CERTIFICATE OF EXHIBIT

Exhibit 3 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

Declarant

Solicitor

B:1377523_1 NMW

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

DOCUMENT TABLE OF CONTENTS

TECHNICAL APPENDICES

- Appendix A – Model Results
- Appendix B – Flood Volume Summary
- Appendix C – Quantitative Precipitation Forecasts
- Appendix D – Catchment Rainfall
- Appendix E – Situation Reports
- Appendix F – Communication Protocol Technical Situation Reports
- Appendix G – Severe Weather Warnings
- Appendix H – Flood Event Notification Email
- Appendix I – Flood Readiness Checklists
- Appendix J – 3-Day and 7-Day Rainfall Forecast Information
- Appendix K – Model Results For 3-Day and 7-Day Forecasts
- Appendix L – Flood Operations Directives
- Appendix M – Flood Event Log
- Appendix N – Flood Operations Engineers Resumes

Appendix O - Hourly Rainfall Tables
P - IFD
Appendix Q - Recorded Hydrographs and Hydrographs
R - RATINGS

CERTIFICATE OF EXHIBIT

Exhibit 4 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]

Declarant

[redacted]

Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07) [redacted]
Ref: TZB:11800005

7/2/11 @ 1400

EXECUTIVE SUMMARY

Background

The Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (the Manual) defines the objectives and procedures for operating the dams during flood events.

Flood Events impacting on Wivenhoe and Somerset dams are caused by actual rainfall events that vary in intensity, duration and distribution over a catchment area above the dams in excess of 7000 square kilometres. When making decisions on releasing water from the dams during flood events, consideration is also given to rain falling in the catchment areas of the Brisbane River not controlled by the dams. These catchment areas which include the Lockyer Creek and Bremer River catchments also consist of an area in excess of 7000 square kilometres and rain falling in these catchments will vary in intensity, duration and distribution. Accordingly, there is an infinite number of Flood Event scenarios that the Manual needs to account for.

Given the infinite number of scenarios to be catered for, it is not possible for the Manual to contain a specific procedure relating to every possible flood event scenario. Therefore the Manual takes the approach of providing strategies and objectives to guide flood operational decision making. The strategy chosen at any point in time will depend on the actual levels in the dams and flood modelling predictions which are made using the best forecast rainfall and stream flow information available at the time.

Given the current state of science, it is not possible for the Bureau of Meteorology to provide completely accurate rainfall forecasts for the dam catchment areas. A degree of uncertainty is present in all forecasts and the further forward in time that forecasts are provided, the greater the degree of uncertainty that will be present in the forecast. Accordingly three primary factors are always considered in flood operations decision making:

- The safety of the public is paramount.
- The safety of the dam is paramount.
- Every attempt is made to ensure that the extent to which water flows over the floors or residential/urban and commercial buildings downstream of the dam is minimized. Dam outflows that contribute to such flooding are delayed until it is apparent that no other options are available without risking the safety of the dams.

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

Significance of the Flood Event

The January 2011 flood event was ~~extremely~~ large ~~and~~ to rare. Relevant statistics that demonstrate this fact are:

- Catchment average rainfalls recorded for the catchment area above Wivenhoe Dam indicate rainfall intensities for the 72 hour and 120 hour periods to Tuesday 11 January 2011 at 19:00 had an annual recurrence interval of between 1 in 500 years and 1 in 1000 years. These appear larger in magnitude than the 1893 flood of record.

- Point rainfalls experienced in the Wivenhoe Dam storage area between 05:00 and 13:00 on Tuesday 11 January 2011 are estimated to have an annual recurrence interval of between 1 in 500 years and 1 in 1000 years. Although this rainfall was not recorded at a single station, it must have occurred in order to reproduce the rapid storage level rises experienced at Wivenhoe Dam during this period.

- The volume of total inflow into Wivenhoe Dam experienced during this event has been calculated to be in the order of 90% more that the comparable volume of inflow calculated from the January 1974 event.

- The water flow into Wivenhoe Dam experienced during this event is represented by a dual peaked hydrograph with the two peaks separated by 30 hours and the maximum flow rate at both peaks estimated to be in the order of 50% greater that the comparable flow rate calculated from the January 1974 event.

Flood Mitigation Benefits of the Dams

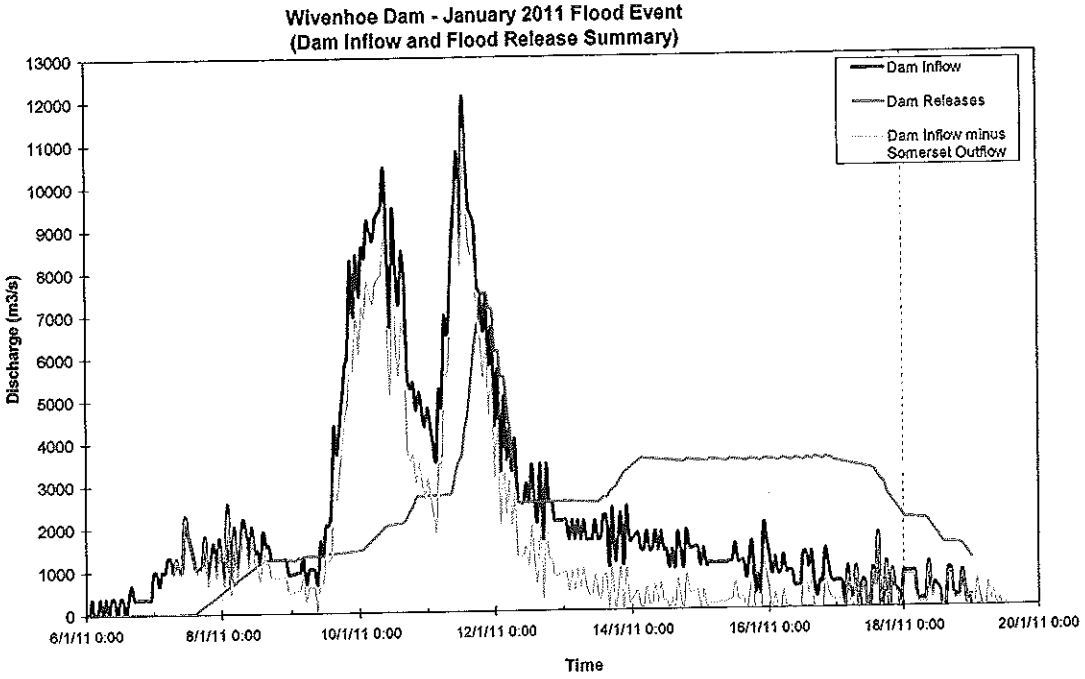
Wivenhoe Dam provided clear and greatly significant flood mitigation benefits during the event, with some relevant statistics being:

- The following graph demonstrates the significant benefits of Wivenhoe Dam in mitigating the current flood event. Just below the dam, the maximum hourly flow rate in the Brisbane River was reduced by 38%, the maximum three hourly flow rate was reduced by 30% and maximum six hourly flow rate was also reduced by 30%.

- If the above flow rate reductions are translated to reductions in flood peak height downstream of Wivenhoe Dam, the estimated flood peak height reductions are up to 2.5 metres in the City Area, up to 4.0 metres in the Jindalee Area and up to 5.5 metres in the Moggill Area.

- These projected reductions in the flood peak height equates to significant reductions in the potential for loss of life as well as saving in damages in the order of up to $1.6 billion based on current damage curves (Source: Flood Damage Tables provided to Seqwater by the Brisbane City Council).

- Without Wivenhoe Dam and without the above flow rate reductions, it is estimated that up to 13,000 more properties would have been impacted by the event. (Source: Flood Damage Tables provided to Seqwater by the Brisbane City Council).



Flood Operations During the Event

During the Flood Event, flood operations decision making was made in accordance with the Manual of Operational procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (Revision 7). In making decisions in accordance with the Manual, three primary factors were always considered:

- The safety of the public was paramount. Every attempt was made to ensure that public roads were closed by the relevant authorities prior to them being inundated by controlled dam outflows; and every attempt was made to allow authorities to make appropriate arrangements to prepare for community isolations and to undertake any necessary evacuations.

- The safety of the dam was paramount. At no stage was a situation allowed to develop that would put either dam at any risk of overtopping or failing. This is because a failure of Wivenhoe Dam would likely result in damage and loss of life that would be 100 to 1000 times greater than that which was experienced (Ref: Wivenhoe Dam Break Study).

- Every attempt was made to ensure that the extent to which water flowed over the floors of urban and commercial buildings was minimized. Dam outflows that contributed to such flooding were delayed until it was apparent that no other option was available without risking the safety of Wivenhoe Dam. This is demonstrated by the above inflow graph which shows that the impact of the first inflow peak was completely mitigated. The second peak, which resulted from rainfall on the dam with an annual recurrence interval of between 1 in 500 years and 1 in 1000 years, could not be completely mitigated but its impacts were certainly greatly reduced. The location of the rainfall associated with this second peak, on and near the dam, also minimized available mitigation options.

of residential

adjacent to

It should also be noted that weather forecasts in the early stages of the event did not support flood releases being made from Wivenhoe Dam greater than those that actually occurred. Increased flood releases in the later stages of the event (prior to the morning of 11 January 2011) had the potential to worsen urban damage, due to the apparent southward movement of the prevailing weather system. Had the rain that fell on the 11 January 2011 fallen south of the dam, the transition to Strategy W4 may have been avoided. However urban damage would have likely increased under this scenario, due to the loss of the attenuation effects provided by the dam.

CERTIFICATE OF EXHIBIT

Exhibit 5 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]

Declarant

[redacted]

Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

EXECUTIVE SUMMARY

Background

Since the original Wivenhoe Dam investigations commenced in the 1970s, it has been shown in many engineering studies (see Appendix U) that a flood event similar in magnitude and circumstances to the January 2011 Flood Event would result in urban damage below Moggill. The most notable recent studies are contained in the design report associated with the 2005 spillway upgrade of Wivenhoe Dam; and the 2009 Wivenhoe - Somerset Interaction Study that was prepared to support the 2009 review of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (Revision 7) ("**the Manual**"). The Manual defines the objectives and procedures for operating the dams during flood events and an understanding of the Manual is important when reading this report.

Flood events impacting Wivenhoe and Somerset dams are caused by rainfall events that vary in intensity, duration and distribution over a catchment area exceeding 7,000 square kilometres above the dams. When making decisions about releasing water from the dams during flood events, consideration is also given to rain falling in Brisbane River catchment areas not controlled by the dams. These catchment areas, which include the Lockyer Creek and Bremer River catchments, also comprise an area in the order of 7,000 square kilometres and rain falling in these catchments will also vary in intensity, duration and distribution. Accordingly, there is an infinite number of flood event scenarios that the Manual needs to account for.

Given the infinite number of potential scenarios, it is not possible for the Manual to contain a specific procedure relating to every possible flood event. Therefore the Manual takes the approach of providing strategies and objectives to guide operational decision making during a flood event. The strategy chosen at any point in time will depend on the actual levels in the dams and flood modelling predictions which are made using the best forecast rainfall and stream flow information available at the time.

A number of strategies in the Manual are likely to be used over the course of the event. Strategies change during a flood event as forecasts change and rain is collected in the catchments. It is not possible to predict the range of strategies that will be used during the course of a flood event before or at any time during the event, prior to the event peak. Strategies are altered in response to changing rainfall forecasts and stream flow conditions to maximise the flood mitigation benefits of the Dams.

Additionally, given the current level of forecasting technology available, it is not possible for the Bureau of Meteorology to provide completely accurate rainfall forecasts for the dam catchment areas. A degree of uncertainty is present in all forecasts and the further forward in time that forecasts are provided, the greater the degree of uncertainty there is in the forecast. Accordingly, three primary factors are always considered in flood operations decision making:

1. The safety of the public is paramount.

2. The safety of the Dam is paramount.

3. Every attempt is made to ensure the extent to which water flows over the floors of residential and commercial buildings downstream of the dam is minimised. Dam outflows contributing to such flooding are delayed until it is apparent no other options are available without risking the safety of the Dams.

CERTIFICATE OF EXHIBIT

Exhibit 6 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]

.....
Declarant

[redacted]

Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

DATE/TIME	DIRECTIVE	DAM LEVELS	MODEL RESULTS	STRATEGY
06 Jan 2011 07:42	Event Mobilisation, currently using Strategy W1A. 24/7 staffing of the Flood Operations Centre and dams to continue until official de-mobilisation announced.	Wivenhoe Dam 67.31 Somerset Dam 99.34	• Lake level not expected to reach 67.50 (Strategy W1B) until 07 January 2011. • Significant inflows expected from Lockyer Creek into the Brisbane River and these inflows likely to impact on College's Crossing. (Estimate of Lockyer flows needed) • Wivenhoe Lake level forecast to peak at ??	**Strategy W1A** **(Lake Level greater than 67.25, maximum release 110 cumecs)** • Endeavour to maintain College's Crossing trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 175 cumecs. • Water held in Wivenhoe in an attempt to maintain College's Crossing trafficable in accordance with Strategy W1A.
07 Jan 2011 02:00	Transition from Strategy W1A to W1B.	Wivenhoe Dam 67.52 Somerset Dam 99.55	• Lake level not expected to reach 67.75 (Strategy W1C) for at least six hours. • Significant inflows expected from Lockyer Creek into the Brisbane River and these inflows likely to impact on Burton's Bridge, although there is uncertainty as to whether the Lockyer flows alone will be sufficient to inundate Burtons Bridge. (Estimate of Lockyer flows needed) • Wivenhoe Lake level forecast to peak at ??	**Strategy W1B** **(Lake Level greater than 67.50, maximum release 110 cumecs)** • Endeavour to maintain Burtons Bridge trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 430 cumecs. • Water held in Wivenhoe in an attempt to maintain Burtons Bridge trafficable in accordance with Strategy W1B.

07 Jan 2011 07:00	Transition from Strategy W1B to W1C.	Wivenhoe Dam 67.52 Somerset Dam 99.55 FORECAST 660 m³/s 1900 7/1 68.3 550 m³/s RELEASE	• Significant inflows expected from Lockyer Creek into the Brisbane River and these inflows likely to impact on Kholo Bridge, although there is uncertainty as to whether the Lockyer flows alone will be sufficient to inundate Kholo Bridge. (Estimate of Lockyer flows needed) 460 1900 7/1 • Wivenhoe Lake level forecast to peak at ?? 68.4 NO RELEASE	**Strategy W1C** **(Lake Level greater than 67.75, maximum release 500 cumecs)** • Endeavour to maintain Kholo Bridge trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 550 cumecs. • Water held in Wivenhoe in an attempt to maintain Kholo Bridge trafficable in accordance with Strategy W1C.

07 Jan 2011 08:30	• Transition from Strategy W1C to W1E. Based on rainfall on the ground, it becomes apparent that all bridges apart from the Mt Crosby Weir Bridge and Fernvale Bridge will be flooded by Lockyer Creek flows alone. • All impacted Councils are notified of situation and that releases are to be commenced from Wivenhoe Dam. Releases were delayed until 15:00 to allow bridges to be closed and arrangements to be made to cater for rural community isolation. The impacted rural communities had been isolated over the Christmas period and time was needed for suitable arrangements to be made to allow these communities to be prepared for another extended period of isolation. • Rainfall on the ground and rainfall forecasts did not suggest that the event was likely to approach the use of Strategy W4.	Wivenhoe Dam 67.52 Somerset Dam 99.79	• Significant inflows expected from Lockyer Creek into the Brisbane River and these will be sufficient to inundate all bridges downstream of the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. (Estimate of Lockyer flows needed). • Wivenhoe Lake level forecast to peak at ??	**Strategy W1C** **(Lake Level greater than 67.75, maximum release 500 cumecs)** • Endeavour to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 1900 cumecs. • Releases from Wivenhoe Dam managed in an attempt to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable in accordance with Strategy W1E.

Commenced 07 Jan 2011 15:00 Completed 08 Jan 2011 14:00	Wivenhoe Directives #1 to #4. • Gates opened continuously at Wivenhoe Dam for 23 hours in accordance with the standard gate opening sequence at a rate or 0.5 metres of opening per hour. • At 14:00 on 08 January 2011, Wivenhoe discharge is 1271 cumecs. All bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level rises from 68.03 to 68.61 over the 23 hour period.		

CERTIFICATE OF EXHIBIT

Exhibit 7 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]
Declarant

[redacted]
Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

Rob MRL
1346 2/2/11

SIT RESULTS :- PROFORMA WITH AGREED INFO

SUMMARY OF JANUARY 2011 FLOOD EVENT

The following series of tables provides a detailed summary of the operation of Wivenhoe and Somerset Dams during the January 2011 Flood Event that impacted on Brisbane. Each table covers a period of the event during which one of the following occurred:

- There was a transition or change to the flood operation strategy used as defined by the Manual.
- There was a period of stability during which no gate operations from either Wivenhoe Dam or Somerset Dam were directed.
- There was a period of sustained gate operations (either opening of closing) at either Wivenhoe Dam or Somerset Dam.

Each table also provides a summary of both relevant background information and a summary of the information that was used in decision making during the period covered by the table. This information includes:

- Details of the time period covered by the table.
- Relevant background information from the period leading up to and during the time period covered by the table.
- Changes in dam levels during the period.
- Rainfall information (including forecast rainfall) and model results available during the period.
- The Strategy used and/or adopted during the period.

Further reports and appendices are available to explain in detail the derivation of the technical information presented in the tables. Much of the background detail in the reports is taken from the event log.

Not X

In summary, the event was extreme with some relevant statistics that demonstrate this fact as follows:

- Catchment average rainfalls recorded for the catchment area above Wivenhoe Dam indicate rainfall intensities for the 72 hour and 120 hour periods to Tuesday 11 January 2011 at 19:00 had an annual exceedance probability of between 1 in 500 years and 1 in 1000 years.
- Point rainfalls experienced in the Wivenhoe Dam storage area experienced between 05:00 and 13:00 on Tuesday 11 January 2011 have been calculated to have an annual exceedance probability of between 1 in 500 years and 1 in 1000 years. Although this rainfall was not recorded at a single station, it is calculated to have occurred based on the extreme storage level rises experienced at Wivenhoe Dam during this period.
- The volume of total inflow into Wivenhoe Dam experienced during this event has been calculated to be in the order of 88% more that the comparable volume of inflow calculated from the January 1974 event.
- The peak inflow into Wivenhoe Dam experienced during this event has been calculated to be in the order of 50% more that the comparable peak inflow calculated from the January 1974 event.

QPF
SILO
ADAR
INTERACTIVE WEATHER WATCH
UNO WATER 4 DAY

JANUARY 2011 FLOOD EVENT - PERIOD 1 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W1A and Strategy W1B; and Strategy S2			**Strategy W1A and Strategy W1B; and Strategy S2 (Lake Level greater than 67.25, maximum release 110 cumecs)**
Commenced Thursday 06 Jan 2011 07:42 Completed Friday 07 Jan 2011 02:00	• No significant rainfall occurred in the 24 hours to 0900 on 5 January 2011. • Catchment average rainfalls in the 24 hours to 0800 on 6 January 2011were: o Wivenhoe 25mm; o Somerset 21mm; o Lockyer 23mm; o Bremer 23mm. • Event Mobilisation occurred at 7:42 on Thursday 6 January 2011, using Strategies W1A and S2. • Once mobilisation occurs, 24/7 staffing of the Flood Operations Centre and dams continues until official de-mobilisation is announced. For this event, this occurred at 12:00 on Wednesday 19 January 2011. • Duty Engineer called back early from annual Christmas holidays to assist with the management of the event. • Transition from Strategy W1A to W1B once the Wivenhoe Lake Level exceeded 67.50.	Wivenhoe Dam level rises from 67.31 to 67.52 over the 18 hour period. Somerset Dam level rises from 99.34 to 99.55 over the 18 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 53mm; Somerset 44mm; Lockyer 53mm; Bremer 54mm.	• Catchment average rainfalls over this period were: o Wivenhoe 28mm; o Somerset 23mm; o Lockyer 30mm; o Bremer 31mm. • Forecast rainfall is 25mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.2 (excluding forecast) 68.7 (including forecast). • Somerset Lake level forecast to peak at 99.7 (excluding forecast) 100.1 (including forecast). • Total dam inflow volume forecast is 204,000ML (excluding forecast) 343,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 470 cumecs (excluding forecast) 720 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 550 cumecs (excluding forecast) 960 cumecs (including forecast).	• Peak inflows into the Brisbane River from Lockyer are estimated to be in the order of 400 cumecs, but these flows will not inundate Colleges Crossing until the morning of Friday 07 January 2011. • Lake level not expected to reach 67.50 (Strategy W1B) until Friday 7 January 2011. Lake level may not exceed 68.5. • Endeavour to maintain College's Crossing trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 175 cumecs. • Water held in Wivenhoe in an attempt to maintain College's Crossing trafficable in accordance with Strategy W1A. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge and the low level regulators and sluices at Somerset Dam were kept closed.

JANUARY 2011 FLOOD EVENT - PERIOD 2 OF 20

DATE/TIME	BACKGROUND	DAM LEVELS	RAINFALL AND MODEL RESULTS	STRATEGY
	Strategy W1B and Strategy S2			**Strategy W1B and Strategy S2 (Lake Level greater than 67.50, maximum release 110 cumecs)**
Commenced Friday 07 Jan 2011 02:00 Completed Friday 07 Jan 2011 09:00	• Transition from Strategy W1A to W1B due to the Wivenhoe Lake Level exceeding 67.50. • Transition from Strategy W1B to W1C once the Wivenhoe Lake Level exceeds 67.75.	Wivenhoe Dam level rises from 67.52 to 67.75 over the 7 hour period. Somerset Dam level rises from 99.55 to 99.65 over the 7 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 64mm; Somerset 60mm; Lockyer 57mm; Bremer 60mm.	• Catchment average rainfalls over this period were: o Wivenhoe 11mm; o Somerset 15mm; o Lockyer 4mm; o Bremer 5mm. • Forecast rainfall is 25mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.2 (excluding forecast) 68.5 (including forecast). • Somerset Lake level forecast to peak at 99.7 (excluding forecast) 100.2 (including forecast). • Total dam inflow volume forecast is 242,000ML (excluding forecast) 380,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 470 cumecs (excluding forecast) 670 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 570 cumecs (excluding forecast) 970 cumecs (including forecast).	• Peak inflows into the Brisbane River from Lockyer are estimated to be in the order of 500 cumecs, but these flows may not be sufficient to inundate Burtons Bridge. • Lake level not expected to reach 67.75 (Strategy W1C) for at least 6 hours. Lake level may not exceed 68.5. ✓ • Endeavour to maintain Burtons Bridge trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 430 cumecs. • Water held in Wivenhoe in an attempt to maintain Burtons Bridge trafficable in accordance with Strategy W1B. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge and the low level regulators and sluices at Somerset Dam were kept closed. REG 50%

JANUARY 2011 FLOOD EVENT - PERIOD 3 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W1C and Strategy S2			**Strategy W1C (Lake Level greater than 68.00, maximum release 1900 cumecs)**
Commenced Friday 07 Jan 2011 09:00 Completed Friday 07 Jan 2011 15:00	• At around 9:00 it becomes apparent that flows from Lockyer Creek into the Brisbane River combined with local Brisbane River inflows downstream of Wivenhoe will be sufficient to inundate all bridges downstream of the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. • All impacted Councils are notified of situation and that releases are to be commenced from Wivenhoe Dam. Release commencement was delayed until 15:00 to allow bridges to be closed and arrangements to be made to cater for rural community isolation. The impacted rural communities had been isolated over the Christmas period and time was needed for suitable arrangements to be made to allow these communities to be prepared for another potentially extended period of isolation. The delay in releases was also in accordance with the Manual requirements of maintaining Burtons Bridge and Kholo Bridge trafficable when operating under Strategy W1C. • Transition from Strategy W1C to Strategy W1D once the Wivenhoe Dam lake level exceeds 68.0	Wivenhoe Dam level rises from 67.75 to 68.03 over the 6 hour period. Somerset Dam level rises from 99.65 to 99.94 over the 6 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 89mm; Somerset 90mm; Lockyer 71mm; Bremer 74mm.	• Catchment average rainfalls over this period were: o Wivenhoe 24mm; o Somerset 30mm; o Lockyer 14mm; o Bremer 12mm. • Forecast rainfall is 25mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.4 (excluding forecast) 68.9 (including forecast). • Somerset Lake level forecast to peak at 100.3 (excluding forecast) 100.6 (including forecast). • Total dam inflow volume forecast is 346,000ML (excluding forecast) 483,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 530 cumecs (excluding forecast) 710 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 660 cumecs (excluding forecast) 1040 cumecs (including forecast).	• Due to the further rain and observed stream rises, it has become apparent that flows from Lockyer Creek into the Brisbane River combined with local Brisbane River inflows downstream of Wivenhoe will be sufficient to inundate all bridges downstream of the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. • Releases from Wivenhoe Dam managed in an attempt to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable in accordance with Strategies W1D and W1E. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge and the low level regulators and sluices at Somerset Dam were kept closed.

