Brisbane Flooding January 2011

An Avoidable Disaster

20 March 2011

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[redacted]

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Contents

1. INTRODUCTION

This submission is considered relevant to the Queensland Floods Commission of Inquiry under Section 2(f) of the Terms of Reference (1).

Implementation of the systems operation plans for dams across the state and in particular the Wivenhoe and Somerset release strategy and an assessment of compliance with, and the suitability of the operational procedures relating to flood mitigation and dam safety.

This submission: -

- Solely addresses the period 4th to 14th January 2011.
- Reviews the apparent release strategy adopted for Wivenhoe and to a lesser extent Somerset, and its impact on flood mitigation and dam safety.
- Concentrates on issues at the two dams and in Brisbane but it is likely that these impacted the Brisbane River Valley and areas of both Lockyer Creek and the Bremer River.
- To a limited degree, compares the operational procedures adopted during this period with the requirements of the Manual of Operational Procedures for Flood Mitigation – Revision 7 (2) which is the current manual.

Severe limitations have been imposed on the capacity to perform detailed analyses of the events as only very limited information on the actual operation of the dams was made available. Critical basic data such as gate opening strategies and release rates from both dams was only made available by SEQWater on 7th March, less than four days prior to the date for submissions. Even then only a summary of the data was provided and the raw data necessary for a complete analysis was not included. It is not possible, for instance, to determine the period for the maximum releases from Wivenhoe on the evening of Tuesday 11th. Based on the data currently provided by SEQWater the period of these releases could be anywhere between two and four hours. This information is critical to any detailed analysis of the impact on the flood in Brisbane. It is understood that an earlier submission to the Commission requested that such data be provided directly by the Commission.

The objective of this submission is to provide an accurate analysis of the events and demonstrate that the conclusions are broadly valid. However it may be necessary to present a supplementary submission when a more detailed review of the data provided by SEQWater can be completed.

This submission does not attempt to put this event into the context of the 1974 flood nor attempt to assign a return frequency for this event, primarily for two reasons: -

- It is not considered to have a high degree of relevance to this submission, and
- Secondly, it is not my area of expertise.

For this submission the three issues of importance are: -

- The volumes of water involved in the event.
- Based on the available information, did the system have sufficient capacity to manage the event?
- Did the system perform to its capabilities?

However, it is very important to determine peak rainfall and durations and assign an ARI to every portion of this event: -

- For modelling of the performance of the system to ensure that appropriate assets and procedures are in place for future expected events, and
- To determine the level of responsibility of parties involved in managing the event and circumstances leading up to the event.

This submission does not attempt to apportion responsibility but poses a series of questions about the event and decisions made leading up to the event that could be usefully investigated by the Commission.

2. CONCLUSIONS

This submission draws the following conclusions.

2.1 Specific Event Related

1. The flooding in Brisbane could have, and should have been substantially avoided.
2. Some 50% to 60% of the water passing the Brisbane City Gauge during the Major, Moderate and Minor flooding was water released from Wivenhoe.
3. SEQWater's own analysis indicates that flows from Wivenhoe alone would result in flows at the City Gauge during the peak of the flood of approximately 5000 cubic metres per sec. Based on the rating curve developed this would represent approximately 3.0 mAHD added to the peak of the flood peak.
4. The volume of water released from Wivenhoe that contributed to the Major Flooding, (518,000 ML) had all been collected in Wivenhoe by 01:00 Monday 10th January at which time the total estimated cumulative releases during the flood event were only 221,000 ML.
5. SEQWater were slow to react through the whole period examined.
6. The delay in responding, especially in the days leading up to Monday 10th January, eventually left SEQWater with few alternatives.
7. Even after SEQWater were aware at 0:55 on Monday 10th that increases in release rates were required to avoid triggering the fuse plug, the required release rates were not implemented until after 09:00 Tuesday 11th.
8. Given the delay in responding leading up to Monday 10th, if SEQWater had increased the release rates at 0:55 on Monday 10th the duration and extent of the Major Flooding in Brisbane would have been substantially reduced and potentially eliminated.
9. In only 14 out of the 180 hours in the lead up to the very high releases at 19:00 on Tuesday 11th did the releases from Wivenhoe exceed the inflows. In this period SEQWater were collecting water in Wivenhoe that was subsequently released into the peak of the flood in Brisbane.
10. It is likely the delay in acting and the resulting very high rates of release that became necessary also increased flooding in the Lockyer and Bremer and caused damage to the banks in the Brisbane River Valley.
11. In the Flood Event Report (3) SEQWater has relied on an undocumented rainfall event, twice the size of any of the actual rainfall events to support the dam level readings that were used as a basis for the maximum releases late Tuesday 10th.
12. For reasons that are not apparent, SEQWater did not use the available capacity of the flood storage system. This could be because the declared capacity is truly unavailable: -
    - due to operational concerns,
    - changes to the assets, or
    - SEQWater deliberately or unconsciously choose not to use the available capacity.

2.2 Operational Manual

1. While compliance with the Operational Manual is not a focus of this submission, it would appear that at times SEQWater did not comply with the requirements of the Manual, while at other times, appear not to have used the flexibility that the Manual provided and consequently would fail to meet the objectives of the Manual.
2. There appears to be no provision in the Operational Manual (2) which prevented the Operator from reducing the level in the dam below FSL.
3. The Operational Manual does not appear to substantially constrain the Operator's ability to undertake the appropriate course of action.
4. It is of concern that based on the Flood Event Log entry for 00:45 Monday 10th January, the non-damaging flow within Brisbane is not well understood by all parties, especially as achieving the maximum rate of release from Wivenhoe up to this flow is essential for maintaining the maximum capability for flood mitigation.

2.3 Events Outside Current Flood

1. Changes in the assets and to operational procedures appear to have substantially reduced the capacity of the dams to provide flood mitigation for Brisbane.
2. Even with this apparent reduction in the capacity of the dams for flood mitigation, the flooding in Brisbane could still have been avoided or substantially mitigated.

3. SUMMARY

3.1 A Simple Plan

At a simple conceptual level, a flood storage system, such as Wivenhoe-Somerset, established to mitigate downstream flooding can only remove the downstream peak from a flood event if there is sufficient unused capacity in the flood compartments of those dams which would permit the retention of water in the dam during the peak inflow period.

Subject to limits for safeguarding the structural integrity of the dam, a managed release of the water in the flood compartments should be accomplished progressively as inflows diminish and the risk of flood subsides.

If the storage system becomes full before the flood event has passed there is simply no option other than for releases to match the inflow. In this latter circumstance the storage system provides no further mitigation of the flood event. However at no stage should there be a need for the releases from the storage system to exceed the inflows otherwise the downstream flooding is magnified.

From this would flow the following simple operating philosophies: -

- The flood storage should generally be kept empty by releasing all the water flowing into the flood storage system until the defined downstream flood event is reached.
- Releases from the storage system should then be selected to remain below the defined downstream flood event until the flood event has passed or the storage system becomes full.
- If the flood storage system becomes full, the storage system must then release all the inflows but releases should never exceed inflows.

In the current event it would appear that none of these principles were followed: -

- The flood storage system was allowed to continue to fill from at least Tuesday 4th January even though there was no downstream flooding.
- At the time of the peak releases, the releases from Wivenhoe appear to exceed the inflow.
- The peak releases from the Wivenhoe-Somerset system appear to actually correspond with the peak of the flood in Brisbane.

Accurate rainfall forecasts are not required, water is simply not stored in the designated flood compartment unless it is necessary to prevent downstream flooding. Retaining water in the flood compartment is simply taking a gamble that the flood event for which the storage system is designed will not occur. Accurate weather forecasts can reduce the odds of that gamble; but it remains a gamble.

How did the operation of the Wivenhoe-Somerset system appear to breach all the fundamental operating philosophies for a flood mitigation system?

Why did the operation appear to breach these fundamental operating philosophies?

3.2 An Avoidable Flood

The impact of the January 2011 flood would have been reduced or avoided if releases from Wivenhoe did not add to the flows coming from streams downstream of the dam so as to add to the flood peak in Brisbane.

As we will see in Section 7.2, releases from Wivenhoe between 11:00 Tuesday 11th and 19:00 Wednesday 12th would simply add to flows already in the river to create or increase the peak of the Major Flood in Brisbane. Releases from Wivenhoe between 13:00 Monday 11th through to 21:00 Thursday 13th would take the river above Minor flood levels. Following the operating principles in Section 3.1, releases from Wivenhoe should be controlled, to the maximum extent possible, to be outside these times.

More detailed analysis is provided later and in the Attachments but the analysis indicates that, if the releases from Wivenhoe were timed so that: -

- 123,000 ML was discharged either earlier than 11:00 Tuesday 11th or later than 19:00 Wednesday 12th rather than during this period, the flood level at the Brisbane City Gauge would not have exceeded the Major flood level.
- 335,000 ML was discharged outside of the period 02:00 Tuesday 10th to 08:00 Thursday 13th rather than during the period, the flood level at the Brisbane City Gauge would not have exceeded the Moderate flood level.
- 623,000 ML was discharged outside of the period 13:00 Monday 10th to 21:00 Thursday 13th rather than during the period, there would not have been a flood at the Brisbane City Gauge.

These volumes compare with the: -

- 772,000 ML which was held in the flood storage compartments of Wivenhoe and Somerset at 0900 Monday 10th January prior to the flood event.
- 691,000 ML of apparently unused flood storage volume at the peak of the event based on the quoted flood storage capacities of both dams.
- 419,000 ML of unused flood storage volume at the peak of the event even after adjusting for the apparently reduced flood storage capacity in both dams.

There were therefore two options for mitigating or avoiding the flood and they were early release of water from Wivenhoe, such as over the weekend of the 8th and 9th or retention of water within the flood compartments until after the peak flows from downstream events had passed.

This indicates that there could have been no flood in Brisbane if SEQWater had either: -

- Not retained water in the flood storage compartments of Wivenhoe and Somerset prior to 0900 Monday 10th January, or
- Had access to full quoted flood storage volumes in Wivenhoe and Somerset.

The flooding would have been substantially reduced if SEQWater had used all the available storage capacity at the peak of the event.

The volumes of water above are the absolute minimum reductions that would have been necessary to achieve the outcomes described and there is no suggestion that the system releases could have been managed to the accuracy required. However it gives an indication of the potential improvements in flood management that appear to have been available.

An alternative is to look at what would have been achieved if absolutely no management was applied to these same releases. In this case: -

- 123,000 ML less released during the same period as above would have resulted in a reduction in the flood height of the Major Flood by 0.64 m and the duration by 14.5 hours.
- 335,000 ML less during the same period as above would have resulted in a reduction in the flood height during the whole of the period designated as Moderate flooding by 1.04 m and there would have been no Major flood.
- 623,000 ML less during the same period as above would have resulted in a reduction in the flood height during the whole of the period designated Minor flooding by 1.31 m and there would have been no Major flood.

Somewhere between these two bounds is the outcome that should have been achieved by reasonable management.

Why did not the dams achieve the level of mitigation possible?

3.3 Too Little Too Late

While the detail is presented later under Section 10.3, SEQWater was obliged to declare a flood event prior to 06:30 Tuesday 4th January. Once this flood event had been declared SEQWater was then required to select various operating strategies for both Wivenhoe and Somerset based on the predicted levels in each of these dams. While we don't have access to these predictions, we do have access to the actual dam levels and any reasonable predictive model will converge with the actual value at any given time. The following analysis is based on the latest dates and times that the trigger levels for the various strategies would have been exceeded.

