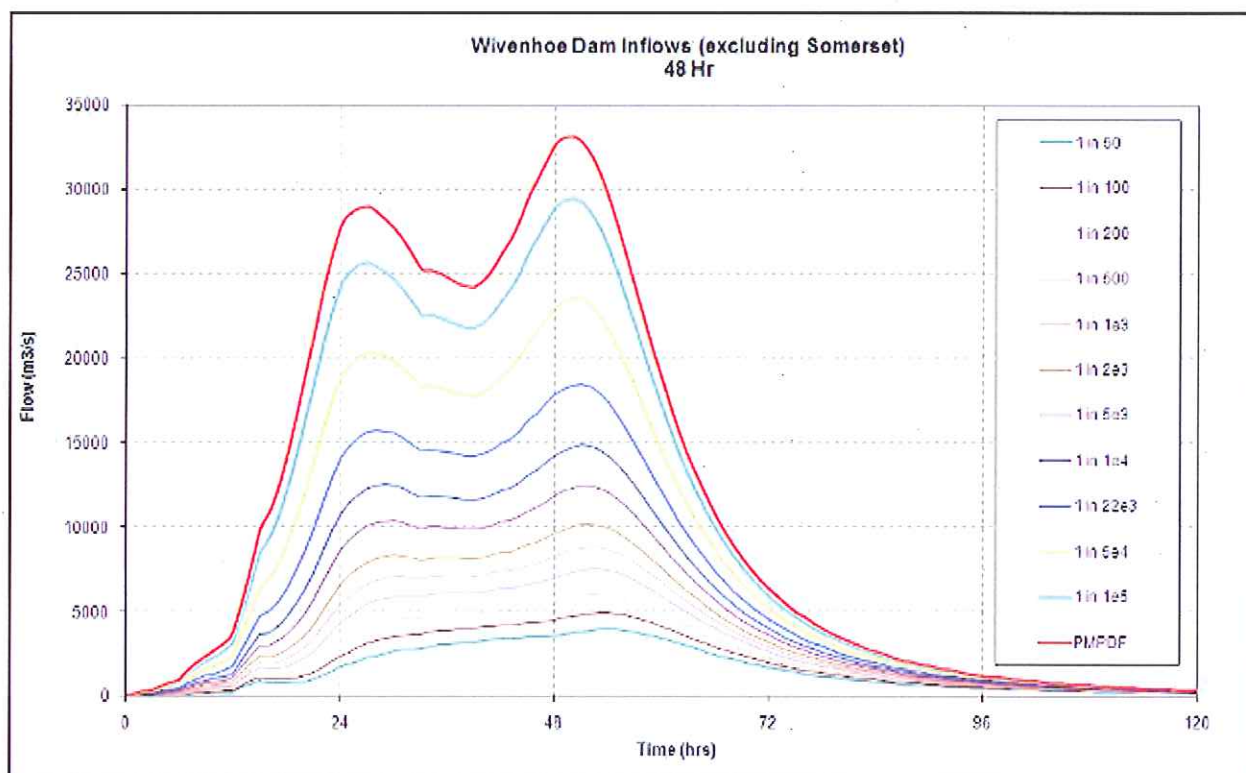
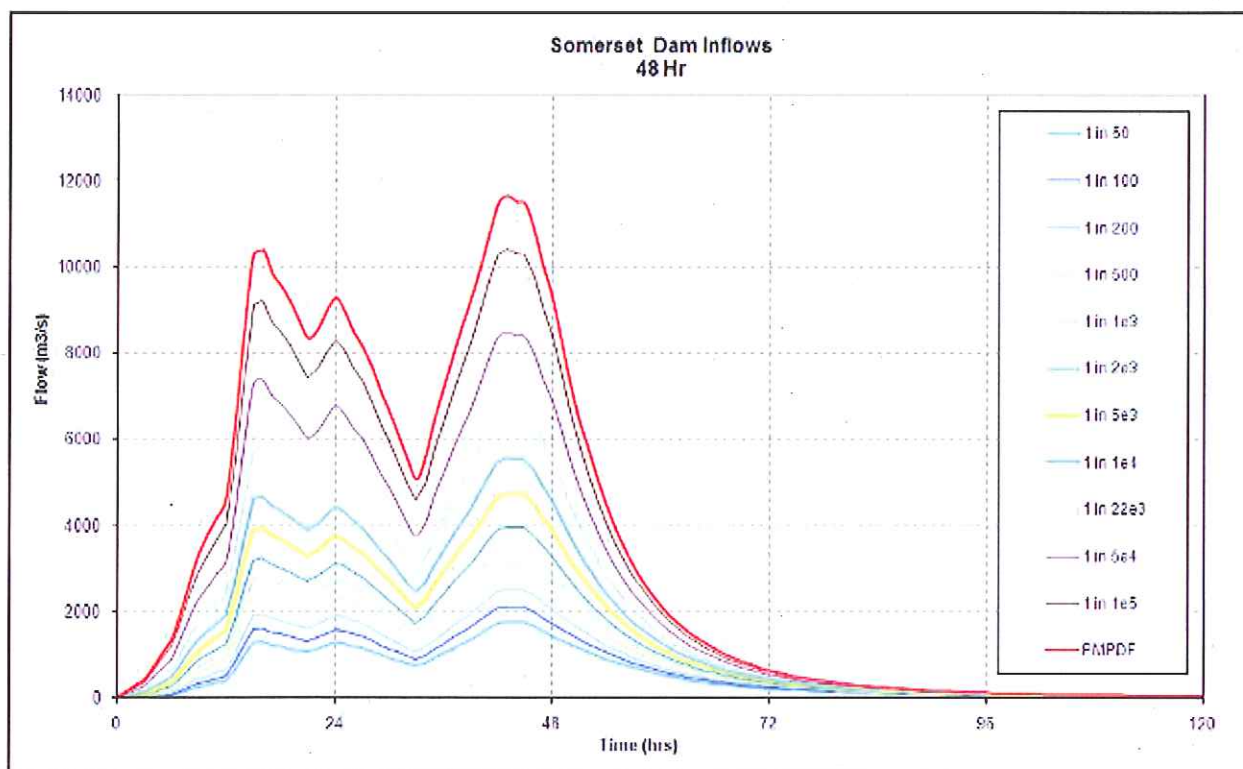
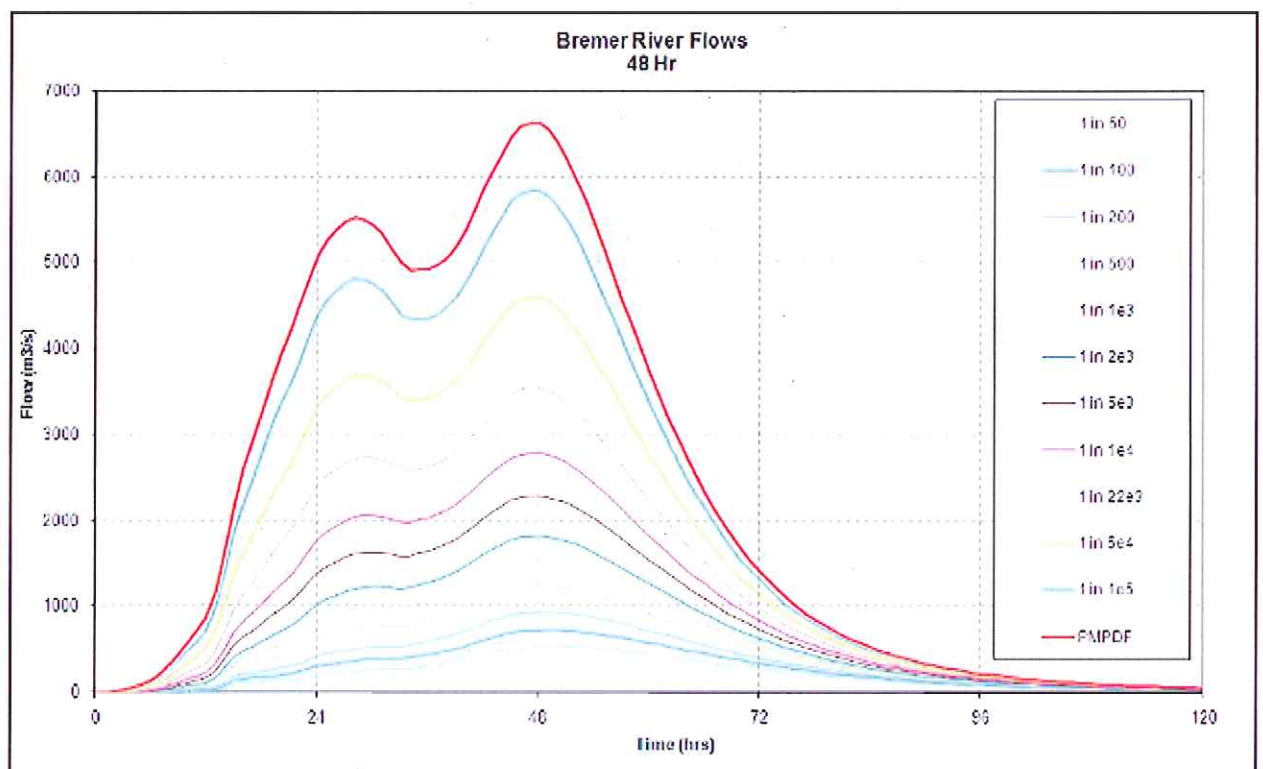
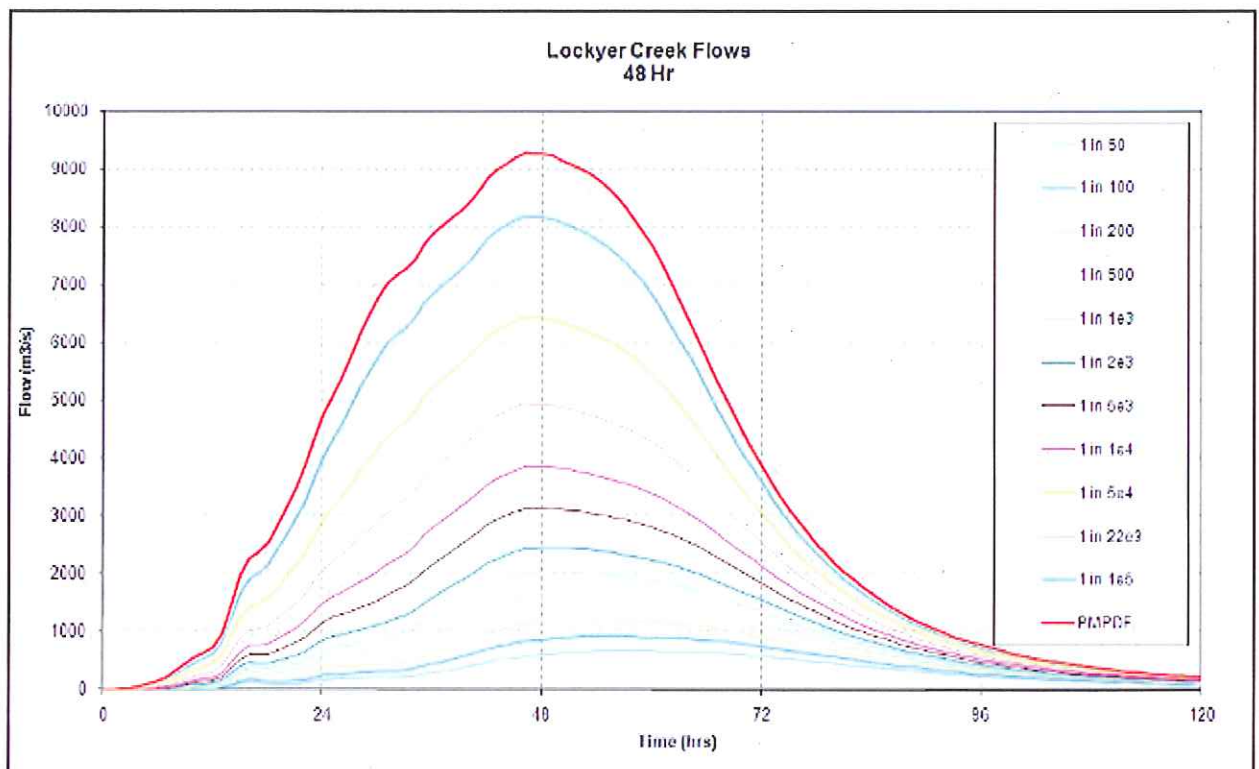


