Do we need to change the way that we model runoff?

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The way in which we model runoff into sewerage models has remained substantially unchanged for probably 20 years. We have changed the detail of the equations that we use, but we still generally calculate the runoff from a subcatchment and put it into a manhole. We don't consider the limiting capacities of the roof gutters, the downpipes or the road gullies that might reduce the flow getting into the sewerage system.

For some complex studies we model the catchment as a 2D surface with representation of the gully inlets; but this is still rare and can slow down the model.

So, we go from one extreme of not considering the limiting entry capacity to a detailed consideration of inlet capacity of every gully.

But there are lots of additional runoff features in InfoWorks ICM, many of them put in to align with modelling practice in other countries. So is there some half way house that makes use of these features to improve our representation of runoff without going to detailed 2D modelling.

WHY DO WE NEED TO CHANGE?

We are being expected to look at larger rainfall events where the restricted inlet capacity becomes more of a limitation. DWMPs require consideration of 1:50 annual probability events for the resilience metric. They also require engagement with other stakeholders including local authorities; who often look at surface flooding in 1:200 annual probability events. Considering future climate change gives a further increase in rainfall intensity of up to 40%. For these rainfall conditions the inlet capacity can be significant in which flow path the runoff takes. Assuming that it all gets into the sewer will over-predict sewer flooding and under-predict other flooding. Increased use of Sustainable Drainage will also increase the integration of piped and surface flow and require better representation of the interface between them.

LEARNING FROM OTHER COUNTRIES

We are currently carrying out a project to update the modelling specification for the Greater Toronto Authority in Canada to bring the perceived advanced knowledge of the UK to improve how they build models there; but in practice they may be ahead of us in finding this middle way of representing runoff. However, we are finding ways to simplify and speed up what they currently do by challenging existing practice.

Current practice in Toronto is to represent roof drainage and ground drainage as separate sub-catchments. Each represents the inlet capacity limitations of downpipes or gullies as a gully entry. However, the capacity limitations are represented not as every individual downpipe or gully but as a single notional control to represent the capacity of all of the downpipes or gullies in the subcatchment. Flow that exceeds the capacity of the control and so does not directly enter the manhole is transferred to an overland flow conduit to enter a different manhole through a road gully.

The method is complex to set up with each subcatchment needing an extra node and two extra notional conduits to represent the different flow paths.

SUGGESTED APPROACHES

The recent development of SuDS components in InfoWorks ICM gives a potential simpler method to give an improved representation of the limitations of inlet capacity. Each roof subcatchment can have a SuDS control that provides a bewildering array of options to represent all different types of sustainable drainage features. However, the simplest of these intended to represent water butts provides for a limiting discharge for the direct flow to the drainage system, a storage volume for excess flow and an overflow route for when the storage volume is full.

We are now carrying out sensitivity testing of this approach against the existing detailed Toronto approach on some of the existing large-scale drainage models of the Toronto area. The paper will report on the results of this testing and whether representing these inflow limitations is significant for catchment wide results.

FUTURE MODEL IMPROVEMENTS

There may be opportunities for further improvements in runoff representation if SuDS controls could be applied to individual runoff surfaces rather than to a subcatchment with standard parameters for each type of surface.