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24 March, 2011

The Commissioners,
Queensland Floods Commission of Inquiry,
PO Box 1738,
Brisbane QLD 4001

Re: Submission re Operation of Wivenhoe Dam Releases – Major Flood, January, 2011

This submission is made with the objective of demonstrating that if some pre-emptive action had been taken by SEQWater, operator of the Wivenhoe Dam, in relation to releases from the dam in the period leading up to the extreme flood inflows on Mon. 10 & Tues. 11 Jan. 2011 then the need for an excessive outflow release late on Tues. 11 Jan. 2011 could have been minimised.

According to the SEQWater report of 02 March 2011 two inflow peaks occurred, one on Mon. 10 Jan. 2011 of 10,095 cubic metres per second (cumecs) at about 8.00 am and the other on Tues. 11 Jan. 2011 of 11,561 cumecs at about 1.00 pm. These inflows led to the dam lake level reaching 74.97 m AHD in the period 7.00 to 8.00 pm on the Tuesday evening. This dam level represents a critical situation as it appears that the operators attempt to prevent the dam lake level exceeding EL 75.00 as this is to prevent initiation of the first (lowest) fuse plug, which it is understood is triggered at EL 75.50 (ie. 0.5m freeboard).

The dam has three fuse plugs which are intended to prevent overtopping of the main embankment wall, a situation where catastrophic failure of the dam could occur. Initiation or triggering of one or more fuse plugs would have led to uncontrolled release into the downstream section of Brisbane River with possibly more severe consequences downstream in parts of Ipswich and Brisbane cities, than actually occurred in the period 12 Jan. 2011 onwards.

It was when the lake level reached the abovementioned critical level, with concern about possible fuse plug initiation, that the operators proceeded to release an excessively high outflow discharge of up to 7,464 cumecs via the radial gates at the dam spillway. This extreme outflow when combined with inflow to the river from the Bremer River, Lockyer Creek etc. led to the peak of the extreme flood event in the City of Brisbane, some 36 hours later on the morning of Thurs. 13 Jan. 2011.

In the period from midnight on 07 Jan. 2011 (ie. 00.00 on 08 Jan. 2011) the outflow discharge from the dam was varied from 509 cumecs at the above time to 1,138 cumecs at midday, 1,241 at midnight on 08 Jan. 2011 and was then only slowly increased to 1944 cumecs at 08.00 am on 10 Jan. 2011. The relevance of the latter figure is that under *The Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam* (Operational Procedures) a release of 1900 cumecs is warranted under Operation Strategies W1D and W1E when the lake level reaches 68.00 m or 68.25 m AHD respectively. These strategies are intended to protect certain downstream infrastructure from inundation, Kholo Bridge and Mt. Crosby Weir Bridge in the case of W1D and Mt. Crosby Weir Bridge and Fernvale Bridge for W1E. Under Operation Strategy W1E if the lake level reaches EL68.5m provision is made for a switch to Strategy W2 or W3, as appropriate. Strategy W2 is a Transition Strategy with

maximum release of 3,500 cumec and is intended to minimise impact on downstream rural life and protecting urban areas from inundation. Strategy W3 provides for a maximum release of 4,000 cumec and its primary consideration is protecting urban areas from inundation.

It is contended that enhanced releases from the dam could and should have been initiated earlier and were warranted under the Operation Strategies. The following table summarises reported inflows, outflows and lake levels in the period leading up to, what may have been a panic situation, where releases took place exceeding 7,000 cumecs in the period from 18.00 to 23.00 on Tues 11 Jan. 2011.