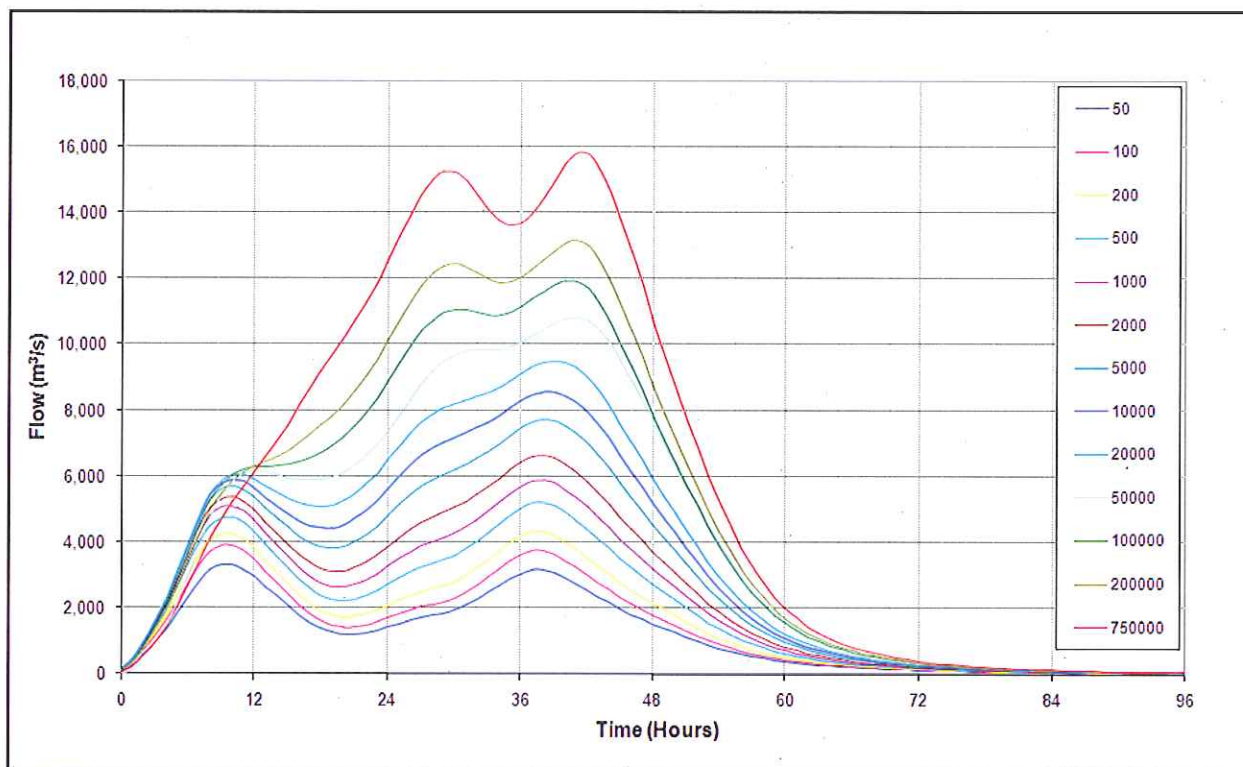
## Appendix A

### Wivenhoe Centred Design Flows





## Somerset Centred Design Flows

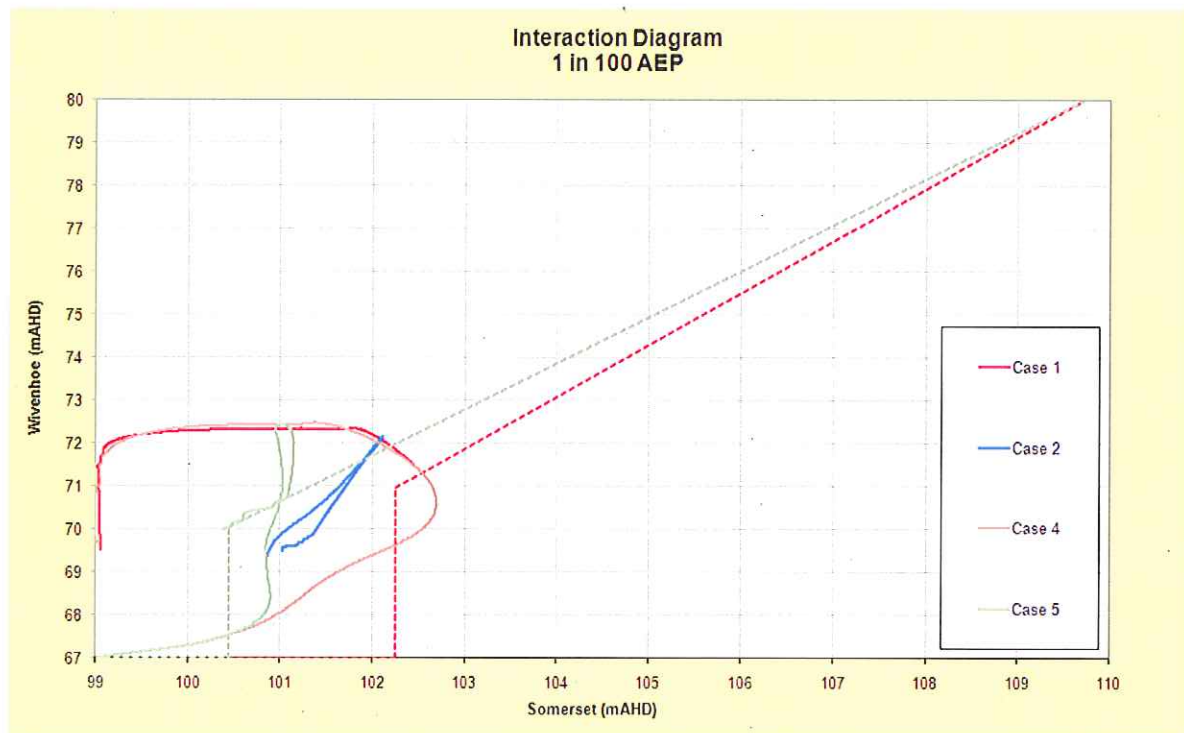


## Appendix B

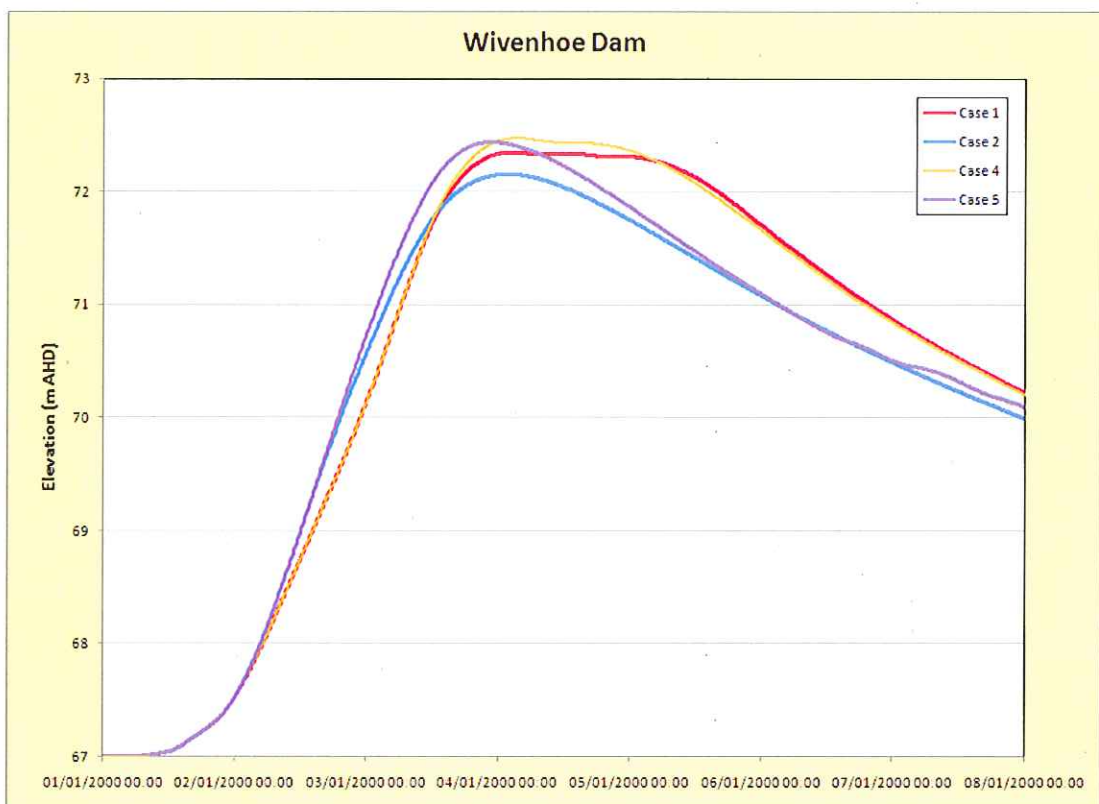
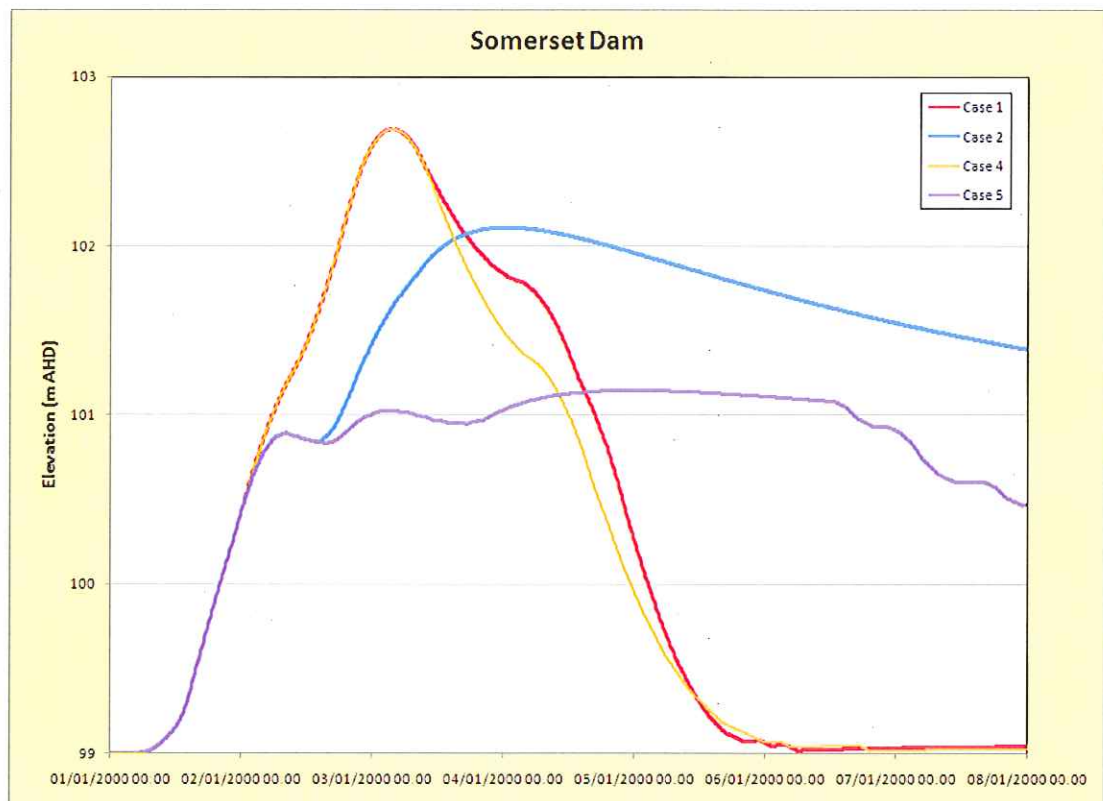
### Wivenhoe Centred Results

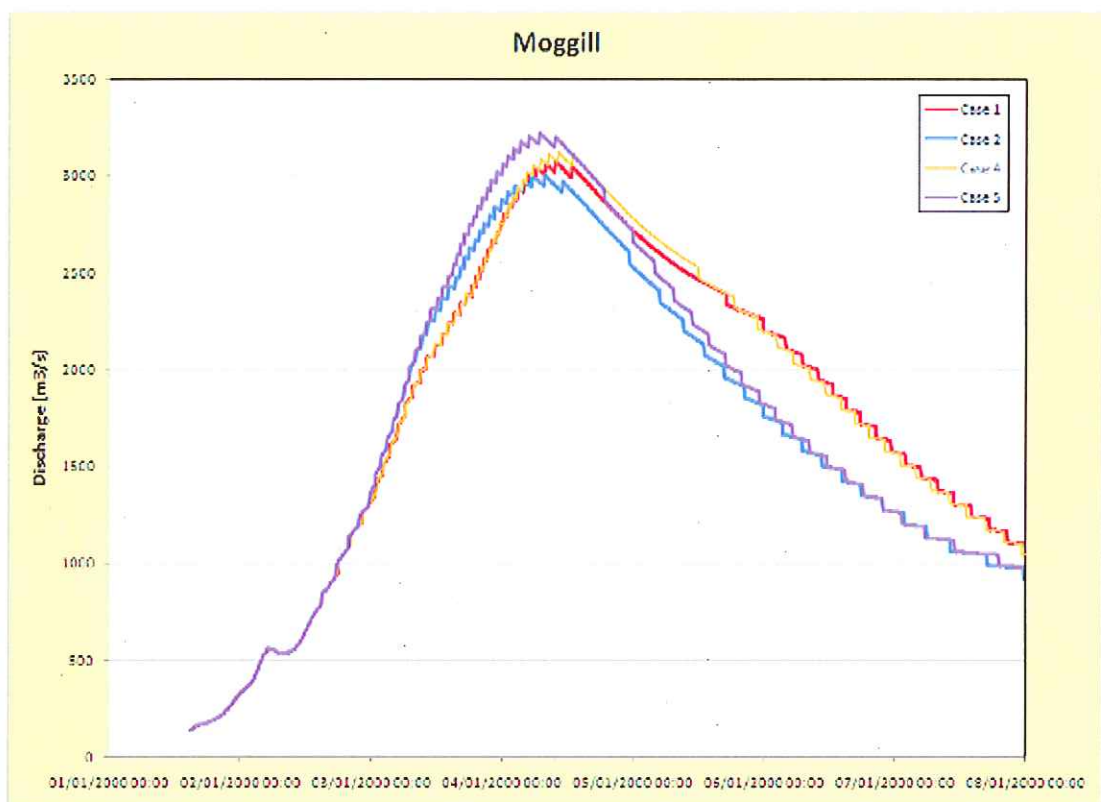
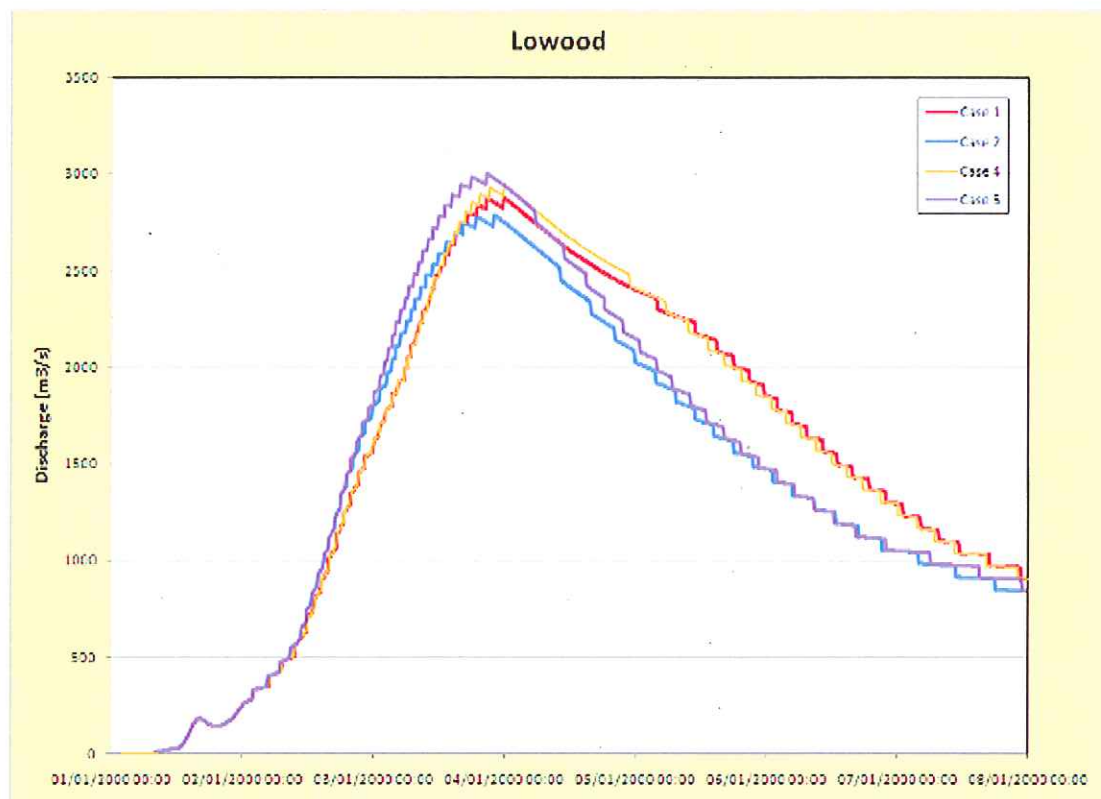
#### 1 in 100 AEP

Item	Unit	Wivenhoe Operating Level			
		67.0 m AHD		68.5 m AHD	
		Somerset Operating Level		Somerset Operating Level	
		102.25	100.45	102.25	100.45
		Case 1	Case 2	Case 4	Case 5
Somerset Peak Elevation	m AHD	102.69	102.11	102.69	101.15
Wivenhoe Peak Elevation	m AHD	72.35	72.15	72.48	72.44
Lowood Peak Flow	m <sup>3</sup> /s	2,877	2,784	2,937	2,999
Moggill Peak Flow	m <sup>3</sup> /s	3,075	3,002	3,123	3,220