JANUARY 2011 FLOOD EVENT - PERIOD 4 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Transition from Strategy W1D to W1E to W3; and Strategy S2 Wivenhoe Directives #1 to #4. Somerset Directives #1 to #3.			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Friday 07 Jan 2011 15:00 Completed Saturday 08 Jan 2011 14:00	• Gates opened continuously at Wivenhoe Dam for 23 hours in accordance with the standard gate opening sequence at a rate or 0.5 metres of opening per hour. • Transition from Strategy W1D to W1E once the Wivenhoe Dam level exceeds 68.25 (22:00 on 7 Jan 2011). • Transition from Strategy W1E to W2 once it becomes apparent that the Wivenhoe Dam level exceesd 68.50 (08:00 on 8 Jan 2011). However it was not possible to meet the intent of Strategy W2 by limiting the flow in the Brisbane River to less than the naturally occurring peaks at Lowood and Moggill. This is because the calculated naturally occurring peaks at Lowood and Moggill were 530 cumecs and 800 cumecs respectively, whereas the release rate from the dam was already 940 cumecs. Accordingly Strategy W2 was bypassed and Strategy W3 was adopted for use at 08:00 on Saturday 8 January 2011. • At 14:00 on 08 January 2011, Wivenhoe discharge is 1239 cumecs. All rural bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level rises from 68.03 to 68.61 over the 23 hour period. Somerset Dam level rises from 99.94 to 100.44 over the 23 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 92mm; Somerset 95mm; Lockyer 72mm; Bremer 72mm.	• Catchment average rainfalls over this period were: o Wivenhoe 3mm; o Somerset 5mm; o Lockyer 1mm; o Bremer 1mm. • Forecast rainfall is 40mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.7 (excluding forecast) 69.1 (including forecast). • Somerset Lake level forecast to peak at 100.5 (excluding forecast) 100.6 (including forecast). • Total dam inflow volume forecast is 420,000ML (excluding forecast) 662,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 530 cumecs (excluding forecast) 530 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 770 cumecs (excluding forecast) 940 cumecs (including forecast). This peak was calculated to already have occurred at 05:00 on 8 January 2011. • Predicted peak Wivenhoe Dam outflow was 1480 cumecs (excluding forecast) 1540 cumecs (including forecast). This is significantly greater than the calculated natural peak that excluded Wivenhoe releases.	• Inflows from Lockyer Creek into the Brisbane River have inundated all bridges downstream of the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. • The Strategy transitions from W1 to W3 once it becomes apparent that the Wivenhoe Dam level is likely to exceed 68.5 and Strategy W2 cannot be applied. • Strategy W3 requires the flow at Moggill to be lowered to 4000 cumecs as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe releases). This was already achieved. • Strategy W3 also requires consideration of lower level Manual objectives. Therefore consideration during this period was given to minimizing disruption to downstream rural life and endeavoring to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • Due to rainfall on the ground, it was apparent that the Somerset Dam level would exceed 100.45. Accordingly two sluice gates were opened during this period to allow dam levels to move towards the Wivenhoe/Somerset Operations Target Line in accordance with Strategy S2.

JANUARY 2011 FLOOD EVENT - PERIOD 5 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Saturday 08 Jan 2011 14:00 Completed Sunday 09 Jan 2011 01:00	**Strategy W3 and Strategy S2** • Releases maintained from both dams to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • No change to gate settings over this period. Wivenhoe discharge is 1240 cumecs. All rural bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level rises very slightly from 68.61 to 68.63 over the 13 hour period. Somerset Dam level falls from 100.44 to 100.32 over the 13 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 100mm; Somerset 111mm; Lockyer 75mm; Bremer 75mm.	• Catchment average rainfalls over this period were: o Wivenhoe 8mm; o Somerset 16mm; o Lockyer 3mm; o Bremer 2mm. • Forecast rainfall is 40mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.7 (excluding forecast) 68.9 (including forecast). • Somerset Lake level forecast to peak at 100.5 (excluding forecast) 100.6 (including forecast). • Total dam inflow volume forecast is 457,000ML (excluding forecast) 697,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 530 cumecs (excluding forecast) 530 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 770 cumecs (excluding forecast) 840 cumecs (including forecast). This peak was calculated to already have occurred at 05:00 on 8 January 2011. • Predicted peak Wivenhoe Dam outflow was 1480 cumecs (excluding forecast) 1520 cumecs (including forecast). This is significantly greater than the calculated natural peak that excluded Wivenhoe releases.	**Strategy W3 and Strategy S2 (Lake level greater than 68.50, maximum release 4000 cumecs)** • Strategy W3 requires the flow at Moggill to be lowered to 4000 cumecs as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe releases). This was already achieved. • Strategy W3 also requires consideration of lower level Manual objectives. Therefore with lake levels rising slightly (Wivenhoe) and falling (Somerset) consideration during this period remained on minimizing disruption to downstream rural life and endeavoring to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With the Somerset Lake Dam Level still expected to exceed 100.45 and the level in Wivenhoe remaining relatively static, releases from Somerset Dam continued. In any event, closing of the sluices would have resulted in dam levels quickly moving under the Wivenhoe/Somerset Operations Target Line requiring sluice re-opening within a short period.

JANUARY 2011 FLOOD EVENT - PERIOD 6 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2 Wivenhoe Directives #5 to #7.			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Sunday 09 Jan 2011 01:00 Completed Sunday 09 Jan 2011 08:00	• Releases increased marginally from Wivenhoe Dam to account for the passing of the Lockyer peak while maintaining Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • Wivenhoe discharge increased from 1240 cumecs to 1334 cumecs. • No change to Somerset Dam gate settings over this period. • All rural bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level falls from 68.63 to 68.56 over the 7 hour period. Somerset Dam level falls from 100.32 to 100.28 over the 7 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 112mm; Somerset 146mm; Lockyer 76mm; Bremer 75mm.	• Catchment average rainfalls over this period were: o Wivenhoe 12mm; o Somerset 36mm; o Lockyer 1mm; o Bremer 0mm. • Forecast rainfall is 40mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 68.7 (excluding forecast) 69.3 (including forecast). • Somerset Lake level forecast to peak at 100.5 (excluding forecast) 101.0 (including forecast). • Total dam inflow volume forecast is 569,000ML (excluding forecast) 814,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 530 cumecs (excluding forecast) 530 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 770 cumecs (excluding forecast) 780 cumecs (including forecast). This peak was calculated to already have occurred at 05:00 on 8 January 2011. • Predicted peak Wivenhoe Dam outflow was 1500 cumecs (excluding forecast) 1550 cumecs (including forecast). This is significantly greater than the calculated natural peak that excluded Wivenhoe releases.	• Strategy W3 requires the flow at Moggill to be lowered to 4000 cumecs as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe releases). This was already achieved. • Strategy W3 also requires consideration of lower level Manual objectives. Therefore with lake levels falling at both dams, consideration during this period remained on minimizing disruption to downstream rural life and endeavoring to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With the Somerset Lake Dam Level still expected to exceed 100.45 and the level in Wivenhoe Dam falling, releases from Somerset Dam continued. In any event, closing of the sluices would have resulted in dam levels quickly moving under the Wivenhoe/Somerset Operations Target Line requiring sluice re-opening within a short period, particularly given the rainfall that occurred in the Somerset Dam catchment during this period.

JANUARY 2011 FLOOD EVENT - PERIOD 7 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Sunday 09 Jan 2011 08:00 Completed Sunday 09 Jan 2011 14:00	**Strategy W3 and Strategy S2 Wivenhoe Directives #7. Somerset Directives #4 to #5.** • Releases increased marginally from Wivenhoe Dam to account for the passing of the Lockyer peak while maintaining Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • Wivenhoe discharge increased from 1334 cumecs to 1386 cumecs. • Somerset Dam sluice gates opened progressively over this period to allow dam levels to move towards the Wivenhoe/Somerset Operations Target Line in accordance with Strategy S2. • All rural bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level rises very slightly from 68.56 to 68.58 over the 6 hour period. Somerset Dam level rises from 100.28 to 100.47 over the 6 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 146mm; Somerset 199mm; Lockyer 94mm; Bremer 90mm.	• Catchment average rainfalls over this period were: o Wivenhoe 34mm; o Somerset 53mm; o Lockyer 18mm; o Bremer 15mm. • Forecast rainfall is 50mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 70.0 (excluding forecast) 71.3 (including forecast). • Somerset Lake level forecast to peak at 100.7 (excluding forecast) 101.1 (including forecast). • Total dam inflow volume forecast is 804,000ML (excluding forecast) 1,108,000ML (including forecast). • Peak flow at Lowood (excluding Wivenhoe releases) estimated at 530 cumecs (excluding forecast) 690 cumecs (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 770 cumecs (excluding forecast) 1210 cumecs (including forecast). This peak was calculated to already have occurred at 05:00 on 8 January 2011. • Predicted peak Wivenhoe Dam outflow was 1490 cumecs (excluding forecast) 1560 cumecs (including forecast). This is significantly greater than the calculated natural peak that excluded Wivenhoe releases.	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)** • With lake levels rising at both dams and heavy rain being experienced in the dam catchments, consideration is given to transitioning the consideration from minimizing disruption to downstream rural life to protecting urban areas from inundation. • Model results also showing likely rises in water levels in the dams provides further justification to consider transitioning to Strategy W3 within the next 6 hours. • Using the BOM interactive Model, a three day assessment shows the lower limit of three day forecast inflow to be similar to the October 2010 event, with the upper limit similar to the February 1999 event. Therefore, during this period consideration remained on minimizing disruption to downstream rural life and endeavoring to maintain Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With dam levels under the Wivenhoe/Somerset Operations Target Line at the end of this period, releases continued from Somerset Dam.

JANUARY 2011 FLOOD EVENT - PERIOD 8 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Sunday 09 Jan 2011 14:00 Completed Sunday 09 Jan 2011 19:00	• During this period releases continued from both dams at a level that maintained Mt Crosby Weir Bridge and Fernvale Bridge trafficable. Gate settings were unchanged and the Wivenhoe discharge was 1411 cumecs. • Due to rainfall on the ground and the modeled rapid lake level rises, a decision is made to transition to focus on protecting urban areas from inundation at 19:00. • Councils and the Seqwater CEO were notified of the decision soon after 19:00. The ramifications of the decision were that the new estimated peak flow at Moggill of 3300 cumecs would impact properties and commence to cause damage in the urban areas of Brisbane. Damage tables supplied by the Brisbane City Council indicated that at flows of 3000 cumecs, damage costs would exceed $5M and 2600 properties would be impacted in some way. These impacts rise steeply as flows increase, so the focus was on minimizing the flow at Moggill. • A decision is also made at 19:00, that because of the serious nature of the event, the Flood Operations Centre will be staffed with at least two Duty Engineers at all times until at least the peak of the event has occurred.	Wivenhoe Dam level rises from 68.58 to 68.97 over the 5 hour period. Somerset Dam level rises from 100.47 to 101.43 over the 5 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 208mm; Somerset 305mm; Lockyer 116mm; Bremer 96mm.	• Catchment average rainfalls over this period were: o Wivenhoe 62mm; o Somerset 106mm; o Lockyer 22mm; o Bremer 6mm. • Forecast rainfall is 65mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 72.1 (excluding forecast) 73.9 (including forecast). • Somerset Lake level forecast to peak at 102.3 (excluding forecast) 103.0 (including forecast). • Total dam inflow volume forecast is 1,272,000ML (excluding forecast) 1,712,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 770 cumecs (excluding forecast) 1940 cumecs (including forecast). This peak was calculated to already have occurred at 05:00 on 8 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 3300 cumecs (excluding forecast) 4400 cumecs (including forecast).	• With lake levels continuing to rise at both dams combined with heavy rain in the dam catchments during this period, the decision was made at the end of this period no longer consider minimizing disruption to downstream rural life and to focus on protecting urban areas from inundation. • Towards the end of this period, it was also ~~starting to~~ become apparent that Moggill was likely to experience a second naturally occurring peak on 10 January 2011 or later and that the Manual required the flow at Moggill to be minimized prior to this peak occurring. This requirement was competing with the need to protect urban areas by not allowing the Wivenhoe Dam level to reach a level that invoked Strategy W4. After considering these issues it was decided that the best course of action would be to increase releases as quickly as possible to the limit of non-damaging flows at Moggill. However before this could occur, Councils needed to be advised, bridges needed to be closed and actions needed to be taken to prepare for rural communities for isolation and Brisbane for river flows approaching 3500 cumecs. • With dam levels under the Wivenhoe/Somerset Operations Target Line during this period, releases continued from Somerset Dam.

JANUARY 2011 FLOOD EVENT - PERIOD 9 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Sunday 09 Jan 2011 19:00 Completed Monday 10 Jan 2011 01:00	• Council and Agency notifications commenced at 7:00pm. The likely peak flow at Moggill of over 3000 cumecs was communicated to the Brisbane City Council and the Seqwater CEO. • Damage tables supplied by the Brisbane City Council indicated that at flows of 3000 cumecs, damage costs would exceed $5M and 2600 properties would be impacted in some way. These impacts rise steeply as flows increase, so the focus was on minimizing the flow at Moggill. • Fernvale Bridge closed by police at around 01:00 on 10 January 2011 and once this was confirmed a directive was issued to increases releases from Wivenhoe Dam. • No change to gate settings over this period due to the potential danger to the public associated with inundating Fernvale Bridge from Wivenhoe Dam outflows prior to the bridge being closed to traffic. Councils also required time to prepare for the isolation of rural communities, the onset of urban damage in Brisbane and to undertake any necessary evacuations. Wivenhoe discharge is 1473 cumecs. All rural bridges below the dam with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge are flooded.	Wivenhoe Dam level rises from 68.97 to 69.97 over the 6 hour period. Somerset Dam level rises from 101.43 to 102.54 over the 6 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 232mm; Somerset 343mm; Lockyer 131mm; Bremer 102mm.	• Catchment average rainfalls over this period were: o Wivenhoe 24mm; o Somerset 38mm; o Lockyer 14mm; o Bremer 6mm. • Forecast rainfall is 65mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 72.9 (excluding forecast) 74.7 (including forecast). • Somerset Lake level forecast to peak at 102.9 (excluding forecast) 103.4 (including forecast). • Total dam inflow volume forecast is 1,468,000ML (excluding forecast) 1,922,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 820 cumecs (excluding forecast) 2000 cumecs (including forecast). This peak was calculated to occur at 16:00 on 10 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 3240 cumecs (excluding forecast) 4480 cumecs (including forecast).	• Consideration was on protecting urban areas from inundation. However before releases are increased to and above the limit of non-damaging floods at Moggill, Councils and other impacted agencies are notified so that appropriate actions can be taken including any necessary evacuations and the closure of both the Mt Crosby Weir Bridge and Fernvale Bridge. • The Manual requires the flow at Moggill to be minimized prior to its naturally occurring peak and this requirement was balanced against the need to protect urban areas by releasing water from the dams in an attempt to keep the Wivenhoe Dam lake level below a level that will invoke Strategy W4. However the onset of increased releases did roughly coincide with the calculated naturally occurring peak at Moggill (based on a 16 hour travel time between the dam and Moggill). • With dam levels under the Wivenhoe/Somerset Operations Target Line during this period, releases continued from Somerset Dam. • Although there is a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy is not to release flows that will cause high level urban inundation until it is certain that this cannot be avoided. Model results continue to indicate that this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 10 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2 Wivenhoe Directives #8 to #10.			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Monday 10 Jan 2011 01:00 Completed Monday 10 Jan 2011 09:00	• Gates opened continuously at Wivenhoe Dam for 8 hours in accordance with the standard gate opening sequence at a rate or 0.5 metres of opening per hour. • Wivenhoe discharge is increased from 1473 cumecs to 2015 cumecs. All rural bridges below the dam are flooded. • Further gate openings at Wivenhoe Dam were paused at 09:00 in an attempt to allow the Lockyer and Bremer peaks to pass Brisbane and to restrict Brisbane River flows at Moggill to 3500 cumecs. This was done following discussions with the Brisbane City Council that advised a flow of 3500 cumecs at Moggill will fully submerge 322 properties and impact on 7000 properties. • No gate movements occurred at Somerset Dam during this period, with dam levels plotting under the Wivenhoe/Somerset Operations Target Line. This meant that the only gate movements allowable at Somerset under Strategy S2 would be openings and this was not done to limit further rises in Wivenhoe.	Wivenhoe Dam level rises from 69.97 to 71.56 over the 8 hour period. Somerset Dam level rises from 102.54 to 103.08 over the 8 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 244mm; Somerset 373mm; Lockyer 143mm; Bremer 120mm.	• Catchment average rainfalls over this period were: o Wivenhoe 12mm; o Somerset 30mm; o Lockyer 12mm; o Bremer 18mm. • Forecast rainfall is 65mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 72.9 (excluding forecast) 74.5 (including forecast). • Somerset Lake level forecast to peak at 103.1 (excluding forecast) 103.5 (including forecast). • Total dam inflow volume forecast is 1,531,000ML (excluding forecast) 1,985,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 1090 cumecs (excluding forecast) 2090 cumecs (including forecast). This peak was calculated to occur at 16:00 on 10 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 3420 cumecs (excluding forecast) 4680 cumecs (including forecast).	• Consideration on protecting urban areas from inundation and minimizing urban damage. • Due to advice received from the Brisbane City Council that a flow of 3500 cumecs at Moggill will fully submerge 322 properties and impact on 7000 properties, an attempt is made to remain within this flow • The Manual states that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and this approach was adopted. Advice received during the event from the Brisbane City Council that the upper limit of non-damaging floods was below the 4000 cumecs stated in the manual was noted and taken into account in the decision making processes. • With dam levels under the Wivenhoe/Somerset Operations Target Line during this period, releases continued from Somerset Dam. • Although there is a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy is not to release flows that will cause high level urban inundation until it is certain that this cannot be avoided. Model results continue to indicate that this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 11 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Monday 10 Jan 2011 09:00 Completed Monday 10 Jan 2011 15:00	**Strategy W3 and Strategy S2** • No change to gate settings occurred at Wivenhoe Dam over this period. Wivenhoe discharge is 2087 cumecs. All rural bridges below the dam are flooded. • At 15:00 the attempt to restrict Brisbane River flows at Moggill to 3500 cumecs was abandoned due to the rainfall being experienced in the dam catchments. A new target of 4000 cumecs was set in accordance with the Manual, on the basis that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and minimize urban damage. • No gate movements occurred at Somerset Dam during this period, with dam levels plotting under the Wivenhoe/Somerset Operations Target Line. This meant that the only gate movements allowable at Somerset under Strategy S2 would be openings and this was not done to limit further rises in Wivenhoe.	Wivenhoe Dam level rises from 71.56 to 72.54 over the 6 hour period. Somerset Dam level rises from 103.08 to 103.43 over the 6 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 274mm; Somerset 407mm; Lockyer 169mm; Bremer 149mm.	• Catchment average rainfalls over this period were: o Wivenhoe 34mm; o Somerset 31mm; o Lockyer 27mm; o Bremer 30mm. • Forecast rainfall is 75mm in the next 24 hours. • Wivenhoe Lake level forecast to peak at 73.6 (excluding forecast) 75.2 (including forecast). • Somerset Lake level forecast to peak at 103.4 (excluding forecast) 103.7 (including forecast). • Total dam inflow volume forecast is 1,708,000ML (excluding forecast) 2,162,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 1500 cumecs (excluding forecast) 2570 cumecs (including forecast). This peak was calculated to occur at 20:00 on 10 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 3910 cumecs (excluding forecast) 5180 cumecs (including forecast).	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)** • Consideration on protecting urban areas from inundation and minimizing urban damage. • A decision is made at 15:00 to attempt to remain within a target flow of around 4000 cumecs at Moggill. • The Manual states that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and this approach continues to be followed. • With dam levels under the Wivenhoe/Somerset Operations Target Line during this period, releases continued from Somerset Dam. • Although there is a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy is not to release flows that will cause high level urban inundation until it is certain that this cannot be avoided. Model results continue to indicate that this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 12 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2 Wivenhoe Directive #11.			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Monday 10 Jan 2011 15:00 Completed Monday 10 Jan 2011 20:00	• Gates opened continuously at Wivenhoe Dam for 5 hours in accordance with the standard gate opening sequence at a rate or 1.0 metres of opening per hour. • A target of 4000 cumecs at Moggill was set in accordance with the Manual, on the basis that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and minimize urban damage. • Wivenhoe discharge is increased from 2087 cumecs to 2695 cumecs. • Further gate openings at Wivenhoe Dam were paused at 20:00 in an attempt to allow the Lockyer and Bremer peaks to pass Brisbane and to restrict Brisbane River flows at Moggill to 4000 cumecs. • No gate movements occurred at Somerset Dam during this period, with dam levels plotting under the Wivenhoe/Somerset Operations Target Line. This meant that the only gate movements allowable at Somerset under Strategy S2 would be openings and this was not done to limit further rises in Wivenhoe.	Wivenhoe Dam level rises from 72.53 to 73.06 over the 5 hour period. Somerset Dam level rises from 103.43 to 103.45 over the 5 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 279mm; Somerset 415mm; Lockyer 174mm; Bremer 153mm.	• Catchment average rainfalls over this period were: o Wivenhoe 4mm; o Somerset 8mm; o Lockyer 5mm; o Bremer 3mm. • Forecast rainfall is 36mm in the next 24 hours, with isolated falls to 100mm. • Wivenhoe Lake level forecast to peak at 73.6 (excluding forecast) 74.3 (including forecast). • Somerset Lake level forecast to peak at 103.5 (excluding forecast) 103.5 (including forecast). • Total dam inflow volume forecast is 1,731,000ML (excluding forecast) 1,982,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 1500 cumecs (excluding forecast) 1840 cumecs (including forecast). This peak was calculated to occur at 20:00 on 10 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 3980 cumecs (excluding forecast) 4470 cumecs (including forecast).	• Consideration on protecting urban areas from inundation and minimizing urban damage. • The target maximum flow at Moggill is now 4000 cumecs. The Manual states that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and this approach continues to be followed. • With dam levels under the Wivenhoe/Somerset Operations Target Line during this period, releases continued from Somerset Dam. • The reduced QPF provides justification to retain the target of 4000 cumecs at Moggill, with the Wivenhoe peak of 74.3 (including forecast) indicating that it may be possible to keep urban damage within tolerable limits. A discussion is held with the Dam Safety Regulator requesting permission to exceed a level of 74.0 in Wivenhoe for a short period without invoking Strategy W4 if the safety of the dam can be guaranteed and urban damage reduced. The Regulator agreed with this approach. • The strategy continues to be not to release flows that will cause high level urban inundation until it is certain that this cannot be avoided. Model results continue to indicate that this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 13 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4000 cumecs)**
Commenced Monday 10 Jan 2011 20:00 Completed Tuesday 11 Jan 2011 04:00	• Gate openings at Wivenhoe Dam were paused at 20:00 in an attempt restrict Brisbane River flows at Moggill to close to 4000 cumecs. No change to gate settings occurred at Wivenhoe Dam over this period. Wivenhoe discharge is 2726 cumecs. • A target of 4000 cumecs is set at Moggill in accordance with the Manual. According to the Manual, the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs. However BCC damage tables indicated this would still impact 5325 properties and cause damage in excess of $47M. • Initial advice on a flash flood originating in Lockyer headwaters received at 20:00 and considerations undertaken during this period to develop a strategy to manage these potential flows. Strategies would involve reducing outflows from Wivenhoe until the peak of this flash flood passed and these strategies were not adopted. • During this period the plotted dam levels drifted just above the Wivenhoe/Somerset Operations Target Line. This lead to a decision at 04:00 to commence closing down releases from Somerset Dam to limit further rises in Wivenhoe.	Wivenhoe Dam level rises from 73.06 to 73.40 over the 8 hour period. Somerset Dam level fell from 103.45 to 103.23 over the 8 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 323mm; Somerset 437mm; Lockyer 186mm; Bremer 167mm.	• Catchment average rainfalls over this period were: o Wivenhoe 44mm; o Somerset 22mm; o Lockyer 12mm; o Bremer 14mm. • Forecast rainfall is 38mm in the next 24 hours, with isolated falls to 100mm. • Wivenhoe Lake level forecast to peak at 74.1 (excluding forecast) 74.9 (including forecast). • Somerset Lake level forecast to peak at 103.5 (excluding forecast) 103.7 (including forecast). • Total dam inflow volume forecast is 2,016,000ML (excluding forecast) 2,267,000ML (including forecast). • Peak flow at Moggill (excluding Wivenhoe releases) estimated at 1500 cumecs (excluding forecast) 1810 cumecs (including forecast). This peak was calculated to occur at 20:00 on 10 January 2011. • Peak flow at Moggill (including Wivenhoe releases) estimated at 4040 cumecs (excluding forecast) 4540 cumecs (including forecast).	• Consideration on protecting urban areas from inundation and minimizing urban damage. The target maximum flow at Moggill remains at 4000 cumecs. The Manual states that the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 cumecs and this approach continues to be followed. • Model results show that a peak level in the dam close to 74.0 remains possible, but is appearing increasing unlikely. • With dam levels moving above the Wivenhoe/Somerset Operations Target Line during this period, a decision is made commence closing down releases from Somerset Dam to limit further rises in Wivenhoe. • Although there is a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy is not to release flows that will cause high level urban inundation until it is certain that this cannot be avoided. Model results continue to indicate that this may be possible, although with continued rainfall, the strategy is now being reviewed on an hour by hour basis. The discussion at 21:00 with the Dam Safety Regulator requesting permission to exceed a level of 74.0 in Wivenhoe for a short period without invoking Strategy W4 (provided the safety of the dam can be guaranteed) is also being considered carefully in view of the continued rainfall.

