

**IN THE MATTER OF  
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY**

**A COMMISSION OF INQUIRY UNDER THE  
COMMISSIONS OF INQUIRY ACT 1950**

**AND PURSUANT TO  
COMMISSIONS OF INQUIRY ORDER (No. 1) 2011**

**THIRD STATEMENT OF TERRENCE ALWYN MALONE**

On the 20<sup>th</sup> day of October 2011, I, Terrence Alwyn Malone of 240 Margaret St, state on oath:

1. I am employed by Queensland Bulk Water Supply Authority (*Seqwater*) in the position of Principal Hydrologist, Water Delivery.

**Preliminary**

2. This statement addresses only the matters raised by Mark Babister in paragraphs 46-48 of his report "*Brisbane River 2011 Flood Event – Flood Frequency Analysis*" dated 18 September 2011. In summary, Mr Babister has suggested that there may have been mechanical failure with Seqwater's City gauge during the January 2011 Flood Event.
3. I do not make any comment on the remainder of Mr Babister's report.

**Brisbane Port Office**

4. The Brisbane Port Office has long been the location at which water levels of floods have been measured and recorded. For a long time, there was a staff gauge (that is, a board from which manual readings can be taken) in Edward St, but it was removed in the early 1990s.
5. There are currently two water level gauges at the Brisbane Port Office – one on each side of the Brisbane River. One is operated by Maritime Safety Queensland (*MSQ*); the other is operated by Seqwater/Bureau of Meteorology (*BoM*).

**MSQ's Brisbane Port Office Gauge**

6. MSQ's gauge is known as the Brisbane Port Office gauge (143919).
7. It is located on the left bank of the Brisbane River, half way along the Town Reach between the Captain Cook and Story Bridges.

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Filed on behalf of: Queensland Bulk Water Supply Authority trading as Seqwater

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8. It consists of a gas purge bubbler with the orifice located under the walkway in a potentially high velocity location. This bubbler automatically (and in real time) records the river height and transmits it to instrumentation located in one of the columns of the building occupied by the Stamford Hotel.
9. There is an accompanying staff gauge on a pylon located in the Brisbane River about 25m upstream of the instrument to enable the water level recorded by the instrumentation to be physically checked.
10. MSQ has advised me that the gauge zero of the gauge is Low Water Datum (*LWD*) which is 1.15m below Australian Height Datum (*AHD*). That is, a reading of 0m LWD is equivalent to a reading of -1.15m AHD. The difference between LWD and AHD reflects the fact that maritime agencies prefer tide heights to be always positive whereas flood levels are always referenced to land levels or height above mean sea level.
11. There is another datum reference which is relevant. It is Lowest Astronomical Tide (*LAT*). LAT is 1.24m below AHD and about 0.09m below LWD.
12. The staff gauge only extends up to 3.8m LWD. This means that for river heights above 3.8m LWD the staff gauge cannot be physically inspected so as to check the readings derived from the instrumentation.
13. Figure 1 below shows the Brisbane Port Office gauge, the upper 1.8m of which was washed away during the January 2011 Flood Event.



