Fine-scale rainfall measurement and prediction to enhance urban pluvial flood control

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Pilot location: Purley Area, London Borough of Croydon (UK)

Monitoring

Rainfall

Rain gauges:

- **6 tipping bucket rain gauges** with 0.2 mm resolution operated by the Environment Agency + **4 new tipping bucket rain gauges** will soon be installed by Imperial College London as part of the RainGain project.

Radars:

- The area is within the coverage of two C-band radars operated by the UK Met Office (see *Figure 5*):

Specifications	Chenies Radar	Thurnham Radar
Radar type	C-band	C-band
Polarisation	Horizontal*	Dual-polarisation
Doppler	No*	Yes
Antenna	Parabolic 3.6 m diameter, 43 dB gain	
Beamwidth	1°	
Frequency range	5.4 – 5.8 GHz	
Range resolution	1 km up to 50 km range/2 km up to 75 km range	
Temporal resolution	5 min scan repeat cycle**	
Elevations (°)	0.5, 1.5, 2.5, 4.0, 5.0	0.5, 1.0, 1.5, 2.5, 4.0

*Currently being upgraded to dual-polarisation and Doppler
**Within the RainGain project the potential benefits of reducing the repetition cycle to 2-3 min will be tested

Water depth sensors

- 10 permanent flow sensors in sewers operated by Thames Water
- 2 new water depth sensors in sewers will be installed by ICL as part of the RainGain project (see *Figure 6*).

Medium term flow survey data: A medium term flow survey consisting of 79 flow monitors and 18 rain gauges (average of 1 gauge per 8.5 km^2) was carried out by Thames Water between 28/01/11 and 13/07/11. These data will be used for calibration of the models of the Purley Area.

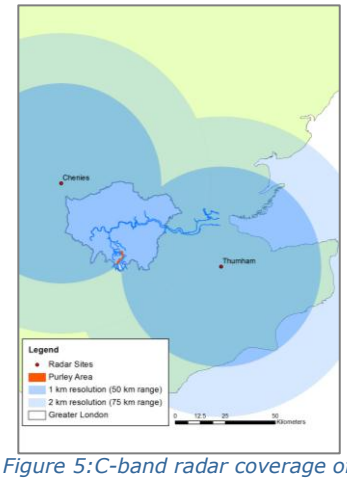

Figure 5:C-band radar coverage of the Purley Area

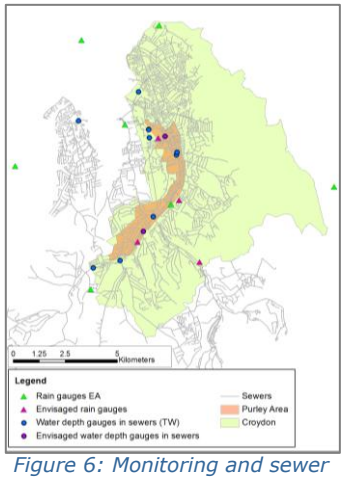

Figure 6: Monitoring and sewer system of the Purley Area

Spatial datasets

- **Digital Terrain Model (DTM):** 1 m horizontal resolution LiDAR-generated DTM with stated vertical accuracy of ±0.15 m and horizontal accuracy smaller than the pixel size (provided by the GLA) (see *Figure 7*). This DTM was used to delineate the watershed that drains to the Purley Area, which should be considering when modelling pluvial flooding.
- **Location of buildings and critical infrastructure:** The Ordenance Survey Master Map of Croydon, including location of roads, buildings and critical infrastructure, was provided by the Spatial Planning Team of Croydon Council. The location of buildings was extracted from this map and will be used for setting up a surface model of the area (see *Figure 7*).
- **Topology of sewer system:** information of the sewer system of the Purley area and surroundings was provided by Thames Water (see *Figure 6*).

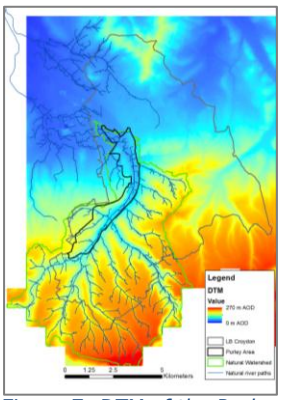

Figure 7: DTM of the Purley Area and surroundings

Figure 8: Location of buildings in the Purley Area

Urban pluvial flood models

An **InfoWorks CS model of the sewer system of the study area was provided by Thames Water** (see *Figure 6*). This model was verified in 2012 based on the medium term flow survey data described above (collected between 28/01/2011 and 13/07/2011). This is a **semi-distributed** model in which the **rainfall is applied through subcatchments** associated to manholes. Each subcatchment is split into different surface types; for impervious surfaces runoff is estimated using a fixed runoff coefficient, whereas the NewUK rainfall-runoff model is used for pervious areas. The flow in the sewer is modelled using the full Saint-Venant equations (i.e. it is a **fully hydrodynamic model**).

During the **RainGain project this model will be coupled with a model of the urban surface**, in order to produce a dual-drainage model which can effectively represent urban pluvial flooding. The model of the surface will be generated based on the DTM of the area and on the location of buildings. **The resulting model will be refined and optimised based on new monitoring data and on improved modelling and calibration techniques**. This model will also be used for identification of local surface water flooding thresholds and for the development of surface water flood warnings.

Project website: http://www.raingain.eu/en/raingain