
Executive Summary

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Townsville City Council received funding under the Natural Disaster Risk Management Studies Program to undertake a Disaster Risk Management Study specific to flooding including a preliminary assessment of storm surge in coastal areas. Primary objectives of the Study included:

- quantifying flood inundation in Townsville and Magnetic Island
- a preliminary assessment of storm surge inundation in Pallarenda and Cungulla
- determining the flood hazards and the vulnerability of community and infrastructure, and
- identifying possible risk mitigation measures and strategies to allow proper and effective management of the identified risks.

The Project Plan identified three distinct yet inter-related phases to the Study. This report addresses Phase 2, which require a comprehensive flood hazard assessment of Townsville and Magnetic Island, using both 1-D and 2-D hydraulic modelling techniques. The study has culminated in detailed inundation mapping of design flood events ranging from 2 Year ARI to Probable Maximum Flood (PMF), and a simplistic assessment of storm surge inundation of coastal areas.

The following sections provide a brief overview of the investigations undertaken in Phase 2:

Available Data

The reliability of results from flood investigations is highly dependent on the extent and accuracy of available data, either for calibration of models or determination of causes of historical flood behaviour. Significant effort was made in gathering relevant information (topographic data, design and as-constructed plans, cadastral data and ground survey, rainfall and stream gauging records, tide and surge data, results of previous investigations and anecdotal flood levels) to assist in determining the extent of flooding throughout the Study Area.

Of particular relevance to the Study was the assessment of overflows from the Bohle River (sourced from the Bohle River Floodplain Management Study). These were determined to occur in events greater than the 10 Year ARI flood event in the Bohle River. During the course of the investigation, additional historical flood level data was sourced for calibration purposes, primarily through a Flood Questionnaire. Fifty-one (51) responses were received from residents detailing flood levels for the 1998 and 2002 flood events. ***An important finding of the review of previous studies was that the local catchment (downstream of the Ross River Dam) can potentially produce a significantly greater runoff peak than the larger dam catchment once routed through the Dam.*** As such, the Study has only focused on local catchment flooding.

Hydrology Modelling

The runoff / routing model RAFTS was used to simulate the hydrological response of the local catchments of Townsville and Magnetic Island. A range of design event durations were run through the RAFTS model and the critical duration event for the Townsville floodplain was found to be between 2 and 6 hours, whereas for Magnetic Island event durations ranging from 45 minutes to 2 hours were critical. The Magnetic Island RAFTS model could not be calibrated due to insufficient data, however the Townsville floodplain model required a joint hydrologic/hydraulic calibration for the February 2002 and January 1998 flood events (the models were also verified for the March 1990 flood). Comparison of recorded rainfall

Executive Summary

with the Townsville design intensity data suggested that the 2002 event was similar to a 5 Year ARI event. The January 1998 event was found to be greater than the 100 Year ARI event, and potentially as high as 500 Year ARI for the critical duration period (6 hours).

Hydraulic Modelling – MIKE11 and MIKE21

For Magnetic Island, dynamic MIKE11 modelling was undertaken for the full range of design events (2, 5, 10, 20, 50, 100 and PMF) at each of the four bays. MIKE11 and MIKE21 modelling of the Townsville floodplain was undertaken, with MIKE11 modelling focussing on the lower end flood events (2-20 Year ARI) confined to the major open channel drainage paths. The MIKE11 hydraulic model was calibrated to the February 2002 event and run for two verification events; January 1998 and March 1990. The MIKE21 model was calibrated to the January 1998 event, and used to predict flood extents and depths for the design events (50 Year ARI up to the PMF). MIKE21 modelling permitted greater representation of the wider floodplain areas and subsequently provides more accurate results for the less frequent rainfall events (ie. greater than 50 Year ARIs).

Storm Surge and Tidal Inundation Maps

Static tidal surge modelling was undertaken for 50 and 100 Year ARI events by applying published static surge levels along the shoreline off Pallarenda and Cungulla. Inundation maps, developed in isolation from freshwater flooding, indicated that significant numbers of properties (particularly at Pallarenda and Cungulla) were impacted by storm surge propagating inland via existing drainage paths. Normal tide inundation maps for Mean High Water Spring (MHWS) and Highest Astronomical Tide (HAT) have also been developed; however negligible impact was predicted. For Townsville, dynamic surge propagation was modelled using MIKE21 for the recorded levels from Cyclone Althea (1971). A synthetic scenario was also modelled representing the surge from Cyclone Althea coincident with a high tide.

Flood Inundation Maps

Flood inundation maps prepared for Magnetic Island indicate that relatively frequent rainfall events (5 Year ARI) can produce flows that exceed the capacity of several of the major drainage paths within the four bays modelled, resulting in overtopping of roads and inundation of a number of properties (however, widespread inundation is not common). In Townsville, inundation mapping has been undertaken using ArcView GIS for both the MIKE11 and MIKE21 modelling results. The two sets of inundation plans overlap and exhibit differences symptomatic of the modelling approach (MIKE21 model was calibrated to a very large event and the 2-Dimensional modelling results are therefore more accurate for design event of 50 Year ARI and greater). ***The representation of the Townsville floodplain on a 20 m grid does not allow the smaller drainage channels to be adequately represented.***

The inundation mapping undertaken for this Phase 2 Report has been used in the assessment of hazard, community vulnerability and estimation of flood damages (detailed in the Phase 3 Report).