- Strategy W1A was triggered prior to 00:46 Thur 6th January.
- Strategy W1B was triggered no later than 00:37 Fri 7th January.
- Strategy W1C was triggered no later than 08:29 Fri 7th January.
- Strategy W1D was triggered no later than 14:34 Fri 7th January.
- Strategy W1E was triggered no later than 21:16 Fri 7th January.
- Strategy W2&3 where the primary consideration is Protecting Urban Areas from Inundation was triggered no later than 07:11 Saturday 8th January.

In addition SEQWater was notifying residents of the Brisbane River Valley at: -

- 12:26 Wednesday 5th that BoM had released a Severe Weather Warning for rainfall commencing that night.
- 12:33 Thursday 6th January that the BoM forecast was for rain up until the Tuesday next week.
- 10:55 Friday 7th January that they expected heavy rainfall from Sunday to Tuesday.
- 20:26 Saturday 8th January that the current BoM Severe Weather Warning predicted return of rainfall that night with the forecast for the next 4 days for significant rainfall.
- 20:33 Sunday 9th January that the current BoM Severe Weather Warning predicted heavy rainfall until Tuesday.

The impact of the rainfall would have been obvious to SEQWater, not only from the streams flowing into Somerset and Wivenhoe, but also from the rapid increase in the level in Wivenhoe that commenced from around 14:00 Sunday 9th January.

We know from the Flood Event Log Appendix M (3), that SEQWater were indeed aware as early as 19:10 Sunday 9th January that substantially increased discharge rates of 3000 cubic metres per sec were required.

Despite this knowledge, the rapid escalation through the Strategies for Wivenhoe, the forecasts and real time data available, SEQWater did not increase the release rate to 3000 cubic metres per sec until after 09:00 Tuesday 11th January.

As discussed in Section 9.2 SEQWater's change in release rates was a case of too little too late.

Why did it take SEQWater so long to respond to the unfolding situation?

3.4 Fundamental Issues

Basic fundamental contributions to this event are: -

- Not releasing sufficient water from the flood storage volume prior to 13:00 Monday 10th January when it could have been released with no downstream flooding.
- Instead retaining this water in the flood storage volume thereby reducing flexibility to cater for design flood events.
- Undertaking peak discharges of this stored water at a time which had maximum impact on downstream flooding.
- Not using the full capacity of the flood storage system at the peak of the flood.

In essence water was banked in the flood storage system to be released at the worst possible time.

4. OUTSTANDING QUESTIONS

1. How did the operation of the Wivenhoe-Somerset system appear to breach all the fundamental operating philosophies for a flood mitigation system? Refer Section 3.1
2. Why did the operation appear to breach these fundamental operating philosophies? Refer Section 3.1
3. Why did not the dams achieve the level of mitigation possible? Refer Section 3.2
4. Why did it take SEQWater so long to respond to the unfolding situation? Refer Section 3.3
5. To make a proper assessment of the contribution of the releases from Wivenhoe to the flood in Brisbane it is essential to make an assessment of the flows past the Brisbane City Gauge during the event. Refer Section 7.3
6. SEQWater has not made an assessment of the contribution of the releases from Wivenhoe to the actual flood in Brisbane. Refer Section 7.3
7. Was there a change in the approach to using the flood mitigation capabilities of Somerset in the period between 2004 and 2009? Refer Section 10.1
8. Questions surrounding the "Out of Action" sensor and discrepancies between the manual gauge boards and sensor 6637 on Wivenhoe dam need to be resolved. Refer Section 9.3
9. Did Somerset ever have useable capacity for 524,000 ML for Temporary Flood Storage? Refer Section 11.3
10. Has some of that capacity become unavailable? Refer Section 11.3
11. Did the installation of the Fuse Plugs fundamentally change the ability of Wivenhoe to mitigate floods of the size of the January 2011 flood? Refer Section 12.4
12. If so what compensating changes have been incorporated in procedures and/or assets? Refer Section 12.4

5. BACKGROUND

I am a qualified engineer BE (Chem) Hons with almost 40 years experience in technical and managerial roles. I have primarily worked in the Australian oil and gas industry mainly in the design construction and operation of field production systems and transmission pipelines.

I have experience in the design, construction and operation of both oil pipelines, including tankage systems, and gas pipelines including high pressure peak shaving storage systems. I have regularly carried out and also reviewed analyses of complex hydraulic and pneumatic systems for single and multi phase compressible and non compressible flows in cross country pipelines and process plant piping systems.

Analysis of rainfall and flood events is not new to me. Professionally I have been required to assess the impact of various rainfall events and to interpret and rely on flood mapping for the design and location of process facilities. I am regularly involved in the determination and selection of appropriate flood protection for infrastructure and plant.

In preparing this submission, I have not carried out any modelling of the hydrology of associated streams and instead relied on the publicly available information from modelling carried out by others.

6. DAM CHARACTERISTICS

In relation to this submission, the following are considered as key characteristics of the dams: -

6.1 Wivenhoe

Item No	Characteristic	Value	Capacity ML	Source
W1	Spillway Fixed Crest Level	57 mAHD	414,000	Page 19 (2)
W2	Full Supply Level (FSL)	67 mAHD	1,165,000	Page 19 (2)
W3	Minimum Level for Opening Gates	67.25 mAHD	1,192,500	Section 8.3 (2)
W4	Top of Closed Radial Gate	73 mAHD	1,926,000	Page 19 (2)
W5	Limit of land acquired by the Corporation to provide temporary flood storage	75 mAHD	2,232,000	Section 8.1 (4)
W6	1st (Central) Fuse Plug Trigger Point	75.7 mAHD	2,347,000	Page 20 (2)
W7	2nd (Right) Fuse Plug Trigger Point	76.2 mAHD	2,442,000	Page 20 (2)
W8	3rd (Left) Fuse Plug Trigger Point	76.7 mAHD	2,537,000	Page 20 (2)
W9	Evaluation Design Flood Level	77 mAHD	2,566,000	Page 19 (2)
W10	Main Embankment Crest Level	79.1 mAHD	2,953,600	Page 19 (2)
W11	Top of Wave Wall	79.9 mAHD	3,112,000	Page 19 (2)
W12	Saddle Dam	80 mAHD	3,132,000	Page 19 (2)
W13	Bottom of Radial Gates (Open)	73 mAHD	1,926,000	Page 56 (2)
W14	Top of Radial Gates (Open)	80.3 mAHD		Page 56 (2)
W15	Maximum Level during Tuesday 11th	74.51 mAHD	2,154,580	
W16	Maximum Level for period	74.85 mAHD	2,208,300	
W17	191% Capacity		2,225,605	

6.2 Somerset

Item No	Characteristic	Value	Capacity ML	Source
S1	Full Supply Level (FSL)	99 mAHD	379,800	Page 77 (2)
S2	Spillway Fixed Crest Level	100.45 mAHD	445,640	Page 77 (2)
S3	Sluice & Regulator Trigger Level	102.25 mAHD	539,000	Page 77 (2)
S4	Crest level	107.46 mAHD	900,728	Page 77 (2)
S5	Top of Deck	112.34 mAHD	1,129,800	Page 77 (2)
S6	Flood Storage		520,887	SEQWater advice to Australian 22nd Feb 2011
S7	Maximum Level during Tuesday 11th	104.42 mAHD	672,988	
S8	Maximum Level for period	104.96 mAHD	709,948	

6.3 Definition of Flood Events

The criteria for flooding used throughout this submission are that provided by the Bureau of Meteorology (BoM). The following are the definitions for minor, moderate and major floods provided by BoM: -

- **Minor flooding**: Causes inconvenience. Low-lying areas next to watercourses are inundated which may require the removal of stock and equipment. Minor roads may be closed and low-level bridges submerged.
- **Moderate flooding**: In addition to the above, the evacuation of some houses may be required. Main traffic routes may be covered. The area of inundation is substantial in rural areas requiring the removal of stock.
- **Major flooding**: In addition to the above, extensive rural areas and/or urban areas are inundated. Properties and towns are likely to be isolated and major traffic routes likely to be closed. Evacuation of people from flood affected areas may be required.

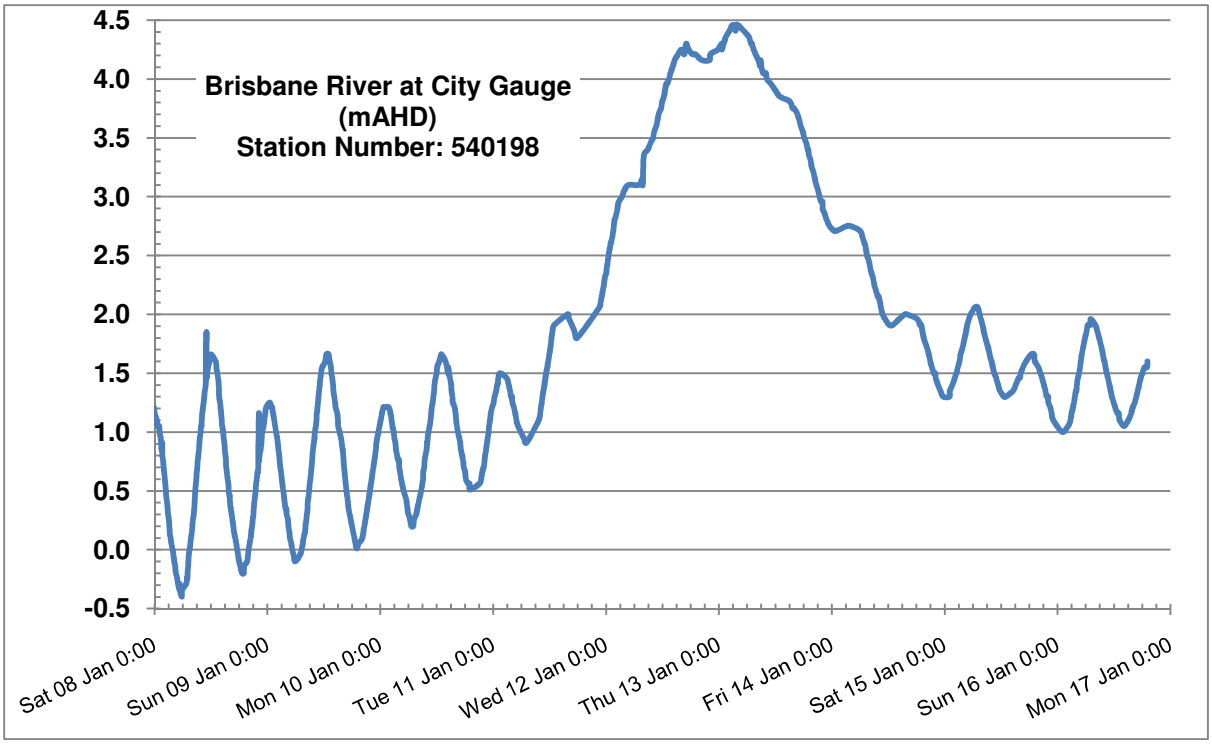
At the Brisbane City Gauge the relevant river heights are: -

Flood Definition	Gauge Height
Major Flooding	3.5 mAHD
Moderate Flooding	2.6 mAHD
Minor Flooding	1.7 mAHD

7. THE FLOOD

7.1 General

Below is a plot of the height of the Brisbane River at the City Gauge between Saturday 8th January and Sunday 16th January (5).