JANUARY 2011 FLOOD EVENT - PERIOD 14 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Transition from Strategy W3 to Strategy W4; and Strategy S2 Wivenhoe Directive #12. Somerset Directive #6.			**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)**
Commenced Tuesday 11 Jan 2011 04:00 Completed Tuesday 11 Jan 2011 08:00	• Extreme intense rainfall (IFD curves indicate that this rainfall **exceeded 1 in 500 year intensities**) is experienced on and close to the Wivenhoe Dam lake area during this period. If the centroid of this rainfall was located east or south, it may have been possible to avoid transition to Strategy W4. • Because this extreme intense rainfall is occurring on and close to the dam rather than in the northern areas of the dam catchment, response time is minimized and actions must be taken quickly to protect the safety of the dam. Accordingly at 08:00 a decision is made to transition to Strategy W4. Significant urban damage can now not be avoided. The Dam Safety Regulator, Seqwater CEO and the Councils are advised of this development. • No change to gate settings occurred at Wivenhoe Dam over this period. Wivenhoe discharge is 2832 cumecs. • During this period sluice gate openings at Somerset Dam are reduced from 5 to 2 as the plotted dam levels had drifted just above the Wivenhoe/Somerset Operations Target Line. This decision is consistent with Strategy S2.	Wivenhoe Dam level rises from 73.40 to 73.70 over the 4 hour period. Somerset Dam level rises from 103.23 to 103.46 over the 4 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 356mm; Somerset 483mm; Lockyer 240mm; Bremer 183mm.	• Catchment average rainfalls over this period were: o Wivenhoe 33mm; o Wivenhoe Local 78mm; o Somerset 46mm; o Lockyer 54mm; o Bremer 16mm. • Forecast rainfall is 38mm in the next 24 hours, with isolated falls to 100mm. • Wivenhoe Lake level forecast to peak at 74.5 (excluding forecast) 75.1 (including forecast). • Somerset Lake level forecast to peak at 103.9 (excluding forecast) 104.2 (including forecast). • Total dam inflow volume forecast is 2,210,000ML (excluding forecast) 2,460,000ML (including forecast). • Peak flow at Moggill (including Wivenhoe releases) estimated at 5870 cumecs (excluding forecast).	• At 08:00, model results show that restricting the peak level in the dam close to 74.0 is no longer possible due to the high intensity rainfall experienced over this period. • At 08:00 a decision is made to transition to Strategy W4 and the Dam Safety Regulator, Seqwater CEO and the Councils are advised of this decision. It is now apparent that significant urban damage resulting from releases from Wivenhoe Dam cannot be avoided due to the extreme intense rainfall (IFD curves indicate that this rainfall **exceeded 1 in 500 year intensities**) that is experienced on and close to the Wivenhoe Dam lake area during this period • With dam levels moving above the Wivenhoe/Somerset Operations Target Line during this period releases from Somerset Dam are closed down to limit further rises in Wivenhoe.

JANUARY 2011 FLOOD EVENT - PERIOD 15 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Tuesday 11 Jan 2011 08:00 Completed Tuesday 11 Jan 2011 13:00	**Strategy W4 and Strategy S2 Wivenhoe Directive #12 to #14. Somerset Directive #7.** • Extreme intense rainfall (IFD curves indicate **greater than 1 in 500 year intensities**) continues on and close to the Wivenhoe Dam lake area during this period. If the centroid of this rainfall was located east or south, it may have been possible to avoid transition to Strategy W4. • Because the extreme rainfall is occurring on and close to the dam rather than in the northern areas of the dam catchment, response time is minimized and actions must be taken quickly to protect the safety of the dam. Once Strategy W4 is invoked, the Manual requires the opening of gates in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. Accordingly gates are opened continuously at Wivenhoe Dam for 5 hours in accordance with the standard gate opening sequence at an average rate of 2.0 metres of opening per hour. This increases the dam discharge from 2753 cumecs to 4250 cumecs. The threshold limit for urban damage has been exceeded and the lake level continues to rise. • During this period sluice gate openings at Somerset Dam are closed off to limit rises in Wivenhoe in accordance with Strategy S2.	Wivenhoe Dam level rises from 73.70 to 74.39 over the 5 hour period. Somerset Dam level rises from 103.46 to 103.83 over the 5 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 382mm; Somerset 570mm; Lockyer 287mm; Bremer 267mm.	• Catchment average rainfalls over this period were: o Wivenhoe 27mm; o Wivenhoe Local 85mm; o Somerset 86mm; o Lockyer 47mm; o Bremer 55mm. • Forecast rainfall is 100mm in the next 24 hours. • A portion of the extreme intense rainfall in the dam catchment was falling outside of rain gauges (e.g. on the dam lake area) and this resulted in difficulties in the model being able to accurately predict lake level rises. Accordingly gauge board readings were obtained every 30 minutes during this period. • Wivenhoe Lake level forecast to peak at 75.0 (excluding forecast) 76.2 (including forecast). • Somerset Lake level forecast to peak at 104.8 (excluding forecast) 105.7 (including forecast). • Total dam inflow volume forecast is 2,506,000ML (excluding forecast) 3,123,000ML (including forecast). • Peak flow at Moggill (including Wivenhoe releases) estimated at 9180 cumecs (excluding forecast).	**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)** • The strategy was to protect the structural safety of the dam. • The Manual requires actions under Strategy 4 to be that Wivenhoe gate openings are to occur in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. • The dam level continued to rise at 13:00. During this period, a Dam Operator was relaying Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four duty engineers were present in the Flood Operations Centre and decisions were being made on a half hourly basis once the gauge board readings were received. • With dam levels above the Wivenhoe/Somerset Operations Target Line during this period releases from Somerset Dam are closed down to limit further rises in Wivenhoe.

JANUARY 2011 FLOOD EVENT - PERIOD 16 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Tuesday 11 Jan 2011 13:00 Completed Tuesday 11 Jan 2011 19:00	**Strategy W4 and Strategy S2 Wivenhoe Directive #12 to #14.** • Extreme lake level rises in Wivenhoe Dam continue during this period and a severe weather warning for intense rainfall remains current (issued at 17:00). The QPF issued at 16:00 is for a catchment average rainfall of 75mm over the next 24 hours. • Gates opened continuously at Wivenhoe Dam for 6 hours in accordance with Strategy W4 and the standard gate opening sequence at an average rate of 4.5 metres of opening per hour. • Wivenhoe discharge is increased from 4250 cumecs to 7464 cumecs. Significant damage to urban areas in Brisbane cannot be avoided. • No releases are made from Somerset Dam to limit increases in Wivenhoe Dam in accordance with Strategy S2.	Wivenhoe Dam level rises from 74.39 to 74.97 over the 6 hour period. Somerset Dam level rises from 103.83 to 104.60 over the 6 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 397mm; Somerset 610mm; Lockyer 325mm; Bremer 278mm.	• Catchment average rainfalls over this period were: o Wivenhoe 15mm; o Wivenhoe Local 35mm; o Somerset 40mm; o Lockyer 38mm; o Bremer 40mm. • Forecast rainfall is 75mm in the next 24 hours (issued at 16:00) and a severe weather warning for potential intense rainfall in the dam catchments remains current. However, catchment average rainfalls for the 24 hour period commencing at 16:00 during this period were: o Wivenhoe 8mm; o Wivenhoe Local 13mm; o Somerset 19mm; o Lockyer 9mm; o Bremer 8mm. • A portion of the extreme intense rainfall in the dam catchment has fallen outside of rain gauges (e.g. on the dam lake area) and this resulted ~~in difficulties in the model~~ being able to accurately predict lake level rises. • Wivenhoe Lake level forecast to peak at 75.0 (excluding forecast) 75.2 (including forecast). • Somerset Lake level forecast to peak at 105.2 (excluding forecast) 105.9 (including forecast). • Total dam inflow volume forecast is 2,659,000ML (excluding forecast) 3,289,000ML (including forecast).	**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)** • The strategy was to protect the structural safety of the dam. • The Manual requires actions under Strategy 4 to be that Wivenhoe gate openings are to occur in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. • The lake level in both dams continued to rise during this period. A dam operator was relaying Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four duty engineers were present in the Flood Operations Centre and decisions were being made on a half hourly basis once the gauge board readings were received. • With dam levels above the Wivenhoe/Somerset Operations Target Line during this period no releases from Somerset Dam are made to limit further rises in Wivenhoe. • The water level in Wivenhoe Dam peaked at 19:00 on 11 January 2011.

JANUARY 2011 FLOOD EVENT - PERIOD 17 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Tuesday 11 Jan 2011 19:00 Completed Tuesday 11 Jan 2011 21:00	**Strategy W4 and Strategy S2 Wivenhoe Directive #15 to #24.** • No change to gate settings occurred at Wivenhoe Dam over this period. Wivenhoe discharge is 7458 cumecs. • The lake level in Wivenhoe dam stabilizes and then falls slightly at 21:00. A severe weather warning for intense rainfall remains current (issued at 17:00), but it appears from the BOM radar that the rainfall may have dissipated. On this basis a decision to commence closing down the gates to reduce urban flood impacts is taken at 21:00. This decision is potentially in contravention of the minimum gate opening settings required under Strategy W4, however it is made in an attempt to minimize urban damage in Brisbane which is an objective that must be considered under Strategy S4. • No releases are made from Somerset Dam in accordance with Strategy S2.	During this 2 hours period, the lake level in Wivenhoe Dam stabilizes at 74.97 and then falls slightly to 74.95 at 21:00. Somerset Dam level rises from 104.60 to 104.78 over the 2 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 398mm; Somerset 610mm; Lockyer 326mm; Bremer 278mm.	• Catchment average rainfalls over this period were: o Wivenhoe 1mm; o Somerset 1mm; o Lockyer 1mm; o Bremer 1mm. • Forecast rainfall is 75mm in the next 24 hours and a severe weather warning for possible intense rainfall in the catchments remains current. • A portion of the extreme intense rainfall in the dam catchment has fallen outside of rain gauges (e.g. on the dam lake area) and this continued to result in difficulties in the model being able to accurately predict lake level behaviour. • Wivenhoe Lake level forecast to peak at 75.0 (excluding forecast) 75.2 (including forecast). • Somerset Lake level forecast to peak at 105.2 (excluding forecast) 105.9 (including forecast). • Total dam inflow volume forecast is 2,659,000ML (excluding forecast) 3,282,000ML (including forecast).	**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)** • The target was to protect the structural safety of the dam. • The Manual requires actions under Strategy 4 to be that Wivenhoe gate openings are to occur at the minimum intervals and sequences until the storage level of Wivenhoe Dam begins to fall. • The dam level stabilized during this period and then fell slightly at 21:00. A dam operator was relaying Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four duty engineers were present in the Flood Operations Centre and decisions were being made on a half hourly basis once the gauge board readings were received. • With dam levels above the Wivenhoe/Somerset Operations Target Line during this period no releases from Somerset Dam are made to limit further rises in Wivenhoe. • The water level in Wivenhoe Dam peaked at around 20:00 on 11 January 2011.

JANUARY 2011 FLOOD EVENT - PERIOD 18 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W4 and Strategy S2 Wivenhoe Directive #25 to #34.			**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)**
Commenced Tuesday 11 Jan 2011 21:00 Completed Wednesday 12 Jan 2011 08:00	• During this period Wivenhoe Dam gates are closed off as quickly as possible without causing rises in lake level. These actions are taken to reduce urban flood impacts downstream. The severe weather warning for intense rainfall is cancelled at 22:00 and it appears from the BOM radar that the rainfall may have dissipated. The decision to close off the release in this way is potentially in contravention of the minimum gate opening settings required under Strategy W4, however it is made in an attempt to minimize urban damage in Brisbane which is an objective that must be considered under this Strategy. • Gates closed continuously at Wivenhoe Dam for 11 hours in accordance with the standard gate closing sequence at an average rate of just over 3.6 metres of opening per hour. • Wivenhoe discharge is decreased from 7464 cumecs to 2547 cumecs. All rural bridges below the dam remain flooded and significant damage to urban areas in Brisbane has not been avoided. • No releases are made from Somerset Dam in accordance with Strategy S2.	Wivenhoe Dam level falls from 74.97 to 74.78 over the 11 hour period. Somerset Dam level rises from 104.78 to 105.11 over the 11 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 399mm; Somerset 613mm; Lockyer 328mm; Bremer 279mm.	• Catchment average rainfalls over this period were: o Wivenhoe 1mm o Somerset 3mm; o Lockyer 3m; o Bremer 1m. • Forecast rainfall is 10mm in the next 24 hours (issued Wednesday morning). • Wivenhoe Lake level forecast to peak at 75.0 (excluding forecast) 75.0 (including forecast). • Somerset Lake level forecast to peak at 105.1 (excluding forecast) 105.1 (including forecast). • Total dam inflow volume forecast is 2,650,000ML (excluding forecast) 2,650,000ML (including forecast).	• The target was to protect the structural safety of the dam. • The Manual requires actions under Strategy W4 to be that Wivenhoe gate openings are to occur at the minimum intervals and sequences until the storage level of Wivenhoe Dam begins to fall. Because the lake level was falling slightly, a decision was made to reduce releases from Wivenhoe Dam as quickly and to as low a level as possible, to minimize urban damage in Brisbane. • It was calculated that reducing to a discharge of 2547 cumecs from Wivenhoe Dam would: o Not increase the downstream flood peak; o Not cause the water level in Wivenhoe Dam to rise and; o Allow the dam to be drained back to FSL in 7 days in accordance with the Manual. • With dam levels above the Wivenhoe/Somerset Operations Target Line during this period no releases from Somerset Dam are made to limit further rises in Wivenhoe.

JANUARY 2011 FLOOD EVENT - PERIOD 19 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Transition from Strategy W4 to the Drain Down Phase **Somerset Directives #8 to #9.**			**Drain Down Phase** **(Stored floodwaters emptied from the dam in seven days)**
Commenced Wednesday 12 Jan 2011 08:00 Completed Thursday 13 Jan 2011 12:00	• No change to gate settings occurred at Wivenhoe Dam over this period. Wivenhoe discharge is 2534 cumecs. All rural bridges below the dam remain flooded. • Releases commenced from Somerset Dam during this period as the plotted dam levels fell below the Wivenhoe/Somerset Operations Target Line. These actions were undertaken in accordance with Strategy S2 and to allow the D'Aguilar Highway to be opened as soon as possible. Even though plotted dam levels later rose above the Wivenhoe/Somerset Operations Target Line during this period, releases from Somerset dam continued to allow the dam to be drained back to FSL in 7 days in accordance with the Manual.	Wivenhoe Dam level falls from 74.78 to 74.61 over the 28 hour period. Somerset Dam level falls from 105.11 to 103.96 over the 28 hour period. Total rainfall since event commencement (including the current period): Wivenhoe 401mm; Somerset 619mm; Lockyer 330mm; Bremer 280mm.	• Catchment average rainfalls over this period were: o Wivenhoe 2mm; o Somerset 6mm; o Lockyer 6mm; o Bremer 6mm. • Forecast rainfall is 10mm in the next 24 hours.	• During this period the strategy transitioned from Strategy W4, during which the target is to protect the structural safety of the dam, to the Drain Down Phase of the event. • Once the Drain Down Phase commenced, the target was to release stored floodwaters from the dam within seven days of the flood peak passing through the dams, while controlling downstream impacts. Considerations impacting on the duration and timing of the Drain Down Phase in this instance included: o Causing no increases in river levels below the dam (except where they were unavoidable due to tidal influences. o Maintaining an adequate release rate to ensure that the temporary pumps providing water supplies to the Lowood area could continue to operate; o Minimizing bank slumping impacts along the river, particularly in key areas such as Coronation Drive (as requested from the Brisbane City Council); o Re-opening the Brisbane Valley highway and key rural bridges as quickly as possible; o Achieving full supply levels in the dams at the conclusion of the event.

JANUARY 2011 FLOOD EVENT - PERIOD 20 OF 20				
DATE/TIME	**BACKGROUND**	**DAM LEVELS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Thursday 13 Jan 2011 12:00 Completed Wednesday 19 Jan 2011 12:00	**Drain Down Phase** **Wivenhoe Directives #35 to #62** **Somerset Directives #10 to #13.** • During this period releases from Wivenhoe Dam are increased to as the peaks from the Lockyer and Bremer subside. Downstream impacts are controlled to ensure that at no time during this phase do downstream water levels rise except if impacted by tidal influences. • During this period, stored flood water in Somerset Dam is drained into Wivenhoe Dam in accordance with the drain down target of seven days. Importance is placed on opening the D'Aguilar Highway as soon as possible.	Wivenhoe Dam level falls from 74.61 to 66.89 over the 6 day period. Somerset Dam level falls from 103.96 to 99.00 over the 6 day period. Total rainfall since event commencement (including the current period): Wivenhoe 415mm; Somerset 626mm; Lockyer 397mm; Bremer 288mm.	• Catchment average rainfalls over this six day period were: o Wivenhoe 14mm; o Somerset 7mm; o Lockyer 7mm; o Bremer 8mm.	**Drain Down Phase** • During this period the target was to release stored floodwaters from the dam within seven days of the flood peak passing through the dams, while controlling downstream impacts. Considerations impacting on the duration and timing of the Drain Down Phase in this instance included: o Causing no increases in river levels below the dam (except where they were unavoidable die to tidal influences. o Maintaining an adequate release rate to ensure that the temporary pumps providing water supplies to the Lowood area could continue to operate; o Minimizing bank slumping impacts along the river, particularly in key areas such as Coronation Drive (as requested from the Brisbane City Council); o Re-opening the Brisbane Valley highway and key rural bridges as quickly as possible; o Achieving full supply levels in the dams at the conclusion of the event.

CERTIFICATE OF EXHIBIT

Exhibit 8 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]
.....
Declarant

[redacted]
..
Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

Formatted: Top: 0.63 cm, Bottom: 0.95 cm

Formatted Table

JANUARY 2011 FLOOD EVENT - PERIOD 1 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
	Strategy W1A and Strategy W1B; and Strategy S2			**Strategy W1A and Strategy W1B; and Strategy S2 (Lake level greater than 67.25, maximum release 110-m³/s)**
Commenced Thursday 06 Jan 2011 07:42 Completed Friday 07 Jan 2011 02:00	• Catchment conditions prior to the event are as described in Section 6.0. The event was considered a continuation of the ongoing wet period that commenced in October 2010. • No significant rainfall occurred in the 24 hours to 09:00 on 5 Jan 2011. • Catchment average rainfalls in the 24 hours to 08:00 on 6 Jan 2011 were: o Wivenhoe Dam 25mm; o Somerset Dam 21mm; o Lockyer Creek 23mm; o Bremer River 23mm. • Event mobilisation occurred at 07:42 on 6 Jan 2011, using Strategies W1A and S2. • Once mobilisation occurs, 24/7 staffing of the Flood Operations Centre and dams continues until official de-mobilisation is announced. This occurred at 12:00 on 19 Jan 2011. • Duty Engineer called back early from holidays to assist with the management of the Event. • Transition from Strategy W1A to W1B once the Wivenhoe Lake level exceeded 67.50.	Total rainfall from 08:00 on 6 Jan 2011 to the end of this period: o Wivenhoe Dam 53mm; o Somerset Dam 44mm; o Lockyer Creek 53mm; o Bremer River 54mm. Wivenhoe Dam level ~~roseises~~ from 67.31 to 67.52 over the 18 hour period. Somerset Dam level ~~rises~~ rose from 99.34 to 99.55 over the 18 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 28mm; o Somerset Dam 23mm; o Lockyer Creek 30mm; o Bremer River 31mm. • Forecast 24 hour catchment average rainfall at 10:00 on 6/11 was 25mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.4 (excluding forecast); 68.7 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 99.7 (excluding forecast); 100.1 (including forecast). • Estimated total dam inflow ~~is~~: 204,000ML (excluding forecast); 343,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 470-m³/s ~~3/s~~ (excluding forecast); 720-m³/s ~~3/s~~ (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 550-m³/s ~~3/s~~ (excluding forecast); 960-m³/s ~~3/s~~ (including forecast). These peaks were not expected to occur for more than 24 hours beyond period end. ~~Therefore~~ College's Crossing remained open in the short term. • Estimated peak Wivenhoe Dam outflow ~~is~~:	• Peak inflows into the Brisbane River from Lockyer Creek ~~are~~ were estimated to be in the order of 400 m³/s. These flows ~~will~~ would not inundate Colleges Crossing until the morning of 7 Jan 2011. • Lake level was not expected to reach 67.50 (Strategy W1B) until 7 Jan 2011. Lake level may not exceed 68.5. • Endeavoured to keep College's Crossing trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 175-m³/s. • Water held in Wivenhoe Dam in an attempt to keep College's Crossing trafficable in accordance with Strategy W1A. Low level releases continued from the Mini-Hydro at this time and at various stages during the event. However, these releases (in the order of 13-m³/s) have low relative significance and are not referred to specifically in the remainder of this summary document. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge. The low level sluices were kept closed. Some regulator releases continued from XX December as part of previous event drain down, (in the order of 35-m³/s). These were shut down at 18:00.

Formatted: Highlight

Formatted: Highlight

			1220-m^3/s ~~3/s~~ (excluding forecast); 1260-m^3/s ~~3/s~~ (including forecast).	
JANUARY 2011 FLOOD EVENT - PERIOD 2 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W1B and Strategy S2			**Strategy W1B and Strategy S2 (Lake level greater than 67.50, maximum release 110-m^3/s)**
Commenced Friday 07 Jan 2011 02:00 Completed Friday 07 Jan 2011 09:00	• Transition from Strategy W1A to W1B due to the Wivenhoe Lake ~~l~~Level exceeding 67.50. • Transition from Strategy W1B to W1C once the Wivenhoe Lake ~~l~~Level exceeds 67.75. • College's Crossing was inundated by natural river flows during this period.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 64mm; Somerset Dam 60mm; Lockyer Creek 57mm; Bremer River 60mm. Wivenhoe Dam level ~~rises~~ rose from 67.52 to 67.75 over the seven~~7~~ hour period. Somerset Dam level ~~rises~~ rose from 99.55 to 99.65 over the seven~~7~~ hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 11mm; o Somerset Dam 15mm; o Lockyer Creek 4mm; o Bremer River 5mm. • Forecast 24 hour catchment average rainfall at 10:00 on 6/11 was 25mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.2 (excluding forecast); 68.5 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 99.7 (excluding forecast); 100.2 (including forecast). • Estimated total Ddam inflow ~~is~~: 242,000ML (excluding forecast); 380,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 470-m^3/s (excluding forecast); 670-m^3/s (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 570-m^3/s (excluding forecast); 970-m^3/s (including forecast). • Estimated peak Wivenhoe Dam outflow ~~is~~: 1,220-m^3/s (excluding forecast); 1,250-m^3/s (including forecast).	• Endeavoured to keep Burtons Bridge trafficable by limiting combined flows from Wivenhoe Dam and Lockyer Creek to a maximum of 430-m^3/s. • Peak inflows into the Brisbane River from Lockyer Creek ~~are~~ were estimated to be in the order of 470 m^3/s. These flows may not be sufficient to inundate Burtons Bridge. • Lake level was not expected to reach 67.75 (Strategy W1C) for at least ~~6~~six hours. Lake level may not exceed 68.5. • Water was held in Wivenhoe Dam in an attempt to keep Burtons Bridge trafficable in accordance with Strategy W1B. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge and the low level regulators and sluices at Somerset Dam were kept closed.

Formatted Table

Formatted: Highlight

JANUARY 2011 FLOOD EVENT - PERIOD 3 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W1C and Strategy S2			**Strategy W1C** **(Lake Level greater than 68.00, maximum release 1,900 m^3/s)**
Commenced Friday 07 Jan 2011 09:00 Completed Friday 07 Jan 2011 15:00	• At around 09:00 it becomes apparent ~~that~~ flows from Lockyer Creek into the Brisbane River, combined with local Brisbane River inflows downstream of Wivenhoe Dam, ~~will~~ would be sufficient to inundate all bridges below the Dam, with the exception of Mt Crosby Weir Bridge and Fernvale Bridge. Burtons Bridge which ~~were~~was inundated by natural river flows near the end of this period. •All impacted Councils ~~are~~ were notified of the situation and that releases ~~will~~ would commence from Wivenhoe Dam. ~~-~~ Releases were timed to occur at 15:00 to allow bridges to be closed and arrangements to be made to cater for rural community isolation. ~~-~~The impacted rural communities had been isolated over the Christmas period and time was needed for suitable arrangements to be made to allow these communities to ~~be~~ prepared for another potentially extended period of isolation. Releases were timed to start ~~The timing of release commencement was also~~ in accordance with the Manual requirements of ~~maintaining~~ keeping Burtons Bridge and Kholo Bridge open to ~~trafficable~~ when operating under Strategy	Total rainfall from 08:00 on 6 ~~January~~ 2011 to the end of this period: Wivenhoe Dam 89mm; Somerset Dam 90mm; Lockyer Creek 71mm; Bremer River 71mm. Wivenhoe Dam level ~~rises~~ rose from 67.75 to 68.03 over the 6six hour period. Somerset Dam level ~~rises~~ rose from 99.65 to 99.94 over the six6 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 29mm; o Somerset Dam 30mm; o Lockyer Creek 14mm; o Bremer River 12mm. • Forecast 24 hour catchment average rainfall at 10:00 on 7/11 was 25mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.4 (excluding forecast); 68.9 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 100.3 (excluding forecast); 100.6 (including forecast). • Estimated total dam inflow ~~is~~: 346,000ML (excluding forecast); 483,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 530-m^3/s (excluding forecast); 710-m^3/s (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 660-m^3/s (excluding forecast); 1,040-m^3/s (including forecast). • Estimated peak Wivenhoe Dam outflow ~~is~~: 1,240-m^3/s (excluding forecast); 1,270-m^3/s (including forecast).	• Due to the further rain and observed stream rises, it ~~has~~ became apparent ~~that~~ flows from Lockyer Creek into the Brisbane River, combined with local Brisbane River inflows downstream of Wivenhoe Dam, ~~will~~ would be sufficient to inundate all bridges downstream of the Ddam, with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. • Releases from Wivenhoe Dam were managed in an attempt to ~~maintain~~ ensure Mt Crosby Weir Bridge and Fernvale Bridge remained trafficable in accordance with Strategies W1D and W1E. • In accordance with Strategy S2, the crest gates at Somerset Dam were raised to enable uncontrolled discharge, and the low level regulators and sluices at Somerset Dam were kept closed.

