CoastAdapt

Snapshot

Kingborough council – coincident flood modelling at Kingston Beach

Summary

When Kingborough's local council in Tasmania first began planning for coastal adaptation in 2012 it didn't have the capacity to consider the combined effects of different impacts which limited the council's risk evaluation. In 2016 the council addressed this gap through a natural hazards planning project.

Keywords

Inundation modelling, coincident flooding, adaptation pathways, hazard planning

In 2012 Kingborough Council participated in the Tasmanian Coastal Adaptation Pathway Project - TCAPP (SGS Economics and Planning 2012), which looked at coastal risks due to sea-level rise and climate change, and response strategies. This project was run at a number of sites around Tasmania, and in Kingborough it focused on Kingston Beach. Kingston Beach is a seaside community along an extended beach, largely enclosed by Browns River which flows into the Derwent Estuary at the northern end of the beach (see Figure 1).

The TCAPP report for Kingston Beach identified that the community was at some risk of localised inundation due to riverine flooding. This risk could worsen in the future due to increased rainfall as a result of climate change. Modelling showed that future sea-level rise and storm surge could also lead to flooding (see Figure 2). The worst case would be a combined high sea-level from a storm (and sea-level rise) coupled with heavy runoff from an extreme rainfall event. The scope of the project however did not permit modelling of the potential implications of such a combination of impacts.

Figure 1: Map showing Kingston Beach, Browns River and Derwent Estuary areas. Source: © NCCARF 2017.

Figure 2: Extreme storm surge event at Kingston Beach. Photo: © Kingborough Council 2011.

This was a concern for council. Hydrological studies typically consider the risks from either catchment flooding or oceanic inundation, and not the risk of both occurring simultaneously as the result of a single storm cell. Failing to consider the possibility of both events happening concurrently exposes the community and its assets to considerable risk. If oceanic inundation or catchment flooding is examined in isolation, the resultant estimated flood risk is likely to be an underestimate in the event of a single storm causing both to occur at once. This became a critical consideration for risk evaluation at Kingston Beach. In this study, the assessment of coincident flood risk was based on the Queensland Government guidelines *Coincident Flooding in Queensland: Joint Probability and Dependence Methodologies* (QLD Government, Oct 2012).

Climate Futures for Tasmania modelling (White et al., 2012) indicates that for a 24hr 1% AEP (annual exceedance probability) rainfall event, intensities may increase by 10 to 30% for Kingborough by 2100. Sea level rise allowances for Kingston Beach were provided by John Hunter (April, 2015) and adopted at 0.3m by 2050 and 1.0m by 2100.

The TCAPP report informed two subsequent council reports:

- The Kingston Beach Integrated Climate Change and Natural Hazards Project (Climate Planning 2016)
- The Kingston Beach Flood Study (Kingborough Council 2016).

For these projects, both catchment and ocean derived flood events in Kingston Beach were considered, as well as coincident events. The predicted impacts of climate change were also considered for the modelling of all future events (see Figures 3 and 4).

Climate Futures for Tasmania modelling (McInnes et al., 2012) indicates that for a 24hr 1% AEP (Annual Exceedance Probability) rainfall event, intensities may increase by 10 to 30% for Kingborough by 2100. Sea-level rise allowances for Kingston Beach were provided by John Hunter (April, 2015) and adopted at 0.3m by 2050 and 1.0m by 2100.

In completing the flood study for Kingston Beach, the following activities were undertaken:

- collection and compilation of available historical and recent climate change data and flood data related to the study area
- development of flood models through a comprehensive computer model using available data
- simple validation of the models using current best available data and sensitivity tests
- production of a range of design flood maps (peak flood level, depth, velocity and hazard) for 1%, 5% and 20% AEP events for the catchment, including allowances for climate change and the effects of storm surge from the sea
- preliminary investigation of potential flood mitigation measures.

The results indicate that most of the Kingston Beach residential and commercial areas are subject to between 2.6 and 3.3 m AHD (Australian Height Datum) water levels during the peak 1% AEP coincident flood in the year 2100.

Figure 3: Example of coincident flood modelling outputs at Kingston Beach. Source: © Kingborough Council.

The results of the modelling indicate that fluvial flooding is the dominant factor affecting flood risk in Kingston Beach, compared with storm surge. The dominance of catchment flooding is expected to reduce as sea-level rise increases throughout the 21st century.

Due to the size of the undeveloped portion of the catchment compared to the projected future urban growth area, there is only a moderate increase predicted in the inflow rate from Browns River and Whitewater Creek (a key tributary) to Kingston Beach due to development. Projected climate change impacts on both rainfall intensity and sea-level are the principle factors causing an increased flood risk in Kingston Beach throughout the 21st century.

A potential flood reduction scheme has been proposed that combines channel straightening with the opening of the Browns River mouth. Both measures are complementary, and combined they have a potentially significant impact on flood behaviour, reducing the risk of flood inundation within the lower Browns River floodplain at Kingston Beach.

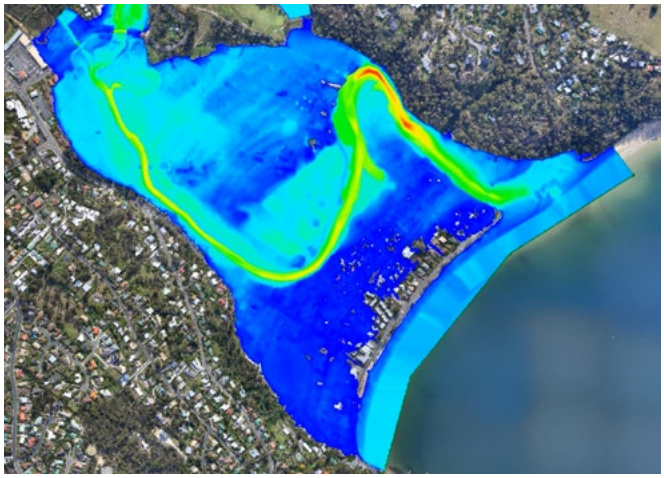

Figure 4: Example of coincident flood modelling outputs at Kingston Beach. Source: © Kingborough Council.

Further detailed assessment of the preferred flood reduction scheme will be undertaken and will include:

- An erosion assessment to identify the erosion potential associated with the design geometry for the scheme. This will inform the erosion protection required to safeguard the scour. This is particularly relevant for the bypass channel where it connects to the Browns River.
- A joint probability analysis to examine the likelihood of coincident freshwater flooding under surge and high tide conditions. This assessment would help to understand the average recurrence interval for combined flood and tail water* events.
- Data collection to improve information on the tidal water level and flow datasets to support improved model calibration for the proposed scheme.
- An assessment to quantify the logistics and ongoing costs associated with maintaining an open entrance at the mouth of Browns River.

In the Kingston Beach Integrated Climate Change and Natural Hazards Project, the coincident flood modelling was used to inform asset exposure projections, including consideration of length of time, depths and velocities of inundation.

* Tailwater: the height of water directly downstream of an area or structure of interest, such as a dam.

All of the aforementioned will form the basis of a Specific Area Plan for Kingston Beach which will be used for development control under the provisions of the Kingborough Planning Scheme. This is assisted by a more comprehensive understanding of inundation risk, currently and up to the year 2100.

References

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