Figure 1 Brisbane Port Office Staff Gauge

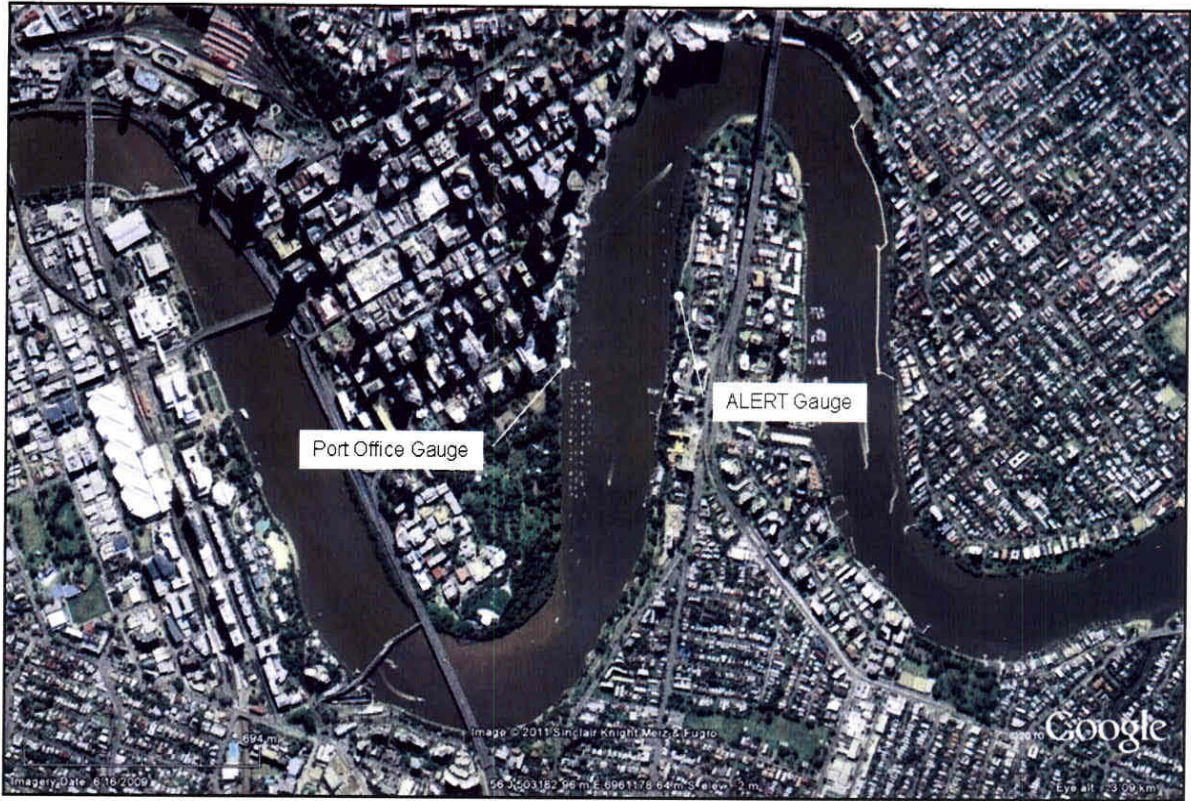
14. According to the data supplied to Seqwater by the BoM, which originated from MSQ during the event, the peak water level at the Port Office gauge was 4.19m AHD at 04:30 on 13 January 2011.
15. However, further inquiries reveal that this data was assumed by BoM to be based on LAT, not LWD. As a result, the peak water level recorded by MSQ's Brisbane Port Office gauge during the event was 4.27m AHD.

**Seqwater's Brisbane ALERT gauge**

16. The Brisbane ALERT gauge (143838) is located on the right bank of the Brisbane River, slightly downstream of MSQ's Port Office gauge.
17. This gauge is owned and operated by Seqwater with a full set of staff gauges which were installed by Australian Surveying and Land Information Group (now known as GeoScience Australia) at BOM's request in June 1992. My understanding is that the surveyor at the time levelled the boards into place with a simultaneous level shot across the river and a Permanent Survey Mark was installed close to the new gauges.
18. The Brisbane ALERT gauge consists of a wet pressure transmitter with a 50mm resolution and reports via radio every incremental change in water level.
19. The staff gauge is in an area of relatively still water away from any high velocities and turbulence.
20. The gauge zero of the Brisbane ALERT gauge is AHD.
21. The Brisbane ALERT gauge is part of the official flood forecasting network operated by BoM and Seqwater and is updated on BoM's web site every hour (the MSQ Brisbane Port Office gauge is not).
22. According to the ALERT data collected during the event, the peak water level at the Brisbane ALERT gauge was 4.46m AHD at 03:39 on 13 January 2011.



23. The relative location of the water level gauges in the Town Reach is shown in Figure 2 below.



*Figure 2 Brisbane Water Level Gauges*

**Operation of Seqwater's Brisbane ALERT gauge and possible explanations for the difference in readings**

24. As can be seen from the above, there is an apparent difference of 190mm between the peak water levels at the MSQ Brisbane Port Office gauge and the Seqwater Brisbane ALERT gauge.
25. For the reasons explained below, my opinion is that the Seqwater Brisbane ALERT gauge readings were accurate during the January 2011 Flood Event.

