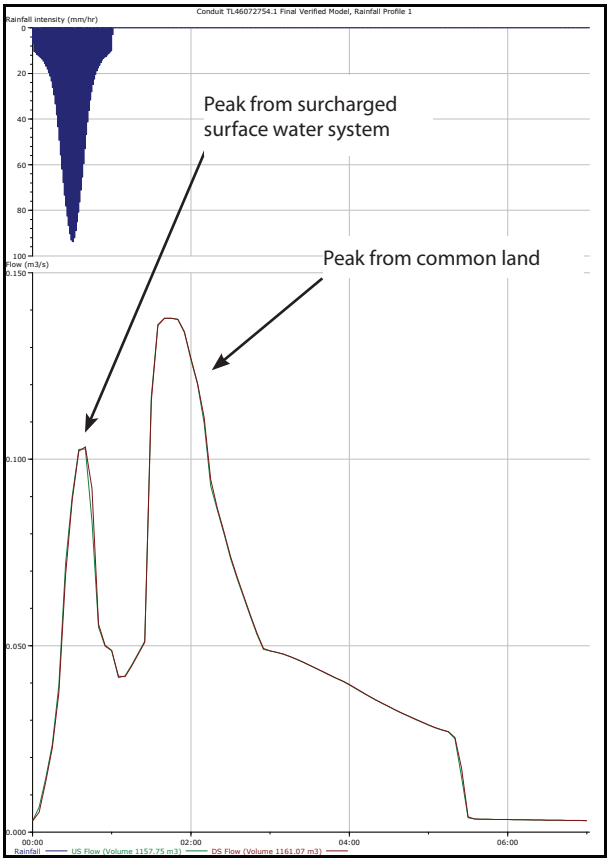

Figure 2: Example of the surface water system hydrograph downstream towards the flooding properties showing the two distinct flow peaks

a range of opportunities that could have controlled water in the housing estate close to its source, as well as further works to manage the greenfield runoff. However, whilst these may be more efficient, time constraints prevented there consideration. This was due to the substantial level of buy and acceptance in public and private land from multiple stakeholders, therefore more centralised opportunities were sought.

Developing the solution

Close to where the flooding was causing the impact, two locations were identified that could provide attenuation to the surface water, as shown in Figure 3 (below). This was in a geocellular modular units under parking bays, for residential flats, (as shown in Figure 4 - *bottom right*) and as a swale in a wide grass verge.

Geocellular modular storage has typically been used in new developments, but very few retrofitting examples exist. At Rye Meads the modular storage was built with 1.2m of cover and where there would be an imposed traffic load. To prevent collapse of the modular units a base and cover for the units was required. An important element was ensuring that the units had the adequate lateral strength.

Assessing the lateral strength of these units indicated that permanent works were required around the geocellular structure to provide this strength due to the ground conditions. This ultimately resulted in partial concrete box to prevent the risk of failure of the units. Avoiding such a need in the future is important to ensure such solutions are cost effective, therefore a stronger system should be designed that enables the modular units to withstand lateral loads better.

Swales are often under-drained to prevent water logging and improve their visual impact. Whilst they are more commonly being retrofitted in countries around the world, there are few examples in the UK urban areas.

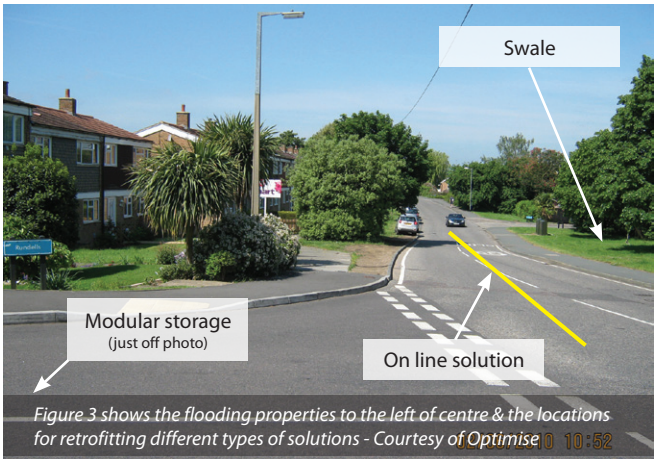

Figure 3 shows the flooding properties to the left of centre & the locations for retrofitting different types of solutions - Courtesy of Optimise

Figure 4: Location of the geocellular modular storage Courtesy of Optimise

An important element of the swale in Rye Meads was to understand how it would work. It would only be operational to 'peak lop' significant rainfall.