From this data the major characteristics of the flood at the Brisbane City Gauge are: -

Characteristic	Time	Height (mAHD)
Peak	02:57 Thursday 13th Jan	4.46
Minor Peak	17:03 Wednesday 12th Jan	4.3

Characteristic	Time into	Time out of	Duration (hrs)
Major Flood	10:00 Wednesday 12th Jan	18:09 Thursday 13th Jan	32.15
Moderate Flood	00:57 Wednesday 12th Jan	06:57 Friday 14th Jan	54
Minor Flood	12:09 Tuesday 11th Jan	20:18 Friday 14th Jan	80.15

The period comprising the designated Major Flood at the City Gauge appears to encompass three high tides which are expected to have influenced the river height at the City Gauge. The estimated times for the major influence of the high tides at the Brisbane City Gauge during this period are: -

- 14:15 Wednesday 12th
- 02:34 Thursday 13th
- 14:54 Thursday 13th

It would appear that initiation of the Major Flood at the City Gauge commenced on the rising tide for the high at 14:15. The major peak of 4.46 mAHD at the City Gauge corresponded almost exactly with the expected influence at 02:34 of the next high tide. The minor peak of 4.3 mAHD at 17:03 Wednesday 12th January therefore probably represents the highest river flows past the Brisbane City Gauge.

SEQWater quote that water released from Wivenhoe takes between 24 to 36 hours to pass the Brisbane City Gauge. The minor peak at 17:03 Wednesday 12th January is approximately 22 hours after the reported time that gates at Wivenhoe were initially opened to their maximum for this event. For the purposes of analysing this event it is assumed that 23 hours represents the time between releases at Wivenhoe and flow past the Brisbane City Gauge.

The estimated flows past the Brisbane City Gauge for each of the flood periods is shown below. The estimated flow past the City Gauge has been calculated using the rating curve developed for the Brisbane City Gauge in Attachment 2. The lower value has been calculated directly using the rating curve. However as noted in Section 14.2, it appears that this rating curve assumes a tail water level of 0.92 mAHD which is higher than the average during most of the flood period. Therefore an upper range of flows has been estimated by adjusting the rating curve for the actual tail water level in Moreton Bay as measured at Whyte Island, Station Number: 540495 (6).

Characteristic	**Time into**	**Time out of**	**Estimated Flow past City Gauge (ML)**
Major Flood	10:00 Wednesday 12th Jan	18:09 Thursday 13th Jan	866,000 to 949,000
Moderate Flood	00:57 Wednesday 12th Jan	06:57 Friday 14th Jan	1,294,000 to 1,447,000
Minor Flood	12:09 Tuesday 11th Jan	20:18 Friday 14th Jan	1,667,000[1]

Note 1: The upper range of flows has not been estimated for the Minor Flood due to the absence of the required data for levels in Moreton Bay.

Note 2: There is no significant change in this data If 22 hours is used instead of 23 hours

7.2 Contribution from Wivenhoe

To determine the contribution of releases from Wivenhoe to the above total flows past the Brisbane City Gauge, the releases from Wivenhoe were calculated for periods 23 hours prior to the above periods using the release data provided in Section 9 of the Flood Event Report (3).

The following table summarises the estimated contribution of releases from Wivenhoe to the flood event at the Brisbane City Gauge.

Starting Time	Finishing Time	Releases from Wivenhoe (ML)	Contribution to Flow at City Gauge (%)
11:00 Tuesday 11th Jan	19:09 Wednesday 12th Jan	518,000	55% to 60%
01:57 Tuesday 10th Jan	07:57 Thursday 13th Jan	729,000	50% to 56%
13:09 Monday 10th Jan	21:18 Thursday 13th Jan	975,000	[3] to 58%

Note 3: The lower bound has not been estimated as an upper range of flows has not been estimated for the Minor Flood due to the absence of the required data for levels in Moreton Bay.

The estimated flows in the last two tables are subject to a degree of uncertainty but nevertheless are considered to be of the correct order.

7.3 SEQWater Assessment

In Section 8 of the Flood Event Report (3) SEQWater has provided a similar comparison and estimated the impact of flows at the Brisbane City Gauge for a number of different cases. Case 1 represents the actual flood event and Case 3 reflects the releases from Wivenhoe alone. Three comments are relevant: -

- SEQWater note that the peak height at the City Gauge generally coincides with the highest tide of the tide. This submission has drawn a similar conclusion.
- The peak flow (and consequently height at the City Gauge) for the actual flood event is coincident with the peak that occurs from the Wivenhoe releases alone. This indicates that the peak releases from Wivenhoe occurred at the same time as the peak flows from streams downstream of the dam. The peak flow for the actual flood was determined by SEQWater to be 9,500 cubic metres per sec.
- The actual peak height at the City gauge was 4.46 mAHD and occurred with a high tide which would result in a tail water level of around 1 mAHD. This flow of 9,500 cubic metres per sec is significantly higher than would be expected from the Brisbane River Flood Study (7). For a tail water level of 0.92 mAHD the Brisbane River Flood Study would indicate a flow of 8,000 cubic metres per sec. This estimate by SEQWater appears high.

This underlines the importance of ensuring that releases from Wivenhoe are undertaken either before or after peaks from streams entering downstream. Not as apparently occurred in this event where the peak releases from Wivenhoe occurred during peak downstream flows.

Despite the number of cases examined, SEQWater has made no assessment of the actual contribution of the releases from Wivenhoe to the peak of the flood, but simply looked at Wivenhoe releases alone and compared it with the actual flood. It will be important to understand the impact that very high releases from Wivenhoe on Tuesday 11th had on the incoming flows from Lockyer Creek and the Bremer. Refer to Section 13.1 for additional information.

Overestimation of the flows past the City Gauge will reduce the apparent contribution to the flood from releases at Wivenhoe and conversely underestimation of the flows at the City Gauge will increase the apparent contribution. It will therefore be very important for the analysis of this event to accurately assess the flows at the City Gauge.

SEQWater's analysis indicates that flows from Wivenhoe alone would result in flows at the City Gauge during the peak of the flood of 5000 cubic metres per sec. Based on the rating curve developed in Attachment 2 this would represent approximately 3.0 mAHD added to the peak of the flood.

To make a proper assessment of the contribution of the releases from Wivenhoe to the flood in Brisbane it is essential to make an assessment of the flows past the Brisbane City Gauge during the event.

SEQWater has not made an assessment of the contribution of the releases from Wivenhoe to the actual flood in Brisbane.

8. OPERATION OF THE WIVENHOE SOMERSET SYSTEM

8.1 General

There was a fundamental change in the philosophy of selection of the operating Strategy between Rev 6 and Rev 7 of the Operational Manual and this was to change from selecting the operating Strategy from the actual level in the dam to the predicted level in the dam. Refer to further discussion under Section 10.1.

The impact of this change can be considered by reviewing the statements in the Flood Event Log Appendix M (3), in particular: -

> *Monday 10th January at 12:55 AM Engineer 3 called Dam Operations Manager to discuss BCC's view on damaging flow. Engineer 3 confirmed that if flows were kept below 3500 the fuse plug would be triggered. Agreed that situation reports will not allude to damage levels - the councils can make decisions on what to report in this regard.*

Wivenhoe did not actually exceed EL 74 until 10:49 Tuesday 11th January, so under Rev 6 of the Operational Manual, Strategy W4 would not have been selected until 10:49 Tuesday. However the above log entry makes it clear that SEQWater predicted that Wivenhoe would ultimately trigger a Fuse Plug at 75.7 as early as 00:55 on the Monday. Under Rev 7 of the Operational Manual, SEQWater would be obliged to implement Strategy W4 from 00:55 Monday, 35 hours earlier than under Rev 6.

In accordance with the Page 29 of the Rev 7 Manual, The primary consideration for Strategy W4 is Protecting the Structural Safety of the Dam.

SEQWater also repeat this error in the Tables detailing Flood Event Summary in Section 2 of the Flood Event Report (3). Each of the right hand columns under Strategy (except for W4) repeats the same error; e.g. *Strategy W2 and Strategy W3 say (Lake level greater than 68.50m, maximum release 4,000m^3/s)*. Whereas Rev 7 actually says *Wivenhoe Storage Level **predicted** to be between 68.50 and 74.00 m AHD.*

8.2 Critical Lead Up Period

A review of the gate opening strategies and release rates provided in Section 9 of the Flood Event Report (3) shows: -

1. Releases through the gates commenced only at 15:00 Friday 7th when Wivenhoe was at 109.6% and Somerset at 110.9% with a total of 153,000 ML in the flood storage compartments of both dams.
2. For all periods through until 21:00 Saturday 8th inflows to Wivenhoe continued to exceed outflows
3. From 10:00 Sunday 9th inflows again exceeded outflows and this situation remained until 19:00 Tuesday 11th.

So in the week (180 hours in total) from 06:30 Tuesday 4th January when Wivenhoe was at 102.1% and Somerset was at 102.9% and SEQWater were required under the Operational Manual to declare a Flood Event, there were only 14 hours during which the release rates from Wivenhoe exceed the inflows.

The Flood Event Log Appendix M (3) shows that SEQWater were forecasting at 00:55 Monday 10th January that the fuse plug could be triggered if flows were kept below 3500 cubic metres per sec. At

the time releases was less than 1500 cubic metres per sec. Under these circumstances SEQWater were required by the Operational Manual (2) to be operating under Strategy W4 from early Monday 10th.

However significant changes in the gate opening strategies were not made until 13:00 Tuesday 11th.