Formatted Table

Formatted: Highlight

	W1C. • • Transitioned from Strategy W1C to Strategy W1D once the Wivenhoe Dam Llake level exceedsed 68.0			

JANUARY 2011 FLOOD EVENT - PERIOD 4 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
Commenced Friday 07 Jan 2011 15:00 Completed Saturday 08 Jan 2011 14:00	**Transition from Strategy W1D to W1E to W3; and Strategy S2 Wivenhoe Directives #1 to #4. Somerset Directives #1 to #3.** • Gates opened continuously at Wivenhoe Dam for 23 hours, in accordance with ~~the~~ standard gate opening sequence at a rate or 0.5 metres of opening per hour. • Transitioned from Strategy W1D to W1E ~~once~~ when the Wivenhoe Dam level exceededs~~ed~~ 68.25 (22:00 on 7 Jan 2011). • Transitioned from Strategy W1E to W3 ~~once~~ as it becaemes apparent ~~that the~~ Wivenhoe Dam level wouldill exceed 68.50 (08:00 on 8 Jan 2011). ~~–~~Strategy W2 was by-passed as it was not possible to ~~meet the intent of~~achieve this Sstrategy by limiting the flow in the Brisbane River to less than the naturally occurring peaks at Lowood and Moggill. This is because the calculated naturally occurring peaks at Lowood and Moggill were 530-m^3/s and 800-m^3/s respectively, whereas the release rate from the Ddam was already 940-m^3/s. -Limiting releases to these naturally occurring peak flows would also have compromised the Ddam drain down requirements.	Total rainfall from 0800 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 92mm; Somerset Dam 95mm; Lockyer Creek 72mm; Bremer River72mm. Wivenhoe Dam level ~~rises~~ rose from 68.03 to 68.61 over the 23 hour period. Somerset Dam level ~~rises~~ rose from 99.94 to 100.44 over the 23 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 3mm; o Somerset Dam 5mm; o Lockyer Creek 1mm; o Bremer River 1mm. • Forecast 24 hour catchment average rainfall at 10:00 on 8/11 was 40mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.7 (excluding forecast); 69.1 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 100.5 (excluding forecast); 100.6 (including forecast). • Estimated total Ddam inflow ~~is~~: 420,000ML (excluding forecast); 662,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 530-m^3/s (excluding forecast); 530-m^3/s (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 550-m^3/s (excluding forecast); 960-m^3/s (including forecast). This peak ~~was~~ is estimated to have occurred at 05:00 on 8 Jan~~uary~~ 2011.	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000-m^3/s)** • Inflows from Lockyer Creek into the Brisbane River have inundated all bridges downstream of the Ddam, with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge. •The Strategy transitioneds from W1 to W3 ~~once~~ as it beceames apparent ~~that the~~ Wivenhoe Dam level wais likely to exceed 68.5 and Strategy W2 ~~cannot~~ could not be applied. • • Strategy W3 requireeds the flow at Moggill to be lowered to 4,000 m^3/s as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe Dam releases).- This was already achieved. •Strategy W3 also requiresd ~~consideration of~~ lower level Manual objectives to be considered.- Therefore consideration ~~during this period~~ was given to minimiszing disruption to downstream rural life and ~~endeavoring~~endeavouring to ~~maintain~~ keep Mt Crosby Weir Bridge and Fernvale Bridge trafficable.

Formatted Table

Formatted: Highlight

	• At 14:00 on 08 Janu~~ary~~ 2011, Wivenhoe Dam discharge wa~~is~~ 1,239 m^3/s. ~~-~~All rural bridges below the D~~d~~am, with the exception of ~~the~~ Mt Crosby Weir Bridge and Fernvale Bridge, ~~are~~ were flooded.		• Estimated peak Wivenhoe Dam outflow ~~is~~: 1,480 m^3/s (excluding forecast); 1,540 m^3/s (including forecast). This flow wa~~is~~ significantly greater than the calculated natural peak that excluded Wivenhoe Dam releases.	• Due to rainfall on the ground, it was apparent ~~that~~ the Somerset Dam level would exceed 100.45. Accordingly, two sluice gates were opened during this period to allow D~~d~~am levels to move towards the Wivenhoe/Somerset Operating Target Line in accordance with Strategy S2.

JANUARY 2011 FLOOD EVENT - PERIOD 5 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
	Strategy W3 and Strategy S2			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000 m^3/s)**
Commenced Saturday 08 Jan 2011 14:00 Completed Sunday 09 Jan 2011 01:00	• Releases maintained from both Wivenhoe and Somerset d~~d~~ams to ensure Mt Crosby Weir Bridge and Fernvale Bridge remained trafficable. • No change to gate settings over this period. ~~-~~Wivenhoe Dam discharge ~~was-is~~ 1,240 m^3/s. All rural bridges below the D~~d~~am, with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge, ~~are-~~were flooded.	Total rainfall from 08:00 on 6 Janu~~ary~~ 2011 to the end of this period: Wivenhoe Dam 100mm; Somerset Dam 111mm; Lockyer Creek 75mm; Bremer River 75mm. Wivenhoe Dam level ~~rises-~~rose very slightly from 68.61 to 68.63 over the 13 hour period. Somerset Dam level ~~falls-~~fell from 100.44 to 100.32 over the 13 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 8mm; o Somerset Dam 16mm; o Lockyer Creel 3mm; o Bremer River 2mm. • Forecast 24 hour catchment average rainfall at 16:00 on 8/11 was 40mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.7 (excluding forecast); 69.9 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 100.5 (excluding forecast); 100.6 (including forecast). • Estimated total D~~d~~am inflow ~~is~~: 457,000ML (excluding forecast); 697,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 530 m^3/s (excluding forecast); 530 m^3/s (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~:	• Strategy W3 required the flow at Moggill to be lowered to 4,000 m^3/s as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe Dam releases). ~~-~~This was already achieved. • Strategy W3 also required ~~consideration of~~ lower level Manual objectives to be considered. ~~-~~Therefore, with Llake levels rising slightly (Wivenhoe Dam) and falling (Somerset Dam) consideration during this period remained on minimi~~s~~zing disruption to downstream rural life and endeavouring to ~~maintain~~ keep Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With the Somerset Lake Dam l~~L~~evel still expected to exceed 100.45, and the level in Wivenhoe Dam remaining relatively static, releases from Somerset Dam continued. Closing of the sluices would have resulted in D~~d~~am levels quickly

Formatted Table

Formatted: Highlight

			770 m^3/s (excluding forecast); 840 m^3/s (including forecast). This peak ~~was~~ is estimated to have occurred at 05:00 on 8 Jan~~uary~~ 2011. • Estimated peak Wivenhoe Dam outflow ~~is~~: ~~-~~1,480 m^3/s (excluding forecast); 1,520 m^3/s (including forecast). This flow ~~is~~ was significantly greater than the calculated natural peak that excluded Wivenhoe Dam releases.	moving under the Wivenhoe/Somerset Operating Target Line requiring sluice re-opening within a short period.

JANUARY 2011 FLOOD EVENT - PERIOD 6 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
	Strategy W3 and Strategy S2 Wivenhoe Directives #5 to #7.			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000 m^3/s)**
Commenced Sunday 09 Jan 2011 01:00 Completed Sunday 09 Jan 2011 08:00	• Releases increased marginally from Wivenhoe Dam to account for the passing of the Lockyer Creek peak while ~~maintaining~~ ensuring Mt Crosby Weir Bridge and Fernvale Bridge remained trafficable. • Wivenhoe Dam discharge increased from 1,240 m^3/s to 1,334 m^3/s. • There were ~~N~~no change to Somerset Dam gate settings over this period. • All rural bridges below the ~~D~~dam, with the exception of the Mt Crosby Weir Bridge ~~and~~ Fernvale Bridge, were ~~are~~ flooded.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 112mm; Somerset Dam 146mm; Lockyer Creek 76mm; Bremer River 75mm. Wivenhoe Dam level ~~falls~~ fell from 68.63 to 68.56 over the ~~7~~seven hour period. Somerset Dam level ~~falls~~ fell from 100.32 to 100.28 over the seven~~7~~ hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 12mm; o Somerset Dam 36mm; o Lockyer Creek 1mm; o Bremer River 0mm. • Forecast 24 hour catchment average rainfall at 16:00 on ~~8~~/11 was 40mm. • Estimated peak Wivenhoe Dam level ~~is~~: 68.7 (excluding forecast); 69.3 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 100.5 (excluding forecast); 101.0 (including forecast). • Estimated total D~~d~~am inflow ~~is~~: 569,000ML (excluding forecast); 814,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 530 m^3/s (excluding forecast); 530 m^3/s (including forecast). • Estimated peak flow at Moggill excluding	• Strategy W3 require~~s~~d the flow at Moggill to be lowered to 4,000 m^3/s as soon as possible after the naturally occurring peak at Moggill (excluding Wivenhoe Dam releases). ~~-~~This was already achieved. • Strategy W3 also require~~s~~d ~~consideration of~~ lower level Manual objectives to be considered. ~~-~~Therefore, with ~~l~~Lake levels falling at both dams, consideration during this period remained on minimi~~z~~sing disruption to downstream rural life and endeavouring to ~~maintain~~ keep Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With the Somerset Lake Dam ~~l~~Level still expected to exceed 100.45, and the level in Wivenhoe Dam falling, releases from Somerset Dam continued. Closing of the sluices would have resulted in d~~d~~am levels quickly moving under the

Formatted Table

Formatted: Highlight

			Wivenhoe Dam releases ~~is~~: 770 m^3/s (excluding forecast); 780 m^3/s (including forecast). This peak ~~was~~ is estimated to have occurred at 05:00 on 8 Jan~~uary~~ 2011. • Estimated peak Wivenhoe Dam outflow ~~is~~: 1,500 m^3/s (excluding forecast); 1,550 m^3/s (including forecast). This flow is significantly greater than the calculated natural peak that excluded Wivenhoe Dam releases.	Wivenhoe/Somerset Operating Target Line requiring sluice re-opening within a short period, particularly given the rainfall that occurred in the Somerset Dam catchment during this period.

JANUARY 2011 FLOOD EVENT - PERIOD 7 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
Commenced Sunday 09 Jan 2011 08:00 Completed Sunday 09 Jan 2011 14:00	**Strategy W3 and Strategy S2 Wivenhoe Directives #7. Somerset Directives #4 to #5.** • Releases increased marginally from Wivenhoe Dam to account for the passing of the Lockyer Creek peak while ~~maintaining~~ ensuring Mt Crosby Weir Bridge and Fernvale Bridge remained trafficable. • Wivenhoe Dam discharge increased from 1,334 m^3/s to 1,386 m^3/s. • Somerset Dam sluice gates opened progressively over this period to allow Ddam levels to move towards the Wivenhoe/Somerset Operating Target Line in accordance with Strategy S2. • All rural bridges below the dDam, with the exception of the Mt Crosby Weir Bridge and Fernvale Bridge, ~~are~~ were flooded.	Total rainfall from 08:00 on 6 Jan ~~January~~ 2011 to the end of this period: Wivenhoe Dam 146mm; Somerset Dam 199mm; Lockyer Creek 94mm; Bremer River 90mm. Wivenhoe Dam level ~~rises~~ rose very slightly from 68.56 to 68.58 over the 6six -hour period. Somerset Dam level ~~rises~~ rose from 100.28 to 100.47 over the 6six hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 34mm; o Somerset Dam 53mm; o Lockyer Creek 18mm; o Bremer River 15mm. • Forecast 24 hour catchment average rainfall at 10:00 on 9/11 was 50mm. • Estimated peak Wivenhoe Dam level ~~is~~: 70.0 (excluding forecast); 71.3 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 100.7 (excluding forecast); 101.1 (including forecast). • Estimated total Ddam inflow ~~is~~: 804,000ML (excluding forecast); 1,108,000ML (including forecast). • Estimated peak flow at Lowood excluding Wivenhoe Dam releases ~~is~~: 530 m^3/s (excluding forecast); 690 m^3/s (including forecast).	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000 m^3/s)** • With Llake levels rising at both Ddams and heavy rain being experienced in the dDam catchments, consideration was given to transitioning ~~the consideration~~ from minimizing disruption to downstream rural life to protecting urban areas from inundation. • However, using the B~~O~~oM rainfall forecasts, a three day assessment showed the lower limit of three day forecast inflow to be similar to the October 2010 Flood Eevent, with the upper limit similar to the February 1999 Flood eEvent. Therefore, during this period, consideration remained on minimizsing disruption to downstream rural life and endeavouring to ~~maintain~~ keep Mt Crosby Weir Bridge and Fernvale Bridge trafficable. • With Ddam levels under the Wivenhoe/Somerset Operating

Formatted Table

Formatted: Highlight

			• Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 770-m^3/s (excluding forecast); 1,210-m^3/s (including forecast). This peak was estimated to have occurred at 05:00 on 8 Jan~~uary~~ 2011. • Estimated peak Wivenhoe Dam outflow ~~is~~: 1,490-m^3/s (excluding forecast); 1,560-m^3/s (including forecast). This flow ~~i~~was significantly greater than the calculated natural peak that excluded Wivenhoe Dam releases.	Target Line at the end of this period, releases continued from Somerset Dam.

JANUARY 2011 FLOOD EVENT - PERIOD 8 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
Commenced Sunday 09 Jan 2011 14:00 Completed Sunday 09 Jan 2011 19:00	**Strategy W3 and Strategy S2** • During this period, releases continued from both Ddams at a level that ~~maintained ensured~~ Mt Crosby Weir Bridge and Fernvale Bridge remained trafficable. ~~-~~Gate settings were unchanged and the Wivenhoe Dam discharge was 1,411-m^3/s. • Due to rainfall on the ground and the modelled rapid Llake level rises, a decision ~~i~~was made ~~to transition to~~ focus on protecting urban areas from inundation ~~at~~ 19:00. • Councils, the Dam Safety Regulator and ~~the~~ Seqwater's CEO were notified of the decision soon after 19:00. ~~-~~The ramifications of the decision were that the new estimated peak flow at Moggill of 3,300-m^3/s would impact properties and ~~commence to~~ begin to ~~cause~~ damage ~~to~~ urban areas below Moggill. ~~-Damage tables supplied~~	Total rainfall from 08:00 on 6 January 2011 to the end of this period: Wivenhoe Dam 208mm; Somerset Dam 305mm; Lockyer Creek 116mm; Bremer River 96mm. Wivenhoe Dam level ~~rises~~ rose from 68.58 to 68.97 over the ~~5~~five hour period. Somerset Dam level ~~rises~~ rose from 100.47 to 101.43 over the five~~5~~ hour period.	Catchment average rainfalls during this period were: o Wivenhoe Dam 62mm; o Somerset Dam 106mm; o Lockyer Creek 22mm; o Bremer River 6mm. • Forecast 24 hour catchment average rainfall at 16:00 on 9/11 was 65mm. • Estimated peak Wivenhoe Dam level ~~is~~: 72.1 (excluding forecast); 73.9 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 102.3 (excluding forecast); 103.0 (including forecast). • Estimated total Ddam inflow ~~is~~: 1,272,000ML (excluding forecast); 1,712,000ML (including forecast).	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000-m^3/s)** • ~~With~~ Llake levels continuing to rise at both ddams, and combined with heavy rain in the Ddam catchments during this period, it was decided at the end of the period to ~~the decision was made at the end of this period~~ no longer consider minimiszing disruption to downstream rural life and to focus only on protecting urban areas from inundation. • Towards the end of this period, it became ~~was becoming~~ apparent ~~that~~ Moggill was likely to experience a second naturally occurring peak on 10 Jan~~uary~~ 2011 or later. ~~-and~~ T~~that~~ the Manual required the flow at Moggill to be minimiszed prior to this peak occurring. ~~-~~This requirement competed ~~was competing~~ with the need to protect urban areas by not allowing the Wivenhoe Dam ~~level~~ to reach a level that invoked Strategy W4. ~~-After considering these issues i~~It was decided ~~that~~ the best course of action ~~would b~~wase to increase

Formatted Table

Formatted: Highlight

	~~by the~~ Brisbane City Council damage tables indicated ~~that~~ at flows of 3,000-m^3/s, damage costs would exceed $5.0 million~~M~~ and 2,600 properties would be impacted in some way. ~~-~~ The level of ~~so~~ impacts would ~~rise~~ increase significantly~~steeply~~ as flows increased and therefore ~~, so~~ the focus was on minimi~~s~~zing the flow at Moggill. • A decision wa~~i~~s ~~also~~ made at 19:00, to ~~that because of the serious nature of the event,~~ staff the Flood Operations Centre ~~will be staffed~~ with at least two Duty Engineers at all times until ~~at least~~ the peak of the Eevent has~~d~~ occurred.		• Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 770-m^3/s (excluding forecast); 1,940-m^3/s (including forecast). This peak was estimated to have occurred at 05:00 on 8 Jan~~uary~~ 2011. • Estimated peak flow at Moggill including Wivenhoe Dam releases ~~is~~: 3,300-m^3/s (excluding forecast); 4,400-m^3/s (including forecast).	releases as quickly as possible to the limit of non-damaging flows at Moggill. ~~-~~ However, before this could occur, Councils needed to be advised, bridges needed to be closed and actions needed to be taken to prepare ~~for~~ rural communities for isolation and urban areas below Moggill for river flows approaching 3,500-m^3/s. • With Ddam levels under the Wivenhoe/Somerset Operating Target Line during this period, releases continued from Somerset Dam.

JANUARY 2011 FLOOD EVENT - PERIOD 9 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W3 and Strategy S2			**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000-m^3/s)**
Commenced Sunday 09 Jan 2011 19:00 Completed Monday 10 Jan 2011 01:00	• Agency notifications commenced at 07:00~~pm~~. ~~The likely peak flow at Moggill of over 3000 m^3/s was communicated to the~~ Brisbane City Council, the Dam Safety Regulator and Seqwater's CEO were advised the likely peak flow at Moggill would exceed ~~-~~3,000 m^3/s • ~~Damage tables supplied by the~~ Brisbane City Council damage tables indicated, ~~that~~ at flows of 3,000-m^3/s, damage costs would exceed $5.0 million~~M~~ and 2,600 properties would be impacted in some way. ~~-~~ The level of ~~so~~ impacts would ~~rise~~ increase ~~steeply~~ significantly as flows increased, ~~so~~ and therefore the focus was on minimizsing the flow at Moggill.	Total rainfall from 08:00 ~~on~~ 6 Jan ~~January~~ 2011 to the end of this period: Wivenhoe Dam 232mm; Somerset Dam 343mm; Lockyer Creek 131mm; Bremer River 102mm. Wivenhoe Dam level ~~rises~~ rose from 68.97 to 69.97 over the six~~6~~ hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 24mm; o Somerset Dam 38mm; o Lockyer Creek 14mm; o Bremer River 6mm. • Forecast 24 hour catchment average rainfall at 16:00 on 9/11 was 65mm. • Estimated peak Wivenhoe Dam level ~~is~~: 72.9 (excluding forecast); 74.7 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 102.9 (excluding forecast); 103.4 (including forecast).	• Consideration now focused on ~~was on~~ protecting urban areas from inundation. However, before releases were ~~are~~ increased to and above the limit of non-damaging floods at Moggill, Councils and other impacted agencies ~~are~~ were notified so ~~that~~ appropriate actions ~~can~~ could be taken, including any necessary evacuations and the closure of ~~both~~ the Mt Crosby Weir Bridge and Fernvale Bridge. • The Manual requires the flow at Moggill to be minimi~~s~~zed prior to its naturally occurring peak. T ~~and~~ this requirement was balanced against the need to protect urban areas by releasing water from the ~~d~~Dams in an attempt to keep the Wivenhoe Dam

Formatted Table

Formatted: Highlight

	• Fernvale Bridge was closed by police at around 01:00 on 10 January 2011. ~~and once this was confirmed a~~A directive was issued to increases releases from Wivenhoe Dam. • Gate~~No change to gate~~ settings did not change over this period due to the potential danger to the public associated with inundating Fernvale Bridge from Wivenhoe Dam outflows prior to the bridge being closed to traffic. Councils also required time to prepare for the isolation of rural communities, the onset of urban damage below Moggill and to undertake any necessary evacuations. Wivenhoe Dam discharge wais 1,473 m^3/s. All rural bridges below the dDam, with the exception of ~~the~~ Mt Crosby Weir Bridge and Fernvale Bridge, were~~are~~ flooded.	Somerset Dam level ~~rises~~ rose from 101.43 to 102.54 over the six~~6~~ hour period.	• Estimated total Ddam inflow ~~is~~: 1,468,000ML (excluding forecast); 1,922,000ML (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 820 m^3/s (excluding forecast); 2,000 m^3/s (including forecast). This peak was estimated to occur at 16:00 on 10 January 2011. • Estimated peak flow at Moggill including Wivenhoe Dam releases ~~is~~: 3,240 m^3/s (excluding forecast); 4,480 m^3/s (including forecast).	Llake ~~level~~ below a level that ~~will~~ would invoke Strategy W4. Based on an estimated 16 hour travel time between the Ddam and Moggill, this did occur. • With Ddam levels under the Wivenhoe/Somerset Operating Target Line during this period, releases continued from Somerset Dam. • Although there wais a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy wais not to release flows that ~~will~~ould cause high level urban inundation until it wais certain ~~it that this cannot~~ could not be avoided. Model results continued to indicate ~~that~~ this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 10 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
Commenced Monday 10 Jan 2011 01:00 Completed Monday 10 Jan 2011 09:00	**Strategy W3 and Strategy S2 Wivenhoe Directives #8 to #10.** • Gates opened continuously at Wivenhoe Dam for eight~~8~~ hours in accordance with ~~the~~ standard gate opening sequence at a ~~rate~~ of 0.5 metres of opening per hour. • Wivenhoe Dam discharge ~~is~~ increased from 1,473 m^3/s to 2,015 m^3/s. All rural bridges below the Ddam ~~a~~were flooded. • Further gate openings at Wivenhoe Dam were paused at 09:00 in an attempt to allow the Lockyer Creek and Bremer River	Total rainfall from 08:00 on 6 January 2011 to the end of this period: Wivenhoe Dam 244mm; Somerset Dam 373mm; Lockyer Creek 143mm; Bremer River 120mm. Wivenhoe Dam level ~~rises~~ rose from 69.97 to 71.56	• Catchment average rainfalls during this period were: o Wivenhoe Dam 12mm; o Somerset Dam 30mm; o Lockyer Creek 12mm; o Bremer River 18mm. • Forecast 24 hour catchment average rainfall at 16:00 on 9/11 was 65mm. • Estimated peak Wivenhoe Dam level ~~is~~: 72.9 (excluding forecast); 74.5 (including forecast). • Estimated peak Somerset Dam level ~~is~~:	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000 m^3/s)** • Consideration was ~~on~~ given to protecting urban areas from inundation and minimis~~z~~ing urban damage. • Due to advice received from ~~the~~ Brisbane City Council that a flow of 3,500 m^3/s at Moggill ~~will~~ would fully submerge 322 properties and impact ~~on~~ 7,000 properties, an attempt was made to remain below this flow level. • The approach in the Manual which states ~~that~~ the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than