Date	Time	Inflow (cumecs)	Outflow(cumecs)	Lake Level m AHD
08 Jan. 2011	0000	818	509	68.32
08 Jan. 2011	0600	1867	825	68.46
08 Jan. 2011	1200	1260	1138	68.60
08 Jan. 2011	1800	1255	1242	68.65
09 Jan. 2011	0000	926	1241	68.64
09 Jan. 2011	0600	1047	1335	68.58
09 Jan. 2011	1200	2080	1384	68.54
09 Jan. 2011	1800	5454	1404	68.86
10 Jan. 2011	0000	7936	1462	69.80
10 Jan. 2011	0600	9312	1806	70.96
10 Jan. 2011	1200	9026	2053	72.07
10 Jan. 2011	1800	7141	6774	74.95

The writer of this submission contends that a warrant existed under the Operational Procedures, the rainfall information for the dam catchment being reported by the Bureau of Meteorology (BOM) and the actual extreme inflows into the dam being experienced, for higher outflow discharges to be pre-emptively initiated. It is also to be recognised that storage up to EL 67.00 represents the urban water supply component of the dam and any lake level above that represents flood storage. The above table indicates that the lake level was already above EL 67.00 well before major discharge was initiated and that earlier and higher releases could have and should have been undertaken by the operators. There would not been any compromise to the urban water component of the dam storage.

In preparing this submission reliance has been placed upon the hourly lake storage levels, lake storage volumes and outflow discharges contained in section 9 of the SEQWater report of 02 March, 2011. It is noted that there appears to be some discrepancies or inconsistencies in the inflow data contained in that report and this shall addressed later in this submission.

A Storage – Discharge Analysis of the actual flood events at the dam over the period 07 Jan. 2011 to 15 Jan. 2011 was undertaken by the writer of this submission using 6 hour time steps. This was to verify the modelling procedure. This model resulted in an accurate reproduction of the same lake levels and storages portrayed in the SEQWater report. This analysis is attached as Annexure 1. As noted previously this involved the need by the operators to make extremely high outflow releases of over 7,000 cumecs (and up to 7,464 cumecs) in the period from 18.00 to 23.00 on Tues. 11 Jan. 2011.

Annexure 2 details a modified pre-emptive release scenario. This used the relevant parts of the abovementioned analysis but with earlier outflow discharges, in accordance with the operational strategies for the dam. This involved an initial release of 1,900 cumecs, increasing to 3,500

cumecs and then with a constant discharge of 4,000 cumecs over the period from 00.00 on 10 Jan. 2011 onwards. Accordingly in this analysis the outflow discharge was not allowed to exceed 4,000 cumecs. It can be seen that under this scenario the lake water level only rises to EL 73.20 m AHD. This is 1.75m below that which was allowed to occur by the dam operators during the actual flood event and well below the fuse plug water surface limit of EL 75.00 m AHD. Accordingly this operating scenario not only addresses the issue of dam safety but also meant that the flow contribution to the downstream reaches of the Brisbane River would have been minimised during the time that other inflows to the lower reaches were impacting on rural and urban areas including parts of Ipswich and Brisbane cities. Under this modified release scenario there would not have been a need to invoke Release Strategy W4 (ie protecting the structural integrity of the dam).

This operating scenario would have reduced the peak outflow discharge from the dam to slightly more than half that actually released. The extent of flooding in the Ipswich and Brisbane areas would thus have been markedly reduced, even allowing for the inflows from the Bremer River and Lockyer Creek etc.

As mentioned above some discrepancies or inconsistencies have been noted in the reported inflow data in Section 9 of the SEQWater, 02 March, 2011 Report. It is acknowledged that the actual inflow (in cumecs) to the dam is difficult to determine given the areal and temporal variations of rainfall over the catchment and the dam water surface. Accordingly it has been assumed that two basic pieces of data are well understood and likely to be more correct. From these data actual average 6 hour inflows into the dam to in cumecs and ML have been determined. The two pieces of data relied upon are:

1. The Lake Storage Level vs Storage Volume in ML as this information should have been based upon detailed survey and photogrammetry;
2. The outflow rating curves for the radial gates ie the discharge in cumecs for each gate vs the degree of opening and the upstream lake level.

As noted I have used these data as a basis for determining the actual average 6 hour inflows and have used these in both the above analyses. I should be pleased to meet with members of the Commission or SEQWater to clarify or correct the data, although the outcome may not materially changed.

I trust that these analyses are helpful to the deliberations of the Commission and I am available to be of further assistance, if needed. My spread-sheets are available to the Commission, if desired, to allow other outflow scenarios to be analysed.

It would be appreciated if you would acknowledge receipt of this submission.