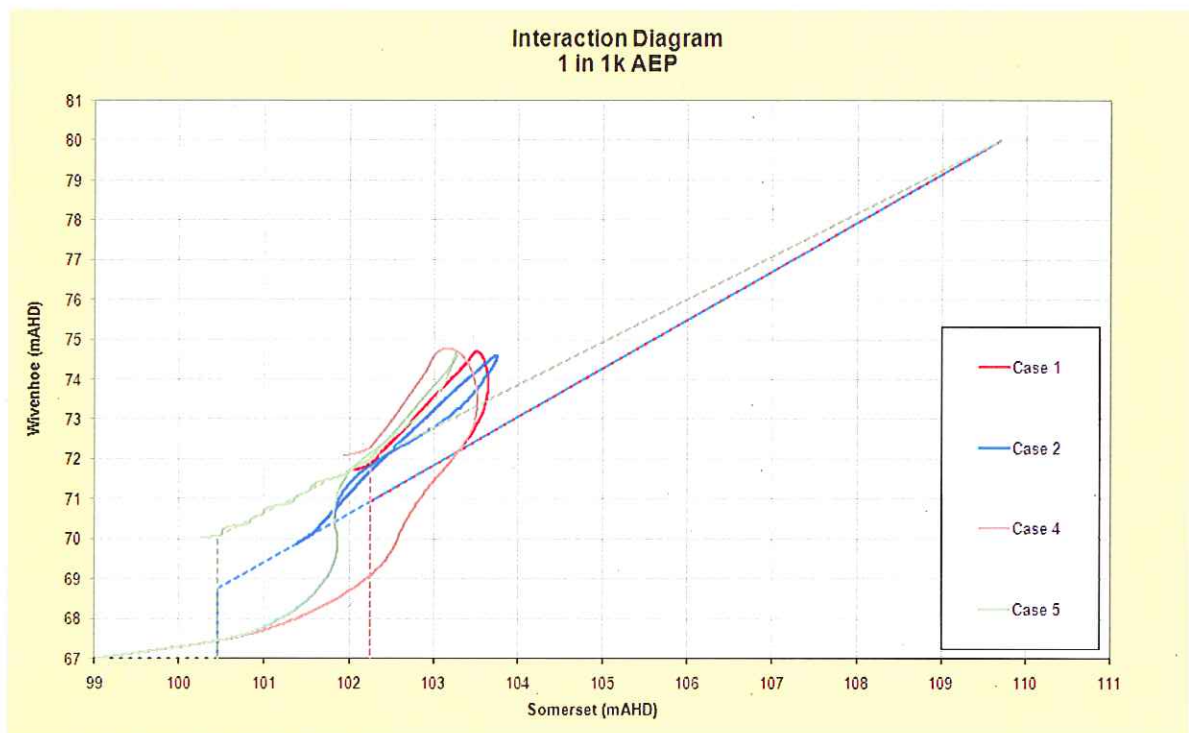


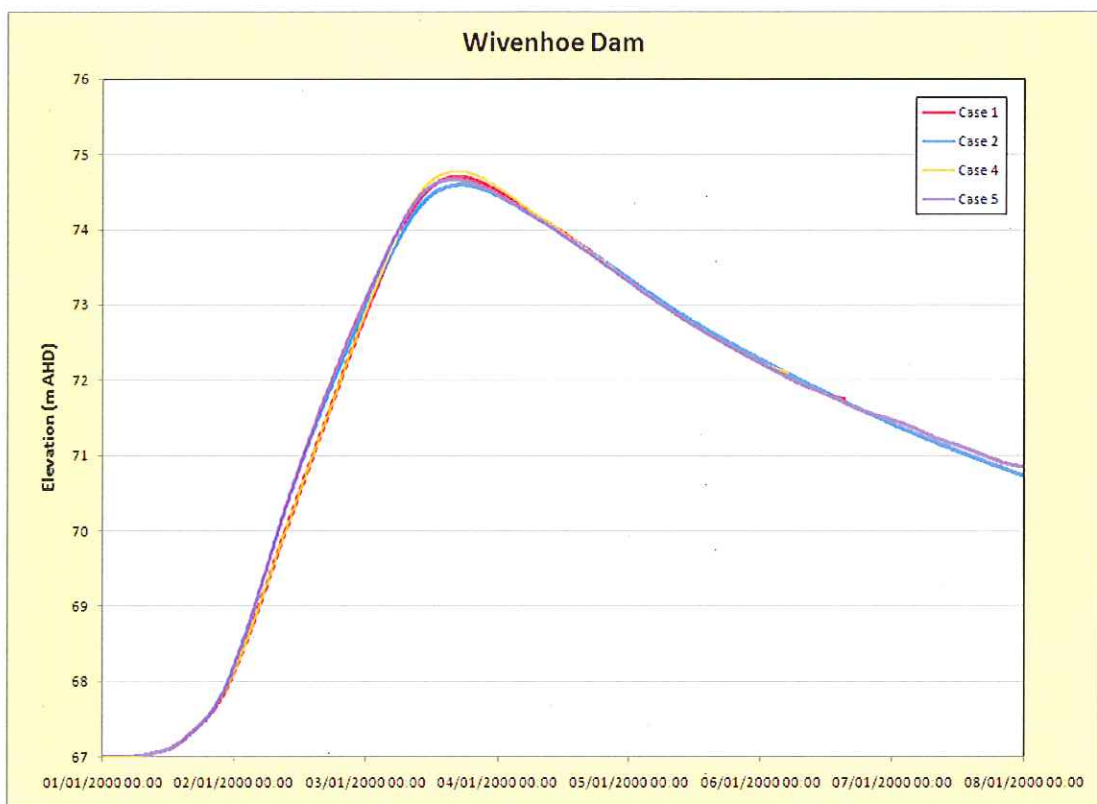
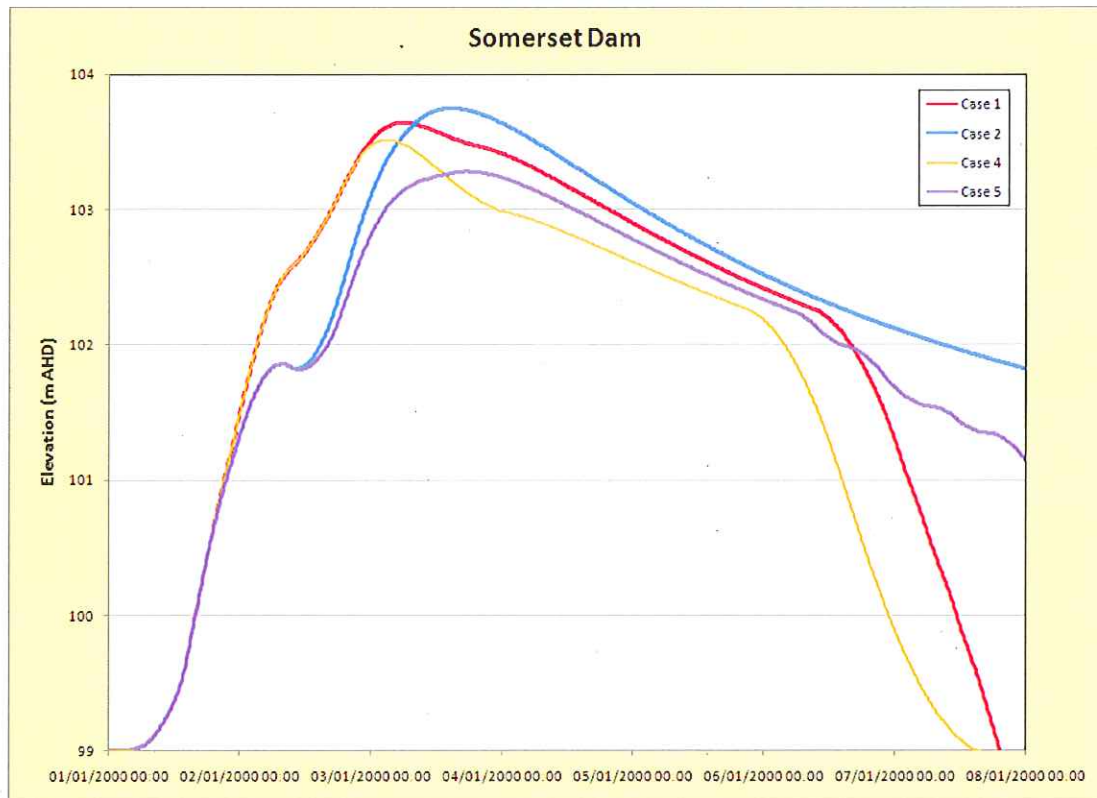




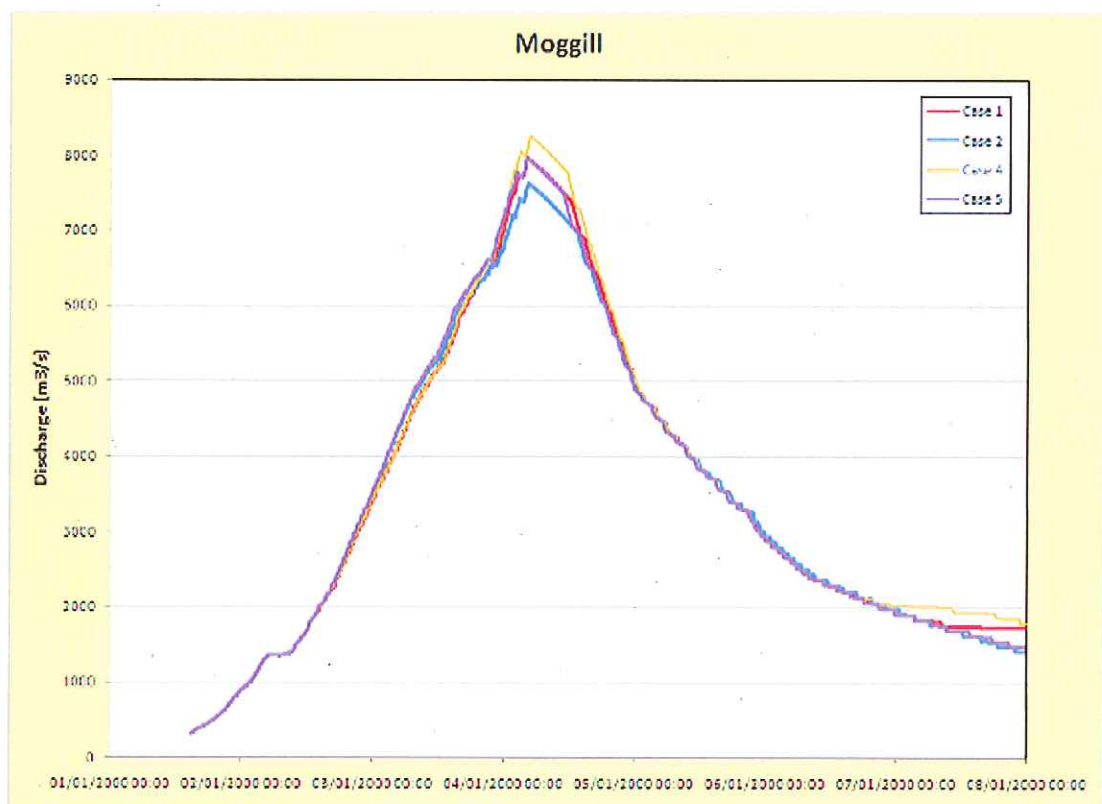
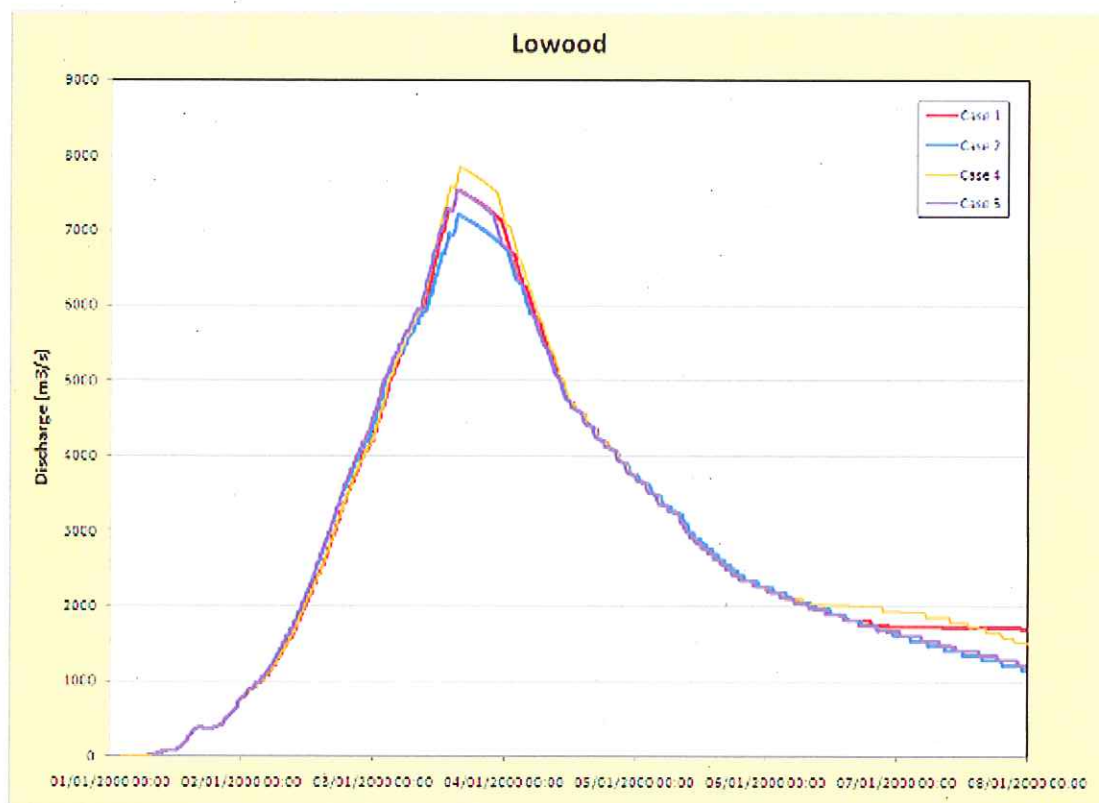
## 1 in 1,000 AEP

Item	Unit	Wivenhoe Operating Level			
		67.0 m AHD		68.5 m AHD	
		Somerset Operating Level		Somerset Operating Level	
		102.25	100.45	102.25	100.45
		Case 1	Case 2	Case 4	Case 5
Somerset Peak Elevation	m AHD	103.64	103.75	103.51	103.28
Wivenhoe Peak Elevation	m AHD	74.70	74.59	74.77	74.66
Lowood Peak Flow	m <sup>3</sup> /s	7,535	7,207	7,844	7,534
Moggill Peak Flow	m <sup>3</sup> /s	7,963	7,630	8,258	7,961