Formatted: Highlight

	peaks to pass Moggill, and to restrict Brisbane River flows at Moggill to 3,500-m³/s.- This was ~~done~~ achieved following discussions with ~~the~~ Brisbane City Council that advised a flow of 3,500-m³/s at Moggill ~~will~~ would fully submerge 322 properties and impact ~~on~~ 7,000 properties. • No gate movements occurred at Somerset Dam during this period, with ~~d~~Dam levels plotting under the Wivenhoe/Somerset Operating Target Line. -This meant ~~that~~ the only gate movements allowable at Somerset Dam under Strategy S2 would be openings and this did not happen ~~was not done~~ to limit further rises in Wivenhoe Dam.	over the eight~~8~~ hour period. Somerset Dam level ~~rises~~ rose from 102.54 to 103.08 over the eight~~8~~ hour period.	103.1 (excluding forecast); 103.5 (including forecast). • Estimated total Ddam inflow ~~is~~: 1,531,000ML (excluding forecast); 1,985,000ML (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 1,090-m³/s (excluding forecast); 2,090-m³/s (including forecast). This peak was estimated to occur at 16:00 on 10 Jan~~uary~~ 2011. • Estimated peak flow at Moggill including Wivenhoe releases ~~is~~: 3,420-m³/s (excluding forecast); 4,680-m³/s (including forecast).	4,000m³/s, ~~and this approach~~ was adopted. -Advice received ~~during the event~~ from ~~the~~ Brisbane City Council that the upper limit of non-damaging flood~~s~~ was below the 4,000-m³/s stated in the ~~m~~Manual was noted and taken into account in the decision making processes. • With Ddam levels under the Wivenhoe/Somerset Operating Target Line during this period, releases continued from Somerset Dam. • Although there wais a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy wais not to release flows that ~~will~~ would cause high level urban inundation until it iwas certain it ~~that this could ann~~not be avoided. -Model results continued to indicate ~~that~~ this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 11 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Monday 10 Jan 2011 09:00 Completed Monday 10 Jan 2011 15:00	**Strategy W3 and Strategy S2** • G~~No change to gate settings occurred~~ at Wivenhoe Dam did not change over this period. Wivenhoe Dam dischafge wais 2,087-m³/s. -All rural bridges below the Ddam were~~are~~ flooded. • At 15:00, the attempt to restrict Brisbane River flows at Moggill to 3,500-m³/s was abandoned due to ~~the~~ rainfall ~~being experienced~~ in the Ddam catchments. A new target of 4,000-m³/s was set in	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 274mm; Somerset Dam 407mm; Lockyer Creek 169mm; Bremer River 149mm.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 34mm; o Somerset Dam 31mm; o Lockyer Creek 27mm; o Bremer River 30mm. • Forecast 24 hour catchment average rainfall at 10:00 on 10/11 was 75mm. • Estimated peak Wivenhoe Dam level ~~is~~: 73.6 (excluding forecast); 75.2 (including forecast).	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000-m³/s)** • Consideration ~~was~~ focused on protecting urban areas from inundation and minimizsing urban damage. • ~~A decision was made~~It was decided at 15:00 to attempt to remain below a target flow of around 4,000-m³/s at Moggill. • The approach in t~~T~~he Manual which states ~~that~~ the intent of Strategy W3 is to limit the flow in the Brisbane

Formatted: Highlight

	accordance with the Manual, on the basis that ~~the intent of~~ Strategy W3 intends ~~is~~ to limit the flow in the Brisbane River at Moggill to less than 4,000-m^3/s and minimisze urban damage. • GNo ~~g~~ate movements ~~occurred~~ at Somerset Dam did not change during this period, with Ddam levels plotting under the Wivenhoe/Somerset Operating Target Line. ~~-~~This meant ~~that~~ the only gate movements allowable at Somerset Dam under Strategy S2 ~~was~~would ~~be~~ openings and this was not done to limit further rises in Wivenhoe Dam.	Wivenhoe Dam level ~~rises~~ rose from 71.56 to 72.54 over the six~~6~~ hour period. Somerset Dam level ~~rises~~ rose from 103.08 to 103.43 over the ~~6~~six hour period.	• Estimated peak Somerset Dam level ~~is~~: 103.4 (excluding forecast); 103.7 (including forecast). • Estimated total Ddam inflow ~~is~~: 1,708,000ML (excluding forecast); 2,162,000ML (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 1,500-m^3/s (excluding forecast); 2,570-m^3/s (including forecast). This peak was estimated to occur at 20:00 on 10 Januar~~y~~ 2011. • Estimated peak flow at Moggill including Wivenhoe Dam releases ~~is~~: 3,910-m^3/s (excluding forecast); 5,180-m^3/s (including forecast).	River at Moggill to less than 4,000 m^3/s, ~~and this approach~~ continued to be followed. • With Ddam levels under the Wivenhoe/Somerset Operating Target Line during this period, releases continued from Somerset Dam. • Although there wais a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy ~~i~~was not to release flows that ~~will~~ would cause high level urban inundation until it wais certain ~~that this cannot~~it could not be avoided. Model results continued to indicate ~~that~~ this may be possible.

JANUARY 2011 FLOOD EVENT - PERIOD 12 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Monday 10 Jan 2011 15:00 Completed Monday 10 Jan 2011 20:00	**Strategy W3 and Strategy S2 Wivenhoe Directive #11.** • Gates opened continuously at Wivenhoe Dam for five~~5~~ hours in ~~accordance~~ line with ~~the~~ standard gate opening sequence, at a rate or 1.0 metres of opening per hour. Wivenhoe Dam discharge ~~is~~ increased from 2,087-m^3/s to 2,695-m^3/s. • In accordance with the Manual, Aa target of 4,000-m^3/s at Moggill was set ~~in accordance with the~~	Total rainfall from 08:00 on 6 Januar~~y~~ 2011 to the end of this period: Wivenhoe Dam 279mm; Somerset Dam 415mm; Lockyer Creek 174mm; Bremer River 153mm.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 4mm; o Somerset Dam 8mm; o Lockyer Creel 5mm; o Bremer River 3mm. • Forecast 24 hour catchment average rainfall at 16:00 on 10/11 was 38mm. • Estimated peak Wivenhoe level ~~is~~: 73.6 (excluding forecast);	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000-m^3/s)** • Consideration focused ~~was~~ on protecting urban areas from inundation and minimisizing urban damage. • The target maximum flow at Moggill was now 4,000-m^3/s.~~-~~ The approach in the Manual which states ~~that~~ the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4,000-m^3/s, ~~and this approach~~ continued to be followed.

Formatted: Highlight

	~~Manual~~, on the basis of ~~that~~ the intent of Strategy W3 ~~is~~ to limit the flow in the Brisbane River at Moggill to less than 4,000 m³/s and minimi~~z~~se urban damage. • Further gate openings at Wivenhoe Dam were paused at 20:00 in an attempt to allow the Lockyer Creek and Bremer River peaks to pass Moggill and to restrict Brisbane River flows at Moggill to 4,000 m³/s. • No gate movements occurred at Somerset Dam during this period, with ~~D~~dam levels plotting under the Wivenhoe/Somerset Operating Target Line. This limited further rises in Wivenhoe. • Initial advice on a major flash flood originating in the Lockyer headwaters was received from BoM at 17:32. No volume or flow details were available and gauges in the area were not indicating a significant event. The event could not impact on the Brisbane River for 24 hours.	Wivenhoe Dam level ~~rises~~ rose from 72.53 to 73.06 over the five~~5~~ hour period. Somerset Dam level ~~rises~~ rose from 103.43 to 103.45 over the five~~5~~ hour period.	74.3 (including forecast). • Estimated peak Somerset level ~~is~~: 103.5 (excluding forecast); 103.5 (including forecast). • Estimated total dam inflow ~~is~~: 1,731,000ML (excluding forecast); 1,982,000ML (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases ~~is~~: 1,500 m³/s (excluding forecast); 1,840 m³/s (including forecast). This peak was estimated to occur at 20:00 on 10 Jan~~uary~~ 2011. • Estimated peak flow at Moggill including Wivenhoe Dam releases ~~is~~: 3,980 m³/s (excluding forecast); 4,470 m³/s (including forecast). • The extreme rainfall ~~event~~ that occurred in ~~the~~ Lockyer Creek catchment during this period was not recorded in the remotely-accessible rain gauges in the catchment, and was not indicated on the BoM weather radar.	• With dam levels under the Wivenhoe/Somerset Operating Target Line during this period, ~~releases continued from~~ Somerset Dam releases continued. • The reduced rainfall forecast ~~provides justification to retain~~ justified retaining the target of 4,000 m³/s at Moggill, ~~with~~ while the Wivenhoe Dam peak of 74.3 (including forecast) indicated ~~ing that~~ it may be possible to keep urban damage within tolerable limits. A discussion w~~a~~is held with the Dam Safety Regulator to request~~ing~~ permission to exceed a level of 74.0 in Wivenhoe Dam for a short period (maximum 12 hours) without invoking Strategy W4, if the safety of the ~~D~~dam could~~an~~ be guaranteed and urban damage reduced. The Regulator agreed with this approach and provided permission. • The strategy continue~~d~~s to ~~be not to~~ release flows that ~~will~~ would cause high level urban inundation until it ~~i~~was certain ~~that this can~~ it could not be avoided. Model results continued to indicate ~~that~~ this may be possible.
JANUARY 2011 FLOOD EVENT - PERIOD 13 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Monday 10 Jan 2011 20:00 Completed Tuesday 11 Jan 2011 04:00	**Strategy W3 and Strategy S2** • Gate openings at Wivenhoe Dam were paused at 20:00 in an attempt to restrict flows at Moggill to close to 4,000 m³/s. There were ~~n~~No changes to gate settings ~~occurred~~ at Wivenhoe Dam over this period. ~~Wivenhoe~~ The Dam discharge w~~a~~is 2,726 m³/s.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 323mm; Somerset Dam 437mm; Lockyer Creek	• Catchment average rainfalls during this period were: o Wivenhoe Dam 44mm; o Somerset Dam 22mm; o Lockyer Creek 12mm; o Bremer River 14mm. • Forecast 24 hour catchment average rainfall at 16:00 on 10/11 was 38mm.	**Strategy W3 and Strategy S2 (Lake Level greater than 68.50, maximum release 4,000 m³/s)** • Consideration focused on protecting urban areas from inundation and minimi~~z~~sing urban damage. The target maximum flow at Moggill remaine~~d~~s ~~at~~ 4,000 m³/s. The approach in the Manual which states ~~that~~ the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4,000 m³/s, ~~and~~

Formatted: Highlight

	• In accordance with the Manual, aA target flow of 4,000-m^3/s at Moggill iwas set at Moggill in accordance on the basis of with the Manual (the intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4,000-m^3/s). However, Brisbane City Council damage tables indicated this would still impact 5,325 properties and cause damage in excess ofexceeding $47.0 millionM. • At 17:32, iInitial advice was provided on about a significant flash flood originating in the Lockyer Creek headwaters, received at 17:32De, with details were received at 20:00. The focus Considerations were undertaken during this period was on developingto develop strategies to manage these potential flows, however, as but because any strategy would involve significantly reducing outflows from Wivenhoe Dam, the strategies were not adopted. • During this period the plotted dam levels drifted just above the Wivenhoe/Somerset Operating Target Line. This leadad to a decision at 04:00 to commence start closing down releases from Somerset Dam to limit further rises in Wivenhoe Dam.	186mm; Bremer River 167mm. Wivenhoe Dam level rises rose from 73.06 to 73.40 over the eight8 hour period. Somerset Dam level fell from 103.45 to 103.23 over the 8eight hour period.	• Estimated peak Wivenhoe level is: 74.1 (excluding forecast); 74.9 (including forecast). • Estimated peak Somerset level is: 103.5 (excluding forecast); 103.7 (including forecast). • Estimated total dam inflow is: 2,016,000ML (excluding forecast); 2,267,000ML (including forecast). • Estimated peak flow at Moggill excluding Wivenhoe Dam releases is: 1,500-m^3/s (excluding forecast); 1,810-m^3/s (including forecast). This peak was estimated to have occurred at 20:00 on 10 January 2011. • Estimated peak flow at Moggill including Wivenhoe Dam releases is: 4,040-m^3/s (excluding forecast); 4,540-m^3/s (including forecast).	this approach continueds to be followed. • Model results showed that a peak level in the Ddam close to 74.0 remains was possible, but is appearing appeared increasing unlikely. • With Ddam levels moving above the Wivenhoe/Somerset Operating Target Line during this period, it was a decidedsion is made commence to begin closing down releases from Somerset Dam to limit further rises in Wivenhoe Dam. • Although there wais a full awareness of the rainfall forecasts and associated potential flood impacts, the strategy wa is not to release flows that wilould cause high level urban inundation until it wais certain it could that this cannot be avoided. Model results continued to indicate that this may be possible, although however, aswith rainfall continued rainfall, the strategy wasis now being reviewed each on an hourly basis. At 21:00 discussion with the Dam Safety Regulator is held at 21:00was asked for obtaining permission to exceed a level of 74.0 in Wivenhoe Dam for a short period (maximum 12 hours) without invoking Strategy W4, (provided the safety of the dDam can could be guaranteed). This was issue is considered carefully during the period in view of the continued rainfall.

JANUARY 2011 FLOOD EVENT - PERIOD 14 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Transition from Strategy W3 to Strategy W4; and Strategy S2 Wivenhoe Directive #12. Somerset Directive #6.			**Strategy W4 and Strategy S2 (Lake lLevel predicted to exceed 74.00, no maximum release rate)**

Commenced Tuesday 11 Jan 2011 04:00 Completed Tuesday 11 Jan 2011 08:00	• Extreme intense rainfall (estimated after the event to exceed **1 in 500 year intensities**) commenced on and close to the Wivenhoe Dam lake area during this period. ~~-~~If the centroid of this rainfall was located further east or south, it may have been possible to avoid transition to Strategy W4. • Because the extreme intense rainfall was occurring on and close to the ~~D~~dam rather than in the northern areas of the ~~D~~dam catchment, response time wa~~s~~ minimi~~s~~zed and quick actions ~~must be~~ had to be taken ~~quickly~~ to ~~prevent a situation arising during which~~ protect the safety of the ~~D~~dam ~~is put at risk~~. Accordingly, at 08:00, a decision wa~~s~~ made to transition to Strategy W4. ~~-~~Significant urban damage ~~can~~ was~~now~~ not to be avoided and ~~. T~~the Dam Safety Regulator, Seqwater's CEO and the Councils ~~are~~ were advised ~~of this development~~. • G~~No change to g~~ate settings ~~occurred~~ were not changed at Wivenhoe Dam over this period. Wivenhoe Dam discharge ~~i~~was 2,832-m^3/s. • S~~During this period s~~luice gate openings at Somerset Dam were~~are~~ reduced from ~~5~~five to two~~2~~ as the plotted dam levels had drifted just above the Wivenhoe/Somerset Operating Target Line.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 356mm; Somerset Dam 483mm; Lockyer Creek 240mm; Bremer River 183mm. Wivenhoe Dam level ~~rises~~ rose from 73.40 to 73.70 over the four~~4~~ hour period. Somerset Dam level ~~rises~~ rose from 103.23 to 103.46 over the four~~4~~ hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 33mm; o Wivenhoe Dam (~~l~~Local) 78mm; o Somerset Dam 46mm; o Lockyer Creek 54mm; o Bremer River 16mm. • Forecast 24 hour catchment average rainfall at 16:00 on 10/11 was 38mm. • Estimated peak Wivenhoe ~~l~~level ~~is~~: 74.5 (excluding forecast); 75.1 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 103.9 (excluding forecast); 104.2 (including forecast). • Estimated total dam inflow ~~is~~: 2,210,000ML (excluding forecast); 2,460,000ML (including forecast). Estimated peak flow at Moggill including Wivenhoe Dam releases ~~is~~: 5,870-m^3/s (excluding forecast).	• At 08:00, model results showed ~~that~~ restricting the peak level in the ~~D~~dam close to 74.0 wa~~is~~ no longer possible due to the high intensity rainfall experienced over this period. • At 08:00 it was decided to~~a decision is made to~~ transition to Strategy W4 and the Dam Safety Regulator, Seqwater's CEO and ~~the~~ Councils ~~are~~ were advised ~~of this decision~~. ~~-~~It was now apparent ~~that~~ significant urban damage resulting from releases from Wivenhoe Dam could not be avoided due to the extreme intense rainfall (estimated after the event to exceed **1 in 500 year intensities**) that commenced on and close to the Wivenhoe Dam lake area during this period. • ~~With~~ As dam levels mov~~inged~~ above the Wivenhoe/Somerset Operating Target Line during this period, releases from Somerset Dam were progressively closed down to limit further rises in Wivenhoe Dam (sluices were closed down at hourly intervals in accordance with the Manual).

JANUARY 2011 FLOOD EVENT - PERIOD 15 OF 20

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY

Formatted: Highlight

Formatted: Highlight

	Strategy W4 and Strategy S2 Wivenhoe Directive #12 to #14. Somerset Directive #7.			**Strategy W4 and Strategy S2 (Lake ~~L~~level predicted to exceed 74.00, no maximum release rate)**
Commenced Tuesday 11 Jan 2011 08:00 Completed Tuesday 11 Jan 2011 13:00	• Extreme intense rainfall (estimated after the event to exceed **1 in 500 year intensities**) continued on and close to the Wivenhoe Dam lake area during this period. ~~-~~If the centroid of this rainfall was located further east or south, it may have been possible to avoid transition to Strategy W4. • Because the extreme intense rainfall ~~wa~~is occurring on and close to the ~~d~~Dam rather than in the northern areas of the Ddam catchment, response time ~~wa~~is minimi~~s~~zed and quick actions ~~must~~ had to be taken ~~quickly~~ to protect the safety of the Ddam. Once Strategy W4 is invoked, the Manual requires the opening of gates in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. Accordingly gates ~~were~~are opened continuously at Wivenhoe Dam for five~~s~~ hours in accordance with the standard gate opening sequence at an average rate of 2.0 metres of opening per hour. This increase~~d~~s the ~~d~~Dam discharge from 2,753 m^3/s to 4,250 m^3/s. The threshold limit for urban damage has~~d~~ been exceeded and the ~~l~~Lake level continue~~d~~s to rise. • During this period Somerset Dam sluice gate openings were at ~~Somerset Dam are~~ closed ~~off~~ to limit rises in Wivenhoe Dam in accordance with Strategy S2.	Total rainfall from 08:00 on 6 Janu~~ary~~ 2011 to the end of this period: Wivenhoe Dam 382mm; Somerset Dam 570mm; Lockyer Creek 287mm; Bremer River 237mm. Wivenhoe Dam level ~~rises~~ rose from 73.70 to 74.39 over the five~~s~~ hour period. Somerset Dam level ~~rises~~ rose from 103.46 to 103.83 over the five~~s~~ hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 27mm; o Wivenhoe Dam ~~L~~(local) 85mm; o Somerset Dam 86mm; o Lockyer Creek 47mm; o Bremer River 55mm. • Forecast 24 hour catchment average rainfall at 10:00 on 11/11 was 100mm. • A portion of the extreme intense rainfall in the ~~d~~Dam catchment fell~~was falling~~ in an un-gauged area (e.g. on the Ddam lake area) ~~and this~~which made it difficult for the ~~resulted in difficulties in the~~ model to ~~being able to~~ accurately predict lake level rises. Accordingly, ~~during this period dam~~ operations at Wivenhoe Dam ~~-~~commenced ~~taking~~ gauge board readings every 30 minutes during this period and relaye~~d~~ing this information to the Flood Operations Centre by telephone. • Estimated peak Wivenhoe Dam level ~~is~~: 75.0 (excluding forecast); 76.2 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 104.8 (excluding forecast); 105.7 (including forecast). • Estimated total Ddam inflow is: 2,506,000ML (excluding forecast); 3,123,000ML (including forecast).	• The strategy was to protect the structural safety of the Ddam. • The Manual requires actions under Strategy W4 to ~~be that~~ensure Wivenhoe Dam gate openings ~~are to~~ occur in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. • The Ddam level continued to rise at 13:00. During this period, a Dam Operator ~~was~~ relaye~~d~~ing Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four Dduty eEngineers were present in the Flood Operations Centre and flood operations decisions were ~~commenced to be~~ made ~~on a~~every half hour upon receipt of ~~ly basis once~~ the gauge board readings ~~from Wivenhoe Dam were received~~. • With Ddam levels above the Wivenhoe/Somerset Operating Target Line during this period, releases from Somerset Dam ~~are~~ were closed down (all sluices closed at 10:00) to limit further rises in Wivenhoe Dam.

Formatted: Highlight

Formatted: Highlight

JANUARY 2011 FLOOD EVENT - PERIOD 16 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
	Strategy W4 and Strategy S2 Wivenhoe Directive #12 to #14.			**Strategy W4 and Strategy S2 (Lake Level predicted to exceed 74.00, no maximum release rate)**
Commenced Tuesday 11 Jan 2011 13:00 Completed Tuesday 11 Jan 2011 19:00	• Extreme rapid lake level rises in Wivenhoe Dam continued during this period. -The QPF issued at 16:00 wais for a catchment average rainfall of 75mm over the next 24 hours. • Gates ~~are~~ were opened continuously at Wivenhoe Dam for 6six hours in accordance with Strategy W4 and the standard gate opening sequence at an average rate of 4.5 metres of opening per hour. • Wivenhoe Dam discharge wais increased from 4,250 m^3/s to 7,464 m^3/s. Significant damage to urban areas below Moggill ~~cannot~~ could not be avoided. Estimated peak inflow during this period exceeded ~~is in excess of~~ 12,000 m^3/s. • No releases ~~are~~ were made from Somerset Dam to limit increases in Wivenhoe Dam in accordance with Strategy S2.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 397mm; Somerset Dam 610mm; Lockyer Creek 325mm; Bremer River 278mm. Wivenhoe Dam level ~~rises~~ rose from 74.39 to 74.97 over the six~~6~~ hour period. Somerset Dam level ~~rises~~ rose from 103.83 to 104.60 over the 6six hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 15mm; o Wivenhoe Dam (~~l~~Local) 35mm; o Somerset Dam ~~46~~mm; o Lockyer Creek 38mm; o Bremer River 40mm. • Forecast 24 hour catchment average rainfall at 16:00 on 11/11 was 75mm. However, catchment average rainfalls totals this period were: o Wivenhoe Dam 8mm; o Wivenhoe Dam (~~l~~Local) 13mm; o Somerset Dam 19mm; o Lockyer Creek 9mm; o Bremer River 8mm. • A portion of the extremely intense rainfall in the Ddam catchment ~~had fa~~ellen in an un-gauged area (e.g. on the dam lake area) which made it ~~and this resulted in difficulties for in~~ the model to ~~being able to~~ accurately predict lake level rises. • Estimated peak Wivenhoe level ~~is~~: 75.0 (excluding forecast); 75.2 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 105.2 (excluding forecast); 105.9 (including forecast). • Estimated total dam inflow ~~is~~: 2,659,000ML (excluding forecast); 3,289,000ML (including forecast).	• The strategy was to protect the structural safety of the Ddam. • The Manual requires actions under Strategy W4 to ~~be that~~ensure Wivenhoe Dam gate openings ~~are to~~ occur in accordance with standard sequences until the storage level of Wivenhoe Dam begins to fall. • The lake level in both Ddams continued to rise during this period. A Ddam operator ~~was relay~~inged Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four Dduty eEngineers were present in the Flood Operations Centre and decisions were ~~being~~ made every ~~on a~~ half hourly ~~upon basis once~~ receipt of the gauge board readings ~~were received~~. • With Ddam levels above the Wivenhoe/Somerset Operating Target Line during this period no releases were made from Somerset Dam ~~are made~~ to limit further rises in Wivenhoe Dam. • The water level in Wivenhoe Dam peaked at 19:00 on 11 Jan~~uary~~ 2011 at 74.97m AHD.

Formatted: Highlight

Formatted: Highlight

JANUARY 2011 FLOOD EVENT - PERIOD 17 OF 20				
DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY

	Strategy W4 and Strategy S2 Wivenhoe Directive #15 to #24.			**Strategy W4 and Strategy S2 (Lake lLevel predicted to exceed 74.00, no maximum release rate)**
Commenced Tuesday 11 Jan 2011 19:00 Completed Tuesday 11 Jan 2011 21:00	• GNo change to gate settings occurred at Wivenhoe Dam did not change over this period. Wivenhoe Dam discharge is 7,458 m^3/s. • The lake level in Wivenhoe Ddam stabilizesd and then fealls slightly at 21:00. At the same time a , A decision was made to commence closinge down the gates as quickly as possible to reduce urban flood impacts is taken at 21:00. This decision requires gate openings below minimum recommended settings; however, it wais made in an attempt to minimisze urban damage below Moggill (which is an objective that must has to be considered under Strategy W4). Gates would have been re-opened if further lake level rises were experienced. • In accordance with Strategy S2, there were nNo releases are made from Somerset Dam in accordance with Strategy S2.	Total rainfall from 08:00 on 6 January 2011 to the end of this period: Wivenhoe Dam 398mm; Somerset Dam 610mm; Lockyer Creek 326mm; Bremer River 278mm. During this two2 hour period, the lake level in Wivenhoe Dam stabiliszeds at 74.97 and then fealls slightly to 74.95 at 21:00. Somerset Dam level rises rose from 104.60 to 104.78 over the 2two hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 1mm; o Somerset Dam 1mm; o Lockyer Creek 1mm; o Bremer River 1mm. • Forecast 24 hour catchment average rainfall at 16:00 on 11/11 was 5mm. • A portion of the extreme intense rainfall in the Ddam catchment had feallen in an un-gauged area (e.g. on the dam lake area) and which made itthis continued to result in difficulties for in the model to being able to accurately predict lake level behaviour. • Estimated peak Wivenhoe Dam level is: 75.0 (excluding forecast); 75.2 (including forecast). • Estimated peak Somerset Dam level is: 105.2 (excluding forecast); 105.9 (including forecast). • Estimated total Ddam inflow is: 2,659,000ML (excluding forecast); 3,289,000ML (including forecast).	• The target strategy was to protect the structural safety of the Ddam. • The Manual requires actions under Strategy W4 to ensure be that Wivenhoe Dam gate openings are to occur at the minimum intervals and sequences until the storage level of Wivenhoe Dam begins to fall. • The Ddam level stabilizsed during this period and then fell slightly at 21:00. A dDam operator was relayinged Wivenhoe Dam gauge board readings to the Flood Operations Centre every 30 minutes. All four dDuty eEngineers were present in the Flood Operations Centre and decisions were being made every on a half hourly basis once upon receipt of the gauge board readings were received. • With Ddam levels above the Wivenhoe/Somerset Operating Target Line during this period, no releases were made from Somerset Dam are made to limit further rises in Wivenhoe Dam. • The water level in Wivenhoe Dam peaked at 19:00 on 11 January 2011 at 74.97m AHD.