9. TUESDAY 11TH JANUARY

By 09:00 Tuesday 11th January, SEQWater no longer had the opportunity to prevent flooding in Brisbane: -

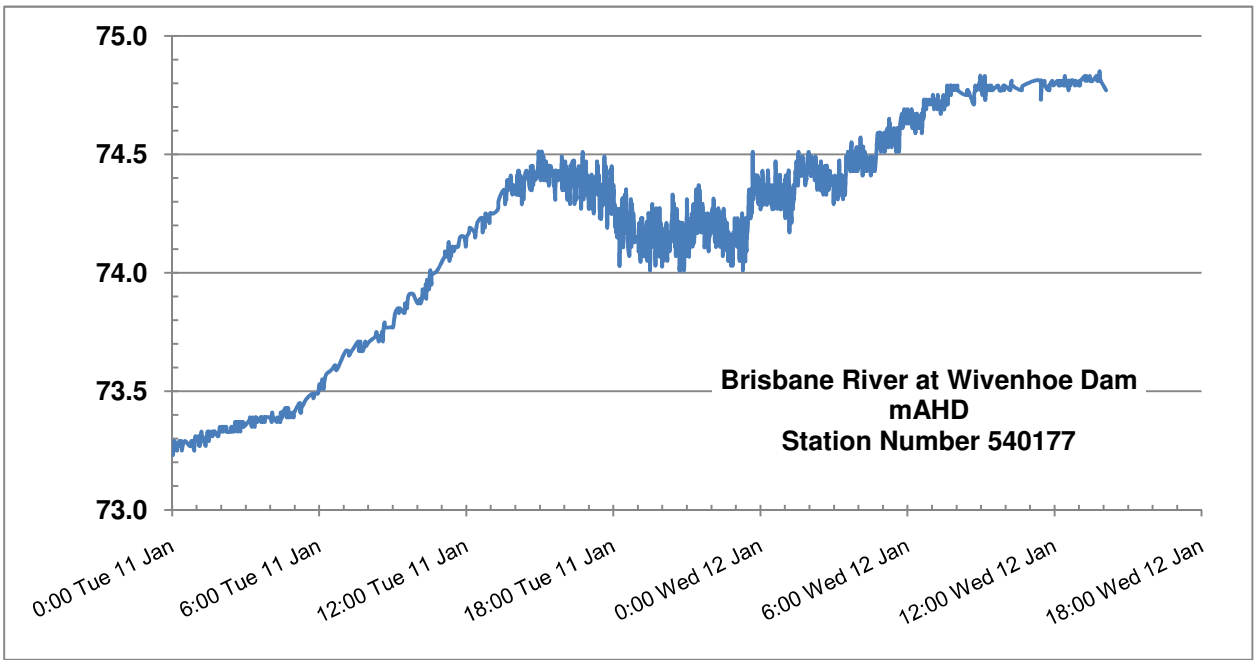
- The Brisbane River at the City Gauge would be at the Minor Flood level within three hours.
- Lockyer Creek was discharging at 1254 cubic metres per sec (8).
- The Bremer River was discharging at 409 cubic metres per sec (9).
- Wivenhoe was at 175.9% or 2,049,705 ML with 884,467 ML in the flood storage compartment.
- Somerset was at 159.2% or 604,632 ML with 224,783 ML in the flood storage compartment.

However the actions taken by SEQWater at Wivenhoe and Somerset over the next 24 hours would be critical to the size and shape of the flood in the downstream Brisbane River Valley and Brisbane. Access has not been provided to forecasts available to SEQWater but SEQWater has recently provided an hourly summary of actual gate openings and discharge rates adopted by SEQWater during this critical period.

The information and analysis below is based on publicly available data. It is important to note that this analysis is based primarily on data from Brisbane River at Wivenhoe Dam Station Number: 540177 (10). SEQWater state that they relied on the manual gauge boards and in Section 6 page 85 of the Flood Event Report (3) discuss discrepancies between the manual gauge board and the Wivenhoe gauge. Refer to additional discussion in Section 9.3 below.

9.1 Dam Levels

Below is a plot of the height of the Brisbane River at Wivenhoe Dam Station Number: 540177 for the period Tuesday 11th January to Wednesday 12th January (10).



This data indicates: -

- The level in Wivenhoe exceeds 74 mAHD at 10:49 Tuesday 11th January.
- The level continues to rapidly increase for the next 4 hours until it peaks at 74.51 mAHD at 14:57 on Tuesday 11th at 184.9% with 2,154,580 ML in storage.
- The level in the dam then starts to fall over the next 3 ½ hours until 18:30 Tuesday 11th when it starts to level off.
- The level again starts to rise from 23:15 Tuesday 11th.
- The level then reaches a higher peak of 74.85 mAHD almost 14 hours later at 13:50 on Wednesday 12th at 189.5% with 2,208,300 ML in storage.
- The dam essentially remains at this level for the next 7 hours until 20:28 Wednesday 12th.

9.2 Discussion

SEQWater recently made available data showing inflows to Wivenhoe and releases from Somerset. Refer to Section 9.3 below for further discussion of how discrepancies between readings of dam levels impact this analysis.

Analysis of the gate opening strategies shown in Section 9 of the Flood Event Report (3) shows: -

1. Releases remained below 3500 cubic metres per sec until 11:00 Tuesday 11th even though SEQWater had forecasting at 00:55 Monday 10th January that the fuse plug could be triggered if flows were kept below 3500 cubic metres per sec.
2. Significant changes in the gate opening strategies were not made until 13:00 Tuesday 11th. Rapid changes in gate openings continued through until the maximum gate openings were reached at 19:00.
3. Gate Openings remained at this level for a minimum of two (2) hours.
4. The greatest change in gate openings then occurred between 23:00 and 24:00 Tuesday 11th during closing of the gates.

This is consistent with what would be interpreted from dam levels recorded by Wivenhoe Dam Station Number: 540177 and assuming a relatively consistent inflow to Wivenhoe over the period from 08:00 through at least until 24:00 Tuesday 11th.

1. The rate of rise in the level of Wivenhoe commences to slow around 13:30 on Tuesday 11th just after the first significant change in gate openings.
2. The level reaches a peak at 14:57 on Tuesday 11th before starting to fall coincident with the period of rapid gate openings.
3. Over the next 3 ½ hours the indicated level in Wivenhoe fell which would be consistent with the Operator releasing more water from Wivenhoe that was actually entering the dam. Even though Section 8.4 of the Operational Manual (2) "Flood Operations Strategies" for Wivenhoe requires that *When determining dam outflows within all strategies, peak outflow should generally not exceed peak inflow*. While it is very difficult to be precise given the lack of data from SEQWater it appears, based on the indicated fall in level, that the rate of release from Wivenhoe during this 3 ½ hours was between 2,000 and 3,000 cubic metres per second higher than the inflow rate to Wivenhoe.
4. From 23:15 Tuesday 11th the dam level again started to rise coincident with the rapid closing of the gates.

5. This data would show that the dam was then allowed to reach a higher peak of 74.85 mAHD almost 14 hours later at 13:50 on Wednesday 12th.

The period from 13:00 through to 23:15 on Tuesday 11th is very significant when looking at the flood peak which occurred at Brisbane City Gauge around the two peaks at 17:03 Wednesday 12th and 02:57 Thursday 13th January. As previously pointed out in Section 7, the peak at 02:57 is almost certain to have corresponded with a high tide impacting on a run down in the discharge rate of the river. The peak at 17:03 Wednesday 12th is 22 hours after the high release rates from Wivenhoe that commenced around 19:00 Tuesday 11th. It is therefore most likely that peak of the flooding at the Brisbane City Gauge was caused by the high release rates from Wivenhoe between 13:00 and 23:15 on Tuesday 11th coincident with three high tides at the mouth of the river.

Between 13:00 and 23:15 on Tuesday 11th, Wivenhoe apparently released an estimated 230,000 ML at an average rate of 6400 cubic metres per sec, the Operator presumably justifying these very high releases on the basis of protecting the structural safety of the dam. However: -

- The Operator was obliged to be implementing this strategy from early Monday morning, and
- Even after deciding at 13:00 that the level in Wivenhoe was detrimental to the structural safety of the dam, the Operator subsequently permitted an additional 91,000 ML to be stored in Wivenhoe and Somerset the following day.

Over a significant period (from 00:55 Monday 10th through to 13:00 Tuesday 11th) the Operator delayed in increasing the release rates from Wivenhoe and was then forced into a high rate discharge strategy.

If, instead, the Operator had acted as soon as it was known that the current operating strategy was likely to result in a breach of a fuse plug the average release rate over the whole period would have only been 3300 cubic metres per sec.

While I am not able to relate the impact on the River Height at the Brisbane City Gauge to the release rate at Wivenhoe, the difference between the 6400 cubic metres per sec actually released and the 3300 cubic metres per sec that should have been necessary, if repeated at the Brisbane City Gauge, would have resulted in a reduction of 1.9 metres in river height.

If the release rate had been 3300 cubic metres per sec for the whole period from 00:55 Monday 10th through to 13:00 Tuesday 11th there would have been 115,000 ML less released into the Brisbane River system to add to the peak of the flood. This compares with the reduction in flow that would have been required to avoid the Major Flood of 123,000 ML.

9.3 Discrepancy in Dam Level

SEQWater noted in the Flood Event Report (3) that there are two electronic gauges and a manual gauge board for reading the levels in Wivenhoe. One of the electronic gauges was "Out of Action" for the whole of the flood event while the remaining electronic gauge functioned for the whole period.

The remaining electronic gauge and the manual gauge board read the same except for a period on Tuesday during the peak of the levels in Wivenhoe when the manual gauge board read higher than the electronic gauge.

SEQWater noted that they relied on the manual gauge board and apparently ignored the electronic gauge. When calculating the dam inflow rates that would be necessary for the manual gauge board to be correct, SEQWater found they needed very high inflow rates, much higher than any other time during the whole flood event.

In the preparation of the Flood Event Report (3) the only way that these inflow rates could be simulated was to postulate a rainfall event in an area where there were no rain gauges and at twice the rate of the highest measured rainfall of any of the other rainfall stations. This rainfall event had an estimated ARI of 2000 years.

In Section 6 page 85 of the Flood Event Report (3) SEQWater state: -

> *The manual read gauge board used during this event is located on the outside of wing wall of the spillway approach. There are two automatic gauges at Wivenhoe Dam. Sensor 6638 was marked as OOA for the Event. The other sensor 6637, located around 50m upstream of the gates, matched the manual gauge board readings until around midday on Tuesday 11 January 2011. It was at this point the large gate openings began to cause noticeable drawdown and surging in the spillway approach. The automatic lake level gauge 6637 is located within the approach and was impacted by this surging and drawdown. This discrepancy combined with a possible sensor blockage resulted in readings which were up to 0.8m lower than the observed manual readings during this period. It should be noted that as previously discussed, gate operations were undertaken based on the accurate manual gauge board observations.*

Because of the significance of this issue further discussion and investigation is warranted. It can be seen from Figures 6.5.5 and 6.5.6 of the Flood Event Report (3) that sensor 6637 faithfully matched the manual gauge board readings for almost the full period reported except for a very short period. A tabulation comparing the manual gauge board reading, the reading from sensor 6637 and the calculated inflow to Wivenhoe minus the Somerset outflow is provided in Attachment 4. This data has been extracted from Section 9 Dam Inflow and Flood Release Details of the Flood Event Report (3).

The tabulation shows that the manual gauge board started reading higher than sensor 6637 around 09:00 Tuesday 11th and the deviation gradually increased through to 20:00 on the same day after which the deviation started to decline until it disappeared around 08:00 Wednesday 12th. It is instructive to examine the Total Inflow to the dam. This is back calculated from the increase in the volume of water in the dam, determined from the dam level, and the known outflows calculated from the gate openings. For a given set of gate openings a more rapidly rising dam level will show up as a higher inflow rate.

The period from 9:00 to 16:00 Tuesday 11th contains the three highest calculated hourly inflow rates and 8 of the 12 highest calculated inflow rates for the whole period reported in the Flood Event Report. The average inflow over this period is 9132.5 cubic metres per sec which is just slightly lower than the highest hourly rate of 9174 calculated for all other hourly periods and higher than 8820 cubic metres per sec which is the second highest calculated hourly rate for all other periods.