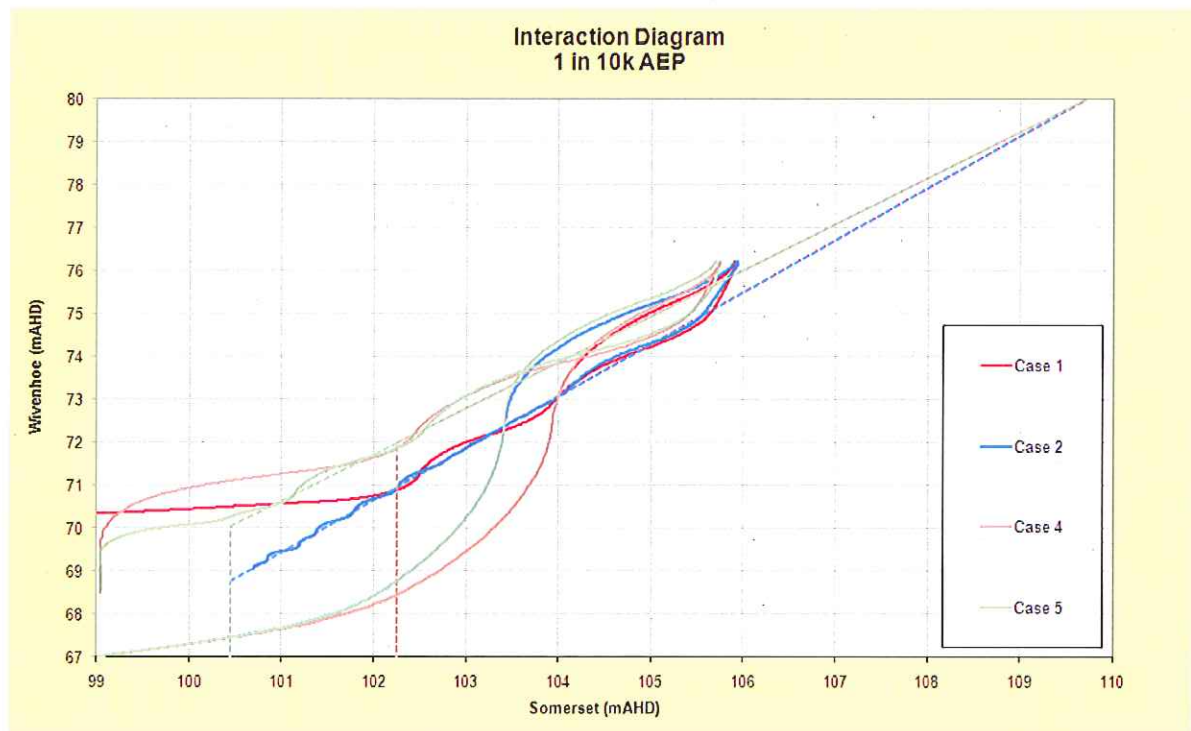


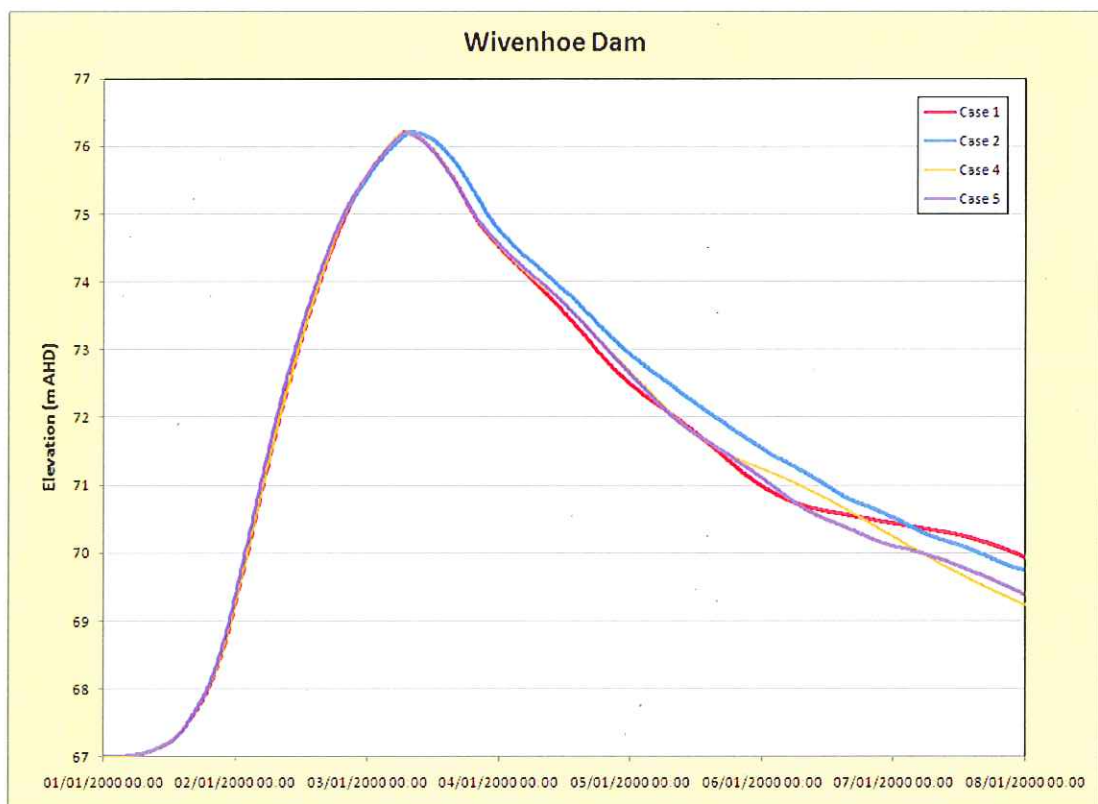
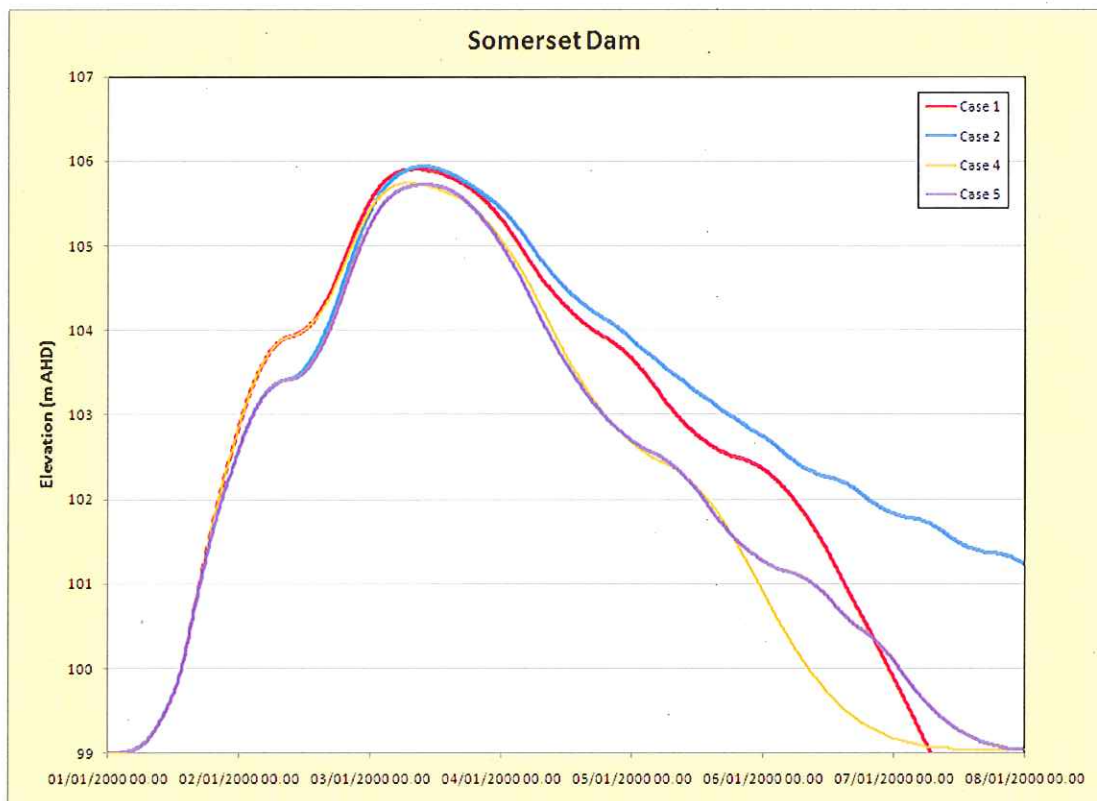


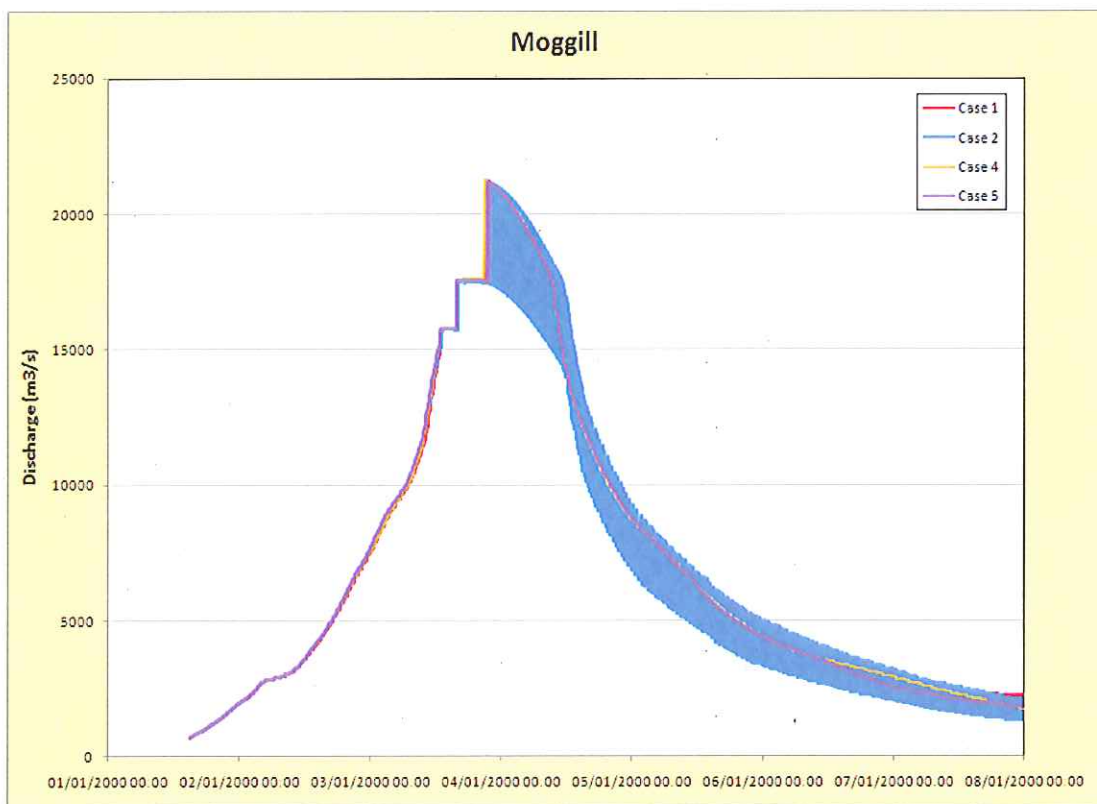
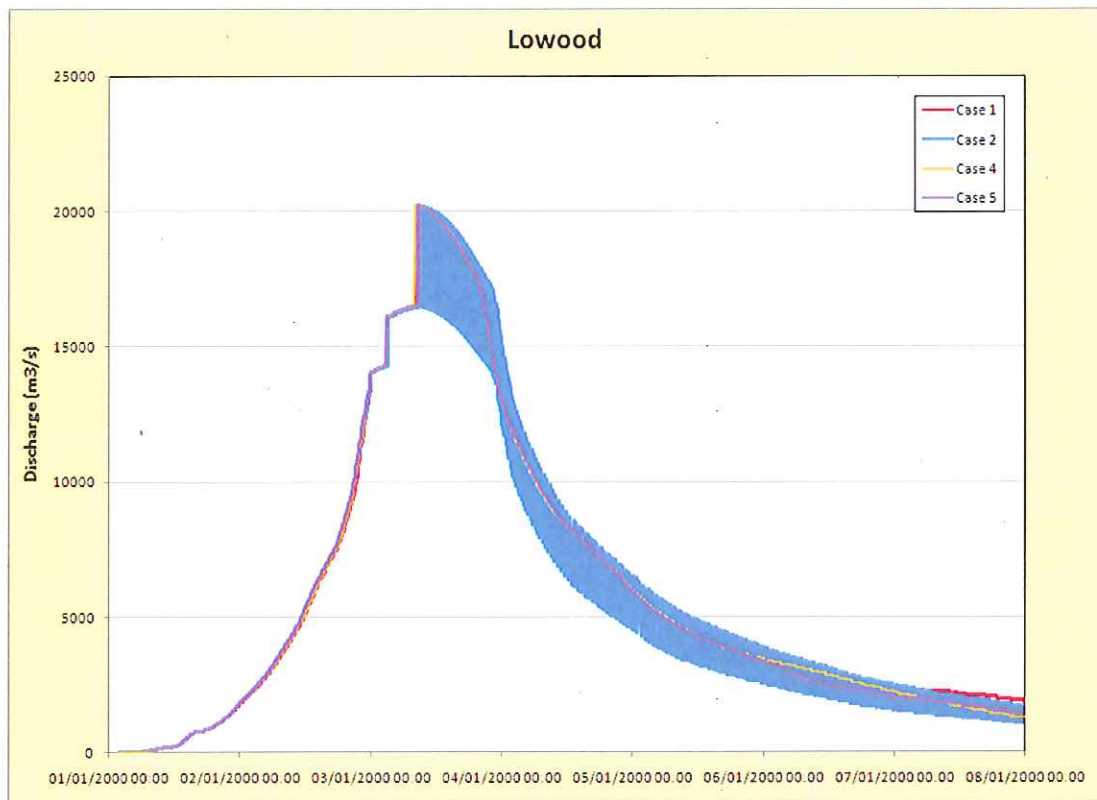


## 1 in 10,000 AEP

Item	Unit	Wivenhoe Operating Level			
		67.0 m AHD		68.5 m AHD	
		Somerset Operating Level		Somerset Operating Level	
		102.25	100.45	102.25	100.45
		Case 1	Case 2	Case 4	Case 5
Somerset Peak Elevation	m AHD	105.91	105.94	105.75	105.72
Wivenhoe Peak Elevation	m AHD	76.21	76.20	76.20	76.21
Lowood Peak Flow	m <sup>3</sup> /s	20,216	20,159	20,238	20,200
Moggill Peak Flow	m <sup>3</sup> /s	21,209	21,085	21,274	21,186