*No mechanical failure of Seqwater Brisbane ALERT gauge*

26. I am not aware of any mechanical failure of the Seqwater Brisbane ALERT gauge during the January 2011 Flood Event. There are no obvious discrepancies in the gauge readings which would give rise to any concern about the accuracy of the sensing equipment.

*Manual readings confirm automatic readings*

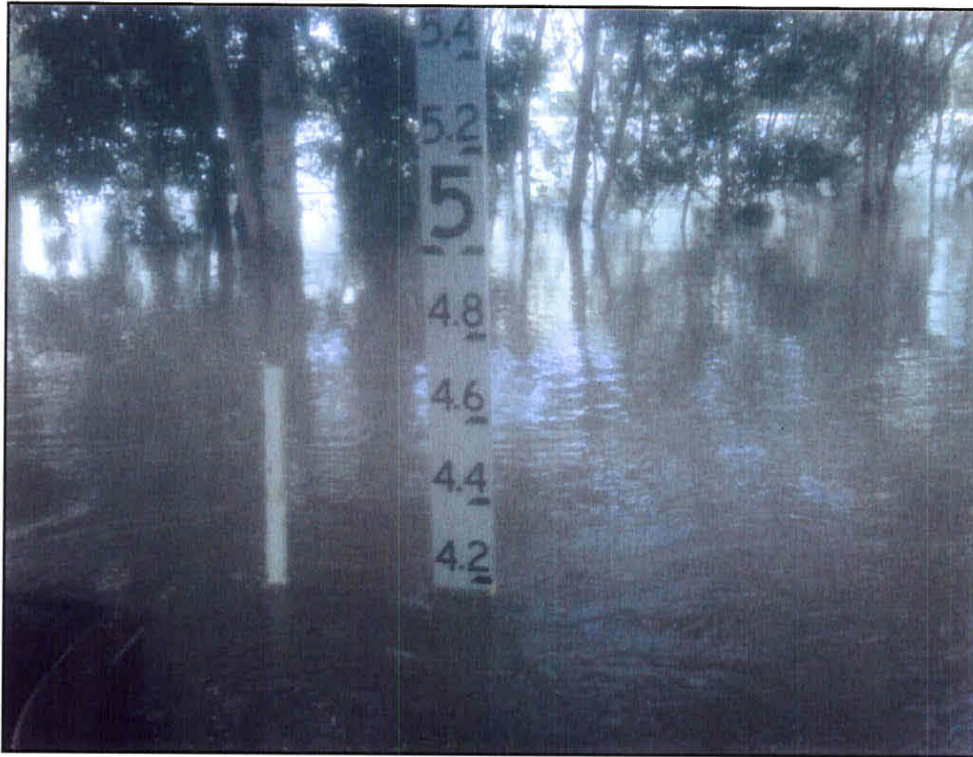
27. My understanding is that during construction of a footpath in the area, the 4-5m staff gauge at the Brisbane ALERT gauge was removed and not replaced. However, my understanding is that a Brisbane City Council (**BCC**) surveyor installed a temporary 4-5m gauge during the early stages of the January 2011 Flood Event. On 8 February 2011, Seqwater hydrographers carried out a check survey of the 4-5 metre gauge board and confirmed that it was installed at the correct level.
28. Before, during and after the event, several manual readings of the Brisbane ALERT staff gauge were taken as indicated in the table below.

*Table 1 Staff Gauge Readings*

<b>Date</b>	<b>Observed Level</b>	<b>Agency</b>
17/11/2010 10:30	-0.05	Seqwater
17/11/2010 11:20	-0.30	Seqwater
18/11/2010 09:25	0.66	Road Tek
22/12/2010 10:30	1.85	BCC Rapid Response
12/01/2011 07:50	3.30	BCC Rapid Response
12/01/2011 09:30	3.40	BCC Rapid Response
12/01/2011 12:00	3.80	BCC Rapid Response
13/01/2011 03:00	4.46	BCC Rapid Response
13/01/2011 07:50	4.20	Senior Flood Operations Engineer
20/01/2011 18:00	-0.50	Seqwater

29. These observations provided a check on the reading obtained via the ALERT system in the Flood Operations Centre. If necessary, the Brisbane ALERT gauge was re-calibrated to match the observed water level (as observed water levels are preferred to the instrumentation readings).
30. Further, the Senior Flood Operations Engineers (Rob Ayre and John Ruffini) took photos of the surveyed staff gauge at the Brisbane ALERT gauge site at 07:50 on 13<sup>th</sup> January 2011, several hours after the peak. The photograph is shown in Figure 3 below.
31. Records previously provided to the Commission show the Brisbane ALERT gauge had fallen from a peak of 4.46m at 03:39 to 4.20m at the time of the photo (07:50).