Refer to Section 8.9 of the Flood Event Report (3) for further discussion on rainfall modelling necessary to generate such high inflow rates to Wivenhoe. However to replicate the rate of rise in the dam level measured using the manual gauge board it was necessary to impute an unmeasured rainfall event that was twice the recorded rainfall of the Mt Glorious measurement station which already had the highest recorded 10 hour rainfalls. SEQWater state: -

> *To model the rapid rise of the recorded Wivenhoe Dam levels between 03:00 to 15:00 on Tuesday 11 January 2011, the Mt Glorious rainfall data was repositioned to the ungauged area immediately upstream of the Dam, where the BoM radar indicated was the centre of the heavy rainfall during that period. It was then necessary to scale this rainfall up by a factor of two to match the rapid lake level rises. This factored Mt Glorious rainfall data had an average intensity of 68mm/hr, which exceeds an annual recurrence interval of 1 in 2,000 years and may be well into the extreme category. Rainfall of this intensity and duration over the Wivenhoe Dam lake area at such a critical stage of a Flood Event was unprecedented. The*

resulting runoff could not be contained without transition to Strategy W4, as discussed in Section 2 and Section 10.

There are two possible explanations: -

- That this period of 8 hours was the period of highest rainfall in the Wivenhoe catchment, or
- The manual gauge board was reading high and the dam level was not increasing at the rate shown by the gauge board. In this case the calculated inflow rates would then be lower than the currently estimated values.

Further detailed analysis of this period is essential because: -

- This is a critical period for gaining a proper understanding of the impact of the releases from Wivenhoe on the flood in Brisbane.
- If correct, the elevated rainfall over this period would represent the most severe inflows to the dam and would be expected to significantly impact on future event forecasting. As noted by SEQWater this would require a rainfall event with an ARI of 2000 years.
- Wivenhoe lake level is one of the most critical readings necessary for managing flood events. For one of the automatic gauges to be "Out of Action" and the second to be located such that drawdown and surging in the spillway during high rate releases renders it unusable, reflects very poorly on the standard of instrumentation available to the Operator.

Questions surrounding the "Out of Action" sensor and discrepancies between the manual gauge boards and sensor 6637 on Wivenhoe dam need to be resolved.

10. MANUAL OF OPERATIONAL PROCEDURES

10.1 General

On January 20th, the Department of Environment and Resource Management (DERM) released the "OPERATIONAL PROCEDURES FOR FLOOD MITIGATION AT WIVENHOE DAM AND SOMERSET DAM" Revision 7 November 2009".

This lists four different main Strategies for the operation of Wivenhoe, with several sub strategies, for water releases from Wivenhoe depending on the predicted Reservoir Level. These strategies were designated as W1A through to W1E, W2, W3 and W4A and W4B each representing an increase in the predicted quantity of water in the flood compartment.

For each Strategy, the document lists the maximum release rate for the predicted reservoir level. That maximum is subject to certain other constraints including downstream river heights and flow rates. However, there are no minimum release rates specified and so there is discretion for the Senior Flood Operations Engineer to select the actual release rate. The Operator could claim compliance with the Operational Manual even if no water was released however, the Operator would then fail to meet the two prime objectives listed below; e.g. ensure the structural safety of the dams and provide optimum protection of urbanised areas from inundation.

Subject to certain prior approvals the Senior Flood Operations Engineer is permitted to depart from the procedures set out in the Manual to meet the flood mitigation objectives. These flood mitigation objectives, in descending order of importance, are set out as: -

- 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.

Rev 6 and Rev 7 of the Manual of Operational Procedures have been reviewed and the essential difference is that in Rev 7, selection of the release criteria is to be based on the predicted levels in the dams whereas Rev 6 is around the actual levels. This would mean that during an event where the dam levels are rising a particular operating strategy would normally be selected earlier under Rev 7 than it would have been under Rev 6.

- Section 8.3 Initial Flood Control Actions Rev 7 specifies that the FOC must make a number of predictions. The equivalent Section in Rev 6 is different.
- Rev 7 includes a flowchart at page 23 and all the decisions on selection of the operating strategy are based on the likely outcome while there is no equivalent in Rev 6.
- Each of the operating strategies in Rev 7 is based on "Wivenhoe Storage Level predicted to be....." whereas in Rev 6 the strategy is based on the actual level.

Rev 6 still required some predictions of river and stream flows but the selection of the operating strategies was not based on the predicted levels in Wivenhoe or Somerset.

Rev 6 of the Manual of Operational Procedures does not include the set of detailed operating procedures for Somerset that form part of Rev 7. The only reference to the crest gates in Rev 6 is in Section 9.2 which requires that any closed gates should be raised and in Section 10.3.2 under

Emergency Flood Operations which basically requires the same. Rev 7 of the Manual of Operational Procedures therefore included a significant change to the Strategies for operating Somerset.

Was there a change in the approach to using the flood mitigation capabilities of Somerset in the period between 2004 and 2009?

10.2 Full Supply Level (FSL)

There has been much discussion on the pre-emptive release of water below FSL under circumstances where future heavy rainfalls are predicted.

Under the current version of the Operational Procedures (2) there is no limitation on the Operator's ability to reduce the level in Wivenhoe below FSL once a flood event has been declared. The obligation is to *Retain the storage at Full Supply Level* ***at the conclusion of the Flood Event*** (my emphasis) and even this obligation is subservient to three overriding requirements to: -

- 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

A "Flood Event" is defined as a situation where the Duty Flood Operations Engineer expects the water level in either of the Dams to exceed the Full Supply Level.

> *The Duty Flood Operations Engineer.....must declare a Flood Event if the water level of either Wivenhoe or Somerset Dam is expected to exceed Full Supply Level as a result of prevailing or predicted weather conditions.* Refer page 5 (2)

Section 8.5 (2) recognises that the level in the dam may be reduced below FSL; e.g.

> *This may mean that the lake level temporarily falls below Full Supply Level to provide for a full dam at the end of the Flood Event.*

The only other potential limitation to the rate at which the Operator is able to reduce the dam level below FSL is in Section 8.3 (2):

> *The spillway gates are not to be opened for flood control purposes prior to the reservoir level exceeding EL 67.25.*

An EL of 67.25 mAHD corresponds to a capacity of approximately 1,192,500 ML or 102.3%. This level was reached prior to 06:30 on Wednesday 05th January. Since this is above FSL, a Flood Event must have been declared prior to this and from this time operation of the spillway gates was permitted, which would have enabled the Operator to reduce the level in the dam below FSL at any reasonable rate.

So for the full period of this event from 06:30 on Wednesday 05th January, there appears to be no provision in the Operational Manual (2) which prevented the Operator from reducing the level in the dam below FSL.

10.3 How does this compare with what happened

Using river height data available on the Bureau of Meteorology website (10), the following table shows: -

- The times at which the trigger point for each of the Strategies was actually exceeded,
- The maximum flow permitted under that Strategy, in both cubic metres per sec (m^3/sec) and megalitres per day (ML/d), and
- The actual releases from Wivenhoe as reported by WaterGrid on their website.

Strategy	$Q_{wivenhoe}$ m^3/sec	$Q_{wivenhoe}$ ML/d	Latest Time for adoption of Strategy	Reported Releases ML/d
W1A	<110	<9500	Prior to 00:46 Thur 6th January	Releases commenced during the evening of the 6th
W1B	<380	<32.832	00:37 Fri 7th January	No Report for 7th
W1C	<500	<43,200	08:29 Fri 7th January	No Report for 7th
W1D	<1900	<164,160	14:34 Fri 7th January	Did not increase release above 116,000ML/d until early Monday 10th
W1E	<1900	<164,160	21:16 Fri 7th January	Did not increase release above 116,000ML/d until early Monday 10th
	$Q_{Loowood}$ m^3/sec	$Q_{Loowood}$ ML/d		
W2&3	<3500	<302,400	07:11 Sat 8th January	Did not increase release above 300,000ML/d until Tuesday 11th
W4A &W4B	No Limit	No Limit	10:49 Tue 11th January	

11. WHERE DID THE FLOOD STORAGE CAPACITY GO?

11.1 General

The combined Flood Storage Capacity in both Wivenhoe and Somerset is claimed to be 1,974,000 ML. On Tuesday 11th January when the Operator made the decision that it was necessary to release very large quantities of water to "ensure the structural integrity of the dams" total combined storage in the flood compartments of both dams was approximately 1,282,000 ML. During the whole of the flood event, the maximum combined storage in the flood compartments of both dams was only approximately 1,373,000 ML.

This means that approximately 690,000 ML of apparent flood storage capacity was not used or was unavailable during the critical period and approximately 600,000 ML of apparent flood storage capacity was never used or was never available. These numbers are highly significant when compared with the 623,000 ML which is the estimated reduction in releases that would have been required so that even Minor Flooding did not occur in Brisbane.

11.2 Wivenhoe

A Flood Storage Capacity of 1,450,000 ML is claimed for Wivenhoe. While it seems possible that, when constructed, Wivenhoe had a Flood Storage Capacity of 1,450,000 ML for a flood event that did not cause major downstream flooding, that certainly does not appear to be the case since the construction of the Fuse Plugs.

In practice, during the most severe flooding event in Brisbane since 1974, the Operator was not prepared to utilise more than 989,000 ML for flood storage in Wivenhoe.

11.3 Somerset

Were SEQWater simply confused about the flood storage capacity of Somerset as they publicly state two different numbers (524,000 ML and 155,000 ML) while they have recently advised that the actual number is 520,887 ML.

Refer http://wivenhoesomersetrainfall.com/images/Dam_features_from_SEQWater_Web.jpg copied below which states 524,000 ML whereas reference to http://www.seqwater.com.au/public/catch-store-treat/dams/somerset-dam shows 155,000 ML.



SOUTH EAST QUEENSLAND WATER CORPORATION LTD
KEY FEATURES OF DAMS AND STORAGES

	Wivenhoe Dam	Somerset Dam	North Pine Dam
Catchment Area (sq km	5,554	1,503	348
Capacity – Water Supply (ML)	1,165,000	380,000	215,000
Capacity – Flood Storage (ML)	1,450,000	524,000	N/A
Submerged Area (ha) at Full Supply Level	10,940	3,967	2,121
Stream Bed Level at Structure (AHD)	23.0	60.4	4.3
Full Supply Level (AHD)	67.0	99.0	39.63
Spillway Level (AHD)	57.0	100.45	32.01
Embankment or Crest Level (AHD)	79.0	107.45	43.2
Type of Structure	Embankment - 4 million m^3 Concrete 140,000 m^3	Concrete 203,000 m^3	Embankment 275,000 m^3 Concrete 175,000 m^3
Year of Completion	1985	1959	1976
Design	Water Resources Commission	Bureau of Industry Stanley River Works Board	Department of Local Government
Length of Wall (m)	2,300	305	1,375
Shoreline (km)	462	237	166
Spillway Gates	5 of 12.0m x 16.6m	8 of 7.97m x 7.01m	5 of 12.2m x 8.3m
Sluice Gates	N/A	8 of7.97m x 7.01m	N/A
Regulator Valves	2 of 1.5m diameter	4 of 2.3m diameter	2 of 1.4m diameter
Average Evaporation (mm/year)	1,872	1,775	1,375
Average Rainfall (mm/year)	940	1,230	1,175
Average Water Supply Yield (ML/year) With 1% risk of depletion	Currently Under Review		54,750
SEQWater's Allocation	345,000 Megalitres		
Hydro Electric Station/dam structure	4.5 megawatts	4 megawatts	N/A
Major Water Supply Customers at 30/6/04	Cities of Brisbane, Ipswich , Logan, Gold Coast, Shires of Beaudesert, Esk, Gatton, Laidley, Kilcoy and Nanango, Tarong Energy, CS Energy		Cities of Redcliffe & Brisbane Shires of Pine Rivers & Caboolture

Reference to Appendix I (2) shows the Crest Level for Somerset as 107.46 mAHD and Appendix D (2) shows Temporary Flood Storage for Somerset at 107.5 mAHD as 524 10^6 m^3 (524,000 ML).

