Case study

Integrated catchment modelling, Colorado, USA

Flood Modeller was linked to the US EPA's Storm Water Management (SWMM) to model the Little Shooks Run drainage basin within the City of Colorado Springs. This allowed Flood Modeller to not only model flood water on the surface but also to dynamically link to the subsurface drainage system beneath, meaning that water could dynamically flow between the surface and subsurface during a simulation.

Linking SWMM to Flood Modeller enabled locations at risk of flooding, when the subsurface drainage system exceeded capacity, to be identified. It also enabled different solutions to reduce flood risk to be efficiently explored and reported to the client.

The model outputs provided guidance to developers and City officials to help them improve the existing drainage system and the street conveyance system throughout the basin.

Key facts

- An improved understanding of the surface flow routes was achieved by linking SWMM to Flood Modeller
- The model identified locations at risk of flooding when the subsurface drainage system exceeds capacity
- The impacts of culvert blockage on the system capacity were investigated
- Different mitigation options were explored effectively
- Modelling enabled the existing drainage system throughout Colorado Springs to be improved

Overview of modelling

To undertake this analysis, it was clear that both the subsurface drainage and surface water flows needed to be modelled dynamically. To do this, a SWMM model was built for the Little Shooks area and linked to a Flood Modeller 2D model. The SWMM model simulates the subsurface drainage system for a range of storm events. As the subsurface drainage system exceeds capacity, flow is routed out of SWMM through manholes and onto the 2D model. As the models are dynamically linked, any flow that has diverted out of the 1D SWMM system into the 2D system is able to flow across the surface and back into the 1D system if there is available capacity within the subsurface drainage network at other locations.

Results and benefits

Linking SWMM to the Flood Modeller 2D solver allowed the team to better understand the uncertainty of surface flow patterns in the sub-basin once the drainage system capacity is exceeded. It was also possible to compare the existing inlet capacity to the overland street conveyance to understand when different locations became at risk of flooding.

Modellers were able to use the model to understand how blockages in a culvert within the sub-drainage basin reduced the capacity of the local system, leading to water being discharged onto the surface upstream. The model showed how in some locations, water was then able to flow overland and back into the drainage system downstream of the blockage, while in other locations water leaving sub-drainage

Flood Modeller

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system ponded and could not re-enter the system. The linked model was therefore vital in understanding how the subsurface drainage basin influenced the surface water conveyance of flood waters.

The model was then applied to test the impact of a range of potential solutions to reduce flooding on the surface. These include incorporating additional inlets into the drainage system, adding storage facilities and increasing pipe capacity. The result was a set of possible approaches that could be adopted by City official and planners to reduce flood risk arising from intense thunderstorm events in the Little Shooks Run drainage basin.

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