Yours faithfully,


Neville D Jones

Enc: Annexure 1: Actual flood event - 6 hour Time Step Analysis
Annexure 2: Modified Outflow - 6 hour Time Step Analysis

Annexure 1:

Wivenhoe - Storage Discharge Analysis - Actual Event

Date	Time	Storage Level	Storage (ML)	Storage Change (ML)	Average Inflow - Outflow (m3/s)	Average Outflow (m3/s)	Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)
7/01/2011	0.00	67.46	1,215,416							1,215,416
				20,022	926.94	0.00	0.0	926.94	20,022.0	
7/01/2011	6.00	67.64	1,235,438							1,235,438.0
				26,991	1,249.58	0.00	0.0	1,249.58	26,991.0	
7/01/2011	12.00	67.88	1,262,429							1,262,429.0
				27,360	1,266.67	85.50	1,846.8	1,352.17	29,206.8	
7/01/2011	18.00	68.12	1,289,789							1,289,789.0
				23,073	1,068.19	379.50	8,197.2	1,447.69	31,270.2	
8/01/2011	0.00	68.32	1,312,862							1,312,862.0
				16,297	754.49	693.17	14,972.5	1,447.66	31,269.5	
8/01/2011	6.00	68.46	1,329,159							1,329,159.0
				16,463	762.18	1006.67	21,744.1	1,768.85	38,207.1	
8/01/2011	12.00	68.60	1,345,622							1,345,622.0
				5,903	273.29	1232.17	26,614.9	1,505.46	32,517.9	
8/01/2011	18.00	68.65	1,351,525							1,351,525.0
				-1,180	-54.63	1241.83	26,823.5	1,187.20	25,643.5	
9/01/2011	0.00	68.64	1,350,345							1,350,345.0
				-7,085	-328.01	1294.50	27,961.2	966.49	20,876.2	
9/01/2011	6.00	68.58	1,343,260							1,343,260.0
				-4,722	-218.61	1341.50	28,976.4	1,122.89	24,254.4	
9/01/2011	12.00	68.54	1,338,538							1,338,538.0
				37,956	1,757.22	1392.50	30,078.0	3,149.72	68,034.0	
9/01/2011	18.00	68.86	1,376,494							1,376,494.0
				115,191	5,332.92	1435.00	30,996.0	6,767.92	146,187.0	
10/01/2011	0.00	69.80	1,491,685							1,491,685.0
				150,000	6,944.44	1639.17	35,406.1	8,583.61	185,406.1	

Wivenhoe - Storage Discharge Analysis - Actual Event

Date	Time	Storage Level	Storage (ML)	Storage Change (ML)	Average Inflow - Outflow (m3/s)	Average Outflow (m3/s)	Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)
10/01/2011	6.00	70.96	1,641,685							1,641,685.0
				151,530	7,015.28	1993.67	43,063.3	9,008.95	194,593.3	
10/01/2011	12.00	72.07	1,793,215							1,793,215.0
				121,408	5,620.74	2177.00	47,023.2	7,797.74	168,431.2	
10/01/2011	18.00	72.92	1,914,623							1,914,623.0
				49,863	2,308.47	2673.00	57,736.8	4,981.47	107,599.8	
11/01/2011	0.00	73.26	1,964,486							1,964,486.0
				37,172	1,720.93	2725.83	58,877.9	4,446.76	96,049.9	
11/01/2011	6.00	73.51	2,001,658							2,001,658.0
				115,505	5,347.45	3172.67	68,529.7	8,520.12	184,034.7	
11/01/2011	12.00	74.27	2,117,163							2,117,163.0
				106,692	4,939.44	5495.17	118,695.7	10,434.61	225,387.7	
11/01/2011	18.00	74.95	2,223,855							2,223,855.0
				-6,348	-293.89	7119.67	153,784.9	6,825.78	147,436.9	
12/01/2011	0.00	74.91	2,217,507							2,217,507.0
				-22,220	-1,028.70	5000.50	108,010.8	3,971.80	85,790.8	
12/01/2011	6.00	74.77	2,195,287							2,195,287.0
				3,174	146.94	2646.33	57,160.7	2,793.27	60,334.7	
12/01/2011	12.00	74.79	2,198,461							2,198,461.0
				1,588	73.52	2548.50	55,047.6	2,622.02	56,635.6	
12/01/2011	18.00	74.80	2,200,049							2,200,049.0
				-1,588	-73.52	2549.00	55,058.4	2,475.48	53,470.4	
13/01/2011	0.00	74.79	2,198,461							2,198,461.0
				-12,626	-584.54	2544.00	54,950.4	1,959.46	42,324.4	
13/01/2011	6.00	74.71	2,185,835							2,185,835.0
				-15,696	-726.67	2536.70	54,792.7	1,810.03	39,096.7	
13/01/2011	12.00	74.61	2,170,139							2,170,139.0
				-17,265	-799.31	2728.20	58,929.1	1,928.89	41,664.1	