On 22nd February the Office of the Hon Stephen Robertson MP Minister for Energy and Water Utilities advised that the temporary flood storage capacity of Somerset is 520,887ML.

All current Strategies for the operation of Somerset (2) appear to require the Crest Gates to be open and the level of 107.46 mAHD would not be achieved without significant flows from the dam.

Appendix D (2) indicates that the discharge over the spillways alone, if only the Crest gates are open, as 2,500 cumecs.

This indicates that while Somerset may indeed once have had the capacity of 524,000 ML for Temporary Flood Storage to the top of the Crest Gates, this capacity is no longer available without significant releases downstream. Moreover, actions by the Operator during the recent flood event would indicate a reluctance to operate Somerset above 104.96 mAHD, equivalent to a Temporary Flood Storage Capacity of 330,000 ML.

Did Somerset ever have useable capacity for 524,000 ML for Temporary Flood Storage?

Has some of that capacity become unavailable?

12. FUSE PLUGS

12.1 General

It appears that the installation of the Fuse Plugs has reduced the effective flood mitigation capability of Wivenhoe from 1,450,000 ML to at least a maximum of 1,180,562 ML which is the trigger point for the first Fuse Plug. Also under the flood conditions on Tuesday 11th January, the Operator was prepared to release very large quantities of water to prevent initiation of a Fuse Plug and appeared prepared to utilise only 989,000 ML of flood storage.

The Wivenhoe Alliance was formed by SEQWater to undertake an assessment and subsequent upgrade of Wivenhoe Dam which resulted in the construction of the Fuse Plugs. The Alliance consisted of SEQ Water, Leighton Contractors, Coffey Geosciences, Department of Commerce (NSW) and MWH.

Construction commenced in April 2004, following several months of investigations including review of design options, hydrological studies, construction techniques, geotechnical conditions, environmental issues and community feedback.

A paper presented by members of the Wivenhoe Alliance included the statement: -

> *Its (*Wivenhoe*) primary function is to provide a safe water supply to the people of Brisbane and adjacent Local Authorities.* (11)

This statement together with the significant reduction in flood mitigation capabilities of Wivenhoe subsequent to the installation of the Fuse Plugs does raise the question as to whether the flood mitigation capabilities of the system were adequately analysed as part of the upgrade.

12.2 Prior to Installation of Fuse Plugs

The EL77 which gives the 1,450,000 ML flood capacity is deemed the Evaluation Design Flood Level. The top of the radial gates when they are closed is EL 73. Therefore at the design flood level there is water being discharged through the gates. It appears that the gates can either be closed, in which case the water is discharged over the top of the gates or, alternatively the gates can be partially open. When each gate is opened by 5.4 metres, the top of the gate is at EL 76.99 so the water discharges under the gate.

The Manual of Operational Procedures states that *"While the radial gates have been designed to withstand overtopping, it should be avoided if possible."* Ref page 61 (2)

Prior to the installation of the fuse plugs, if the dam reached EL 77, the 1,450,000 ML flood volume, water would be discharging through the radial gates, either over the top or under the open gates. According to the Manual the flow over each gate at EL 77 would be 186 cubic metres per sec or if the gate was opened, 734 cubic metres per sec. This means that there could have been a very large difference in the total discharge from the dam depending on whether the radial gates were open or closed with a range of between 930 cubic metres per sec over the top or 3670 cubic metres per sec under the gates.

12.3 Subsequent to Installation of Fuse Plugs

Subsequent to the installation of the fuse plugs, all operating Strategies require that the radial gates be fully open before initiation of any of the fuse plugs. This means that at EL 77, equivalent to a 1,450,000 ML flood volume, releases through the gates would be 3670 cubic metres per second plus

releases from the fuse plugs. There appear to be some discrepancies in the Manual of Operational Procedures as to the release rates from the breached fuse plugs (refer Section 14.3) however based on the table presented on page 57 (2) the total releases from all Fuse Plug Spillways at EL 77 is approximately 10,500 cubic metres a sec.

This results in a total release from Wivenhoe of 14,170 cubic metres per sec at EL 77. This could no longer be reasonably considered as a flood mitigation strategy but would have to be considered as a dam safety strategy.

It therefore appears to be quite unreasonable to continue to quote 1,450,000 ML as the flood storage capacity of Wivenhoe following the installation of the Fuse Plugs.

12.4 Alliance Delivery

A paper presented by several employees of the Wivenhoe Alliance (12) includes some information potentially relevant to the January event. The paper states that: -

> *The proposed works do not change estimated outflows for flood events up to the 1 in 500 AEP event, thereby preserving the flood mitigation benefits of Wivenhoe Dam for more frequent flood events.* Page 4 (12)

For a 1 in 500 AEP event which the design indicates would not result in the initiation of the Fuse Plugs, Table 3 indicates that the estimated Peak Inflow to Wivenhoe is 10,500 cubic metres per sec and a peak outflow is 4,500 cubic metres per sec.

For a 1 in 1000 AEP event which the design indicates would result in the initiation of the Fuse Plugs, the peak inflow is 12,000 cubic metres per sec and peak outflow is 7,200 cubic metres per sec.

For the January 2011 event the Fuse Plugs were not initiated and the estimated peak inflow was 8000 to 9000 cubic metres per sec however the peak outflow was 7,500 cubic metres per sec. This indicates that a substantially different mode of operation was adopted during the January event than was considered in the above design.

The paper also indicates that: -

> *Under the Alliance commercial framework all participants are rewarded for completing the works for less than the TCE budget. Equally all participants will be penalised if the budget is exceeded* (12)

Did the installation of the Fuse Plugs fundamentally change the ability of Wivenhoe to mitigate floods of the size of the January 2011 flood?

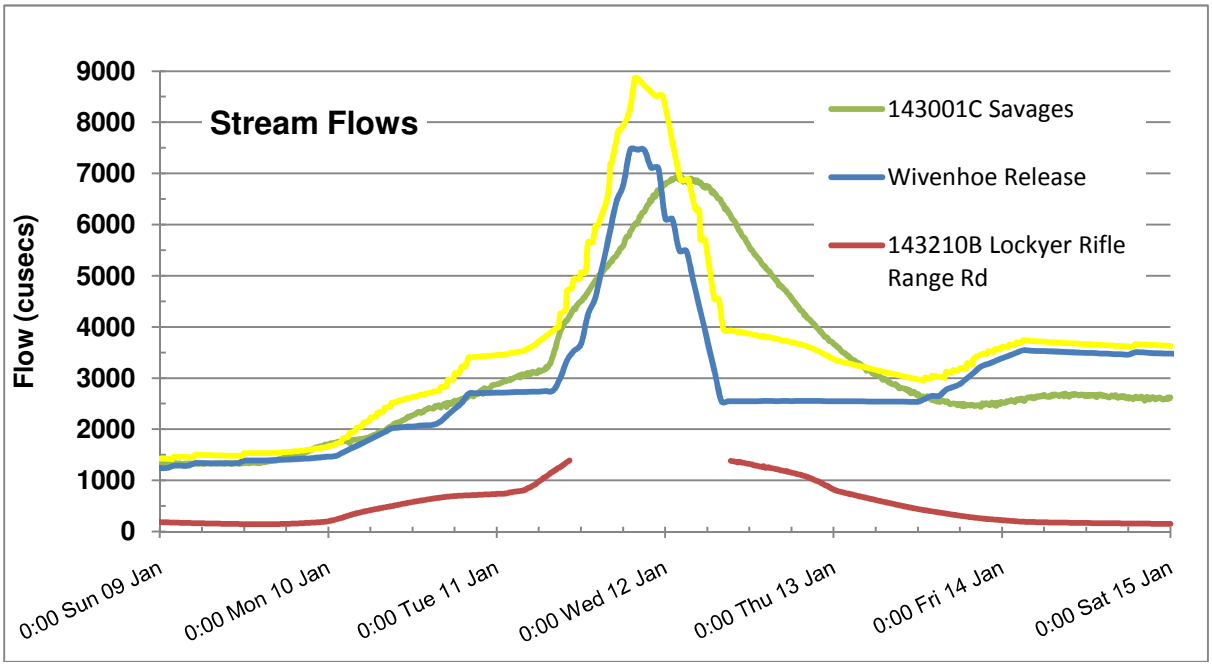
If so what compensating changes have been incorporated in procedures and/or assets?

13. LOCKYER CREEK AND BREMER RIVER

An attempt was made to determine what impact there may have been on the discharge from Lockyer Creek and the Bremer due to the high release rates from Wivenhoe.

13.1 Lockyer Creek

Below is a plot of the release rates from Wivenhoe given in Section 9 of the Flood Event Report (3) compared with flows through the Lockyer Creek Gauge at Rifle Range Road (8) and Savages Crossing (13). A period of data for Lockyer Creek is missing as the gauge was above the rating curve. A plot is also included of the sum of the releases from Wivenhoe and flows in Lockyer Creek. For this later curve a flow of 1400 cubic metres per sec was assumed where no other data was available.



It is apparent from the data that the flow through Savages is generally lower than the flow that would be expected by totalling the releases from Wivenhoe and the flow in the Lockyer. Even on a cumulative basis the data shows that the flow at Savages is lower than expected.

As the flow in Lockyer Creek is developed from a rating curve based on the gauge height, high flows correspond to high stream heights. The most interesting observation is that highest indicated flows in Lockyer Creek, including the period when the stream height was above the limits of the rating curve, correspond with the period of highest releases from Wivenhoe.

It is possible that the high flows in the Brisbane River from the large releases at Wivenhoe raised the level in the Brisbane River sufficiently to affect flows from the Lockyer. And rather than high flows from Lockyer Creek during this period it is indicating that the stream level in Lockyer Creek rose as water could no longer be discharged to the Brisbane River.

13.2 Downstream River Banks

There have been a number of reports together with photographs from residents in the lower Brisbane River Valley detailing significant loss of river bank into the river as the river levels fell. They describe saturated banks collapsing into the river taking with them hectares of productive country.

The very rapid drop in release rates from 6100 cubic metres per sec at 01:00 Wednesday 12th January to 2500 cubic metres per sec at 08:00 on Wednesday is likely to have had a significant impact on the stability banks of the Brisbane River downstream of Wivenhoe. Banks that had been saturated during the flood flows in the river were unsupported as the river level fell rapidly with insufficient time to drain and simply collapsed into the river.

Section 3.6 of the Operations Manual (2) recognises the potential for this impact: -

> *Minimising Impacts to Riparian Flora and Fauna*
>
> *Additionally, when determining the time interval between successive gate closures consideration should also be given to reducing potential bank slumping. Rapid draw down of stream levels where banks are saturated should be avoided if this can be managed within the other flood mitigation objectives.*

While it was necessary to reduce the release rate from Wivenhoe as soon as possible to minimise flooding in the downstream urban areas, the rapid drop in rates during this event was due to the very high release rates that had been instigated on the afternoon of Tuesday 11th. These high release rates would not have been necessary if the water had been discharged earlier and any potential impacts on bank stability would have been reduced.