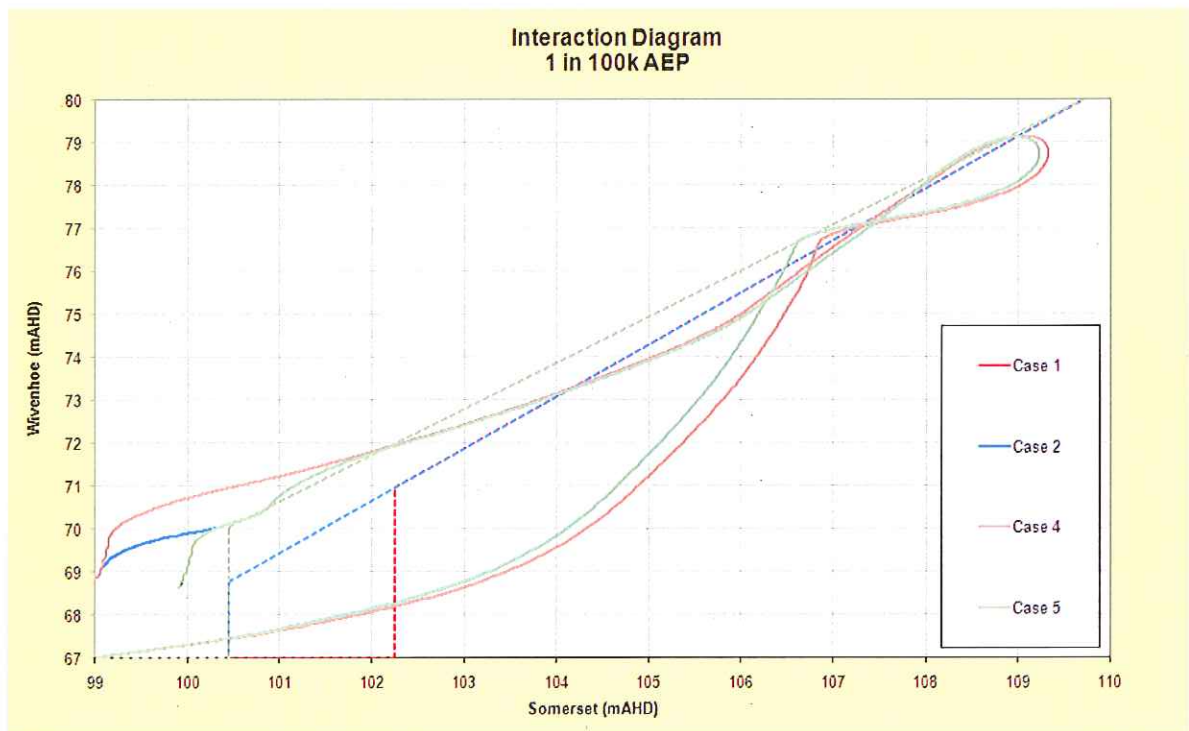


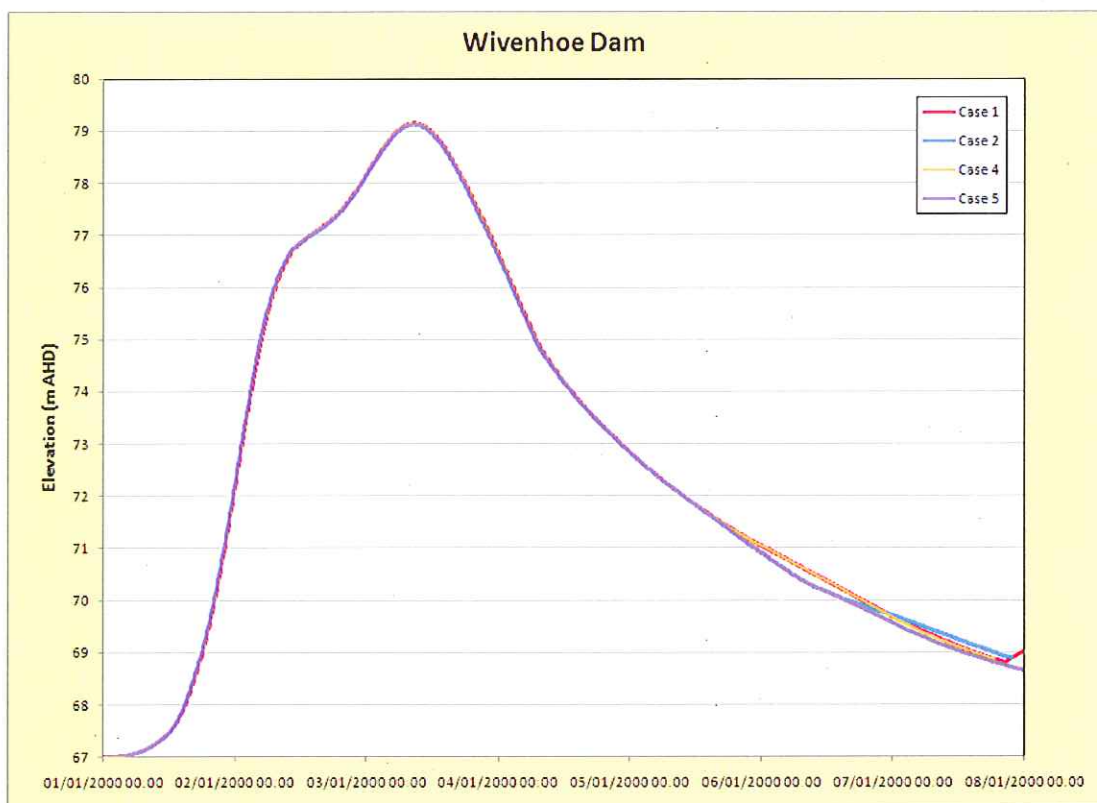
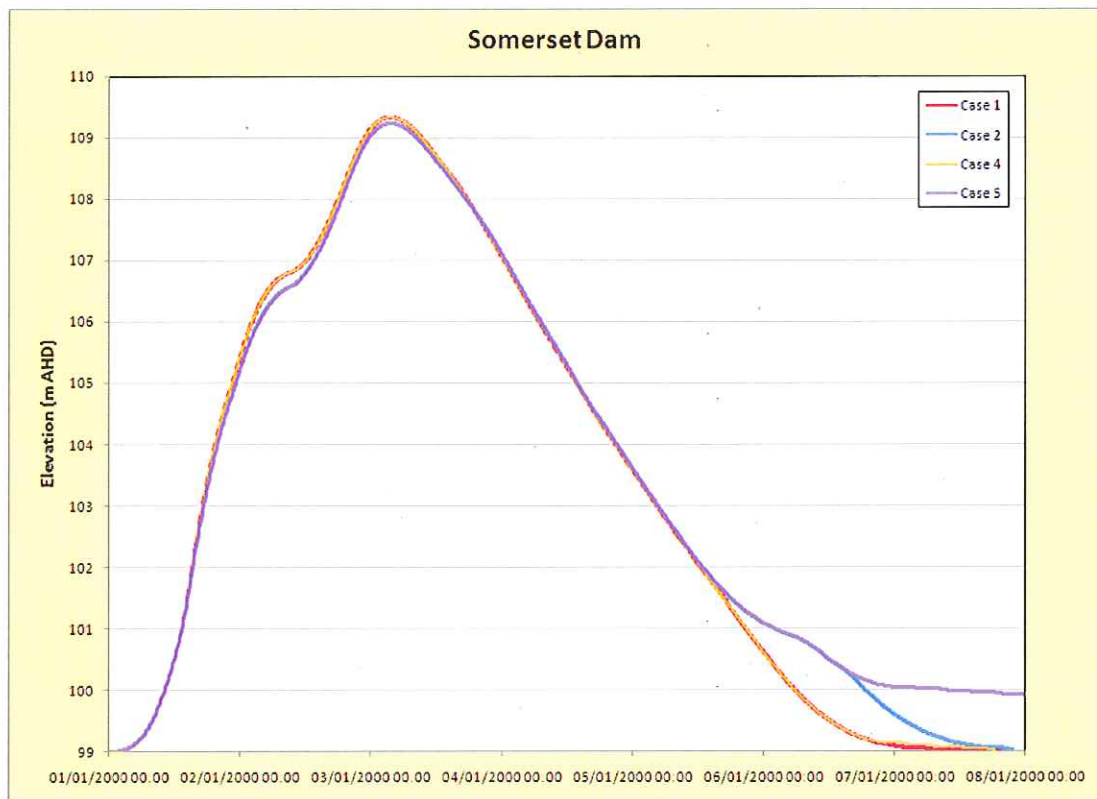


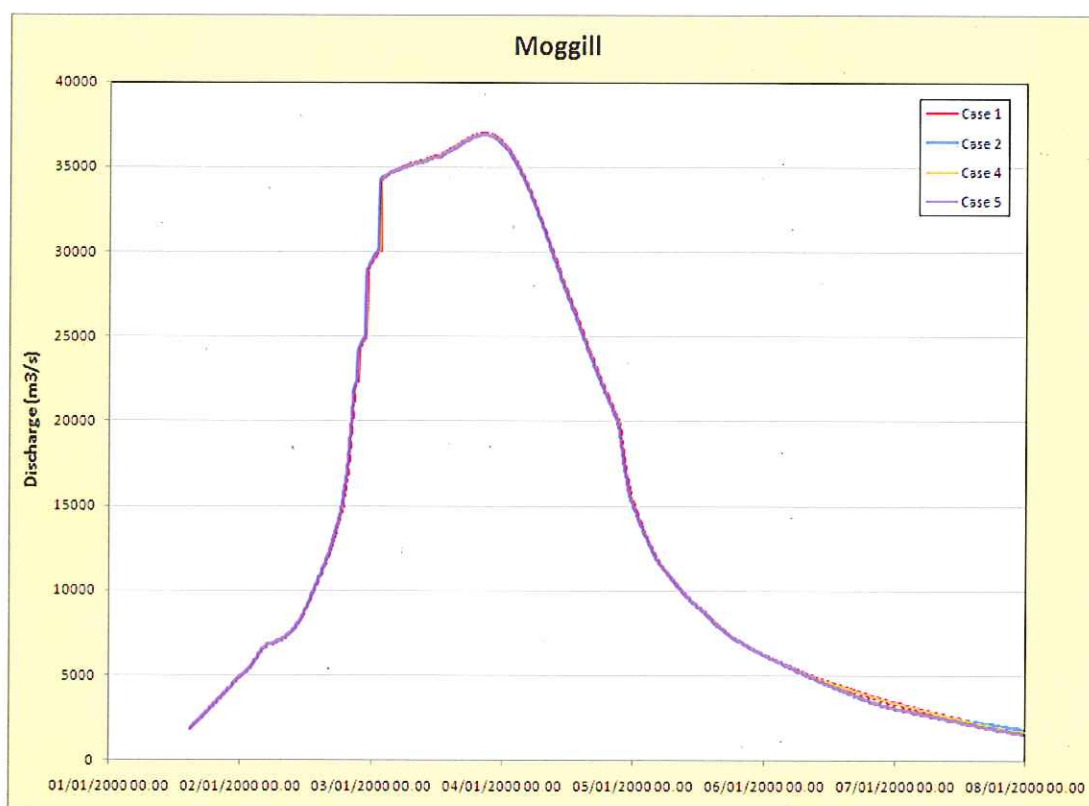
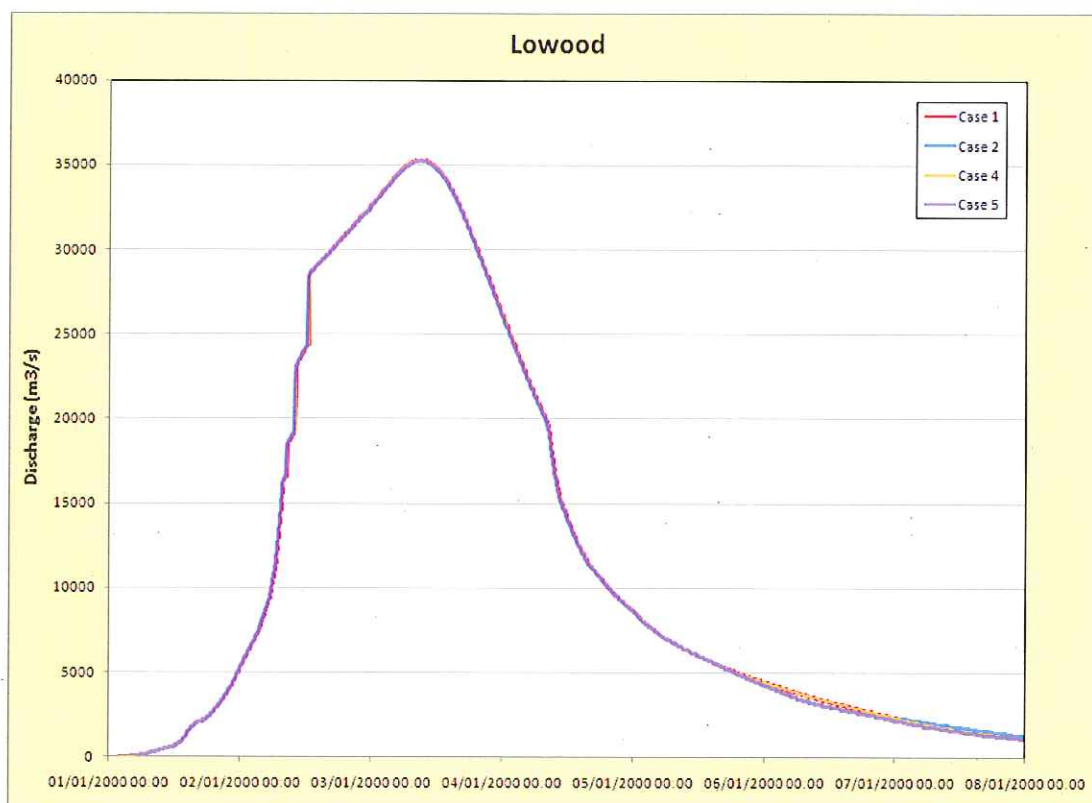


## 1 in 100,000 AEP

Item	Unit	Wivenhoe Operating Level			
		67.0 m AHD		68.5 m AHD	
		Somerset Operating Level		Somerset Operating Level	
		102.25	100.45	102.25	100.45
		Case 1	Case 2	Case 4	Case 5
Somerset Peak Elevation	m AHD	109.33	109.23	109.33	109.23
Wivenhoe Peak Elevation	m AHD	79.15	79.12	79.15	79.12
Lowood Peak Flow	m <sup>3</sup> /s	35,301	35,243	35,301	35,243
Moggill Peak Flow	m <sup>3</sup> /s	36,963	36,906	36,963	36,906