The swale has been developed as a green feature that is landscaped and will be low maintenance in the future. The design also considered how it may attract interest from the public, particularly children, and ensured that a hazard was not created

Engaging with the public

Critical for success if retrofitting SuDS is to become an acceptable way of resolving flooding problems. The planning permission objections to this solution were on a *'NIMBY'* basis.

Identifying the environmental and ecological benefits of this scheme did not motivate the general public.

However, the flooding benefit was to the few, and clearly there was a lack of understanding of the approach being proposed and why it was the 'right' solution.

Some of the specific objections raised by the public included:

- ***Litter:*** The site would attract people and subsequently litter.
- ***Maintenance:*** No one would maintain the swale and it will become an area for vandalism.
- ***Economics:*** The Water Company and Council only wanted this because it was the cheapest.
- ***Danger:*** The Swale would be full of water with a risk of drowning.
- ***Appearance:*** The area would be very muddy and look a mess.
- ***Flood Risk:*** Perceived that a visible storage area was more likely to flood than storage underground.

The objectors did not see the benefits:

- A green area would be preserved, enhance the existing urban area and could not be built on the future (e.g. as in Figure 6 *on the next page*).
- People within their community would stop suffering from flooding in their homes.
- The construction period would be quicker, with less impact on the residential and commercial community.
- The solution had the cheapest whole life cost and minimised carbon footprint and energy usage.
- Health & Safety for construction and maintenance teams.

Using SuDS in the future

Undoubtedly retrofitting SuDS solutions can deliver viable cost effective whole life solutions that can provide multiple benefits. However there are challenges that the industry will need to overcome:

- Physically the solutions will be dependent on the flows that are to be managed and the available space. Working on the surface water system is significantly different to reducing flows entering the combined sewer system.
- Time. As discussions become protracted the more likely we will revert to a 'traditional solution'. Water Companies are under pressure to deliver solutions within tight timescales. All parties are used to developing and constructing 'traditional solutions' where the major limitations are the relevant notice periods. Retrofitting SuDS provides solutions that often remain visible, requires planning approval and often negotiations with community and environmental groups.
- Materials and products. Manufacturers need to develop products that can integrate with the wider network and in this case support the lateral loads that can be imposed.

Swale under construction - Courtesy of Optimise

- Public engagement needs to be carried out as early as possible, understanding the needs of the community and build capacity and knowledge, addressing concerns and highlighting the multiple benefits that SuDS can deliver.
- If retrofitting SuDS is to take off and be driven by the Water Companies, they will have to see a commercial benefit.
- Controlling water at source is seen as a key approach in the future, but this is very much in the infancy stage in the UK. The impact of this on the public will be significant, will require their acceptance and buy in, particularly if private SuDS are to be retrofitted. To do this the benefits of this type of solution needs to be understood.
- Understanding the wider environmental, long term economics and social benefits of options over a projects life span, as in Philadelphia may provide the evidence to raise the profile of sustainable solutions.

The Editor and Publishers thank the following for preparing this paper for publication: Will Neal, Network Modelling Consultant with Thames Water, Lindsay Fulton, Design Engineer, & Neil Marples, Design Team Leader, both with MWH.

The authors would like to acknowledge Harlow District Council, in particular Adam Littler for their support throughout the course of the project.

References

Digman, C J, Ashley, R M, Balmforth, D J, Stovin, V R, Balmforth, D W, Glerum, J W (2012) Retrofitting to manage surface water. C713, CIRIA, London (ISBN: 978-0-86017-915-9).

Figure 6 - Example of a bioretention swale in a public right of way Courtesy of Optimise

Page size should be 147mm
Crop 150mm off