*Figure 3 Brisbane ALERT gauge 07:50 13th January 2011*

*No wave set up or turbulence in area of Seqwater Brisbane ALERT gauge*

32. The staff gauge for Seqwater's Brisbane ALERT gauge is in an area of relatively slack water.
33. The photo in Figure 3 does not show any wave set up or turbulence which might account for artificially elevated water levels.

*No manual readings of MSQ staff gauge available*

34. A comparison of the readings taken at the MSQ Port Office gauge, the Seqwater ALERT gauge and manual readings from the Seqwater staff gauge adjacent to the Seqwater ALERT gauge is shown on Figure 4 below. Up until the early hours of 12<sup>th</sup> January, the difference between the two gauges was less than 50mm. However at that point, the gauges started to deviate but the Brisbane ALERT gauge readings were confirmed by manual readings from the staff gauge. A difference of about 200mm was then maintained for the remainder of the event.
35. I do not know if MSQ took any manual staff gauge readings at the Port Office gauge to confirm that the instrument was reading correctly during the January 2011 Flood Event. In any case, as I explain above, the flood peak was above the maximum height of the gauge board on the pylon so it would not have been possible to perform check readings once the river height exceeded 3.80m (LWD). During the January 2011 Flood Event, the Brisbane River exceeded this height at the Port Office at least 24 hours before the peak of the event.