Comment [MSOffice1]: Should this wording be identical to previous tables?

Formatted: Highlight

Formatted: Highlight

JANUARY 2011 FLOOD EVENT - PERIOD 18 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**

Commenced Tuesday 11 Jan 2011 21:00 Completed Wednesday 12 Jan 2011 08:00	**Strategy W4 and Strategy S2 Wivenhoe Directive #25 to #34.** • During this period, Wivenhoe Dam gates wereare closed ~~off~~ as quickly as possible without causing rises in the Llake level. ~~These actions are taken~~This was done to reduce urban flood impacts downstream. This decision requireds gate openings below minimum recommended settings ~~; however it~~and wais made in an attempt to minimisze urban damage below Moggill ~~(which is~~ an objective that must be considered under this Strategy). • Gates were closed continuously at Wivenhoe Dam for 11 hours in accordance with the standard gate closing sequence, at an average rate of just over 3.6 metres of opening per hour. • Wivenhoe Dam discharge ~~i~~was decreased from 7,464 ~~m³/s~~ to 2,547-m³/s. All rural bridges below the dam remained flooded and significant damage to urban areas below Moggill ~~has occurred~~not been avoided. • No releases ~~are~~ were made from Somerset Dam in accordance with Strategy S2.	Total rainfall from 08:00 on 6 January 2011 to the end of this period: Wivenhoe Dam 399mm; Somerset Dam 613mm; Lockyer Creek 328mm; Bremer River 279mm. Wivenhoe Dam level ~~falls~~ fell from 74.97 to 74.78 over the 11 hour period. Somerset Dam level rose ~~rises~~ from 104.78 to 105.11 over the 11 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 1mm o Somerset Dam 3mm; o Lockyer Creek 3m; o Bremer River 1m. • Forecast 24 hour catchment average rainfall at 16:00 on 11/11 was 8mm. • Estimated peak Wivenhoe Dam level ~~is~~: 75.0 (excluding forecast); 75.0 (including forecast). • Estimated peak Somerset Dam level ~~is~~: 105.1 (excluding forecast); 105.1 (including forecast). • Estimated total Ddam inflow ~~is~~: 2,650,000ML (excluding forecast); 2,650,000ML (including forecast).	**Strategy W4 and Strategy S2 (Lake Llevel predicted to exceed 74.00, no maximum release rate)** • The ~~target~~ strategy was to protect the structural safety of the Ddam. The Manual requires actions under Strategy W4 to ensure~~be that~~ Wivenhoe Dam gate openings ~~are to~~ occur at the minimum intervals and sequences until the storage level of Wivenhoe Dam begins to fall. ~~Because~~ As the lake level was falling slightly, a decision was made to quickly reduce releases from Wivenhoe Dam ~~as quickly and~~ to as low a level as possible, to minimisze urban damage below Moggill. • It was calculated that reducing to a discharge of 2,547-m³/s from Wivenhoe Dam would: o Not increase the downstream flood peak; o Not cause the water level in Wivenhoe Dam to rise and; o Allow the Ddam to be drained back to FSL in seven~~7~~ days, in accordance with the Manual. • With Ddam levels above the Wivenhoe/Somerset Operating Target Line during this period, no releases were made from Somerset Dam ~~are made~~ to limit further rises in Wivenhoe Dam.
JANUARY 2011 FLOOD EVENT - PERIOD 19 OF 20				

Comment [MSOffice2]: Keep in line with previous tables?

Formatted: Highlight

DATE/TIME	BACKGROUND	DAM CONDITIONS	RAINFALL AND MODEL RESULTS	STRATEGY
	Transition from Strategy W4 to the Drain Down Phase **Somerset Directives #8 to #9.**			**Drain Down Phase** **(Stored floodwaters emptied from the dam in seven days)**
Commenced Wednesday 12 Jan 2011 08:00 Completed Thursday 13 Jan 2011 12:00	• ~~No change to gate settings occurred at~~ Wivenhoe Dam gate settings did not change over this period. Wivenhoe Dam discharge ~~i~~was 2,534 ~~m~~^{3}/s and a~~.~~ All rural bridges below the D~~d~~am remained flooded. • Releases ~~commenced~~ from Somerset Dam began during this period as the plotted D~~d~~am levels fell below the Wivenhoe/Somerset Operating Target Line. -These actions were undertaken in accordance with Strategy S2 and to allow the D'Aguilar Highway to be re-opened as soon as possible. Releases from Somerset Dam continued e~~E~~ven though plotted D~~d~~am levels later rose above the Wivenhoe/Somerset Operating Target Line during this period, ~~releases from Somerset dam continued~~ to allow the D~~d~~am to be drained back to FSL in seven~~7~~ days, in accordance with the Manual.	Total rainfall from 08:00 on 6 Janu~~ary~~ary 2011 to the end of this period: Wivenhoe Dam 401mm; Somerset Dam 619mm; Lockyer Creek 330mm; Bremer River 280mm. Wivenhoe Dam level ~~falls~~ fell from 74.78 to 74.61 over the 28 hour period. Somerset Dam level fell ~~falls~~ from 105.11 to 103.96 over the 28 hour period.	• Catchment average rainfalls during this period were: o Wivenhoe Dam 2mm; o Somerset Dam 6mm; o Lockyer Creek 6mm; o Bremer River 6mm. • Forecast 24 hour catchment average rainfall at 10:00 on 12/11 was 10mm.	• ~~D~~During this period the strategy transitioned from Strategy W4. The~~,~~ ~~during which the~~ target ~~i~~was to protect the structural safety of the dam~~,~~ to the Drain Down Phase of the E~~e~~vent. • Once the Drain Down Phase commenced, the target was to release stored floodwaters from the D~~d~~am within ~~7~~seven days of the flood peak passing through the dams, while controlling downstream impacts. -Considerations impacting ~~on~~ the duration and timing of the Drain Down Phase in this instance included: o Causing no renewed increases in river levels below the D~~d~~am (except where they were unavoidable due to tidal influences)~~;~~. o Maintaining an adequate release rate to ensure ~~that the~~ temporary pumps providing water supplies to the Lowood area could continue to operate; o Minimi~~z~~sing bank slumping impacts along the river, particularly in key areas such as Coronation Drive (as requested ~~from by~~the Brisbane City Council); o Re-opening ~~the~~ Brisbane Valley ~~h~~Highway and key rural bridges as quickly as possible; o Achieving ~~f~~Full ~~s~~Supply ~~l~~Levels in the D~~d~~ams at the conclusion of the E~~e~~vent.

Formatted: Highlight

JANUARY 2011 FLOOD EVENT - PERIOD 20 OF 20				
DATE/TIME	**BACKGROUND**	**DAM CONDITIONS**	**RAINFALL AND MODEL RESULTS**	**STRATEGY**
Commenced Thursday 13 Jan 2011 12:00 Completed Wednesday 19 Jan 2011 12:00	**Drain Down Phase** **Wivenhoe Directives #35 to #62** **Somerset Directives #10 to #13.** • During this period, releases from Wivenhoe Dam ~~are~~ were increased as the peaks from ~~the~~ Lockyer Creek and Bremer River subside. Downstream impacts were~~are~~ controlled to ensure that, at no time during this phase, ~~do~~ downstream water levels ~~rise~~ rose, except if impacted by tidal influences. • During this period, stored flood water in Somerset Dam was drained into Wivenhoe Dam in accordance with the drain down target of seven days. Importance was placed on opening the D'Aguilar Highway as soon as possible.	Total rainfall from 08:00 on 6 Jan~~uary~~ 2011 to the end of this period: Wivenhoe Dam 415mm; Somerset Dam 626mm; Lockyer Creek 337mm; Bremer River 288mm. Wivenhoe Dam level ~~falls~~ fell from 74.61 to 66.89 over the six~~6~~ day period. Somerset Dam level ~~falls~~ fell from 103.96 to 99.00 over the 6six day period.	• Catchment average rainfalls during this six day period were: o Wivenhoe Dam 14mm; o Somerset Dam 7mm; o Lockyer Creek 7mm; o Bremer River 8mm.	**Drain Down Phase** • During this period the target was to release stored floodwaters from the Ddam within ~~7~~seven days of the flood peak passing through the ~~d~~Dams, while controlling downstream impacts. ~~-~~Considerations impacting ~~on~~ the duration and timing of the Drain Down Phase in this instance included: o Causing no renewed increases in river levels below the ~~d~~Dam (except where ~~they were~~ unavoidable due to tidal influences)~~.~~; o Maintaining an adequate release rate to ensure ~~that the~~ temporary pumps providing water supplies to the Lowood area could continue to operate; o Minimis~~z~~ing bank slumping impacts along the river, particularly in key areas such as Coronation Drive (as requested ~~from the~~by Brisbane City Council); o Re-opening ~~the~~ Brisbane Valley H~~h~~ighway and key rural bridges as quickly as possible; o Achieving F~~f~~ull S~~s~~upply ~~l~~Levels in the Ddams at the conclusion of the E~~e~~vent.

CERTIFICATE OF EXHIBIT

Exhibit 9 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

..... [redacted] .....
Declarant

[redacted]
Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07) [redacted]
Ref: TZB:11800005

2 SUMMARY OF JANUARY 2011 FLOOD EVENT

The following summary must be read in conjunction with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (Revision 7) ("the Manual"). It provides a detailed summary of the operation of Wivenhoe and Somerset Dams during the January 2011 Flood Event that impacted Brisbane. Each table covers a period of the event during which one of the following occurred:

- There was a transition or change to the flood operation strategy used as defined by the Manual.
- There was a period of stability during which no gate operations from either Wivenhoe Dam or Somerset Dam was directed.
- There was a period of sustained gate operations (either opening or closing) at either Wivenhoe Dam or Somerset Dam.

Each table also provides a summary of relevant background information and a summary of the information that was used to make decisions during the period covered by the table. This information includes:

- Details of the time period.
- Relevant background information from the period leading up to and during the period.
- Changes in dam conditions during the period.
- Rainfall information (including forecast rainfall) and model results available during the period.
- The strategy used and/or adopted during the period.

It should be noted that the forecast rainfall model results apply the full 24 hour catchment average rainfall forecast from the Bureau of Meteorology (BoM) Quantitative Precipitation Forecasts (QPF) to the model run. It does not take into account the model run time in relation to the issue time of the forecast or the rainfall since the forecast was issued. In effect, this provides a "worst case" 24 hour scenario. Full details of the modeling results are shown in the tables contained in Appendix A. Other tools used to support decisions that were examined and considered in conjunction with the modeling results and the 24 hour QPF included:

- The BoM weather radar available through the BoM website.
- BoM SILO Meteograms Forecast Rainfall (based on BoM ACCESS Model).
- BoM Interactive Weather and Wave Forecast Rainfall Maps (based on BoM ACCESS Model).
- BoM Water and the Land Forecast Rainfall (based on an ensemble of several numerical weather prediction models).
- Severe Weather Warnings issued by BoM.

QPF are considered the primary forecast tool as they are provided by BoM to give specific forecast information in relation to the dam catchment areas.

A significant quantitative variation from BoM model results presenting three day and five day rainfall forecasts can be expected in relation to other available rainfall forecast information. This is demonstrated in the following table that contains translated rainfall forecasting results using ACCESS model result data provided by BoM during the critical period of the event between 6 and 11 January 2011. The original BoM data has been translated to forecast catchment

average rainfall results, based on a derived catchment centroid rainfall estimated by using Seqwater's Flood Early Warning Modeling System.

COMPARISON OF ACTUAL AND FORECAST RAINFALL FROM BOM ACCESS MODEL								
Forecast Date and Time	Somerset Dam Catchment Average Rainfall				Wivenhoe Dam Catchment Average Rainfall (excluding Somerset Dam Catchment)			
	3 Days from		5 Days from		3 Days from		5 Days from	
	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)
06/01/2011 00:00	90	73	403	115	79	90	275	114
06/01/2011 12:00	150	85	515	133	87	51	335	78
07/01/2011 00:00	298	189	568	206	180	133	347	144
07/01/2011 12:00	321	123	536	137	183	79	322	89
08/01/2011 00:00	332	191	527	206	205	207	309	218
08/01/2011 12:00	447	165	527	169	284	136	309	139
09/01/2011 00:00	500	230	510	231	298	267	301	268
09/01/2011 12:00	441	140	446	141	271	170	273	171
10/01/2011 00:00	278	463	280	465	169	171	170	171
10/01/2011 12:00	218	59	219	60	140	389	141	390
11/01/2011 00:00	196	19	197	19	105	231	105	231

The table above shows:

- There are variations in excess of 700% between successive three day catchment average rainfall forecasts made 12 hours apart.
- There are variations in excess of 700% between successive five day catchment average rainfall forecasts made 12 hours apart.
- There are eight instances in which actual rainfall recorded is greater than 200% (highest is more than 1,000%) of the three day forecast rainfall.
- There are three instances in which the three day forecast rainfall is greater than 150% (highest is 280%) of the actual rainfall recorded.
- There are nine instances in which actual rainfall recorded is greater than 300% (highest is over 1,000%) of the five day forecast rainfall.
- There are two instances in which the five day forecast actual rainfall is greater than 200% (highest is 280%) of the actual rainfall recorded.

These results clearly show three day and five day forecasts only provide an indication of future rainfall and these forecasts cannot be used as a basis of flood operations decision making where public safety in both rural and urban areas is directly impacted. This forecasting information uses the most up-to-date scientific information available at the present time. Future improvements in this area will be examined with interest in order to maximise the flood mitigation benefits of the dams. This issue is discussed further in Section 6.0.

The source data for the information shown in the tables below is contained in the following Appendices of this report:

- Appendix A – Model rResults
- Appendix B – Flood vVolume Ssummary
- Appendix C – Quantitative Precipitation Forecasts (QPF)

- Appendix D – Catchment rRainfall
- Appendix E – Situation rReports
- Appendix G – Severe wWeather wWarnings
- Appendix H – Flood eEvent Nnotification eEmail
- Appendix L – Flood Ooperations Ddirectives
- Appendix M – Flood eEvent lLog

CERTIFICATE OF EXHIBIT

Exhibit 10 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

Declarant

Solicitor

B:1377523_1 NMW

CERTIFICATE OF EXHIBIT

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07)
Fax: (07)
Ref: TZB:11800005

Zissis, Michael

From: DutyEngineer [dutyseq[redacted]
Sent: Saturday, 15 January 2011 6:57 PM
To: jtibaldi[redacted]
Subject: Event StrategySummary
Attachments: Strategy-Summary-Log.xls

John

Excel spreadsheet of strategies and directives for Wivenhoe

Rob

DATE	TIME	ACTION	CATEGORY	INITIALS
Thursday 6/1/2011	7:00 AM	TM duty Engineer. Rainfall and water had been remote monitored to this point in time. TM advises Senior Duty Engineer that Flood Operations are required at both Somerset, Wivenhoe and North Pine Dams. TM arrived at FOC to assess strategies and mobilises FOC, Wivenhoe, Somerset and North Pine Dam. North Pine Dam At 07:00hrs Thursday, North Pine Dam was 39.60m, 0.05m below gate trigger level and having risen 0.18m since 2/1/2011 due to a combination of base flow and runoff from rain in the last 24 hours. Given the forecast rain, gate operations will commence tonight. MBRC will be advised this morning. Somerset Dam At 07:00hrs Thursday, Somerset Dam was 99.34m, 0.34m above FSL, and rising slowly. The rain in the Stanley River catchment has produced a small amount of runoff in the upper Stanley but there have been significant rises in Kilcoy Ck. Further regulator operations will be required later Thursday. Wivenhoe Dam The regulator and hydro were discharging at 50 cumecs to manage baseflow recession from previous flow event. At 07:00hrs Thursday, Wivenhoe Dam was 67.31m and rising slowly. This is 0.31m above FSL and above the gate trigger level of 67.25m. There have been rises recorded at rivers and stream upstream of Wivenhoe Dam. Gates will be opened in the next 24 hours to manage the inflows from the upper Brisbane River	Situation Report	MI
		Strategy W1 - Various		
	8:14 AM	Situation Report 0800 06/01/2011 Rainfall - Since 9am Wednesday, there have been widespread falls of 30mm with isolated heavy falls up to 50mm in the Somerset and Wivenhoe catchments. Totals in the North Pine catchment have generally been below 10mm. Falls up to 60mm were recorded in the Leslie Harrison catchment. - The forecast for the next 24 to 48 hours is for totals up to 150mm in SE Qld. - The catchments remain wet and are likely to generate additional runoff in the event of rain. North Pine Dam - At 0700 Thursday, North Pine Dam was 39.60m, 0.05m below gate trigger level and having risen 0.18m since 2/1/2011 due to a combination of baseflow and runoff from rain in the last 24 hours. - Given the forecast rain, gate operations will commence tonight. MBRC will be advised this morning Somerset Dam - At 0700 Thursday, Somerset Dam was 99.34m, 0.34m above FSL, and rising slowly. The rain in the Stanley River catchment has produced a small amount of runoff in the upper Stanley but there have been significant rises in Kilcoy Ck. Further regulator operations will be required later Thursday.	Situation Report	TM

DATE	TIME	ACTION	CATEGORY	INITIALS
		Wivenhoe Dam - At 0700 Thursday, Wivenhoe Dam was 67.31m and rising slowly. This is 0.31m above FSL and above the gate trigger level of 67.25m. There have been rises recorded at rivers and stream upstream of Wivenhoe Dam. Gates will be opened in the next 24 hours to manage the inflows from the upper Brisbane River and the outflow from Somerset. Impacts of Wivenhoe Dam Releases - Somerset Regional, Ipswich City and Brisbane City Councils will be advised of the potential for gate operations after a full assessment of the situation this morning. At this stage it is anticipated that peak releases from Wivenhoe will be below 500m3/s but this will depend on the forecast rain and flows downstream of the dam. - The expected Wivenhoe release and local flows will at least impact upon Twin Bridges, Savages Crossing, Kholo Bridge and Colleges Crossing for several days. At this stage, there are not expected to be any adverse impacts upon Fernvale Bridge, Burtons Bridge or Mt Crosby Weir Bridge Leslie Harrison Dam Following the heavy rainfall Wednesday night, gate operations commenced at Leslie Harrison Dam late Wednesday night and are continuing. Given the forecast rainfall, gate operations are expected to continue for the next 24 to 48 hours. The next situation report will be issued at 1800 Thursday 6/1/2011.	Situation Report	
1:30 PM		**Revised Operating Strategy 1200 6/1/2011** North Pine - On track to open tonight Somerset/Wivenhoe - No change to current status – expected inflow volume about 45,000ML. Will reach about 99.7m AHD without releases. - Expected inflow volume about 130,000ML including Somerset. Will reach about 68.3m AHD without releases. - There has been further heavy falls in the Lockyer since 0900 Thursday and the flow from the Lockyer is going to be larger than initially assessed, possibly as high as 600m3/s peaking Saturday. This may close Burtons without any contribution from Wivenhoe. The opening of the Wivenhoe gates will therefore be delayed until the Lockyer peak passes.	Situation Report	TM
2:54 PM		**Situation Report 1500 06/02/2011** Rainfall - In the 6 hours since 9am Wednesday, there have been general totals around 30mm with isolated heavy falls up to 60mm in the Somerset and Wivenhoe catchments. Totals in the North Pine catchment have generally been between 20 and 30mm. Falls between 20 and 30mm were recorded in the Leslie Harrison catchment. -The forecast for the next 24 to 48 hours is for totals up to 100mm in SE Qld. -The catchments remain wet and are likely to generate additional runoff in the event of rain. North Pine Dam At 1400 Thursday, North Pine Dam was 39.66m, 0.01m above gate trigger level. Gate operations will commence at 1900 Thursday and will impact upon Youngs Crossing. MBRC have been advised and will confirm closure of Youngs Crossing prior to gate operations. Given the forecast rainfall during Friday, gate operations may continue into Saturday. Somerset Dam At 0700 Thursday, Somerset Dam was 99.34m, 0.34m above FSL, and rising slowly. The rain in the Stanley River catchment has produced a small amount of runoff in the upper Stanley but there have been significant rises in Kilcoy Ck, adding to the Somerset inflows. Further regulator/sluice operations will be required in the next 24 to 48 hours. The estimated event inflow volume into Somerset Dam is 50,000ML.	Situation Report	TM

DATE	TIME	ACTION	CATEGORY	INITIALS
		Wivenhoe Dam - At 0700 Thursday, Wivenhoe Dam was 67.31m and rising slowly. This is 0.31m above FSL and above the gate trigger level of 67.25m. There have been rises recorded at rivers and stream upstream of Wivenhoe Dam. The estimated event inflow volume into Wivenhoe Dam is 180,000ML including Somerset Dam outflow. - There has been significant rainfalls in the Lockyer Ck catchment since 0900 Thursday and a peak of about 800m3/s is expected from the Lockyer late Friday. Wivenhoe gates will be opened after flood levels in the lower Lockyer subside. At this stage Wivenhoe releases during Saturday may be as high as 1,500m3/s and continue for a couple of days. Impacts of Wivenhoe Dam Releases - Somerset Regional, Ipswich City and Brisbane City Councils have been advised of the potential for gate operations during the next 24 hours. - The will at least impact upon Twin Bridges, Savages Crossing, Kholo Bridge and Colleges Crossing for several days. The relatively high Lockyer flows will at least impact upon Twin Bridges, Savages Crossing, Kholo	Situation Report	
7/01/11				
	5:33 PM	Situation Report 1800 06/01/2011 Rainfall - In the 8 hours since 9am Wednesday, there have been general totals around 30mm with isolated heavy falls up to 60mm in the Somerset and Wivenhoe catchments. There have been significant rainfalls in the Lockyer Ck catchment in the last 24 hours with widespread falls of 50mm and isolated falls up to 75mm. Totals in the North Pine catchment have generally been about 30mm. Falls between 20 and 30mm were recorded in the Leslie Harrison catchment. - The forecast for the next 24 to 48 hours is for totals up to 100mm in SE Qld. North Pine Dam At 1700 Thursday, North Pine Dam was 39.68m, 0.03m above gate trigger level. Gate operations will commence at 1900 Thursday and will impact upon Youngs Crossing. Moreton Bay Regional Council has been advised and will confirm closure of Youngs Crossing prior to gate operations. Given the forecast rainfall during Friday, gate operations may continue into Saturday. Somerset Dam At 1700 Thursday, Somerset Dam was 99.45m, 0.45m above FSL, and rising slowly. The rain in the Stanley River catchment has produced a small amount of runoff in the upper Stanley but there have been significant	Situation Report	TM
		Wivenhoe Dam - At 1700 Thursday, Wivenhoe Dam was 67.39m and rising slowly. This is 0.39m above FSL and above the gate trigger level of 67.25m. Upstream of the dam river levels are still rising at the Linville and Gregors Ck gauges. The estimated event inflow volume into Wivenhoe Dam is 180,000ML including Somerset Dam outflow. - A peak of about 600m3/s is expected from the Lockyer late Friday. At this stage there is some uncertainty associated with this estimate and it may or may not impact Burtons Bridge. Wivenhoe gates will be opened after the impact of Lockyer flows on Burtons Bridge has been ascertained and flood levels in the lower Lockyer subside. At this stage Wivenhoe releases will commence late Friday/early Saturday and may be as high as 1,500m3/s, similar to recent events, and continue for a couple of days. Impacts of Downstream of Wivenhoe - Somerset Regional, Ipswich City and Brisbane City Councils have been advised of the potential for gate operations during the next 24 hours. - The relatively high Lockyer flows will adversely impact upon Twin Bridges, Savages Crossing, Kholo Bridge and Colleges Crossing for several days and may impact upon Burtons Bridge early Saturday. At this stage,	Situation Report	
7/01/11				
7/01/11	8:07 AM	FOC Situation Report at 06:00 on Friday 7 January 2011 Rainfall - There have been general totals around 30 to 50 mm with isolated heavy falls up to 75mm in the Somerset and Wivenhoe catchments since the event commenced on Wednesday 5 January 2011. There have been significant rainfalls in the Lockyer Ck catchment in the last 72 hours with widespread falls of 50mm and isolated falls up to 100mm. - Totals in the North Pine catchment have generally been about 35mm. - Falls between 20 and 30mm were recorded in the Leslie Harrison catchment. - The forecast for the next five days is for totals between 100 and 200mm in SE Qld. Given the saturated condition of the catchments further runoff will most likely be generated from this rainfall. North Pine Dam At 0600 Friday, North Pine Dam was at 39.48m, 0.12m below FSL. Gate operations commenced at 1915 on Thursday 6 January and are expected to continue until at least mid-day Friday 7 January when North Pine Dam is expected to be at 39.40m. These releases have impacted upon Youngs Crossing. Moreton Bay Regional Council was advised and they closed Youngs Crossing prior to gate operations commencing. Based	Situation Report	LVB
		Wivenhoe Dam - At 0600 Friday, Wivenhoe Dam was at 67.64m and rising slowly. This is 0.64m above FSL and above the gate trigger level of 67.25m. Upstream of the dam river levels have peaked at the Linville and Gregors Ck gauges. The estimated event inflow volume into Wivenhoe Dam is 230,000ML including Somerset Dam outflow. - A peak of about 470 cumecs is expected from Lockyer Creek by mid-afternoon on Friday 7 January. At this stage there is some uncertainty associated with this estimate but it may be of sufficient magnitude to inundate Burtons Bridge. - Wivenhoe gate releases will occur after the impact of Lockyer flows on Burtons Bridge has been ascertained and flood levels in the lower Lockyer subside. It is proposed that Wivenhoe releases will commence late Friday/early Saturday and may be as high as 1,200 cumecs, (similar but slightly smaller to recent events), and the releases are expected to continue over the weekend though to Monday or Tuesday. Impacts of Downstream of Wivenhoe - Somerset Regional Council, Ipswich City Council and Brisbane City Council have been advised of the potential for gate operations during the next 24 hours. - The relatively high Lockyer flows will adversely impact upon Twin Bridges, Savages Crossing, and Colleges Crossing for several days and may impact upon Burtons Bridge from Friday mid-day and Kholo Bridge later on	Situation Report	

