Greenstreets@Counters Creek SuDS Retrofit Pilot

using green and grey infrastructure to develop a programme to alleviate flood risk from combined sewers in West London

by Matthew Jones & Kyle Robins

Counters Creek is one of the lost rivers of London that was culverted in the late nineteenth century to form part of the combined sewerage network in the London Borough of Hammersmith & Fulham (LBHF) and the Royal Borough of Kensington & Chelsea (RBKC). The Counters Creek catchment is highly urbanised, has no remaining local open watercourses and has a high density of residential basements. Urban creep in the area is estimated to have led to a loss of 17% of permeable space between 1971 and 2007. Over 2,000 properties within the catchment have reported sewer flooding in recent years and widespread basement flooding occurred in July 2007 following severe weather.

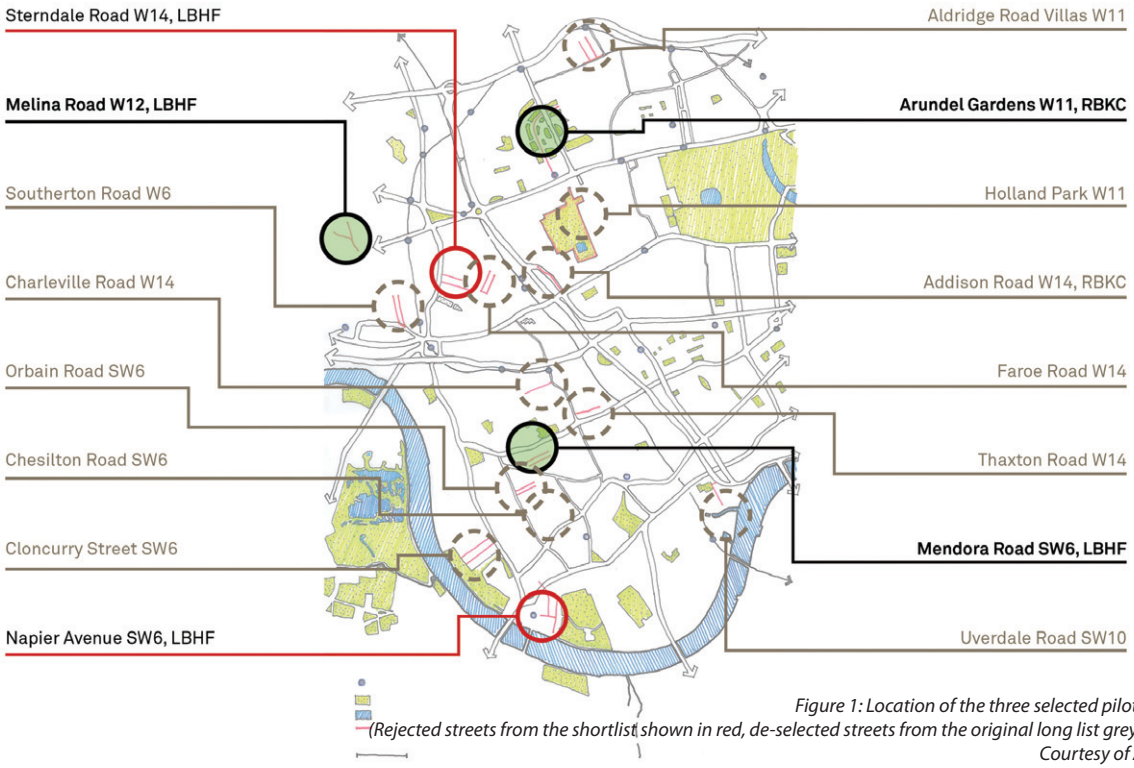

Figure 1: Location of the three selected pilot streets (Rejected streets from the shortlist shown in red, de-selected streets from the original long list greyed out) Courtesy of AECOM

Background

As part Thames Water's drive to reduce sewer flooding in the catchment, more than 3,000 door to door surveys were completed and a range of options developed to alleviate the risk of flooding. The potential for SuDS was fully explored, to limit the extent of grey infrastructure, with all options challenged by leading academics in the field of urban drainage. Customer willingness to pay information was applied to develop a cost beneficial programme.

To ensure that service is delivered to customers now and in the future as our climate changes, the retrofit of SuDS measures has been a key aspect of the programme. In response, TWUL commissioned a series of retrofit pilots in three streets in the catchment to help understand the costs, benefits, deliverability and customer acceptability of SuDS.