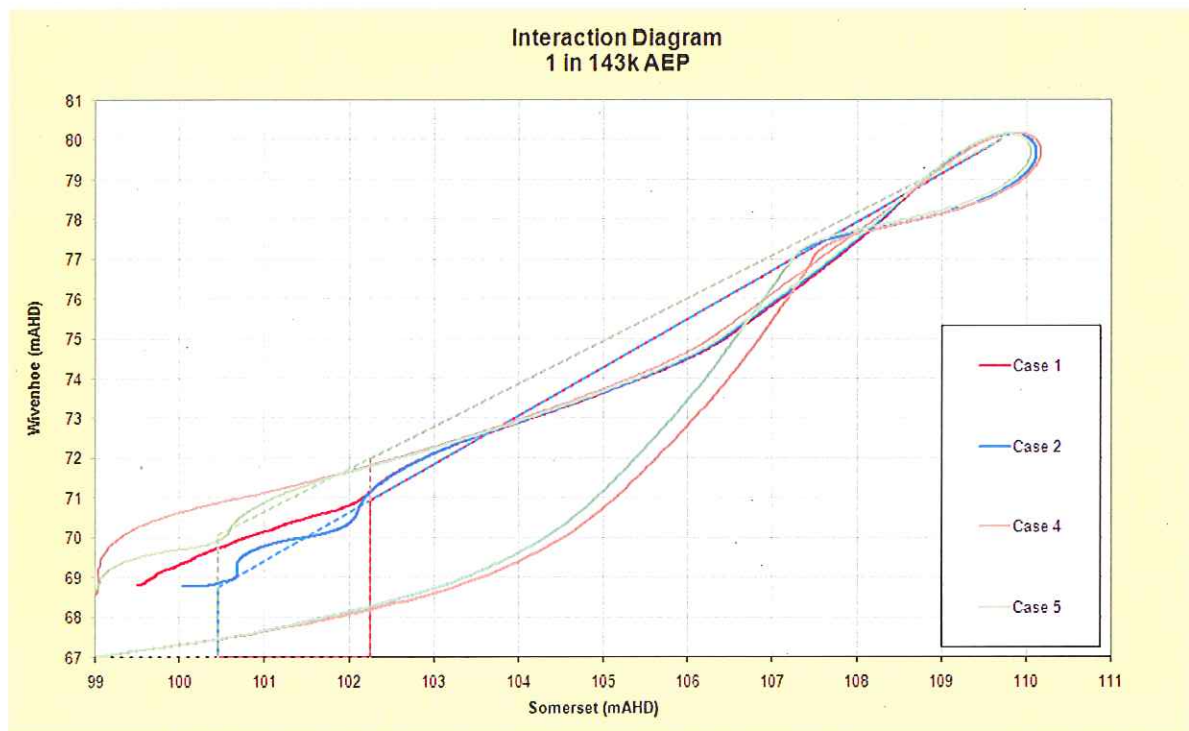




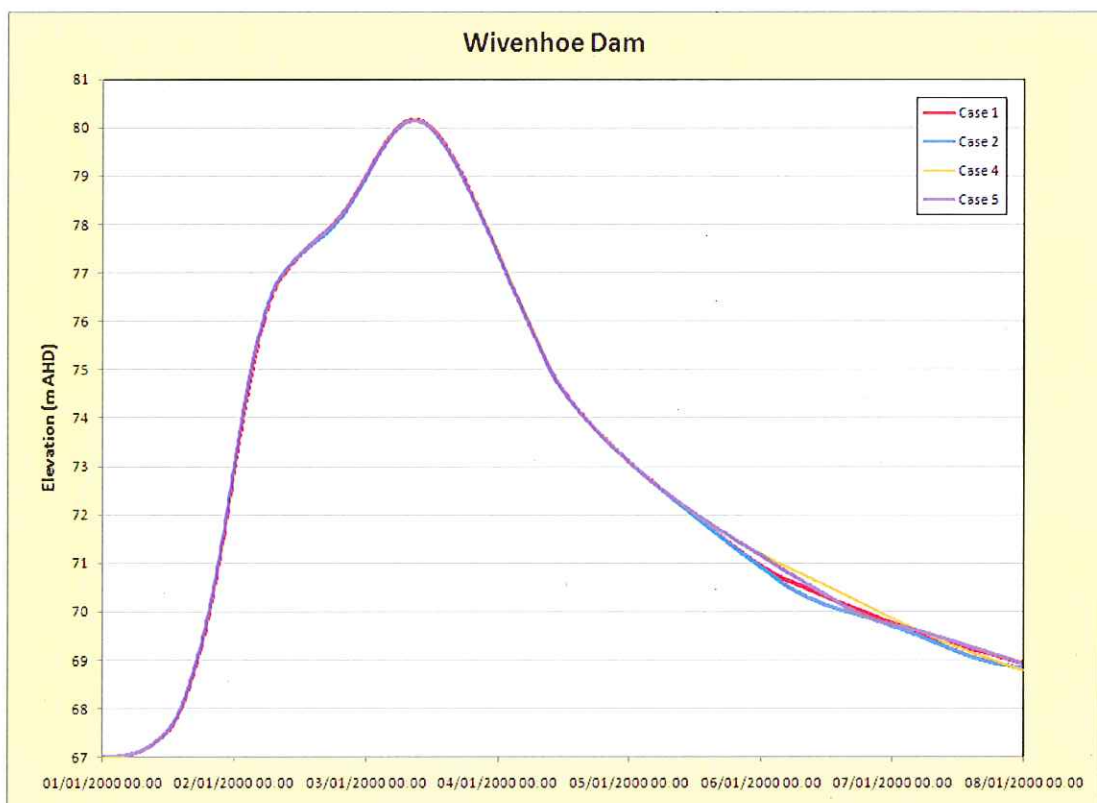
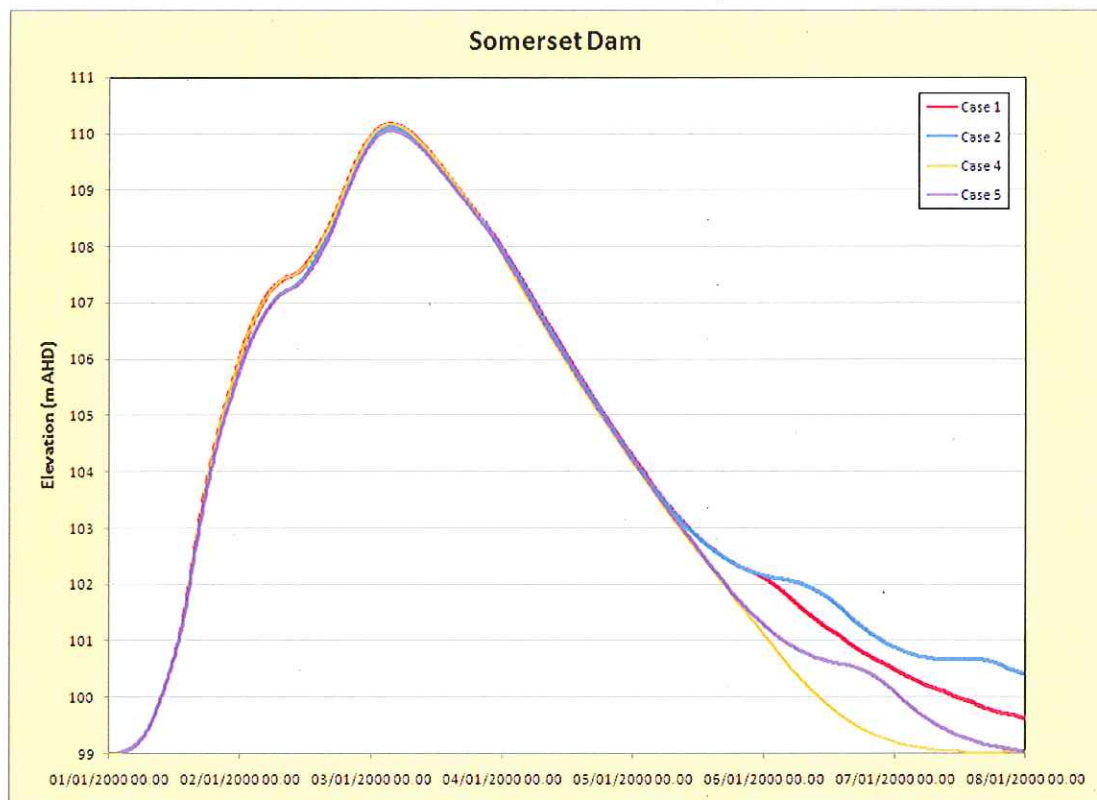


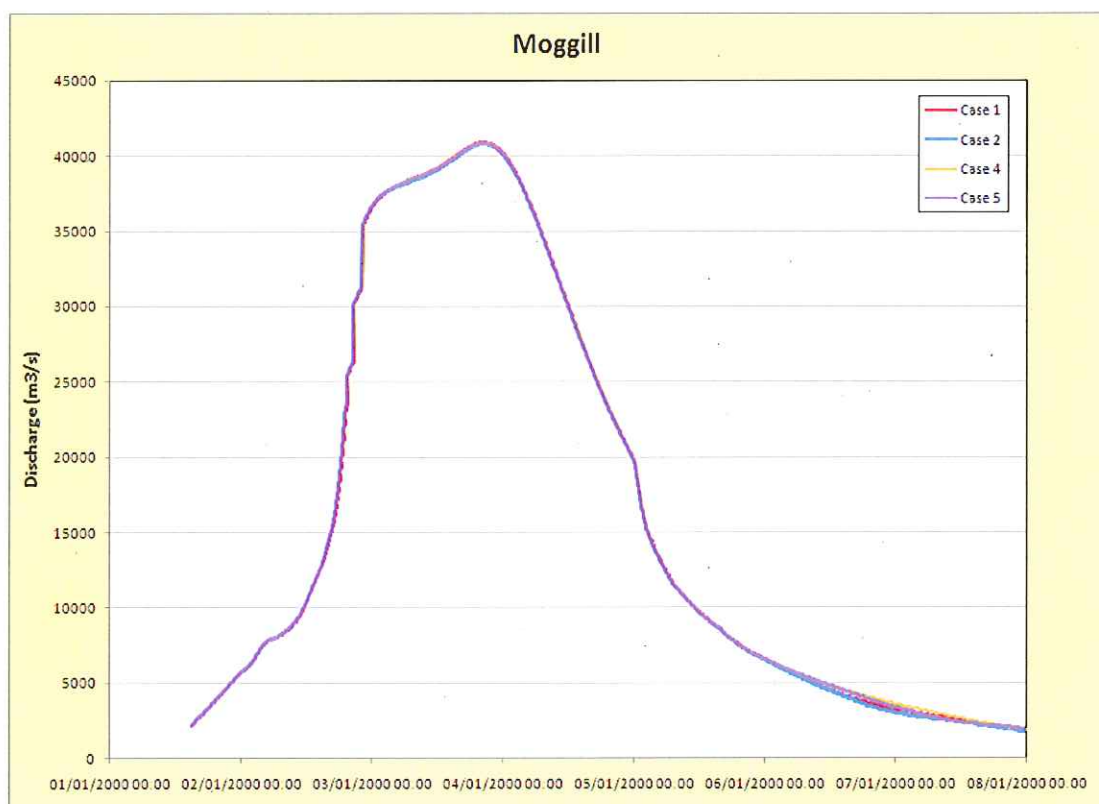
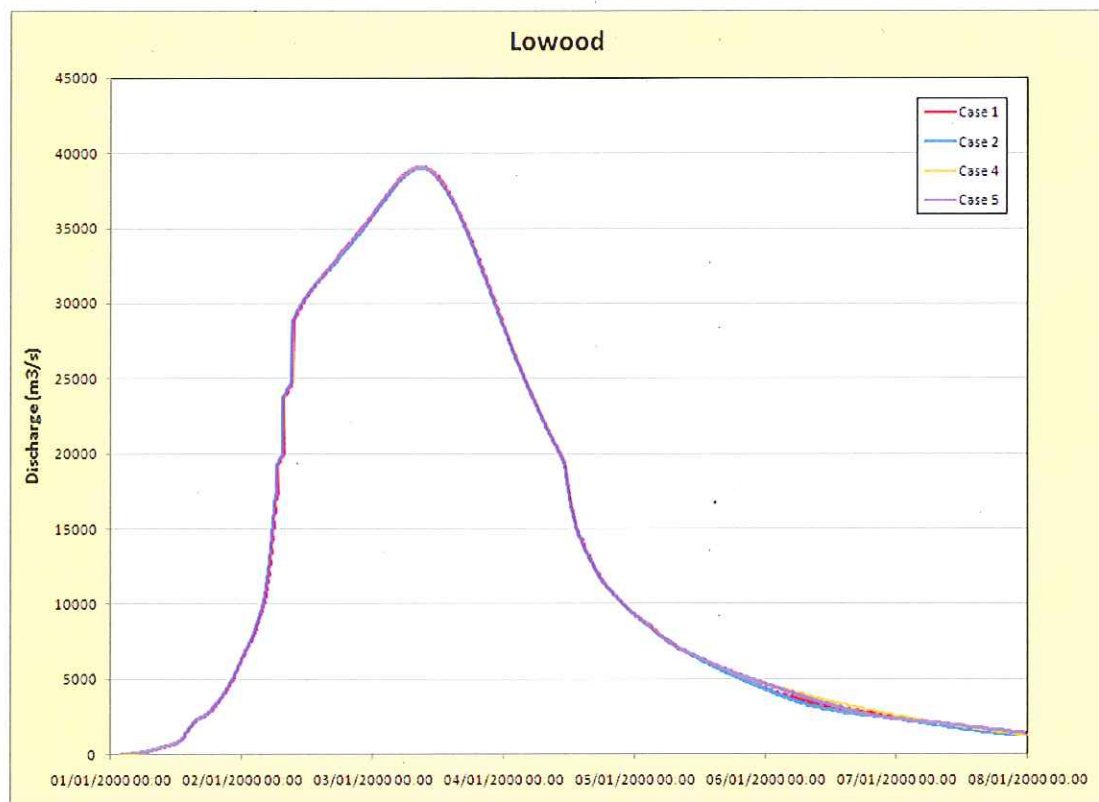
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Item	Unit	Wivenhoe Operating Level			
		67.0 m AHD		68.5 m AHD	
		Somerset Operating Level		Somerset Operating Level	
		102.25	100.45	102.25	100.45
		Case 1	Case 2	Case 4	Case 5
Somerset Peak Elevation	m AHD	110.17	110.12	110.17	110.05
Wivenhoe Peak Elevation	m AHD	80.17	80.14	80.17	80.15
Lowood Peak Flow	m <sup>3</sup> /s	39,066	38,996	39,066	39,018
Moggill Peak Flow	m <sup>3</sup> /s	40,868	40,796	40,868	40,823







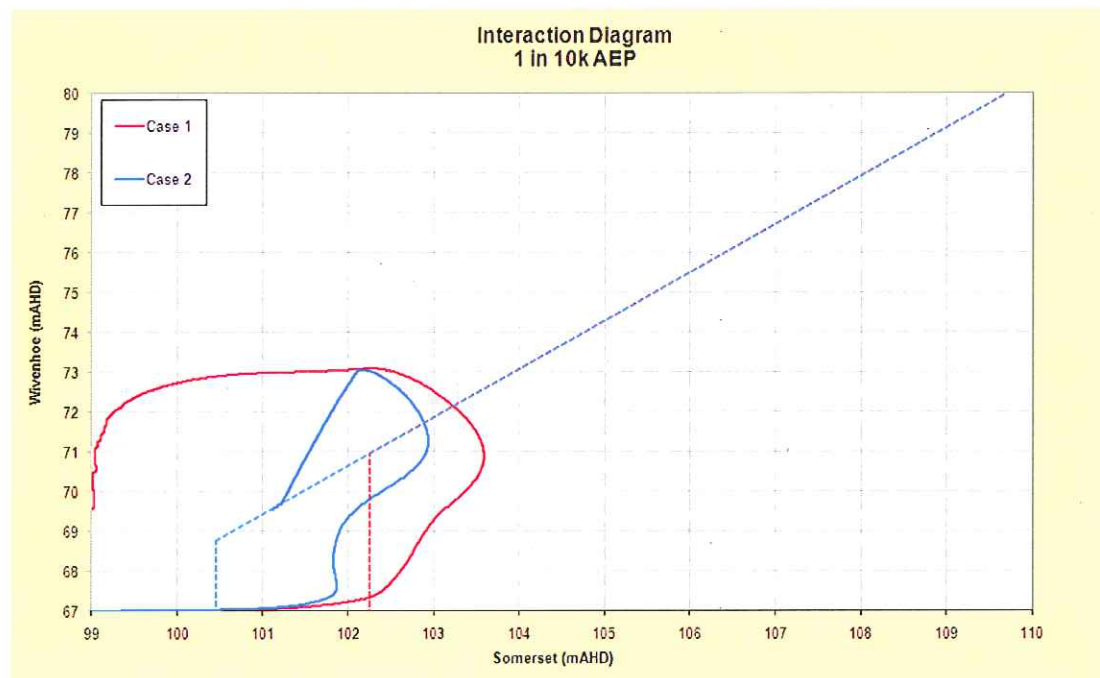


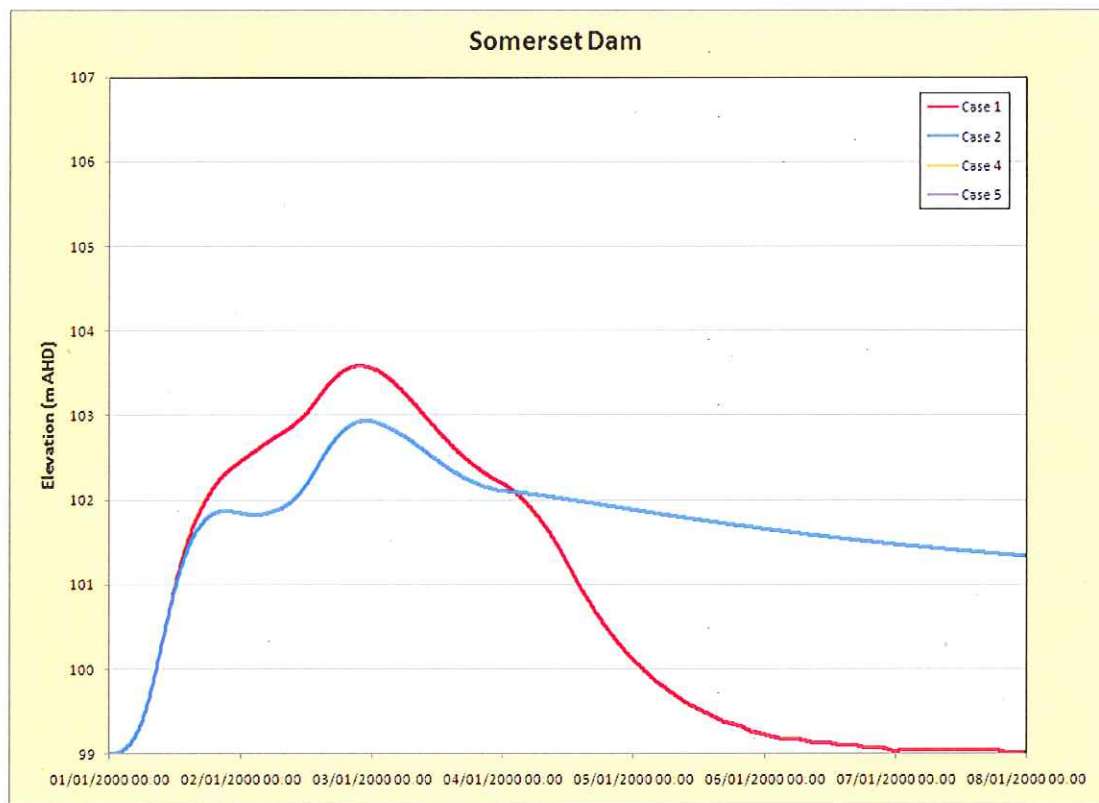
## Appendix C

### Somerset Centred Results

#### 1 in 100 AEP

Item	Unit	Wivenhoe Operating Level	
		67.0 m AHD	
		Somerset Operating Level	
		102.25	100.45
		Case 1	Case 2
Somerset Peak Elevation	m AHD	103.59	102.93

