

Wivenhoe Dam – Development of Flood Operational Rules

1. Introduction

This briefing note has been prepared to detail the development of the flood operational rules for Wivenhoe and Somerset Dam and the extensive reviews undertaken for the studies.

The flood operational procedures were developed during an extensive hydrological study of the Brisbane and Pine Rivers catchments by the DPI, Water Resources between 1990 and 1994 which was reviewed by an external expert panel. Subsequently, the flood operational rules have been reviewed during the Brisbane Valley Flood Damages Minimisation Study in 2006 and the latest revision to the flood manual in 2009. Both reviews have included expert review panels comprising key stakeholders.

2. History

The Brisbane River Basin is the major water supply source for the City of Brisbane and many of the nearby local authorities. The major floods which are derived from the basin have a history of causing significant damage to the local communities.

Somerset Dam was constructed on the Stanley River over the period 1936 to 1954 and was the major regional water supply source up until the late 1970's

During the early 1970's it was identified that both the water supply and flood mitigation of Somerset Dam would need to be augmented. Shortly after the 1974 floods planning for the construction of Wivenhoe Dam began with construction commencing in 1979 and final completion being achieved in 1987.

The main functions of Wivenhoe Dam are to meet the water supply demands of the Moreton Region, provide the lower pool for the 500MW Wivenhoe Pumped Storage Project and provide flood mitigation for the cities of Brisbane and Ipswich.

Changes to the methods used to determine the rainfall for extreme events during the 1980's resulted in significant changes to the design flood for the newly constructed dam.

In 1990, the owners of the Dam, South East Queensland Water Board, undertook a dam safety review of the three dams owned and operated by the Board. A key component of this study was the Brisbane and Pine Rivers Flood Study.

3. Development of the Flood Operations Rules

In August 1990, the South East Queensland Water Board (SEQWB) commissioned the Department of Primary Industries, Water Resources Business Group (DPI,WR) to undertake the Brisbane and Pine Rivers Flood Study. The flood Study was initiated as part of an overall safety review of the Board's dams, Somerset Dam, Wivenhoe Dam and North Pine Dam. The need for the safety review of the dams stemmed from a number of factors including

- the emergence of new techniques for the estimation of probable maximum precipitation and subsequent flooding,
- the development of computer software capable of simulating the hydraulic behaviour of whole river basins and simulating dam failure scenarios,
- advancements in technology associated with real time weather monitoring.

The scope of the flood study was to review the hydrology for each dam and hydraulic aspects associated with the relevant flood studies and to develop real time model programmes for use in flood control operations and forecasting. Key aspects of the study were:

- hydrologic review
- flood operating procedure
- hydraulic analysis, flood studies
- dam break (failure) analysis
- flood inundation.

This study was undertaken from 1990 until 1994 and represented a thorough review of the flooding in the Brisbane and Pine Rivers and the associated role of the dams within the catchment.

i. Brisbane and Pine Rivers Flood Review

The Brisbane and Pine Rivers Flood Study comprise multiple reports, produced at the completion of each stage of the study. The reports were subject to extensive internal review by the Water Resources Group before being reviewed by an independent review panel comprising Professor Colin Apelt, Head of Department, Department of Civil Engineering, University of Queensland and Mr Eric Lesleighter, Principal Hydraulic Engineer and Chief Engineer Water Resources, Snowy Mountains Engineering Corporation.

ii. Real Time Flood Model

The outcome of the Brisbane River and Pine River Flood Studies were used to develop a real time flood model for the three dams. This real time flood model consists of alert stations within the catchment to provide real time rainfall and stream level data, a calibrated run off model to convert rainfall data into flows, a gate operating model to allow decisions on gate openings to be made and a downstream flood model to provide predictions on flood levels.

iii. Flood Operations Manual

The Flood Operation Manual is the key legislative document prepared by the owner of the dam and approved and gazetted by the Qld Dam Safety Regulator. The manual defines flood procedures, roles and responsibilities, staffing and operational requirements.

The manual in its current form was developed in 1992 using the operational procedures developed during the Brisbane and Pine Rivers Flood Study and a manual written in 1968 covering flood operations at Somerset Dam (Wivenhoe Dam was completed in 1984). Six revisions of the Manual have occurred since 1992 to account for updates to the Flood Alert Network and the Real Time Flood Models, the construction of an Auxiliary Spillway at Wivenhoe Dam in 2005 and to account for institutional and legislative changes.

The primary objectives of the procedures contained in the flood manual are, in order of importance:

- Ensure the structural safety of the dams;
- Provide optimum protection of urbanised areas from inundation;
- Minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers;
- Retain the storage at Full Supply Level at the conclusion of the Flood Event.
- Minimise impacts to riparian flora and fauna during the drain down phase of the Flood Event.

To meet the objectives, there are four strategies for Wivenhoe Dam defining the gate operations as a flood event unfolds. The first three strategies are focused on delivering the optimal flood mitigation outcomes based on inflows, downstream flooding and forecast rainfall. Once the water level in Wivenhoe Dam exceeds 7m above the normal operating level, the strategies shift from flood mitigation to ensuring that the dam is not overtopped.

4. Subsequent Reviews of the Flood Operational Procedures

iv. Brisbane Valley Flood Damage Minimisation Study

In 2005 and 2006, Brisbane City Council (BCC) undertook the Brisbane Valley Flood Damage Minimisation Study (BVFDMS) in conjunction with Ipswich City Council and Esk Shire Council. The study provided a flood damage assessment for Brisbane River floods. The study aimed to estimate the potential flood damage in the Brisbane Valley and then assess the flood operation rules for the Wivenhoe Dam flood gates to determine whether the current rules could be modified to reduce flood damage in the valley.

This extensive study involved detailed survey assessment of the flood damages within the Brisbane City and Ipswich City areas. A Project Technical Review Group was formed for the project involving:

- SEQWater Corporation
- The Bureau of Meteorology
- SunWater as the operator of the SEQWater Corporation Flood Control Centre
- NRM&W Dam Safety Regulator
- WRM Consultants

Key outcomes from this study for the Flood Operational Rules were:

- Confirmation of the 4,000m³/s flood adopted in the flood manual as the start of damaging flows in the Brisbane urban areas.
- Confirmation of the effectiveness of the existing flood operating rules as the optimal method of providing flood mitigation to Brisbane.

v. 2009 Review of the Flood Manual

In 2009, after the formation of the Queensland Bulk Water Supply Authority, a comprehensive review of the flood manual was undertaken. This review was focused on re-writing the manual and

refining the operational procedures. As part of this review Seqwater assembled an expert review panel comprising the following organisations.

- The Bureau of Meteorology
- SunWater as the operator of the Flood Control Centre
- DERM Dam Safety Regulator
- Brisbane City Council

Minor changes made to the manual were extensively tested to ensure that the flood mitigation outcomes from the operation of the dam were not compromised.

5. Conclusions

The flood operational procedures for Wivenhoe and Somerset Dam were developed by a comprehensive study undertaken by the DPI Water Resources between 1990 and 1994. These operational rules have been reviewed by independent parties to identify any opportunities to improve the flood mitigation outcomes including the Brisbane City Council.

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