The Greenstreets@Counters Creek SuDS retrofit projects involve the design and evaluation of water butts, raingardens, bio-retention tree pits, permeable paving, rainwater harvesting systems, green roofs and other modifications to customers' properties and public space to reduce surface water run-off during heavy rainfall. These are assets that TWUL has not delivered in the past, requiring close co-operation and the consent of property owners for the pilot to go ahead.

The approach to this project has been to apply the principles of water sensitive urban design (WSUD), emphasising the wider benefits of integrating SuDS into the streetscape, public realm areas and private land, rather than focusing purely on the flood mitigation benefits. The project team brings together a wide range of disciplines, including social researchers, planners, urban designers, landscape architects, ecologists, water infrastructure designers and community liaison specialists to implement a project which is much more than an engineering solution. The approach looks for innovative ways to minimise rainwater flows to the combined sewer system that also enhance the customer experience by greening streets and engaging the public in water issues.

The pilot project is funded by TWUL but opportunities to attract additional funding for streetscape or environmental improvements from local authorities, the Greater London Authority (GLA),


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charitable sector or other sources are being explored. The Counters Creek scheme is being monitored by a partnership of the GLA, EA and London Councils to share learning on green infrastructure retrofit. The results of the trials will inform the development of a sustainable drainage strategy for London.

Pilot street shortlisting and selection methodology

Three streets were selected for the pilot from an initial long-list of 15. The selection criteria used were that the streets should be hydraulically discrete, have good flow monitoring points at the downstream end of the existing sewers and have suitable control streets adjacent to them (i.e. streets that would not have SuDS measures retrofitted, but where depth and flow would still be monitored). In addition, the streets were selected to represent a range of different types of building stock, street layouts and demographic profiles. These ranged from large terraced villas in Notting Hill with communal garden spaces to smaller Victorian terraces and a street containing a variety of housing types, a school, a park and a public house.

Flow measurement and monitoring

The long term measurement of the effectiveness of retrofit SuDS in reducing peak storm flows to the existing surcharged combined sewer system will inform the future use of SuDS. A baseline flow monitoring exercise began in May 2012 with both the original long-listed streets and their respective adjacent control streets being monitored at the downstream end of the existing local sewers on each street.

The system selected by flow monitoring contractor OnSite to meet TWULs specification for accurate and reliable monitoring over the term of the pilot was its OS8000 system. This employs twin pressure transducers and twin velocity transducers with the aim of improving data accuracy and reliability. The system uploads data wirelessly every five minutes to a secure website which can be reviewed by the project team. This data may in the future be made available to interested residents on the pilot streets to further increase communities' interest in their water environment.

The streets will be monitored for an additional two year period following installation of the retrofit SuDS such that the effectiveness of the measures in reducing peak flows can be assessed. This will be carried out by comparing measured storm flows against a verified InfoWorks CS hydraulic model used to predict what the flows in the sewer system would have been prior to installation of the SuDS.

The measured flows from the control streets will also be used as a sense-check for both the measured flows in the pilot streets and the model predicted flows. In addition it is proposed that V-notch weirs will be installed at the outlet of the SuDS features (since these will be either lined or partial infiltration features), to measure the inflow of relatively clean surface water from the features to the combined sewer network.

Design approach and criteria

The project team has looked for natural opportunities to introduce SuDS within the existing topography. This will enhance the pilot street areas through good landscape design, introducing additional greenery wherever possible, promoting biodiversity, urban cooling and aesthetic benefits and being sensitive to local issues such as parking and proximity to schools and children.

A series of concept designs was created for each of the pilot streets and presented initially to local council officers and councillors for comment. These were then posted to residents on each of the three streets, who were invited to attend design workshops held in December 2012 at Hammersmith Town Hall and Kensington Town Hall. Posted questionnaires and follow-up customer drop-in sessions were also effective in collating community input into the design of the SuDS features.

Figure 2 – Visualisation of a proposed raingarden and connecting permeable resin bound paving in Melina Road, London Borough of Hammersmith and Fulham.jpg - Courtesy of AECOM

Using feedback from residents, local community groups, councillors and council officers AECOM developed a more detailed set of designs. Micro Drainage WinDes was used as the solution design modelling software as this contains specific modules for designing different SuDS options.

Based on the findings of geotechnical desk studies it was assumed that the SuDS features would not be able to dependably infiltrate water into the predominant underlying London Clay. SuDS solutions were therefore sized to attenuate 1 in 30 year storms for a range of durations as per a typical DG5 scheme level of protection. Pass forward flows back to the combined sewer system were limited via flow control orifices to greenfield runoff rates where possible.

