Case study

Integrated 1D-2D modelling of the Parramatta River, Australia

Flood Modeller has been used to simulate combined fluvial and direct rainfall flooding in a sub-catchment of the Parramatta River in Sydney, Australia. Floodplain modelling was conducted as part of a wider floodplain risk management plan for a proposed river bank development of a brownfield site for a multinational environmental services company. The aim was to evaluate the impact of site development on the surrounding water levels.

Key facts

- Flood Modeller was selected due to the speed and stability of its solvers
- The initial phase involved the development and calibration of a 1D model of the Parramatta River
- The second phase involved developing a fully linked 1D-2D model to incorporate both fluvial and direct rainfall events
- Productivity tools within Flood Modeller, such as the spill generator, saved significant time in developing the model

The initial phase of the project involved the development and calibration of a Flood Modeller 1D model of the Parramatta River. This was used to make an initial assessment of the impacts of proposed bank-side regeneration works at the site. This work confirmed the extent of the more detailed modelling that was needed for the site and surrounding sub-catchment.

The second phase of the project involved developing a fully linked 1D-2D model, allowing the modelling of both fluvial and direct rainfall events. Flood Modeller's 2D ADI solver was chosen due to the range of productivity tools available, such as the spill generator in the modelling toolbox, for its speed and stability, and for the ease in which direct rainfall can be modelled in the 2D domain. Rainfall hyetographs were developed for the catchment using locally accepted methods in Sydney and existing hydrographs were used for the flow series in the river.

The 2D model was developed using available LiDAR and aerial imagery data, with more accurate site topographic data overlaid, where appropriate. The domain covers the entire surrounding sub-catchment. Buildings in the catchment have been modelled at ground level with a high roughness to prohibit flow through them, whilst enabling the storage of water within them.

A sensitivity analysis concluded that a 5m grid size provided sufficient accuracy over the 100ha catchment.

The surface water drainage network in the area was not included in the model as the intensity of events being analysed would render it ineffective.

To analyse the impacts of both direct rainfall and fluvial flooding, the events were combined. The peak rainfall-runoff at the site was timed to coincide with the peak river levels adjacent to the site by adjusting the start of rainfall. The baseline model was evaluated for 20-year, 100-year and Probably Maximum Flow events, considering the joint probability of both direct rainfall and fluvial events and their respective impacts on flood levels at the site.

A design scenario model was developed, based on the site design drawings. This model was evaluated

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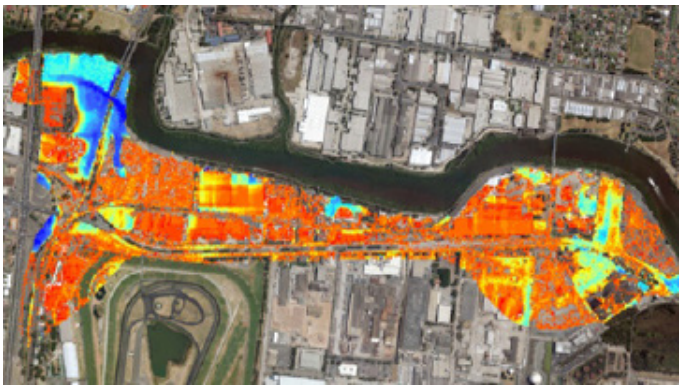
for the same events, and the results were compared. 2D flood maps of depth were used to analyse water levels on site and within the catchment. These maps were used to determine the impact of the design on water levels. They were also used to determine hazard values along proposed evacuation routes from the site to ensure that a safe exit route would be available in the event of a large flood.

Using Flood Modeller, it has been possible to show that the proposed design can be employed without increasing flood levels in the catchment and without increasing downstream water levels in the river, while providing sufficient flood protection for the site.



1D-2D modelling of Parramatta River, Sydney

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