Wivenhoe - Storage Discharge Analysis - Actual Event

Date	Time	Storage Level	Storage (ML)	Storage Change (ML)	Average Inflow - Outflow (m3/s)	Average Outflow (m3/s)	Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)
13/01/2011	18.00	74.50	2,152,874							2,152,874.0
				-31,053	-1,437.64	3221.30	69,580.1	1,783.66	38,527.1	
14/01/2011	0.00	74.30	2,121,821							2,121,821.0
				-40,002	-1,851.94	3511.00	75,837.6	1,659.06	35,835.6	
14/01/2011	6.00	74.04	2,081,819							2,081,819.0
				-42,587	-1,971.62	3507.00	75,751.2	1,535.38	33,164.2	
14/01/2011	12.00	73.76	2,039,232							2,039,232.0
				-46,507	-2,153.10	3471.70	74,988.7	1,318.60	28,481.7	
14/01/2011	18.00	73.45	1,992,725							1,992,725.0
				-44,424	-2,056.67	3490.00	75,384.0	1,433.33	30,960.0	
15/01/2011	0.00	73.15	1,948,301							

Annexure 2:

Wivenhoe - Storage Discharge Analysis - Modified Event

Date	Time	Actual Storage Level	Actual Storage (ML)	Actual Storage Change (ML)	Actual Av. Inflow - Outflow (m3/s)	Modified Average Outflow (m3/s)	Modified Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)	Calculated Water Level (m AHD)
7/01/2011	0.00	67.46	1,215,416							1,215,416.0	67.46
				20,022	926.94	0.00	0.0	926.94	20,022.0		
7/01/2011	6.00	67.64	1,235,438							1,235,438.0	67.64
				26,991	1,249.58	0.00	0.0	1,249.58	26,991.0		
7/01/2011	12.00	67.88	1,262,429							1,262,429.0	67.88
				27,360	1,266.67	85.50	1,846.8	1,352.17	29,206.8		
7/01/2011	18.00	68.12	1,289,789							1,289,789.0	68.12
				23,073	1,068.19	379.50	8,197.2	1,447.69	31,270.2		
8/01/2011	0.00	68.32	1,312,862							1,312,862.0	68.32
				16,297	754.49	693.17	14,972.5	1,447.66	31,269.5		
8/01/2011	6.00	68.46	1,329,159							1,329,159.0	68.46
				16,463	762.18	1900.00	41,040.0	1,768.85	38,207.2		
8/01/2011	12.00	68.60	1,345,622							1,326,326.1	68.45
				5,903	273.29	1900.00	41,040.0	1,505.46	32,517.9		
8/01/2011	18.00	68.65	1,351,525							1,317,804.1	68.35
				-1,180	-54.63	1900.00	41,040.0	1,187.20	25,643.5		
9/01/2011	0.00	68.64	1,350,345							1,302,407.6	68.20
				-7,085	-328.01	1900.00	41,040.0	966.49	20,876.2		
9/01/2011	6.00	68.58	1,343,260							1,282,243.8	68.05
				-4,722	-218.61	1900.00	41,040.0	1,122.89	24,254.4		
9/01/2011	12.00	68.54	1,338,538							1,265,458.2	67.90
				37,956	1,757.22	3000.00	64,800.0	3,149.72	68,034.0		
9/01/2011	18.00	68.86	1,376,494							1,268,692.2	67.90
				115,191	5,332.92	3500.00	75,600.0	6,767.92	146,187.1		
10/01/2011	0.00	69.80	1,491,685							1,339,279.2	68.60
				150,000	6,944.44	4000.00	86,400.0	8,583.61	185,406.0		