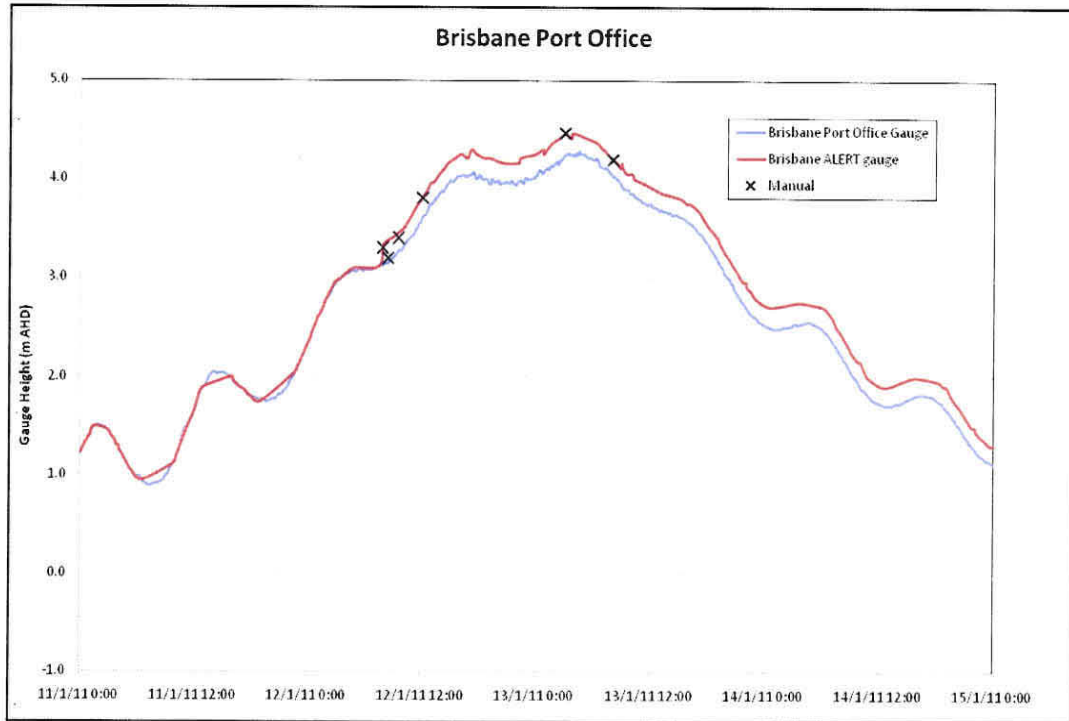


Figure 4 Comparison of Brisbane Gauge Readings

*BCC survey data suggests MSQ gauge reading too low*

36. My understanding is that BCC surveyed peak water levels in the vicinity of the Town Reach as indicated on Figure 5. The red spots indicated surveyed peak water levels and the yellow spots peak water levels at the gauges.
37. In the Town Reach, the surveyed water levels on the left bank upstream and downstream of the Port Office gauge are both higher than the 4.19m/4.27m recorded by the MSQ Port Office gauge and provided to BoM. This suggests that the peak water level recorded at the MSQ Port Office gauge is too low.



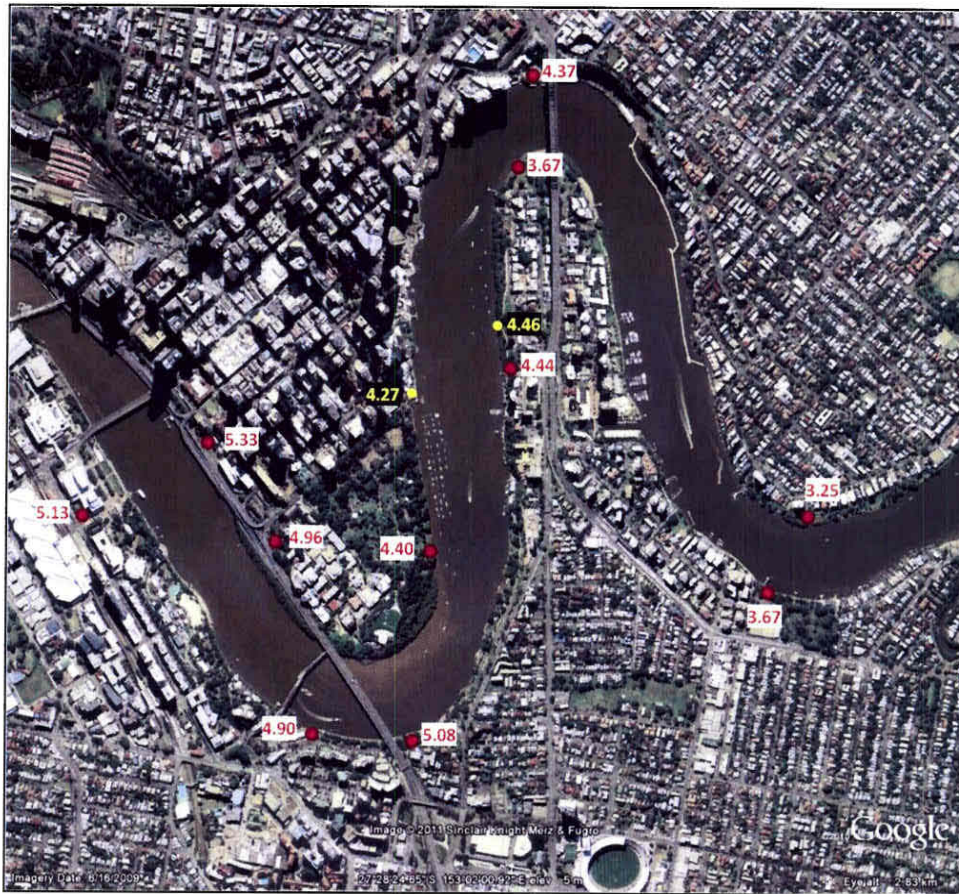


Figure 5 Peak Water Levels in Town Reach Jan 2011

*Superelevation unlikely to be a reason for the difference*

38. The surveyed levels shown in Figure 5 clearly show the impact of superelevation with peak water levels on the outside of the river bends being higher than those on the inside.
39. However, the MSQ Port Office gauge and the Seqwater Brisbane ALERT are located in a relatively straight section in the Town Reach of the Brisbane River.
40. Survey records from 1974 confirm that there is not a large difference in peak water levels between the left and right banks in the vicinity of the Port Office gauge with the difference less than 30mm in January 1974 as shown in Figure 6 below.
41. As a result, my opinion is that superelevation can be discounted as a possible cause of the difference in peak water levels.