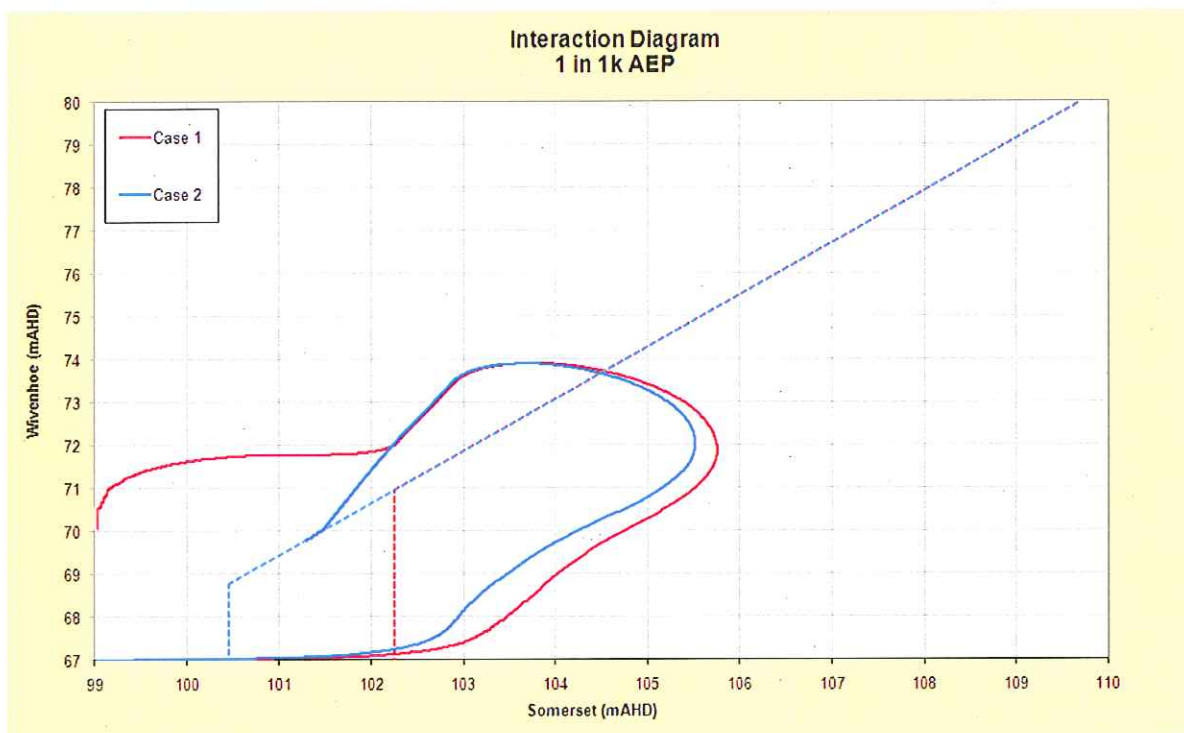


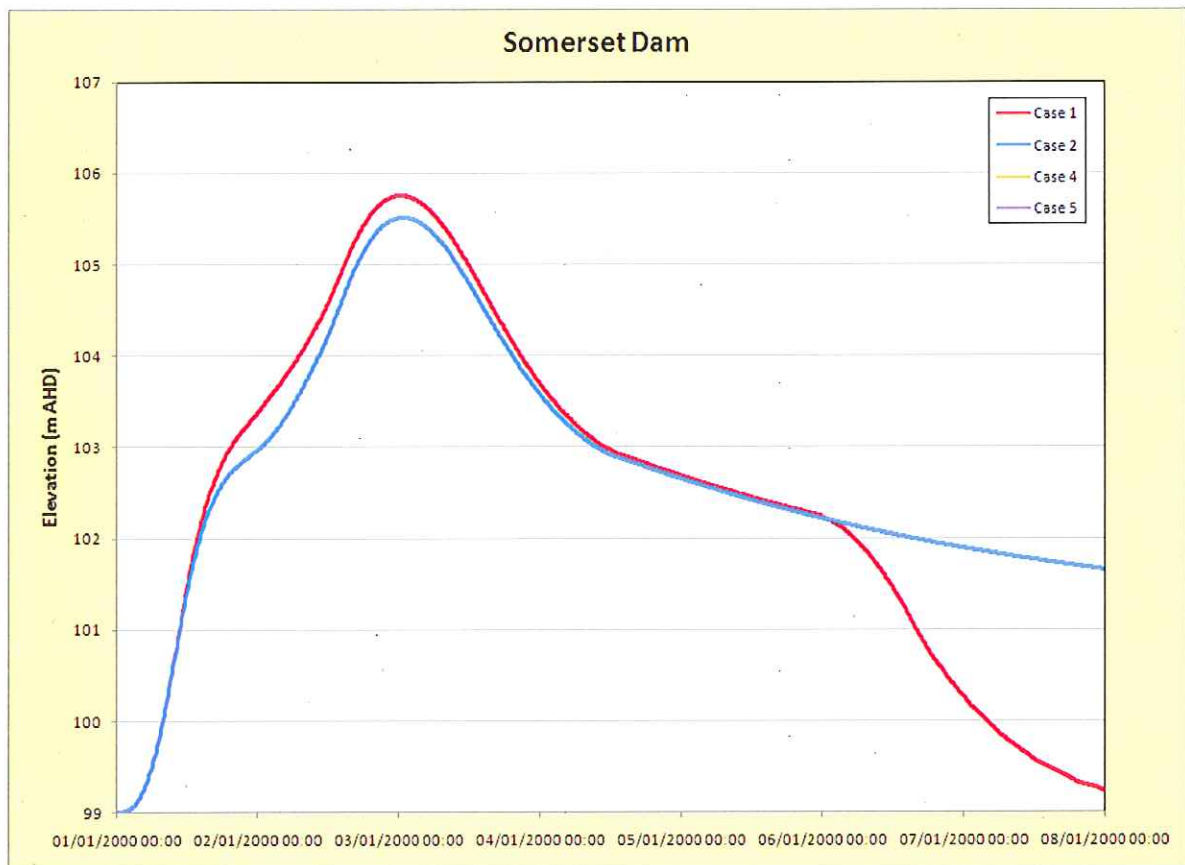




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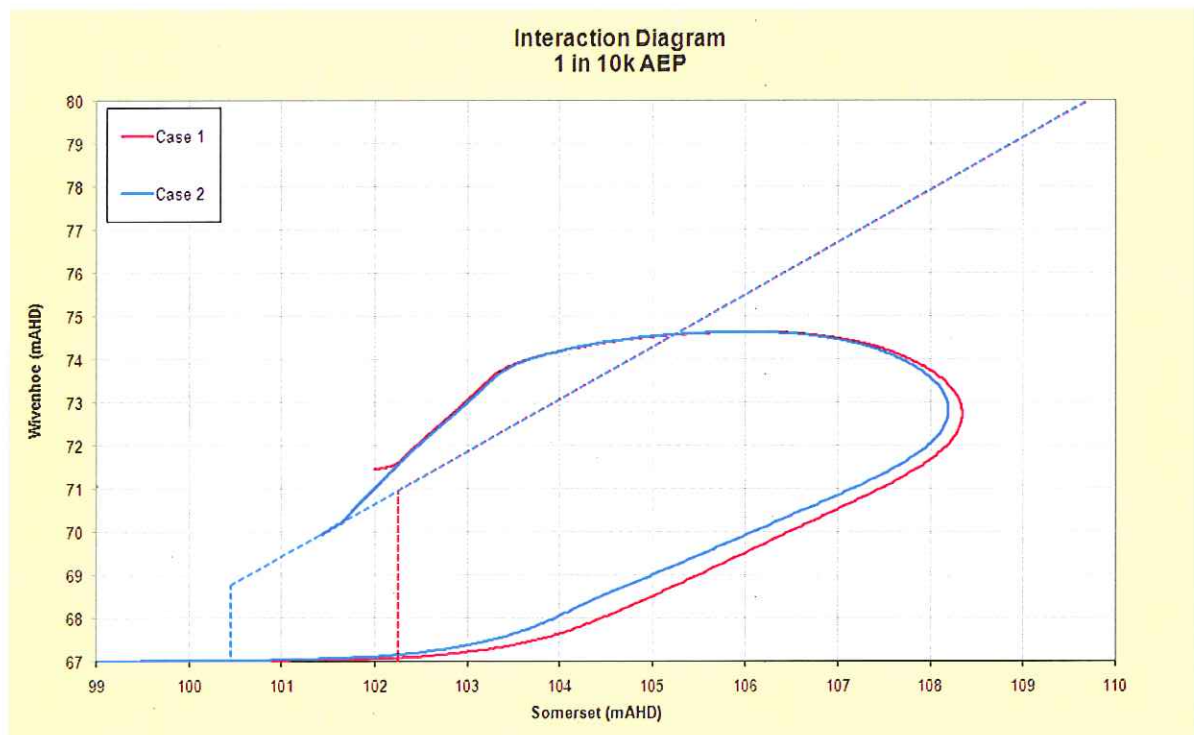
Item	Unit	Wivenhoe Operating Level	
		67.0 m AHD	
		Somerset Operating Level	
		102.25	100.45
		Case 1	Case 2
Somerset Peak Elevation	m AHD	105.75	105.51

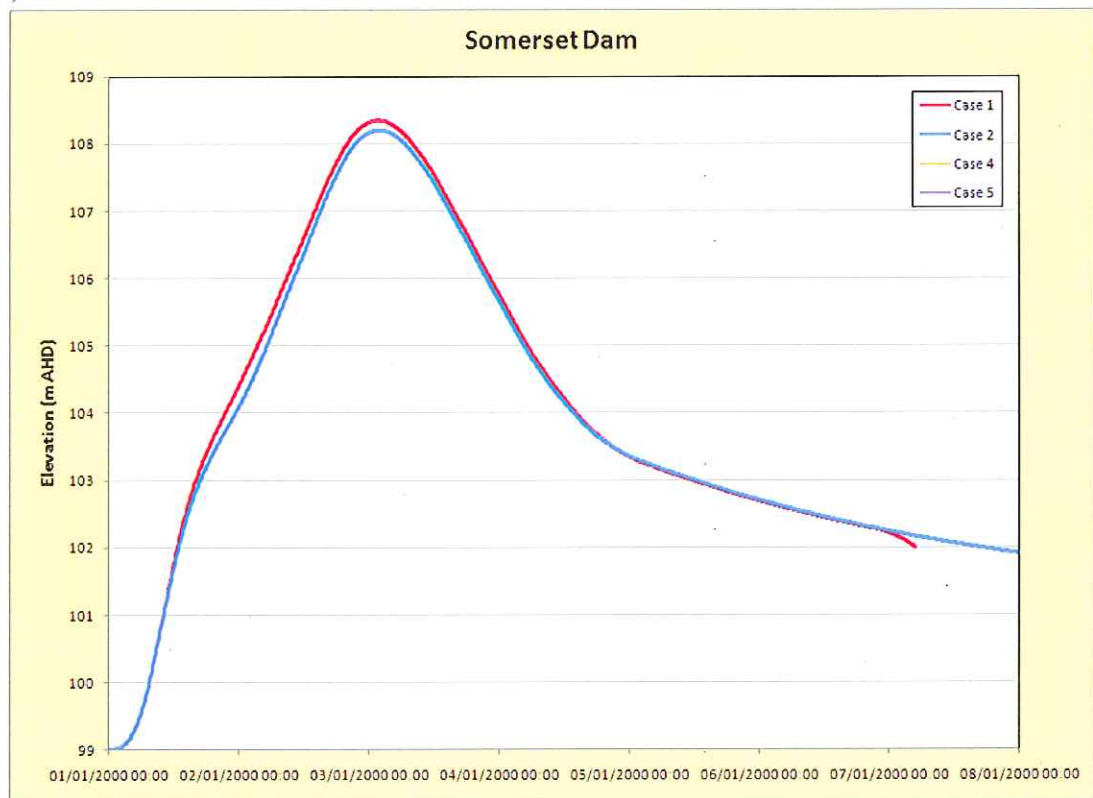




## 1 in 10,000 AEP

Item	Unit	Wivenhoe Operating Level	
		67.0 m AHD	
		Somerset Operating Level	
		102.25	100.45
		Case 1	Case 2
Somerset Peak Elevation	m AHD	108.34	108.20