DATE	TIME	ACTION	CATEGORY	INITIALS
	12:15 PM	SitRep There has been falls between 15 and 30mm in the North Pine catchment in the last 3 hours. This will cause renew rises and increased inflows. There are no gate movements projected for the next 3 hours.	Situation Report	TM
7/01/11	12:34 PM	Issued Wivenhoe Directive #1. • 15:00 Open Gate 3 from 0.0 metres to 0.5 metres • 16:00 Open Gate 3 from 0.5 metres to 1.0 metres • 17:00 Open Gate 3 from 1.0 metres to 1.5 metres • 18:00 Open Gate 3 from 1.5 metres to 2.0 metres • 19:00 Open Gate 3 from 2.0 metres to 2.5 metres • 20:00 Open Gate 3 from 2.5 metres to 3.0 metres • 21:00 Open Gate 3 from 2.5 metres to 3.5 metres	Directive - Strategy W1-C	LVB
7/01/11				
	6:00 PM	Situation Report 1800 Friday 07/01/2011 Rainfall - Since 0900 Friday, there has been widespread 20 to 40mm throughout North Pine, Somerset and Wivenhoe catchments with isolated higher totals of 70mm in the upper reaches of the Brisbane R. - Advice from BoM indicates that SE Qld can expect further high rainfall totals over the next 4 days. Saturday: Rain light at times 15-50mm with higher falls along the coast Sunday: Widespread rain with totals between 50-100mm Monday: Widespread rain again with totals between 50-100mm Tuesday: Rain easing with totals between 25-50mm Given the saturated conditions of the catchments, significant inflows to Seqwater dams will be generated, especially following the forecast rainfall on Sunday/Monday. North Pine (Full Supply Level 39.60 m AHD) - At 1700 Friday, North Pine currently has 5 gates open releasing runoff from rain on Wed/Thursday. Given the very high likelihood of significant runoff during the next 4 days, gates will be kept open to match inflows	Situation Report	TM
		Wivenhoe (Full Supply Level 67.00 m AHD) - At 1700 Friday, Wivenhoe Dam was 68.10 m AHD and rising steadily with one gate open to 1.5 metres and releasing about 168m3/s. River levels upstream of Wivenhoe Dam were rising again, generating further inflow to the dam. It is intended to ramp up the release from Wivenhoe to about 1,200m3/s during the next 18 hours. However, given the high likelihood of significant inflows in the next week, this may be increased later on the weekend. - Since the commencement of the event on 02/01/2011, approximately 140,000ML has flowed into Wivenhoe Dam with a further 160,000ML expected (including Somerset release) based on the recorded rainfall to date. Approximately 24,000ML has been released from Wivenhoe via the hydro and regulator at about 50m3/s. Impacts downstream of Wivenhoe - The projected Wivenhoe release of 1,200m3/s combined with Lockyer flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Savages Crossing, Burtons Bridge, Kholo Bridge and	Situation Report	
7/01/11	9:53 PM	Issued Wivenhoe Directive #2. • 07/01/2011 22:00 Open Gate 2 from 0.0 metres to 0.5 metres • 07/01/2011 23:00 Open Gate 4 from 0.0 metres to 0.5 metres • 08/01/2011 00:00 Open Gate 2 from 0.5 metres to 1.0 metres • 08/01/2011 01:00 Open Gate 4 from 0.5 metres to 1.0 metres • 08/01/2011 02:00 Open Gate 1 from 0.0 metres to 0.5 metres • 08/01/2011 03:00 Open Gate 5 from 0.0 metres to 0.5 metres • 08/01/2011 04:00 Open Gate 2 from 1.0 metres to 1.5 metres	Directive Strategy W1 D	MT
8/01/11	4:55 AM	Issued Wivenhoe Directive #3. • 08/01/2011 05:00 Open Gate 4 from 1.0 metres to 1.5 metres • 08/01/2011 06:00 Open Gate 1 from 0.5 metres to 1.0 metres • 08/01/2011 07:00 Open Gate 5 from 0.5 metres to 1.0 metres • 08/01/2011 08:00 Open Gate 3 from 3.5 metres to 4.0 metres	Directive Strategy W1 D	MT
8/01/11	8:00 AM	Issued Wivenhoe Directive #4. • 08/01/2011 09:00 Open Gate 2 from 1.5 metres to 2.0 metres • 08/01/2011 10:00 Open Gate 4 from 1.5 metres to 2.0 metres • 08/01/2011 11:00 Open Gate 1 from 1.0 metres to 1.5 metres • 08/01/2011 12:00 Open Gate 5 from 1.0 metres to 1.5 metres • 08/01/2011 13:00 Open Gate 2 from 2.0 metres to 2.5 metres • 08/01/2011 14:00 Open Gate 4 from 2.0 metres to 2.5 metres	Directive Strategy W1 D	AN

DATE	TIME	ACTION	CATEGORY	INITIALS
8/01/11	11:30 AM	Issued Somerset Directive #3. - Please open Sluice M to 100% at 12:00.	Directive	AN
9/01/11	12:00 AM			
	1:00 AM	Issued Wivenhoe Directive #5. - Open Gate 3 from 4.0 metres to 4.5 metres	Directive - Strategy W1-E	NGA
	4:30 AM	Issued Wivenhoe Directive #6. - Open Gate 1 from 1.5 metres to 2.0 metres	Directive Staregty W1 E	NGA
	6:15 AM	FOC Situation Report at 06:00 on Sunday 9 January 2011 Rainfall Catchment average rainfall for the past 12 hours is; North Pine Dam (less than 10 mm); Somerset Dam (40 mm); Wivenhoe Dam (less than 10 mm). The bulk of the rain that has fallen in the Somerset Dam catchment has occurred in the last two hours, with recorded falls exceeding 60mm in some areas. The BOM forecast for the next seven days issued at 0450 this morning is:- Sunday: Rain periods. Monday: Rain periods. Tuesday: Rain periods. Wednesday A few showers. Thursday A shower or two. Friday A shower or two. Saturday Mostly fine. A severe whether warning remains current for heavy rainfall in the dam catchment areas. The dam catchments are relatively saturated and significant inflows will be generated if the forecast rainfall eventuates. North Pine Dam (Full Supply Level 39.60 m AHD) The dam level is currently 39.47 m AHD and steady. Two radial gates remain open to release runoff generated from recent rainfall. Based on rainfall forecasts, the radial gates have been kept open in anticipation of further inflows over the next few days. However unless significant rain falls today, consideration will be given to closing the gates late this afternoon or early tomorrow morning and discussions to finalise a decision on the	Situation Report	JT
		Somerset Dam (Full Supply Level 99.00 m AHD) The dam level is currently falling slowly, with the current level being 100.27m AHD. However the rain that has fallen in the dam catchment over the last two hours (recorded falls exceed 60mm in some areas) will result in significant inflows later today. The current release rate into Wivenhoe Dam is 35,000ML/day. Since the commencement of the event on 02/01/2011approximately 56,000ML has been released from the dam, with a total of at least 150,000ML to be released based on the currently recorded rainfall. The total release for the event is likely to increase significantly over the next few days based on the current rainfall forecasts. At this stage, releases will continue until at least Tuesday. Wivenhoe Dam (Full Supply Level 67.00 m AHD) The dam level is currently falling slowly, with the current level being 68.58m AHD. River levels upstream of the dam are receding, however further inflows will result from any additional rainfall. The current gate operation strategy will maintain flows of around 1,600m3/s in the mid-Brisbane River. The current release rate from Wivenhoe Dam is 116,000ML/day. Since the commencement of the event on	Situation Report	
	8:15 AM	Issued Somerset Directive #4. - Please open Sluice K to 100% at 09:00.	Directive	NGA
	10:30 AM	Issued Wivenhoe Directive #7. - Open Gate 5 from 1.5 metres to 2.0 metres	Directive Strategy W1 E	NGA
	12:30 PM	Issued Somerset Directive #5. - Please open Sluice N to100% at 13:00 - Please open Sluice J to 100% at 14:00	Directive	NGA
		Strategy W2		

DATE	TIME	ACTION	CATEGORY	INITIALS
	3:30 PM	Duty Engineer Conference held at the FOC. Attended by RA, JR, [illegible] JT on conf phone. At this stage operating at the top end of W1 and the bottom [illegible] Storing approx. 300,000 Ml at present (above Wivenhoe) with an additional 500,000 Ml expected to flow into the dams from rainfall on the ground. The rainfall system is currently in the N-E part of the catchment and expected to travel south over the next 24-36 hours according to the BoM forecasts. This has the potential to significantly increase flows in Lockyer Ck & the Bremer River which potentially could close Fernvale Bridge and Mt Crosby Bridge and increase the risk of flooding in the Lower Brisbane. Releases from Wivenhoe Dam will be maintained at the current level of ~ 1,400 cumecs. If required, releases from Wivenhoe Dam will be reduced to contain the flow in the Mid-Brisbane to 1,600 cumecs and 3,000 cumecs in the Lower Brisbane. At this stage it is anticipated that levels below 102.5 in Somerset and 72.5 in Wivenhoe can be attained.	Situation Report - Staregty W2	NGA
	5:51 PM	**Situation Report 1700 Sunday 9/1/2011** Rainfall Catchment average rainfall for the past 12 hours is; North Pine Dam (60 mm); Somerset Dam (150 mm); Wivenhoe Dam (80 mm). The bulk of the rain that has fallen in the upper reaches of the Stanley and Brisbane Rivers. The BOM rainfall forecast for the next few days is:- Monday: Very heavy rain periods with totals up to 300mm centred around North Pine. Tuesday: Rain periods with totals up to 150mm centred around North Pine. Wednesday A few showers less than 10mm Thursday A shower or two. Friday A shower or two. Saturday Mostly fine. A severe whether warning remains current for heavy rainfall in the dam catchment areas. The dam catchments are relatively saturated and significant inflows will be generated if the forecast rainfall eventuates. North Pine Dam (Full Supply Level 39.60 m AHD) The dam level is currently 39.65 m AHD and rising at 1600. Following the rain in the 9 hours, the number of open gates has been increased from 2 to 5 which are expected to remain open for the next 12 hours. Youngs Crossing will remain closed while releases are in progress.	Situation Report - Strategy W2	TM
		Somerset Dam (Full Supply Level 99.00 m AHD) - The dam level is 100.75 m AHD and rising quickly. Estimated peak inflow to the dam is about 3,000m3/s. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam will reach at least 101.5 during early Tuesday morning. - Since the commencement of the event on 02/01/2011approximately 80,000ML has been released from the dam, with an event total of at least 320,000ML based on the recorded rainfall to date. The event total is expected to increase significantly due to the forecast rain in the next 24 to 48 hours. At this stage, releases will continue until at least Wednesday. Wivenhoe Dam (Full Supply Level 67.00 m AHD) - The dam level is currently rising again, with the current level being 68.70m AHD. Estimated peak inflow to the dam just from the Upper Brisbane R is about 5,000m3/s and, at this stage, the dam will reach at least 72.5 m AHD during Wednesday morning. River levels upstream of the dam are rising quickly with significant inflow being generated from the intense heavy rainfall. The current gate operation strategy will maintain flows of	Situation Report - Strategy W2	
	7:15 PM	FOC called Peter Allen advising him that FOC is now looking at much larger flows and will have to ramp up releases to around 3000 cumecs as by as early as midnight which is likely to have flooding impacts on low-lying areas of Brisbane.	Correspondence - Strategy W2 - transition to W3	BS
		Strategy W3		

DATE	TIME	ACTION	CATEGORY	INITIALS
	9:04 PM	**Situation Report 2100 9/01/2011** Rainfall - Very heavy rainfall has been recorded in the upper reaches of the Brisbane and Stanley in the last 6 hours with totals up 100 to 140mm. Totals for the last 24 hours range from 100 to 300mm. - Rainfall of similar magnitudes is expected in the 12 to 24 hours, especially around the Bremer/Warrill catchments as the system tracks south. - A severe weather warning remains current for heavy rainfall in the dam catchment areas. Somerset Dam (Full Supply Level 99.00 m AHD) - The dam level is 101.68 m AHD (about 500,000ML currently in storage) and rising quickly. Peak inflow to the dam is estimated to be about 4,000 m3/s based on observed rainfall and could be as high as 5,000m3/s with additional forecast rainfall. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam will reach at least 103.5 early Tuesday morning which will adversely impact areas around Kilcoy. - Since the commencement of the event on 02/01/2011approximately 100,000ML has been released from the dam into Wivenhoe, with an event total of the order of 520,000ML expected. This may increase due to the	Situation Report - Strategy W3	TM
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - River levels upstream of the dam are rising quickly with significant inflow being generated from the intense heavy rainfall. Flows in the Brisbane River at Gregor's Ck have already reached 6,700m3/s and the river is still rising. - The dam level is rising again, with the current level being 69.10m AHD (1,410,000ML with about 300,00 of flood storage). Estimated peak inflow to the dam just from the Upper Brisbane R alone may reach as high as 7,500m3/s and, at this stage, the dam will reach at least 73.0 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it will be necessary to increase the release from Wivenhoe Monday morning. - The objective for dam operations will be to minimise the impact of urban flooding in areas downstream of the dam and, at this stage, releases will be kept below 3,500m3/s and the combined flows in the lower Brisbane will be limited to 4,000m3/s. This is below the limit of urban damages in the City reaches. - The current release rate from Wivenhoe Dam is 1,400m3/s (120,000ML/day). Gate opening will start to be increased from noon Monday and the release is expected increase to at least 2,600m3/s during Tuesday morning.	Situation Report - Strategy W3	
10/01/11				
	1:14 AM	**FOC Situation Report at 01:00 hrs on Monday 10 January 2011** Rainfall - Very heavy rainfall has been recorded in the Upper Brisbane and Stanley Rivers in the last 12 hours with totals up 100 to 240mm. Totals for the last 24 hours range from 100 to 300mm. - Rainfall of similar magnitudes is expected in the 12 to 24 hours around the downstream catchments as the system tracks south. - A severe weather warning remains current for heavy rainfall in the dam catchment areas. North Pine Dam (Full Supply Level 39.60 m AHD) - The dam level was 39.95 m and steady. Five gates are open releasing 445 m3/s. The inflow into the dam since the commencement of the event is 42,000 ML. Estimated event volume is 57,000 ML assuming no further rainfall. Gate operations will continue until at least Tuesday 11 January 2011. Somerset Dam (Full Supply Level 99.00 m AHD) - The dam level is 102.22 m AHD and rising quickly (storing 157,000 ML above FSL). Peak inflow to the dam is estimated to be about 4,200 m3/s based on observed rainfall and could be as high as 5,000m3/s with additional forecast rainfall. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam will reach at least 103.5 on Monday afternoon which will adversely impact areas - Since the commencement of the event on 02/01/2011approximately 115,000ML has been released from the dam into Wivenhoe, with an event total of the order of 520,000ML expected. This is expected to increase du	Situation Report - Strategy W3	JR

DATE	TIME	ACTION	CATEGORY	INITIALS
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - River levels upstream of the dam are rising quickly with significant inflow being generated from the intense heavy rainfall. Flows in the Brisbane River at Gregor's Ck have already reached 7,350m3/s and the river has just peaked at 23:00 on Sunday 9 January. - The dam level is rising quickly, with the current level being 69.60m AHD (storing 301,000 ML). Estimated peak inflow to the dam just from the Upper Brisbane R alone may reach as high as 8,800m3/s and, at this stage, the dam will reach at least 73.3 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it will be necessary to increase the release from Wivenhoe during Monday morning. - The objective for dam operations will be to minimise the impact of urban flooding in areas downstream of the dam and, at this stage, releases will be kept below 3,500m3/s and the combined flows in the lower Brisbane will be limited to 4,000m3/s if possible. - Fernvale Bridge approaches and Mt Crosby Weir Bridge have been inundated and both bridges are now closed or are in the process of being closed. - The current release rate from Wivenhoe Dam is 1,400m3/s (120,000ML/day). Gate opening will start to be increased during early Monday morning and the release is expected to increase to at least 2,600m3/s.	Situation Report - Strategy W3	
2:00 AM		Issued Wivenhoe Directive #8. • Open Gate 1 from 2.0 metres To 2.5 metres At 02:00 • Open Gate 3 from 2.0 metres To 2.5 metres At 03:00 • Open Gate 2 from 2.5 metres To 3.0 metres At 04:00 • Open Gate 4 from 2.5 metres To 3.0 metres At 05:00 • Open Gate 2 from 3.0 metres To 3.5 metres At 06:00	Directive # 8 Strategy W3	BS
6:30 AM		FOC Situation Report at 06:00 on Monday 10 January 2011 Rainfall - Moderate to heavy rainfall has been recorded in the Upper Brisbane and Stanley Rivers in the last 12 hours with totals up to 90 mm. Totals for the last 24 hours range from 100 to 325mm. - Mt Glorious recorded 100 mm in the last 12 hours. - Rainfall of similar magnitudes is expected in the 12 to 24 hours around the downstream catchments as the system tracks south. - A severe weather warning remains current for heavy rainfall in the dam catchment areas. North Pine Dam (Full Supply Level 39.60 m AHD) - The dam level was 39.97 m and steady. Five gates are open releasing 475 m3/s. The inflow into the dam since the commencement of the event is 52,000 ML. Estimated event volume is 72,000 ML assuming no further rainfall. Gate operations will continue until at least Tuesday 11 January 2011. Somerset Dam (Full Supply Level 99.00 m AHD) - The dam level at 05:00 was 102.84 m AHD and rising (storing 193,000 ML above FSL). Peak inflow to the dam is estimated to be about 4,200 m3/s based on observed rainfall and could be as high as 5,000m3/s with additional forecast rainfall. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam lake level will reach about 103.5 mAHD on Monday afternoon. Areas around Kil - Since the commencement of the event on 02/01/2011approximately 142,000ML has been released from the dam into Wivenhoe, with an event total of the order of 520,000ML expected. This is expected to increase du	Situation Report Strategy W3	JR
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - River levels upstream of the dam have peaked and are falling slowly with significant inflow being generated from the intense heavy rainfall. Flows in the Brisbane River at Gregor's Ck have peaked at 7,350m3/s at 23:00 on Sunday 9 January. This peak is bigger than January 1974 and February 1999 at this location. - The dam level is rising quickly, with the current level being 70.77m AHD (storing 450,000 ML). Estimated peak inflow to the dam just from the Upper Brisbane R is around 8,800m3/s and, at this stage, the dam will reach at least 73.3 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it was necessary to start to increase the release from Wivenhoe during Monday morning. - The objective for dam operations will be to minimise the impact of urban flooding in areas downstream of the dam and, at this stage, releases will be kept below 3,500m3/s and the combined flows in the lower Brisbane will be limited to 4,000m3/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000 m3/s.	Situation Report - Strategy W3	
6:30 AM		Issued Wivenhoe Directive #9. • Open Gate 4 from 3.0 metres To 3.5 metres At 07:00 • Open Gate 1 from 2.5 metres To 3.0 metres At 08:00 • Open Gate 5 from 2.5 metres To 3.0 metres At 09:00 • Open Gate 2 from 3.5 metres To 4.0 metres At 10:00 • Open Gate 4 from 3.5 metres To 4.0 metres At 11:00	Directive - Strategy W3	LVB
8:30 AM		Issued Wivenhoe Directive #10. • Open Gate 4 from 3.0 metres To 3.5 metres at 07:00 • Open Gate 1 from 2.5 metres To 3.0 metres at 08:00 • Open Gate 5 from 2.5 metres To 3.0 metres at 09:00	Directive - Strategy W3	LVB

DATE	TIME	ACTION	CATEGORY	INITIALS
	2:58 PM	FOC Situation Report at 12:00 on Monday 10 January 2011 Rainfall Significant rainfall has fallen in the Wivenhoe Dam catchment over the last 3 hours, with falls exceeding 100mm. This rainfall will significantly increase inflows into the dam. A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 10:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (75mm to 150mm); Wivenhoe/Somerset Dam Catchments (50mm – 100mm). Potentially significant rain moving towards the dam catchments is currently evident on the BOM radar. Somerset Dam (Full Supply Level 99.00 m AHD) The dam level is 103.41m AHD and rising. Peak inflow to the dam is estimated to be about 4,200 m3/s. Five sluice gates are open releasing about 1,100m3/s (95,000ML/day) into Wivenhoe Dam. At this stage the dam lake level will reach about 103.5m AHD on Monday afternoon. Areas around Kilcoy will continue to be adversely affected. Wivenhoe Dam (Full Supply Level 67.00 m AHD) - The dam level is 72.41m AHD and rising quickly. The rainfall experienced over the last 2 to 3 hours will result in significant further inflows into the dam and releases from the dam will need to be increased in accordance - Five radial gates are currently open at the dam releasing about 2,000m3/s into the Brisbane River and this will need to be increased steadily to an outflow of 2,800m3/s over the next 9 hours (commencing at 1500). At t - The objective for dam operations is currently to minimise the impact of urban flooding in areas downstream of the dam and to keep river flows in the lower Brisbane River below 4,000m3/s if possible. This is significantly Impacts downstream of Wivenhoe Dam - The projected Wivenhoe Dam releases combined with Lockyer Creek flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Brid - Water levels in the lower Brisbane River will be impacted by the combined flows of Lockyer Creek, Bremer River, local runoff and releases from Wivenhoe Dam. Outlook Heavy rainfall continues throughout South East Queensland and the situation could deteriorate rapidly over the next 24 hours. The flood operation centre will continue to monitor the situation and provide every six hours	Situation Report - Strategy W3	TM
	12:02 PM	Spoke with Peter Borrows (Seqwater) to answer elaborate on Situation Report and inform him of large rainfalls currently occurring in the Wivenhoe catchment.	Correspondence	LVB
	4:00 PM	Issued Wivenhoe Directive #11. - Open Gate 2 to 4.0 m at 15:00 - Open Gate 4 to 4.0 m at 15:30 - Open Gate 3 to 5.0 m at 16:00 - Open Gate 1 to 3.5 m at 16:30 - Open Gate 5 to 3.5 m at 17:00 - Open Gate 2 to 4.5 m at 17:30 - Open Gate 4 to 4.5 m at 18:00 - Open Gate 1 to 4.0 m at 18:30 - Open Gate 5 to 4.0 m at 19:00 - Open Gate 1 to 4.5 m at 19:30	Directive Strategy W3	LVB
	3:15 PM	Had conference call with BoM. They agree with FCC on model discharge results. However, BoM included 6hrs of additional rain which takes the discharge to 4600m3/s	Correspondence	LVB
	6:05 PM	Got weather update from BoM - the forecast now is - still more of the same of what we had today.	Other	LVB

