Finding and Managing Culverted Watercourses

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Historically, many watercourses have been culverted, or piped and buried, as areas became urbanised. Waterbodies were constrained in artificial channels for a number of reasons including allowing roads or rail to cross a stream, making more space for development or to conceal pollution. Over time, the original nature of these structures has become obscured. This is because paper records often recorded all drainage assets on the same map, and so when the records became digitised, many of the culverts were incorrectly recorded as a sewer. This is a significant obstacle to the proper stewardship of the structures – ownership and responsibilities are unclear, flood risk is poorly understood and opportunities for river restoration are not recognised.

Culverts often have grilles at their inlets and outlets, and these can get blocked with twigs and litter which can become a major cause of flooding. It is important to identify these culverts so that the correct legal status can be confirmed and maintenance can be carried out to reduce the risk of flooding.

Many of these watercourses are still connected to catchments that extend far beyond the urban fringe and drain large volumes of runoff, into the culverts. An example is the Caterham Bourne that flows from the North Downs, into South London. Much of its length is culverted and mapped as a sewer. During a recent, severe flood event, there was considerable dispute over responsibility for clearing the culverts and confusion remains over their legal status.

In order to identify the culverts, Sterling Geo created a map of lost rivers for the trial area in north London. This was made using historical data, the EA main river network and EA lidar data. Watercourses from the historical data were compared to the EA main river network, and those that were present on the historical maps only were digitised. The EA lidar data had recently become open data, and the 2m DTM (Digital Terrain Model) was chosen to be utilised. The data was run through an automated drainage extraction routine in Quantum GIS, however man-made features such as railways interfered. The 2m DTM gave a very dense network of drainage, so the scale of the DTM was reduced to 10m resolution, and thinning and cleaning techniques (r.thin and the v.clean routine in QGIS) were used to produce the final simplified drainage output.

The digitised map of lost rivers was used with Thames Water GIS Sewer Mapping to identify the potential culverts. It was decided that surface water and storm overflow sewers are the most likely categories a culverted watercourse would be recorded under, and that a larger diameter sewer is also more likely. Hence the sewer network was filtered to only include sewers with diameter of 300mm or larger with the surface water or storm overflow purpose.

The sewers that followed the same path as the lost rivers were labelled as ‘highly likely’ to be a culvert if they had diameter 600mm or larger, or ‘possible’ if the diameter was between 300mm and 600mm. Another clue was that some sewers were a few meters long and seemed to connect two OS watercourses. Again, these were labelled as ‘highly likely’ if the diameter was 600mm or above, or ‘possible’ if between 300mm and 600mm. Finally, when the OS watercourse ends but the EA river network continues, the sewers connected to the end of the EA river network were all classed as ‘possible’. All other sewers were classed as ‘not likely’.

Flooding data was analysed and it was found that the rate of hydraulic sewer flooding from the highly likely and possible culverted watercourses was significantly more than non-culverted sewers. This is why it is important for these potential culverts to be investigated further to ensure they are getting enough maintenance which can reduce the rate of flooding.

There is also a lot of interest in river ‘daylighting’ – redirecting the culvert into an above ground channel. A wide range of organisations are keen to support the restoration of the culverted watercourses as it can create ‘green corridors’ in cities improving the environment, and can even encourage more animals and plant life.