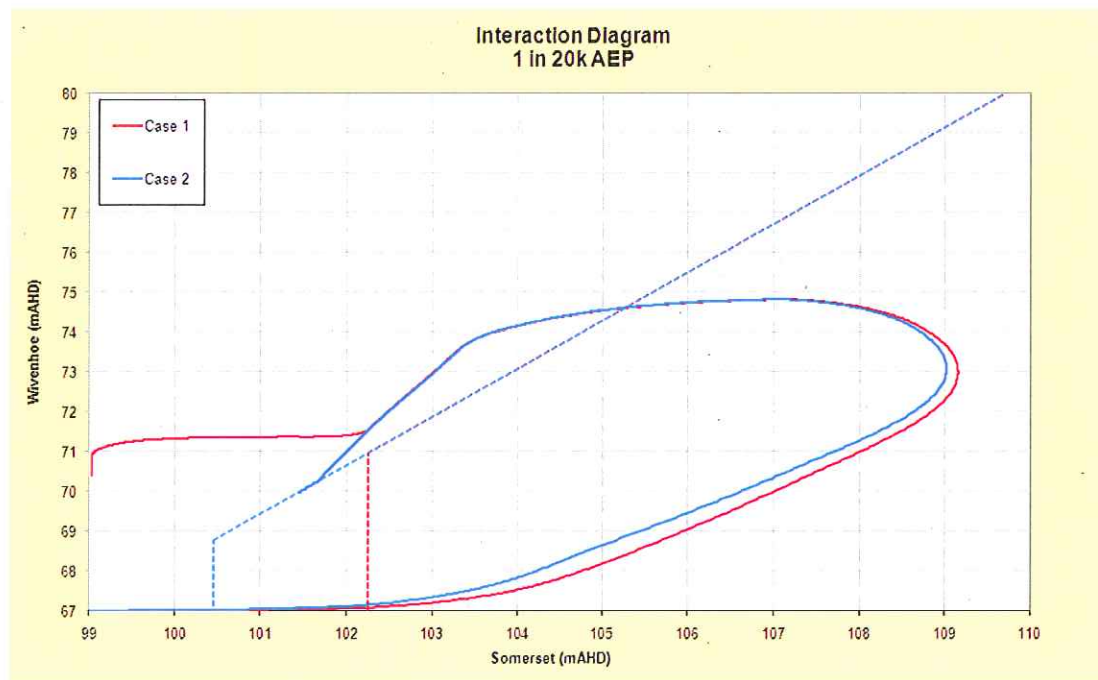


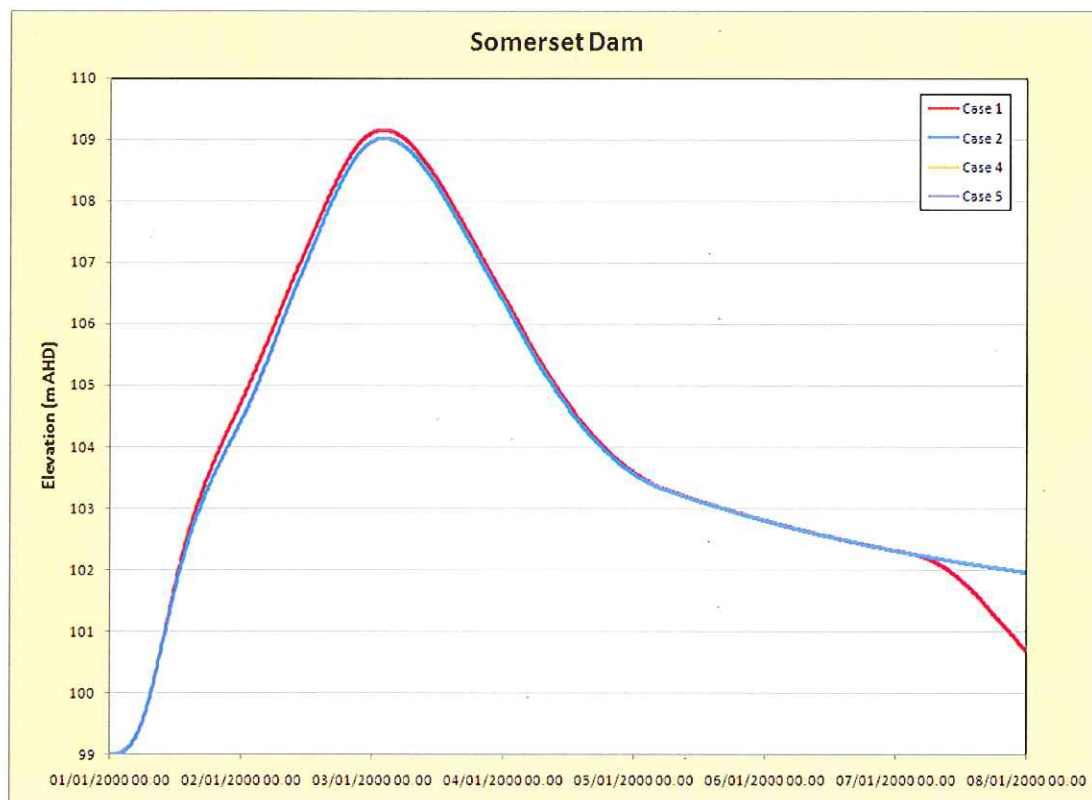




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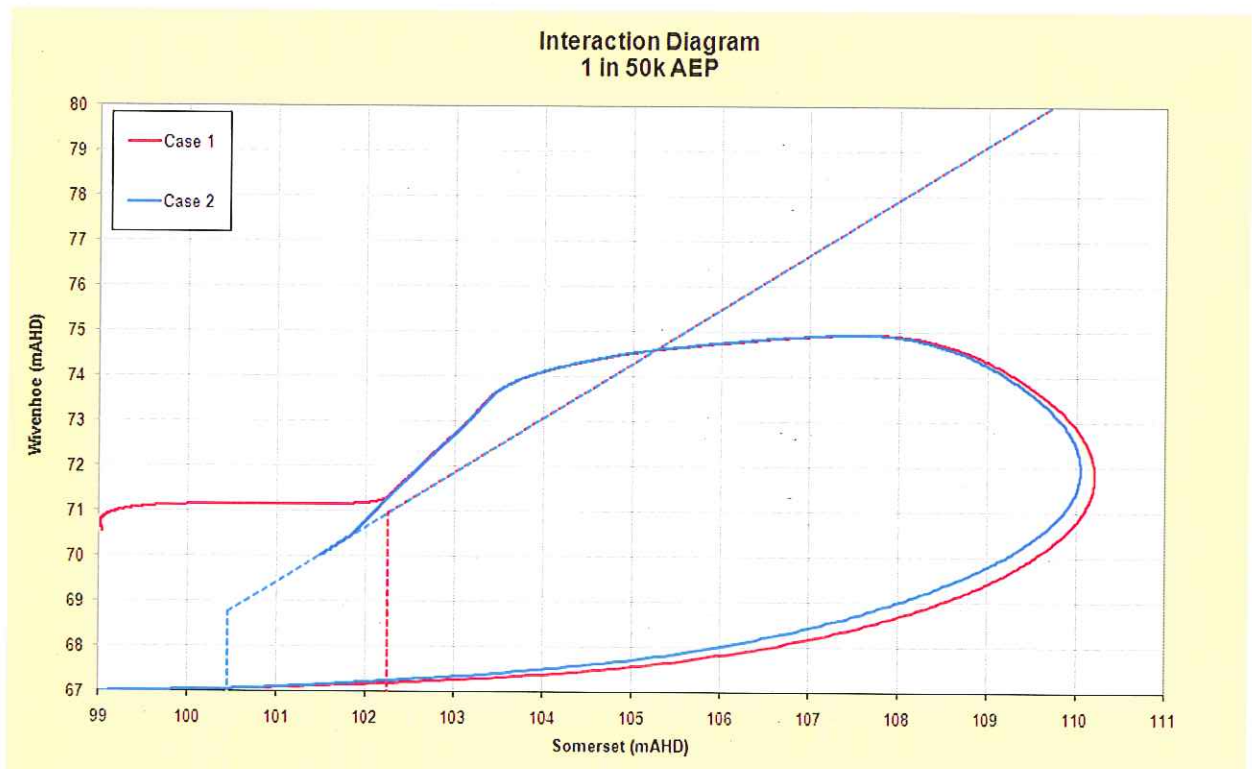
Item	Unit	Wivenhoe Operating Level	
		67.0 m AHD	
		Somerset Operating Level	
		102.25	100.45
		Case 1	Case 2
Somerset Peak Elevation	m AHD	109.15	109.02





## 1 in 50,000 AEP

Item	Unit	Wivenhoe Operating Level	
		67.0 m AHD	
		Somerset Operating Level	
		102.25	100.45
		Case 1	Case 2
Somerset Peak Elevation	m AHD	110.21	110.05



JK2

# MANUAL OF OPERATIONAL PROCEDURES FOR FLOOD MITIGATION AT WIVENHOE DAM AND SOMERSET DAM

## NOTES ON NOVEMBER 2009 REVISION

### INTRODUCTION

Seqwater has recently completed a comprehensive review and revision of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. This work was very extensive and has resulted in a major rewrite of the Manual. Changes to the Manual can be grouped into four broad categories, which are:

- Administrative Issues.
- Improved Operational Descriptions.
- Review of Manual Objectives.
- Technical Amendments.

Changes within these categories are explained in detail below.

### ADMINISTRATIVE ISSUES

Numerous reference changes to the manual were needed to account for the new water management institutional arrangements that were introduced by the Government in 2008. These reference changes resulted from the following:

- Change in relevant legislation to the Water Supply (Safety and Reliability) Act 2008.
- Change in relevant regulatory agency to the Department of Environment and Resource Management.
- Change in dam owner to the Queensland Bulk Water Supply Authority trading as Seqwater.
- Change in Agencies requiring information and holding controlled copies of the Manual in accordance with the Local Government Amalgamations of 2008.

None of these reference changes resulted in any change in operational procedure from the previous version of the Manual.

### IMPROVED OPERATIONAL DESCRIPTIONS

Flood Events impacting on Wivenhoe and Somerset dams are caused by actual rainfall events that can vary in intensity, duration and distribution over a catchment area in excess of 10000 square kilometres. Accordingly, there is an infinite number of Flood Event scenarios that the Manual needs

to account for. Previously, the operational approach taken in the Manual was procedural in nature. However, given the infinite scenarios to be catered for, it was obviously not possible for the Manual to contain a specific procedure relating to every possible flood event scenario. Therefore, following extensive discussion with both the Regulator and the Flood Operations Engineers and also taking into account the experience of previous flood events, a more practical approach was introduced.

The new approach does not change the original operational intent contained in the previous Manual, but does allow the optimisation of flood mitigation benefits, depending on the understanding of the magnitude of the flood event at any point in time. The approach provides strategies and objectives to guide flood operational decision making. The strategy chosen at any point in time will depend on the actual levels in the dams and the following predictions, which are to be made using the best forecast rainfall and stream flow information available at the time:

- Maximum storage levels in Wivenhoe and Somerset Dams.
- Peak flow rate at the Lowood Gauge (excluding Wivenhoe Dam releases).
- Peak flow rate at the Moggill Gauge (excluding Wivenhoe Dam releases).

Strategies are likely to change during a flood event as forecasts change and rain is received in the catchments. It is not possible to predict the range of strategies that will be used during the course of a flood event at the commencement of the event. Strategies are changed in response to changing rainfall forecasts and stream flow conditions to maximise the flood mitigation benefits of the dams.

Flowcharts have been provided in the updated Manual to assist in Strategy selection. Additionally improved detail was provided within each strategy to clarify the intent of the Manual. This improved detail was wholly consistent with the intent and objectives of the previous version. Finally, additional detail was provided to cater for the following scenarios that were not covered in the previous version:

- **Potential to avoid a fuse plug initiation at Wivenhoe Dam by either initiating an early release of water from Wivenhoe Dam or by holding water back in Somerset Dam.** Neither action is allowed to adversely impact on the safety of the dams. In practice, the possibility of such a situation arising is considered extremely unlikely and will only occur if the event is well understood (i.e. no significant further rain is forecast for the event) and the peak flood level in Wivenhoe roughly corresponds to a fuse plug initiation level. However, it was thought that the situation should be covered off in the Manual for completeness.
- **Somerset Dam exceeds full supply level, while Wivenhoe Dam does not.** This scenario is of minor to insignificant risk, because it does not result in releases of water from Wivenhoe Dam. However, the situation was encountered in May 2009 and it was again thought that the situation should be covered off in the Manual for completeness.



## REVIEW OF MANUAL OBJECTIVES

The Flood Mitigation Objectives contained in the previous version of the Manual in order of importance were:

- 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;
- Minimise disruption and impact upon Wivenhoe Power Station;
- Minimise disruption to navigation in the Brisbane River.

Following investigations, it was determined that decisions made during flood events have never given consideration to either minimising disruption and impact upon Wivenhoe Power Station or minimising disruption to navigation in the Brisbane River.

The Wivenhoe Power Station is not adversely impacted to any degree until the Dam Levels exceed EL 74.0 AHD. At these levels, the primary consideration is only the structural safety of the dam and minimising disruption to the power station is not a consideration.

Similarly, at the stage in a flood event where Wivenhoe Dam outflows potentially disrupt navigation in the Brisbane River, the higher level flood objectives dominate decision making processes. Additionally, it is not currently possible to derive a sensible relationship between releases from Wivenhoe Dam and disruption to navigation in the Brisbane River. Recent experience showed that one of the primary disruption mechanisms associated with the Brisbane River navigation is the cancellation of the public transport "CityCat" services. Such cancellations occurred in May 2009, when releases were not being made from Wivenhoe Dam. It is understood that the cancellations at this time were a function of factors associated with debris entering the river system downstream of the dam. Presently, it is not considered possible to incorporate such factors in flood release decision making processes.

Regardless of the difficulties, to provide recognition that in some circumstances considerations of disruption to navigation may be required, the updated Manual allows disruption to navigation in the Brisbane River to be taken into account when considering disruption to rural areas downstream of the dam. The updated manual states however that consideration of navigation is generally secondary to considerations associated with reducing bridge inundation downstream of Wivenhoe Dam.

With consideration to these changes, the Flood Mitigation Objectives contained in the updated version of the Manual in order of importance are:

- 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.

The first three objectives are unchanged from the previous version, while the last two objectives were added to reflect current operating practice. Naturally, at the end of an event, a primary objective is to ensure that the dams are at full supply levels. Additionally in the drain down phase of the event, there has always been an objective to minimise impacts to riparian flora and fauna, particularly critical species such as lung fish.

## TECHNICAL AMMENDMENTS

To maximise the combined flood mitigation benefits of Wivenhoe and Somerset dams, the operation of the dams during floods is interdependent. To determine the optimal flood mitigation strategy, a Somerset-Wivenhoe Operating Target Line is used as a guide to optimise flood mitigation benefits, while protecting the structural safety of the dams.

The existing Somerset-Wivenhoe Operating Target Line required review because it did not properly account for the raising of Wivenhoe Dam and construction of an Auxiliary Spillway that occurred in 2005. It also did not properly account for the revised failure level of Somerset Dam or for scenarios associated with floods centred on the Somerset Catchment.

A report was prepared to examine these issues in detail and the results of this report are the basis for the bulk of the technical amendments contained in the updated manual, particularly in relation to changes to the Somerset-Wivenhoe Operating Target Line. The report is entitled "Somerset-Wivenhoe Interaction Study (October 2009)". This report should be read to understand the nature and reasons for these amendments.

The other significant technical amendment related to the simplification of the loss of communications procedures. The Wivenhoe Dam minimum gate opening sequence was simplified by providing opening increments in steps of either 50 or 100 millimetres. This made the sequence easier to follow for dam operators and had very little change on dam outflows. The other change to the table was made to correct an inconsistency that allowed dam outflows of greater than 4000 m<sup>3</sup>/s at dam levels less than EL 74.0 m AHD. This was considered to be an error in the previous manual as it is inconsistent with the flood manual objectives. Wivenhoe gate opening sequences were also made consistent between "normal communications" and "loss of communications" procedures.

The Somerset Dam Loss of Communication procedure was also simplified to provide straightforward sluice opening and closing procedures in accordance with the Somerset-Wivenhoe Operating Target Line. The simplified procedure was extensively modelled and was found to consistently provide

better results in terms of optimising the flood mitigation benefits of the two dams. This modelling is contained in the Somerset-Wivenhoe Interaction Study (October 2009).

When contacting Seqwater please ask for John Tibaldi

Telephone: [REDACTED]

Reference: 09-000047

3 December 2009

Mr Peter Allen  
Director Dam Safety (Water Supply)  
Department of Natural Resources and Water  
PO Box 2454  
BRISBANE QLD 4001

Dear Mr Allen

**MANUAL OF OPERATIONAL PROCEDURES FOR FLOOD MITIGATION AT WIVENHOE DAM AND SOMERSET DAM**

As you are aware, Seqwater has recently completed a comprehensive review and revision of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. This work has been very extensive and has resulted in a major rewrite of the existing Manual. Your assistance with this work is acknowledged and I would like to thank you for your input.

Now that the revision is complete, I request that you approve the updated Manual by gazette notice, in accordance with the provisions of Chapter 4 (Part 2) of the Water Supply (Safety and Reliability) Act 2008. Two copies of the updated Manual are attached and John Tibaldi will liaise with you directly in relation to the provision of a suitable electronic document to facilitate gazettal. Also attached is a copy of the Somerset -- Wivenhoe Interaction Study, that was the basis of the technical changes in the updated Manual; and a short paper that summarizes the changes made to the Manual.

I trust the information provided is in accordance with your requirements and I ask that you contact me on [REDACTED] should any issues arise that impact on the requested approval.

Yours faithfully

[REDACTED]  
Peter Borrows  
CEO

**Attachments:**

- Summary of Manual changes.
- Revised Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, November 2009 x 2.
- Somerset -- Wivenhoe Interaction Study (October 2009).