14. INCONSISTENCIES

There remain a number of inconstancies in the data that remain unresolved. This may be due to a lack of relevant information or errors in reporting. These are listed below together with an indication of whether the inconsistency has a fundamental impact on this submission.

14.1 Maximum Level in Wivenhoe

SEQWater report that the maximum level achieved in Wivenhoe was 191% at 20:00 Tuesday 11th January.

Based on the Brisbane River Height at Wivenhoe Dam, Station Number 540177 (10), the recorded peak over the period Tuesday 11th January through to early morning Wednesday 12th January was 74.51 mAHD, equivalent to 184.9% and this occurred at 14:57 on Tuesday 11th January

The highest level was 74.85 mAHD which was recorded at 13:50 Wednesday 12th January, equivalent to 189.5%.

Refer to additional discussion in Section 9.3.

14.2 Non Damaging Flood Heights

There appears to be some inconsistence in the flow rates adopted for non damaging floods at the Brisbane City Gauge.

1.7 mAHD appears to be the generally accepted level for Minor Flooding however: -

- Appendix B of the Manual indicates that the flow at this river level is 4000 cubic metres per sec.
- Page 28 of the Manual (2) also indicates that the upper limit of non-damaging floods downstream is 4000 cubic metres per sec at Moggill.
- While Table 1 of the Brisbane River Flood Study (7) indicates that the river flow at this level is 3618 cubic metres per sec.

No attempt has been made to resolve the discrepancy and this submission generally uses flows of 4000 cubic metres per sec for a river height of 1.7 mAHD at the Brisbane City Gauge with one exception. That exception is in the calculation of the total volume of water discharged above the height of Minor Flooding. In this case the calculation uses the 3618 cubic metres per sec and so results in a slightly higher volume of water than would be the case if 4000 cubic metres per sec was selected.

It is possible that this discrepancy relates to the use of different tail water levels for the calculation of river flows at the Brisbane City Gauge. The Brisbane River Flood Study (7) states that the tail water level used is 0.92 mAHD which is the Mean High Water Spring Tide however no reference has been found for the data used in the Operational Manual (2).

It is apparent from the entry in the Flood Event Log, Appendix M (3) for 12:45 AM Monday 10th January that this was an unresolved discrepancy between SEQWater and the Brisbane City Council.

It is of concern that this value is not well understood by all parties especially as the maximum rate of release from Wivenhoe up to the level of a non-damaging flow is essential to maintaining the maximum capability for flood mitigation in the Wivenhoe Somerset system.

14.3 Fuse Plug Flow Rates

While it is not relevant for this submission there appear to be discrepancies in the discharge rates from Wivenhoe in the event that the Fuse Plugs are initiated. All references below are to tables, pages and Appendices in the Operational Manual (2).

Table 10.2 lists the discharge rate for all gates fully open, with all Fuse Plugs intact, at a lake level of EL 75.5 as 10,340 cubic metres per sec. This is consistent with the equivalent data in Appendix C.

On page 44 it states that Table 10.2 is to be substituted with the relevant table from Appendix J when a fuse plug spillway has been triggered.

Appendix J lists the discharge rates as: -

- With Central Fuse Plug only initiated as 10,515 cubic metres per sec
- With Central and Right Fuse Plug initiated as 10,970 cubic metres per sec, and
- With All Fuse Plugs initiated as 11,530 cubic metres per sec

These flows would indicate only minor increase above the discharge rate with all Fuse Plugs intact.

However the Wivenhoe Dam Auxiliary Spillway Rating Table in Appendix C for indicates the following discharge rates for the bays at EL 76: -

- Central 1873 cubic metres per sec
- Right 3553 cubic metres per sec
- Left 3608 cubic metres per sec

This together with the data from Table 10.2 would indicate a discharge rate with all Fuse Plugs initiated of 19,374 cubic metres per sec compared with 11,530 from the Appendix J.

15. NOTES

1. Throughout this submission the words Operator and SEQWater are used interchangeably. The has been no attempt to understand the actual legal structure defining the relationship between the beneficial owners of the assets and any relationships they may have with other parties who may provide services to the owners such as design, construction, maintenance or operating services. The terms Operator and SEQWater are therefore shorthand for the legally responsible entity for the provision of the required services at the particular time.

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17. ABBREVIATIONS

ARI	Average Recurrence Interval
AEP	Annual Exceedance Probability
BoM	Bureau of Meteorology
cumecs	cubic metres per sec, 1000 litres per sec
DERM	Department of Environment and Resource Management (Qld)
EL	Elevation
FOC	Flood Operations Centre
mAHD	metres Australian Height Datum
m^3/sec	cubic metres per sec, 1000 litres per sec
ML	mega litres, 10^6 litres, million litres
ML/d	mega litres per day
MHWS	Mean High Water Spring Tide
Operator	Refer to Section 15
SEQWater	Refer to Section 15
TCE	Target Cost Estimate

ATTACHMENT 1

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Michael J O'Brien

ATTACHMENT 2

Development of a Rating Curve for Brisbane City Gauge

To calculate flows past the Brisbane City Gauge it is necessary to have access to the rating curve for that site. In the absence of ready access to the official rating curve, a rating curve has been developed from publicly available information.

The data points used to create the rating curve and the source of the data is given below. For the data from the Brisbane River Flood Study (7), the Adjusted Flood Level and the Adjusted Flow Rates have been selected.

Recorded Flood Level mAHD	Adjusted Flood Level m AHD	Adjusted Flow m^3/sec	Reference
	1.7	4000	App B Operational Manual (2)
	2.6	5000	App B Operational Manual (2)
	3.5	6500	App B Operational Manual (2)
	3.3	6000	Independent Review Panel (14) page i
8.43	8.03	14100	Table 1 Brisbane River Flood Study (7)
2.76	0.84	1940	Table 1 Brisbane River Flood Study (7)
7.03	5.11	8924	Table 1 Brisbane River Flood Study (7)
6.5	4.58	8120	Table 1 Brisbane River Flood Study (7)
2.91	0.99	2252	Table 1 Brisbane River Flood Study (7)
3.27	1.35	2963	Table 1 Brisbane River Flood Study (7)
3.32	1.8	3789	Table 1 Brisbane River Flood Study (7)
3.78	2.26	4574	Table 1 Brisbane River Flood Study (7)
2.89	1.37	3001	Table 1 Brisbane River Flood Study (7)
2.69	1.17	2614	Table 1 Brisbane River Flood Study (7)
2.61	1.09	2455	Table 1 Brisbane River Flood Study (7)
2.46	0.94	2149	Table 1 Brisbane River Flood Study (7)
3.78	2.26	4574	Table 1 Brisbane River Flood Study (7)
3.75	2.23	4525	Table 1 Brisbane River Flood Study (7)
5.33	3.81	6972	Table 1 Brisbane River Flood Study (7)
8.35	8.35	14600	Table 1 Brisbane River Flood Study (7)
5.02	3.45	8500	Table 1 Brisbane River Flood Study (7)
3.35	1.83	6100	Table 1 Brisbane River Flood Study (7)
1.7	1.7	3618	Table 1 Brisbane River Flood Study (7)
2.15	2.15	4398	Table 1 Brisbane River Flood Study (7)

Recorded Flood Level mAHD	Adjusted Flood Level m AHD	Adjusted Flow m^3/sec	Reference
1.85	1.85	3884	Table 1 Brisbane River Flood Study (7)
3.32	3.32	6245	Table 1 Brisbane River Flood Study (7)
2.36	2.36	6704	Table 1 Brisbane River Flood Study (7)
1.75	1.75	4189	Table 1 Brisbane River Flood Study (7)
1.87	1.87	2990	Table 1 Brisbane River Flood Study (7)
1.97	1.97	4704	Table 1 Brisbane River Flood Study (7)
1.47	1.47	2478	Table 1 Brisbane River Flood Study (7)
5.45	5.45	10364	Table 1 Brisbane River Flood Study (7)
1.82	1.82	2387	Table 1 Brisbane River Flood Study (7)
2	2	3087	Table 1 Brisbane River Flood Study (7)

The Brisbane River Flood (7) study modelled all flows at the Brisbane City Gauge with a tail water level of 0.92 mAHD equivalent to the Mean High Water Spring Tide and the Independent Review Panel (14) used the same value. However no reference has been found for the data used in the Operational Manual (2).

These data points were plotted and a correlation was selected to represent the data. The data appears to fit a linear relationship quite well except when approaching the lower flows and river levels; e.g. below 1.5 mAHD and 2000 cumecs. However these flows and river levels are not significant for the purposes of this submission. Other inconsistencies in the linear relationship were also apparent: -

- There is a bit of variability in the data for river levels in the range of 1.47 mAHD to 1.87 mAHD but are all included in the correlation.
- The following three data points, from the Brisbane River Flood Study (7), appeared to be inconsistent with the other data and were deleted from the correlation: -

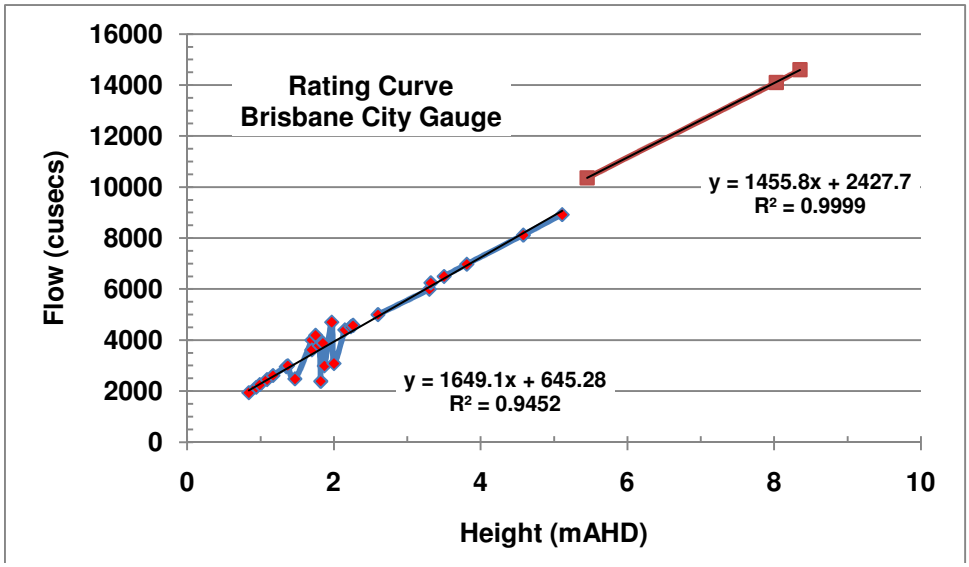
  3.35 mAHD 6100 cumecs

  2.36 mAHD 6704 cumecs

  5.02 mAHD 8500 cumecs

- There seems to be a discontinuity at river levels above 5.11 mAHD and so two correlations were developed.

For reference the plot showing all data points is given at the end of this section.