Wivenhoe - Storage Discharge Analysis - Modified Event

Date	Time	Actual Storage Level	Actual Storage (ML)	Actual Storage Change (ML)	Actual Av. Inflow - Outflow (m3/s)	Modified Average Outflow (m3/s)	Modified Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)	Calculated Water Level (m AHD)
10/01/2011	6.00	70.96	1,641,685							1,438,285.2	69.40
10/01/2011	12.00	72.07	1,793,215	151,530	7,015.28	4000.00	86,400.0	9,008.95	194,593.3		
10/01/2011	18.00	72.92	1,914,623	121,408	5,620.74	4000.00	86,400.0	7,797.74	168,431.2		70.25
11/01/2011	0.00	73.26	1,964,486	49,863	2,308.47	4000.00	86,400.0	4,981.47	107,599.8	1,628,509.7	70.85
11/01/2011	6.00	73.51	2,001,658	37,172	1,720.93	4000.00	86,400.0	4,446.76	96,050.0	1,649,709.5	71.00
11/01/2011	12.00	74.27	2,117,163	115,505	5,347.45	4000.00	86,400.0	8,520.12	184,034.6		
11/01/2011	18.00	74.95	2,223,855	106,692	4,939.44	4000.00	86,400.0	10,434.61	225,387.6	1,756,994.1	71.80
12/01/2011	0.00	74.91	2,217,507	-6,348	-293.89	4000.00	86,400.0	6,825.78	147,436.8	1,895,981.6	72.75
12/01/2011	6.00	74.77	2,195,287	-22,220	-1,028.70	4000.00	86,400.0	3,971.80	85,790.9	1,957,018.5	73.20
12/01/2011	12.00	74.79	2,198,461	3,174	146.94	4000.00	86,400.0	2,793.27	60,334.6	1,956,409.4	73.20
12/01/2011	18.00	74.80	2,200,049	1,588	73.52	4000.00	86,400.0	2,622.02	56,635.6	1,930,344.0	73.05
13/01/2011	0.00	74.79	2,198,461	-1,588	-73.52	4000.00	86,400.0	2,475.48	53,470.4	1,900,579.6	72.80
13/01/2011	6.00	74.71	2,185,835	-12,626	-584.54	4000.00	86,400.0	1,959.46	42,324.3	1,867,650.0	72.55
13/01/2011	12.00	74.61	2,170,139	-15,696	-726.67	4000.00	86,400.0	1,810.03	39,096.6	1,823,574.3	72.25
13/01/2011				-17,265	-799.31	4000.00	86,400.0	1,928.89	41,664.0	1,776,271.0	71.90

Wivenhoe - Storage Discharge Analysis - Modified Event

Date	Time	Actual Storage Level	Actual Storage (ML)	Actual Storage Change (ML)	Actual Av. Inflow - Outflow (m3/s)	Modified Average Outflow (m3/s)	Modified Outflow (ML)	Estim. Av. Inflow (m3/s)	Inflow (ML)	Calculated Storage (ML)	Calculated Water Level (m AHD)
13/01/2011	18.00	74.50	2,152,874							1,731,535.0	71.68
14/01/2011	0.00	74.30	2,121,821	-31,053	-1,437.64	4000.00	86,400.0	1,783.66	38,527.1		
				-40,002	-1,851.94	4000.00	86,400.0	1,659.06	35,835.7	1,683,662.1	71.35
14/01/2011	6.00	74.04	2,081,819	-42,587	-1,971.62	4000.00	86,400.0	1,535.38	33,164.2	1,633,097.8	70.85
14/01/2011	12.00	73.76	2,039,232	-46,507	-2,153.10	4000.00	86,400.0	1,318.60	28,481.8	1,579,862.0	70.60
14/01/2011	18.00	73.45	1,992,725	-44,424	-2,056.67	4000.00	86,400.0	1,433.33	30,959.9	1,521,943.7	70.10
15/01/2011	0.00	73.15	1,948,301							1,466,503.7	69.65