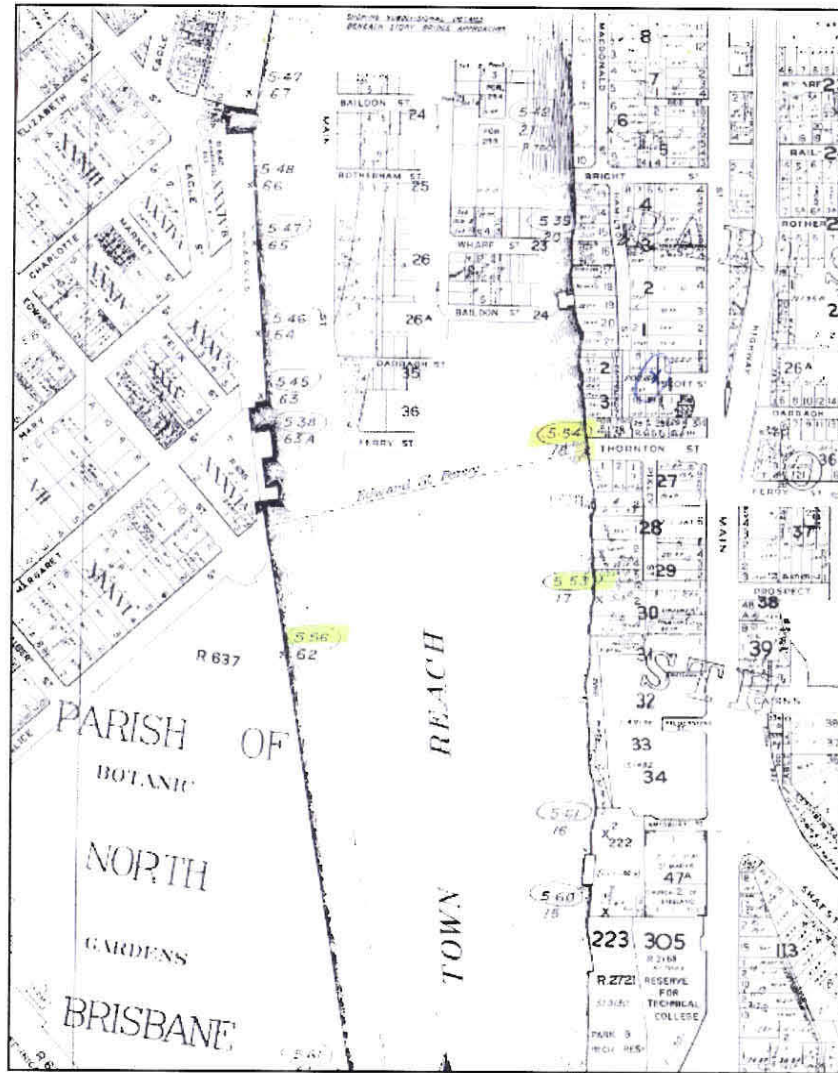


Figure 6 Peak Water Levels in Town Reach Jan 1974

*Slope unlikely to be a reason for the difference*

42. My opinion is that slope is also unlikely to account for the difference as the Seqwater Brisbane ALERT gauge is about 200m metres downstream and the peak at the ALERT gauge is higher than the MSQ Port Office gauge. Under flood conditions the downstream water level is normally lower than the upstream water level.

*MSQ gauge may be affected by high velocity flows*

43. As mentioned above, the Port Office gauge consists of a gas bubble unit which monitors the pressure in a gas line linked to the river. The orifice at the end of the gas line is located in a potentially high velocity zone which could impact upon readings. The gauge may under read as the velocity in the river increases. This effect may not be evident during normal non-flood periods or under static loads during testing.

44. This would explain the similarity between the readings during the rising limb, the differences during the high stage period but I agree that it does not explain the differences on the falling limb.
45. For these reasons, Seqwater has adopted the Seqwater Brisbane ALERT gauge reading of 4.46m AHD as the peak of the January 2011 Flood Event at the Port Office.

**SWORN** by **TERRENCE ALWYN MALONE** on 20 October 2011 at Brisbane in the presence of:



Deponent



Solicitor