The two correlations developed and used for this submission are: -

Less than or equal to 5.11 mAHD

Flow (cumecs) = 1649.1*River Height (mAHD) + 645.28

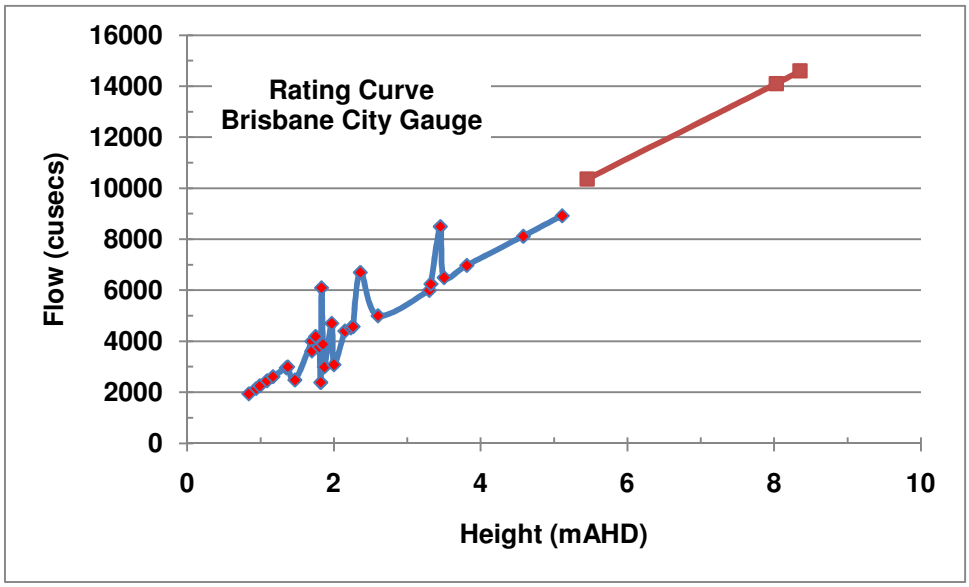
At greater than 5.11 mAHD

Flow (cumecs) = 1455.8*River Height (mAHD) + 2427.7

At less than 5.11 mAHD, 1000 cubic metres per sec represents approximately 0.61 metres in flood height at the Brisbane City Gauge.

At greater than 5.11 mAHD, 1000 cubic metres per sec represents 0.69 metres in flood height at the Brisbane City Gauge.

The following plot includes the three data points that were excluded above.



ATTACHMENT 3

Dam Releases

On 7th March SEQWater released data on actual gate openings and the timing of releases from both Wivenhoe and Somerset.

Prior to release of this data the following table had been generated from a mixture of public sources including media releases by SEQWater, WaterGrid, emails sent by SEQWater to residents in the Brisbane River Valley and river heights provided by BoM and DERM.

Date and Time flow commenced	**Date and Time flow finished**	**Estimated Wivenhoe Release Rate**	
		m^3/sec	ML/d
Prior to	18:00 Thursday 06 Jan	0	0
18:00 Thursday 06 Jan	22:00 Thursday 06 Jan	125	10,800
22:00 Thursday 06 Jan	15:00 Friday 07 Jan	250	21,600
15:00 Friday 07 Jan	20:26 Saturday 08 Jan	1,200	103,680
20:26 Saturday 08 Jan	20:33 Sunday 09 Jan	1,250	108,000
20:33 Sunday 09 Jan	02:00 Monday 10 Jan	1,400	120,960
02:00 Monday 10 Jan	21:03 Monday 10 Jan	2,600	224,640
21:03 Monday 10 Jan	02:42 Tuesday 11 Jan	2,400	207,360
02:42 Tuesday 11 Jan	06:53 Tuesday 11 Jan	2,730	235,872
06:53 Tuesday 11 Jan	08:00 Tuesday 11 Jan	2,750	237,600
08:00 Tuesday 11 Jan	12:00 Tuesday 11 Jan	3,000	259,200
12:00 Tuesday 11 Jan	14:45 Tuesday 11 Jan	3,500	302,400
14:45 Tuesday 11 Jan	18:30 Tuesday 11 Jan	6,700	578,880
18:30 Tuesday 11 Jan	20:30 Tuesday 11 Jan	7,500	648,000
20:30 Tuesday 11 Jan	23:15 Tuesday 11 Jan	6,700	578,880
23:15 Tuesday 11 Jan	05:04 Wednesday 12 Jan	4,300	371,520
05:04 Wednesday 12 Jan	07:30 Wednesday 12 Jan	4,300	371,520
07:30 Wednesday 12 Jan	11:47 Thursday 13 Jan	2,500	216,000
11:47 Thursday 13 Jan	13:00 Thursday 13 Jan	2,500	216,000
13:00 Thursday 13 Jan	18:00 Thursday 13 Jan	2,500	216,000
18:00 Thursday 13 Jan		2,800	241,920

With the release of the actual data by SEQWater this submission has been updated to use the release data provided by SEQWater and this table is present as a matter of history only.

ATTACHMENT 4

Dam Heights and Release Rates

Provided by SEQWater

Date/Time	Lake Level		Difference	Total Inflow minus Somerset Outflow
	Manual Gauge Board mAHD	Sensor 6637 mAHD	m	m^3/s
00:00 Tuesday 11 Jan	73.26	73.25	0.01	3827
01:00 Tuesday 11 Jan	73.31	73.31	0	3349
02:00 Tuesday 11 Jan	73.35	73.35	0	2769
03:00 Tuesday 11 Jan	73.38	73.35	0.03	3564
04:00 Tuesday 11 Jan	73.4	73.39	0.01	4151
05:00 Tuesday 11 Jan	73.46	73.41	0.05	5043
06:00 Tuesday 11 Jan	73.51	73.51	0	5995
07:00 Tuesday 11 Jan	73.61	73.59	0.02	5981
08:00 Tuesday 11 Jan	73.7	73.69	0.01	7240
09:00 Tuesday 11 Jan	73.81	73.77	0.04	8346
10:00 Tuesday 11 Jan	73.95	73.89	0.06	9558
11:00 Tuesday 11 Jan	74.1	74.01	0.09	8789
12:00 Tuesday 11 Jan	74.27	74.11	0.16	9508
13:00 Tuesday 11 Jan	74.39	74.25	0.14	10950
14:00 Tuesday 11 Jan	74.57	74.37	0.2	9128
15:00 Tuesday 11 Jan	74.71	74.45	0.26	8444
16:00 Tuesday 11 Jan	74.81	74.41	0.4	8337
17:00 Tuesday 11 Jan	74.89	74.27	0.62	7586
18:00 Tuesday 11 Jan	74.95	74.37	0.58	6532
19:00 Tuesday 11 Jan	74.97	74.15	0.82	6267
20:00 Tuesday 11 Jan	74.97	74.07	0.9	6451
21:00 Tuesday 11 Jan	74.95	74.31	0.64	6189
22:00 Tuesday 11 Jan	74.95	74.23	0.72	5622
23:00 Tuesday 11 Jan	74.92	74.13	0.79	5357
00:00 Wednesday 12 Jan	74.91	74.27	0.64	4648
01:00 Wednesday 12 Jan	74.87	74.39	0.48	4346
02:00 Wednesday 12 Jan	74.86	74.45	0.41	3692
03:00 Wednesday 12 Jan	74.81	74.35	0.46	4234
04:00 Wednesday 12 Jan	74.8	74.45	0.35	3787
05:00 Wednesday 12 Jan	74.77	74.57	0.2	3882
06:00 Wednesday 12 Jan	74.77	74.69	0.08	3783
07:00 Wednesday 12 Jan	74.76	74.73	0.03	3493
08:00 Wednesday 12 Jan	74.78	74.77	0.01	2272
09:00 Wednesday 12 Jan	74.78	74.77	0.01	2441
10:00 Wednesday 12 Jan	74.78	74.79	-0.01	2735
11:00 Wednesday 12 Jan	74.78	74.79	-0.01	2662
12:00 Wednesday 12 Jan	74.79	74.79	0	2956
13:00 Wednesday 12 Jan	74.79	74.79	0	3030
14:00 Wednesday 12 Jan	74.81	74.81	0	2076
15:00 Wednesday 12 Jan	74.81	74.83	-0.02	2811
16:00 Wednesday 12 Jan	74.8	74.85	-0.05	2443
17:00 Wednesday 12 Jan	74.82	74.83	-0.01	2408
18:00 Wednesday 12 Jan	74.8	74.81	-0.01	3067
19:00 Wednesday 12 Jan	74.82	74.81	0.01	2444
20:00 Wednesday 12 Jan	74.82	74.81	0.01	2261

Date/Time	Lake Level		Difference	Total Inflow minus Somerset Outflow
	Manual Gauge Board mAHD	Sensor 6637 mAHD	m	m^3/s
21:00 Wednesday 12 Jan	74.82	74.81	0.01	2003
22:00 Wednesday 12 Jan	74.81	74.81	0	2039
23:00 Wednesday 12 Jan	74.8	74.81	-0.01	2039

Michael J O'Brien

ATTACHMENT 5

Submission to Commission

10 February 2011

MJ O'Brien
[redacted]
BRIS QLD 4069
[redacted]

10 February 2011
Ref BRI-LET-001

Commissioner
Queensland Floods Commission of Inquiry
NSW 4000

Attention: The Honorable Justice Catherine Holmes

Urgent Submission

Please refer to the attached email response from the Department of Environment and Resource Management to a request for historical stream data from the Brisbane River Valley during the period of the recent floods.

Access to river height and flow data from the Lockyer, Bremer and Brisbane catchments is critical to preparing an informed submission to the Commission on the recent Brisbane flood event. Lack of timely access to such data will seriously inhibit any independent or third part assessment of the flood event.

Given that written submissions to the Commission relating to dam operations must be received by the Commission by 5.00pm, 11 March 2011, such restrictions imposed by the Department may prevent appropriate submissions being prepared by the due date.

We request that the Commission immediately consider: -

- Extending the date for submissions so as to be a reasonable period beyond the date on which the information becomes available;
- Directing the Department of Environment and Resource Management to respond expeditiously to requests for information; or
- Providing such information directly from the Commission's own web site

I appreciate your urgent consideration of this request.

Yours Sincerely

[redacted]

Mick O'Brien

[redacted]

[redacted]

RE: WaterShed data request

[redacted]

8 February 2011 13:27

Dear Mr O'Brien,
We have been directed to temporarily suspend supply of data for requests in the Lockyer, Bremer and Brisbane catchments for both archive and interim telemetry data. However, it is anticipated that the restriction will be lifted in the coming days and where data has not been supplied, the requester will be notified.

If this causes any concern, please let me know, alternatively you may choose to take the matter up with the Director of Water Accounting:

[redacted]
Director, Water Accounting
GPO Box 2454, Brisbane Q 4001
[redacted]

For other catchments, there is also a backlog of data requests due to the impact of flooding upon many services and there may be a delay of a week or more in actioning incoming requests, however if you are able to demonstrate a critical need for the immediate supply of data it will of course then be supplied as soon as possible.

Regards,
[redacted]
A/ Project Officer, Water Quality and Accounting
[redacted]
www.derm.qld.gov.au
Department of Environment and Resource Management, PO Box 318, Toowoomba Q 4350

-----Original Message-----
Sent: Monday, 7 February 2011 8:02 PM
To: DADS Hydstra Support
Subject: WaterShed data request

****

From:

Mick O'Brien

****

Email_Address:

[redacted]

****

Address:

****

Refering_page:

http://www.derm.qld.gov.au/watershed/precomp/143001c/143001c.htm

****

Comment_or_Question:

143210B
143001C
143107A

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dataperiod:

****

dataperiod_from:

06/01/2011

****

dataperiod_to:

15/01/2011

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dataint:

P point

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datatype:

webflow.q