Exceedance flows for storms in excess of the 1 in 30 year storm return period have been designed to return to the combined sewer system via weirs in the flow control chambers at the downstream end of the SuDS features.

SuDS solutions initially proposed

The SuDS features proposed for each of the pilot streets are summarised below:

Arundel Gardens

- Two linear bio-retention tree pit features running the full length of the street were proposed to drain surface water from the highway and footpath. However, these were rejected following discussions with the council, who advised that existing subterranean developments beneath the footpaths would be vulnerable to damage by the construction of the tree pits and, potentially, by subsequent root ingress.
- An alternative proposal to install permeable paving in the centre of the highway was championed by the council and is currently being designed for construction later this year.
- Rainwater harvesting systems are also being considered for private properties to pick up roof water and convey it to rainwater harvesting tanks within the private communal gardens to the rear of each property.

Mendora Road

- A permeable block paving system is proposed for the existing parking bays. On the south side of the road this will be installed above an open graded crushed rock sub-base. On the north side of the road a greater volume of attenuation is required because half of the roof area from houses on this side of the road drains to the highway. In order to minimise excavation depth for the permeable paving it is proposed that a geo-cellular sub-base replacement system (Permavoid or similar) will be used on this side of the road.

  A visualisation of the proposed permeable paving in the parking bays of Mendora Road is shown below:

Melina Road

- The selected proposal involves the installation of new raingardens in the existing pedestrianised area at the southern end of the road. This had the most support from residents, particularly those living closest to the largest expanse of pedestrianised area, because they thought the raingardens would break up an existing large hardstanding area where gangs of youths currently congregate, leading to anti-social behaviour.

Community engagement approach and learning points

The project has taken a twin-track approach to community engagement, undertaking a wide community education and engagement programme in LBHF and more targeted engagement of residents specifically on the shortlisted streets and final pilot

Figure 3 – Visualisation of Mendora Road permeable paving in the existing parking bays - Courtesy of AECOM

Figure 4 – Visualisation of final raingarden proposals for Melina Road - Courtesy of AECOM

streets in both LBHF and RBKC. In addition to the SuDS features that will be installed in public spaces, private property SuDS options will also be installed in each of the three streets, including permeable surfaces for the front and back yards, many of which have been paved over, water butts and dual function rainstores.

The wide community engagement and education programme in LBHF has been led by London Sustainability Exchange (LSx), a charity that promotes sustainability and health and well-being issues. LSx initially researched 45 community groups with a vested interest in flooding including gardening groups, Thames rowing groups, schools, community action groups, tenants and resident's associations and citizen's advice bureaus. LSx recruited community champions from three organisations to support the project - Phoenix High School (Phoenix), Urban Partnership Group (UPG) and Hammersmith Community Gardens Association (HCGA).

The targeted community engagement for the shortlisted streets and final selected streets has been led by AECOM and has been conducted on the basis that community ideas and needs should be embedded in the design of the SuDS from the outset.

What has emerged from the community engagement activities is that a core community of 10-15% of people on each road are highly supportive of the scheme and attend each engagement event, but in order to get wider buy-in a very direct approach is required. Communication messages with customers originally focussed on flood risk issues but have developed over time to focus more on landscaping and the wider benefits of the scheme. One of the most successful methods of engaging customers was the use of simple, graphically attractive postcards offering customers free raingardens if they signed up to the project. Community engagement levels have now increased to between 30% and 60%, depending on the road.

Future maintenance

Within the life-cycle of the project, the implementation of Schedule 3 of the Floods and Water Management Act 2010 is anticipated.

This will have the effect of appointing both LBHF and RBKC as SuDS approving bodies, responsible for approving, adopting and maintaining SuDS on new developments. Both councils have therefore viewed the project as an opportunity to gain experience in evaluating SuDS measures and to understand their maintenance requirements.

Both councils have also embarked on their own research projects and have agreed to share both delivery resources and subsequent learning with TWUL. A programme of engagement events with council officers and councillors has been undertaken during the course of the project. The degree of collaboration is such that TWUL is considering contracting LBHF to deliver some of the SuDS measures in its area.

An agreement has been reached for TWUL to maintain above ground features such as raingardens and tree pits for the first year, after which the councils will take over maintenance.

The below-ground orifice flow control chambers will be maintained for two years by TWUL during which time council operatives will be trained and the successful operation of the SuDS features will be demonstrated. After this, the council has agreed to take over the ownership and maintenance of the whole SuDS assets, including the below-ground chambers and orifice flow control devices.

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