DATE	TIME	ACTION	CATEGORY	INITIALS
	6:43 PM	FOC Situation Report at 18:00 on Monday 10 January 2011 Rainfall - Only minor rainfall has been experienced in the North Pine Dam and Somerset Dam catchments with a catchment averages of less than 20mm. - However, significant rain has fallen in the Wivenhoe Dam catchment over the last 6 hours, with isolated falls exceeding 100mm. This rainfall has significantly increase inflows into the dam. A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 10:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (25mm to 50mm, with isolated falls to 100mm); Wivenhoe/Somerset Dam Catchments (25mm to 50mm, with isolated falls to 100mm). Potentially significant rain moving towards the dam catchments is currently evident on the BOM radar. North Pine Dam (Full Supply Level 39.60 m AHD) - The dam level is 39.84m AHD and falling slowly (storing 8,000ML above FSL). Five gates are open and releasing 362 m3/s. The inflow into the dam since the commencement of the event is 72,000 ML. Estimated event volume is 84,000 ML assuming no further rainfall. Releases from the dam will continue until at least Wednesday 12 January 2011.	Situation Report	TM
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - The dam level is 72.92m AHD and rising quickly. Releases from the dam have been increased over the last 3 hours in accordance with Flood Mitigation procedures and to ensure that a fuse plug is not initiated. The initiation of a fuse plug will result in a rapid uncontrolled outflow from the dam of 2,000m3/s being added to the gate release outflow. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing. The flash flooding experienced in the upper areas of Lockyer Creek have been examined and are not expected to significantly increase Brisbane River flows above the current projection of 4000m3/s at Moggill. - Five radial gates are currently open at the dam releasing about 2,400m3/s into the Brisbane River and this will need to be increased steadily to an outflow of 2,800m3/s. At this stage, the dam will reach about 73.8m AHD during Tuesday morning. - The objective for dam operations is currently to minimise the impact of urban flooding in areas downstream of the dam and to keep river flows in the lower Brisbane River below 4,000m3/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000m3/s. If further rainfall occurs, dam releases may need to be increased further and this may result in river flows in the lower Brisbane R Impacts downstream of Wivenhoe Dam The projected Wivenhoe Dam releases combined with Lockyer Creek flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Bridg - Water levels in the lower Brisbane River will be impacted by the combined flows of Lockyer Creek, Bremer River, local runoff and releases from Wivenhoe Dam. Outlook Heavy rainfall continues throughout South East Queensland and the situation could deteriorate rapidly over the next 24 hours. The flood operation centre will continue to monitor the situation and provide every six hours	Situation Report Strategy W3	
	20:00 PM	Peter Baddiley (BoM) called to advise of situation regarding flows in Lockyer. Estimated very heavy localised rainfall (eg. 600mm in few hours) on Toowoomba escarpment to cause observed flood flooding. Will monitor via Glenore Grove gauging station.	Correspondence	JW
	21:00 PM	Spoke to Peter Allen regarding strategies for reducing Wivenhoe release to mitigate latest event in Lockyer. Peter endorsed variation to manual to operate at minimum gate settings to create gap to allow peak of flash flood to pass. Also endorsed concept allowing Wivenhoe HW to rise above 74 mAHD briefly.	Correspondence	JW
	20:20 PM	Spoke to Peter Baddiley (BoM) regarding reducing Wivenhoe release to accommodate peak of Lockyer flash flood.	Correspondence	JW
	11:20 PM	Spoke to Rob Drury to give situation update. Rob agreed that if possible to reduce flow from Wivenhoe to accommodate Lockyer flash flood peak.	Correspondence	JW

DATE	TIME	ACTION	CATEGORY	INITIALS
	11:56 PM	FOC Situation Report at 00:00 Tuesday 11 January 2011 Rainfall - Rainfall continues in the North Pine Dam, Somerset Dam and Wivenhoe Dam catchments with falls of generally less than 20mm since 18:00 today. However, some isolated falls in the Upper Brisbane River of up to 110 mm have been recorded at Monsildale in this time. This rainfall will increase inflows into the dam. - A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 16:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (25mm to 50mm, with isolated falls to 100mm); Wivenhoe/Somerset Dam Catchments (25mm to 50mm, with isolated falls to 100mm). North Pine Dam (Full Supply Level 39.60 m AHD) The dam level is 39.80m AHD and falling slowly (storing 4,400ML above FSL). Five gates are open, releasing 153 m3/s. The inflow into the dam since the commencement of the event is 74,000 ML. Estimated event volume is 84,000 ML assuming no further rainfall. Releases from the dam will continue until at least Wednesday 12 January 2011. Somerset Dam (Full Supply Level 99.00 m AHD) The dam level is 103.40m AHD and falling slowly. Peak inflow to the dam is estimated to be about 4,200 m3/s. Total discharge into Wivenhoe Dam is currently 1700m3/s and this discharge will decrease slowly in the nex	Situation Report	RA
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - The dam level is 73.22m AHD and rising at about 50 mm/hour. Releases from the dam have been held at a rate of 2,750 m3/s since 19:30 hours. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing. - The BoM has provided further advice about the flash flooding experienced in the upper areas of Lockyer Creek. The rainfall responsible for this event was not observed at any rainfall stations but it is considered to be very significant. Flood levels in the Lockyer Creek catchment will exceed maximum recorded levels in some stations in the upper catchment. This flow may result in increases in Brisbane River levels below the junction of Lockyer Creek. - Five radial gates are currently open at the dam releasing about 2,750m3/s into the Brisbane River. At this stage, the dam will reach about 73.8m AHD during Tuesday afternoon. - The objective for dam operations is currently to minimise the impact of urban flooding in areas downstream of the dam and to keep river flows in the lower Brisbane River below 4,000m3/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000m3/s. If further rainfall occurs, dam releases may need to be increased further and this may result in river flows in the lower Brisbane R Impacts downstream of Wivenhoe Dam - The projected Wivenhoe Dam releases combined with Lockyer Creek flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Brid - Water levels in the lower Brisbane River will be impacted by the combined flows of Lockyer Creek, Bremer River, local runoff and releases from Wivenhoe Dam. - The BoM will provide further information regarding the magnitude of the flash flood event occurring in Lockyer Creek early Tuesday morning. Consideration will be given to modifying the releases from Wivenhoe Dam to Outlook Heavy rainfall continues throughout South East Queensland and the situation could deteriorate over the next 24 hours. The flood operation centre will continue to monitor the situation and provide situation reports every	Situation Report - Strategy W3	
11/01/11				
	4:30 AM	Issued Somerset Directive #6. - Please close Sluice J at 05:00 - Please close Sluice N at 06:00 - Please close Sluice K at 07:00	Directive	JW
	5:15 AM	Spoke to Peter Baddiley (BoM) regarding reducing Wivenhoe release to accommodate peak of Lockyer flash flood. Update: Consensus was that reducing release from Wivenhoe would no longer be feasible due to attenuation of Lockyer peak and significant additional rainfall in upper Brisbane during the night.	Correspondence	JW

DATE	TIME	ACTION	CATEGORY	INITIALS
	8:12 AM	FOC Situation Report at 05:00 on Tuesday 11 January 2011 Rainfall - Rainfall continues in the North Pine Dam, Somerset Dam and Wivenhoe Dam catchments. Isolated falls in the Upper Brisbane River of up to 125 mm have been recorded with widespread falls of 40 to 70 mm in the Somerset Dam catchment. This rainfall will increase inflows into the dam. - There has also been 20 to 60 mm in the Lockyer Creek catchment in the last 12 hours with falls of up to 30 mm in the Bremer River. - A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 16:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (25mm to 50mm, with isolated falls to 100mm); Wivenhoe/Somerset Dam Catchments (25mm to 50mm, with isolated falls to 100mm). North Pine Dam (Full Supply Level 39.60 m AHD) The dam level is 39.80m AHD and has commenced rising again (storing 4,400ML above FSL). Five gates are open releasing 177 m3/s. The inflow into the dam since the commencement of the event is 77,000 ML. Estimated event volume is 88,000 ML assuming no further rainfall. Releases from the dam will continue until at least Wednesday 12 January 2011. Somerset Dam (Full Supply Level 99.00 m AHD) - The dam level is 103.27m AHD and falling slowly. Peak inflow to the dam is estimated to be about 4,200 m3/s. Total discharge into Wivenhoe Dam is currently 1400 m3/s and this discharge will be decreased in the nex - The dam level peaked at 103.52m AHD at 19:00 on Monday 10 January 2011, (unless further significant rainfall is experienced). Areas around Kilcoy will continue to be adversely affected.	Situation Report	
		Wivenhoe Dam (Full Supply Level 67.00 m AHD) - The dam level is 73.51m AHD and rising at about 25 mm/hour. Releases from the dam have been held at a rate of 2,750 m3/s since 19:30 hours on Monday 10 January 2011. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing. - The BoM has provided further advice about the flash flooding experienced in the upper areas of Lockyer Creek. The rainfall responsible for this event was not observed at any rainfall stations but it is considered to be extreme. Flood levels in the Lockyer Creek catchment will exceed maximum recorded levels in some stations in the upper catchment. This flow will result in increases in Brisbane River levels below the junction of Lockyer Creek. - Five radial gates are currently open at the dam releasing about 2,750m3/s into the Brisbane River. At this stage, the dam will reach just over 74.0m AHD during Tuesday evening. - Above EL. 74.0m AHD the objective for dam operations is to maintain the security of the dam and minimise downstream flood flows if possible.	Situation Report - Strategy W3/W4	
	8:00 AM	Issued Wivenhoe Directive #12. - Open Gate 5 to 4.5 m at 08:00 - Open Gates 2 and 4 to 5.0 m at 08:30 - Open Gate 3 to 5.5 m at 09:00	Directive - Strategy W3/W4	DP
	8:10 AM	JT called Peter Allen to advise of current Wivenhoe situation - Will exceed EL74m. Increasing gate opening to a minimum of 3700 m3/s and gate operations will progress. Advising tansition from strategy W3 to W4	Correspondence - Strategy W3/W4	DP
	9:00 AM	Issued Wivenhoe Directive #13. - Open Gates 2 and 4 to 5.5 m at 09:30 - Open Gates 1 and 5 to 5.5 m at 10:00 - Open Gate 3 to 6.0 m at 10:30 - Open Gates 2 and 4 to 6.0 m at 11:00 - Open Gates 1 and 5 to 6.0 m at 11:30	Directive - Strategy W3/W4	DP
	9:09 AM	JT called SEQWater maintenance (Jo Misner) advised that Wivenhoe has lost power, possibly blown high voltage fuses. JO to resolve issue.	Correspondence	DP

DATE	TIME	ACTION	CATEGORY	INITIALS
	9:13 AM	Energex called. All incoming power has been lost at Wivenhoe.	Correspondence	DP
	10:29 AM	Stan from SEQWater called TM. In conference with Barton Maher, internal questioning of release strategy, internal discussion regarding current approved strategy. Preparing a briefing note.	Correspondence	DP
	11:02 AM	Peter Borrows (Seqwater) requested update on situation.	Correspondence	DP
	11:38 AM	JT called Peter Burrows and advised that releases at Wivenhoe will be ramped up to 4000cumecs and strategy will be revised on an hourly basis, in reality releasing slightly less than the Flood Ops manual.	Correspondence	DP
		Strategy W4A		
	12:00 PM	Issued Wivenhoe Directive #14. • Open Gates 2, 3 and 4 to 6.5 m at 12:00 • Open Gates 1 and 5 to 6.5 m at 12:30 • Open Gate 3 to 7.0 m at 13:00	Directive Strategy W4A	DP
	12:11 PM	**SitRep 1200 11/1/2011** Somerset/Wivenhoe - Our current strategy revolves around trying to prevent initiation of the first fuse plug at EL 75.6m. If this happens we will get a rapid increase of about 2,000m3/s in outflow from the dam in addition to the gate release which could be as high as 4,500 to 5,000m3/s at the time. However, it may be that fuse plug initiation might provide a lower outflow than increasing the gate outflow to protect it. In this case, we would adopt an alternate scenario. - Sluices have been closed at Somerset and this will result in high upstream water levels affecting Kilcoy. - With no further rainfall, Wivenhoe will approach 75.0m AHD and there will be an attempt to limit the dam outflow to 4,500m3/s, however this strategy currently being reviewed on an hour by hour basis. The release will be 4,000m3/s by 1300. -With 50mm rainfall in the Stanley and Upper Brisbane in the next 12 to 24 hours, the release will need to be significantly increased to be in the order 6,000m3/s. - It should be noted that the flow in the lower Brisbane River in 1974 was about 9,500m3/s - Wivenhoe has lost incoming mains power and are on backup power. Energex are attempting to rectify. North Pine Inflows and outflows are increasing very rapid and will exceed 2,000m3/s.	Situation Report - Strategy W4A/W4B	
	1:00 PM	Issued Wivenhoe Directive #15. • Open Gates 1,2, 4 and 5 to 7.0 m at 13:15	Directive Strategy W4A	DP
	1:00 PM	Issued Wivenhoe Directive #16. • Open Gates 1,2, 3, 4 and 5 to 7.5 m	Directive Strategy W4A	DP
	1:26 PM	Peter Burrows (Seqwater) called and requested the FOC request the BoM to consider if Wivenhoe is releasing 9000cumecs.	Correspondence	DP
	1:55 PM	SEQWater is continually revising release strategy, could be as high as 6500cumecs by tonight. If dam stabilise, then estimates may be reduce. TM also passed on information for BoM to consider the effects at Brisbane if Wivenhoe releases 9000cumecs.	Situation Report Strategy W4A/W4B	DP

DATE	TIME	ACTION	CATEGORY	INITIALS
	2:00 PM	Issued Wivenhoe Directive #17. • Open Gates 1,2, 3, 4 and 5 to 8.0 m	Directive Staregy W4A	DP
	2:15 PM	Issued Wivenhoe Directive #18. • Open Gates 1,2, 3, 4 and 5 to 8.5 m	Directive Strategy W4A	DP
	3:14 PM	Peter Burrows (Seqwater) called to discuss the proposed release of 10,000cumecs. JT and TM explained release strategy is constantly being revised.	Correspondence Strategy	DP
	3:15 PM	Issued Wivenhoe Directive #19. • Open Gates 1,2, 3, 4 and 5 to 9.0 m	Directive Stratgey W4A	DP
	3:30 PM	Issued Wivenhoe Directive #20. • Open Gates 1,2, 3, 4 and 5 to 9.5 m	Directive Staregy W4A	DP
	3:49 PM	Peter Baddiley & Jimmy Stewart had a conference with JT, JR, TM and RA about current release strategy and possible maximum release scenario of 10000m3/s. This would be of a similar magnitude to the 1893 event (~8.36m in Brisbane Port Office)	Correspondence	DP
	4:15 PM	Issued Wivenhoe Directive #21. • Open Gates 1,2, 3, 4 and 5 to 10.0 m	Directive Stragety W4A	DP
	4:33 PM	Phone call with TM and Peter Burrows. Discussed that even though the magnitude flood in Brisbane is similar to 1974 flood event, the no-dam flood would be significantly larger without Wivenhoe.	Correspondence	DP
	4:41 PM	Peter Allen phone call. PA requested more technical information in the status reports released by Duty Engineers. PA will send through an example of the technical data requested in the report.	Correspondence	DP
	4:45 PM	Issued Wivenhoe Directive #22. • Open Gates 1,2, 3, 4 and 5 to 10.5 m	Directive Staregy W4A	DP
	5:15 PM	Issued Wivenhoe Directive #23. • Open Gates 1,2, 3, 4 and 5 to 11.0 m	Directive Strategy W4A	DP
	5:22 PM	Jimmy Stewart (BoM), TM and JR discussed current Wivenhoe inflows and anticipated outflows, TM confirmed that 7500cumecs is still likely early tonight.	Correspondence	DP
	5:48 PM	Rob Drury asking Tarong Energy to hold off releasing water from Splityard Creek.	Correspondence	DP
	6:00 PM	Issued Wivenhoe Directive #24. • Open Gates 1,2, 3, 4 and 5 to 12.0 m	Directive Strategy W4A	DP
	6:00 PM	**Situation Report 1800 11 January 2011** -In the last twelve hours totals of up to 370mm have fallen in the area around Wivenhoe Dam. In the last hour, rainfalls between 15 and 30mm have been recorded in the same area. At 1600, the BoM advised that falls between 50 to 100mm are still forecast for the 24hrs to 1600 Wednesday 12 January 2011 for the North Pine and Somerset/Wivenhoe catchments. - At 1730 Wivenhoe Dam was 74.92m AHD and rising slowly and releasing about 6,700m3/s. - The current expectation is that the dam will reach a steady state (outflow equals inflow) within the next 3 hours without further significant rainfall. At this time, release from the dam will be about 8,000 m3/s. - If there is no further rainfall, it may be possible to then slowly reduce this release overnight. - The dam is expected to peak below 75.5m AHD which is 100mmm below the first fuse plug initiation level. - Note that the automatic recorder as indicated on the BoM website is effected by drawdown and is not reflecting the actual lake level and tendency. - The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is also maintaining close contact	Situation Report Strategy W4A/W4B	TM
	6:07 PM	Recap of current release strategy amongst Duty Engineers. Current Wivenhoe scenario: 74.9 m - all gates at 12m. Won't go to 13m settings until level reaches 75.0 m AHD.	Correspondence Strategy W4A	DP
	7:30 PM	Doug Grigg (Wivenhoe Dam) called to report that Wivenhoe Level 74.97mAHD is holding.	Correspondence	AN
	8:25 PM	Joe Meisner rang to advise that the high voltage feeder to Wivenhoe will not be restored for the duration of this event. JT advised that Wivenhoe is operating successfully on the generator, and they have a fair bit of diesel. There are still 2 other backups to operate the gates.	Correspondence	AN
	8:30 PM	Doug Grigg (Wivenhoe Dam) called to advise that Wivenhoe's level is 5mm down.	Correspondence	AN

DATE	TIME	ACTION	CATEGORY	INITIALS
	8:30 PM	Issued Somerset Directive #7. • Fully Open Sluice L at 10:30.	Directive	AN
	8:35 PM	Peter Burrows (Seqwater) called FOC to speak with all duty engineers on the operating strategies for Wivenhoe releases.	Correspondence Strategy W4A	AN
	8:55 PM	Peter Burrows (Seqwater) rang asking about possibly reducing releases. TM advised that we are seriously considering it, but this would have little effect on the levels in Brisbane River. Peter would like technical reports every hour throughout the night.	Correspondence	AN
		Drainage Phase		
	9:00 PM	Issued Wivenhoe Directive #25. • Close Gates 1,2, 3, 4 and 5 to 11.0 m	Directive Drainage Phase	AN
	9:25 PM	The last directive to lower the Wivenhoe gates to 11m should have been 11.5m. A new directive to raise to 11.5m was issued.	Directive	AN
	9:30 PM	Mal Lane (North Pine Dam) called. They are still behind in gate closures.	Correspondence	AN
	9:30 PM	Issued Wivenhoe Directive #26. • Close Gates 1,2, 3, 4 and 5 to 11.5 m	Directive	AN
	9:40 PM	JW called Doug Grigg (Wivenhoe Dam) to obtain a current level. EL 74.9? Gates have been raised to 11.5m.	Correspondence	AN
	10:15 AM	Issued North Pine Directive #21a. • Gate B: Close to increment 4 at 22:30 • Gate D: Close to increment 4 at 22:45 • Gate A: Close to increment 4 at 23:00 • Gate E: Close to increment 4 at 23:15 • Gate C: Close to increment 4 at 23:30 • Gate B: Close to increment 3 at 23:45	Directive	AN
	10:35 PM	Doug Grigg (Wivenhoe Dam) called to report lake level of 74.94mAHD @ 10:30hrs.	Correspondence	AN
	11:00 PM	Doug Grigg (Wivenhoe Dam) called to report lake level of 74.92mAHD @ 11:00hrs.	Correspondence	AN
	11:00 AM	Issued Wivenhoe Directive #27 - note directive #26 was a duplicate and not sent • Close Gates 5,1,4,2 and 3 to 10.0 m	Directive	AN
12/01/11	11:30 PM	JW called Doug Grigg (Wivenhoe Dam) to obtain a current level. EL 74.9? Gates have been raised to 11.5m.	Correspondence	AN
	12:00 AM	Issued North Pine Directive #22. • Gate D: Close to increment 3 at 00:15 • Gate A: Close to increment 3 at 00:30 • Gate E: Close to increment 3 at 00:45 • Gate C: Close to increment 3 at 01:00 • Gate B: Close to increment 2 at 01:15	Directive	AN
	12:30 AM	Doug Grigg (Wivenhoe Dam) called to report lake level of 74.88mAHD @ 12:30hrs.	Correspondence	AN
	1:00 AM	John Thornton (SunWater) called to provide Energex contact details; Steve, phone number 0418 186 814. Steve indicated that he didn't believe 179 Turbot St would be disconnected from power grid in the morning.	Correspondence	JW
	1:15 AM	RA rang Doug Grigg (Wivenhoe Dam) advising next directive. We want to get releases down as quick as possible while still lowering lake levels. Advised that we may possibly have a communications problem in the morning if power to 179 Turbot Street is cut.	Correspondence	AN
	1:15 AM	Issued Wivenhoe Directive #29. • Close Gates 5,1,4,2 and 3 to 9.0 m	Directive	AN
	2:00 AM	Issued North Pine Directive #23. • Gate D: Close to increment 2 at 02:15 • Gate A: Close to increment 2 at 02:30 • Gate E: Close to increment 2 at 02:45 • Gate C: Close to increment 2 at 03:00	Directive	AN
	2:10 AM	James Charalambous (BCC) rang enquiring about a release strategy. Advised one will be issued at about 3:00am. Talked about the activities of the last 24 hours.	Correspondence	AN
	3:10 AM	JR rang Mal Lane (NPD) and advised no changes to gate settings planned for the next hour or so.	Correspondence	AN
	3:15 AM	Issued Wivenhoe Directive #30. • Close Gates 5,1,4,2 and 3 to 8.0 m	Directive	AN
	3:30 AM	Brett Myatt (SEQWater Mt Crosby WTP) called enquiring about levels at Mt Crosby.	Correspondence	AN
	3:50 AM	RA called Chris Lahey (BoM) advising him that because inflows are not as much as earlier anticipated, the releases from Wivenhoe are less than previously suggested.	Correspondence	AN
	4:05 AM	Ian Douglas, OIC of Lowood Police, rang enquiring about the Wivenhoe fuse plug. JW advised that there is no danger of the fuse plug falling, and that current releases from Wivenhoe Dam are about 4,900 cumecs.	Correspondence	AN

DATE	TIME	ACTION	CATEGORY	INITIALS
	4:15 AM	Issued North Pine Directive #24. • Gate B Close to increment 1 at 04:30 • Gate D: Close to increment 1 at 04:45 • Gate A: Close to increment 1 at 05:00 • Gate E: Close to increment 1 at 05:15	Directive	AN
	4:30 AM	Issued Wivenhoe Directive #31. • Close Gates 5,1,4,2 and 3 to 7.0 m	Directive	AN
	5:30 AM	Issued Wivenhoe Directive #32. • Close Gates 5,1,4,2 and 3 to 6.0 m	Directive	AN
	5:30 AM	Issued Wivenhoe Directive #33. • Close Gates 5,1,4,2 and 3 to 5.0 m	Directive	AN
	5:49 AM	Situation Report 0600 Wed 12/01/2011 - No significant rain has fallen over the catchments in the past twelve hours. Less than 10 to 15 millimeters of rainfall is expected over the next 24-48 hours. - Wivenhoe Dam peaked on the 11th January, Tuesday night at 19:00 at 74.97 mAHD with a corresponding discharge of 7,450 m3/s. The release have now been scaled back to 4,300m3/s at 05:00 am. Wivenhoe Dam is currently 74.77 m AHD and falling slowly. - The releases from Wivenhoe Dam will be temporarily reduced to 2,500 m3/s to allow the peak of Lockyer Creek to enter the Brisbane River, after which they will be increased to maximum of 3,500 m3/s. This release will then be maintained to drain the flood storage component within the required 7 days. - Somerset Dam is at 105.10 mAHD and slowly rising. The dam is discharging 1,230 m3/s over the spillway. The dam is expected to peak this morning near its current level. Sluice gates will be utilised to assist the draining of the flood storage compartment commencing on Thursday. - The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2 million megalitres. - North Pine Dam is currently releasing 105 m3/s through five gates. At 17:00 the lake was 39.78 mAHD. The event has a volume of around 200,000 ML. The peak discharge from the dam was 2,800 m3/s. This is categ - The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is also maintaining close contact - The next report will be issued at 08:00 12 January 2011.	Situation Report	RA
	7:15 AM	Issued Wivenhoe Directive #34. • Close Gates 1 and 5 to 3.5 m • Close Gates 2 and 4 to 4.0 m	Directive	KH

DATE	TIME	ACTION	CATEGORY	INITIALS
	7:57 AM	Situation Report 0600 Wed 12/01/2011 Rainfall - No significant rain has fallen over the catchments in the past twelve hours. Less than 10 to 15 millimeters of rainfall is expected over the next 24-48 hours. Somerset/Wivenhoe - Somerset Dam has peaked at 105.11 mAHD at 06:00 on 12 January 2011 and the dam is discharging 1,230 m3/s over the spillway. Sluice gates will be utilised to assist the draining of the flood storage compartment commencing later Wednesday. - Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on 11 January 2011 with a corresponding discharge of 7,450 m3/s. Wivenhoe Dam was 74.75 m AHD at 07:30 and generally falling slowly. - The releases from Wivenhoe Dam have been temporarily reduced to 2,500 m3/s at 07:30 to allow the peak of Lockyer Creek to enter the Brisbane River. After the downstream peak in the lower Brisbane River has passed, releases will be increased to maximum of 3,500 m3/s. This release will then be maintained to drain the flood storage component within the required 7 days. - The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2 million megalitres. North Pine At 07:00 North Pine Dam was 39.78 mAHD falling and releasing about 105 m3/s. North Pine has peaked at 41.11 mAHD at 14:00 on 11 January 1974 with peak release of 2,800 m3/s. The event has a volume of around Strategy - The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is maintaining close contact with - The next report will be issued at 12:00 12 January 2011.	Situation Report	7M
	8:30 AM	Issued North Pine Directive #25. • Gate E: Open to increment 2 at 08:45	Directive	KH
	10:15 AM	Issued Somerset Directive #8. • Fully Open Sluice L at 10:30.	Directive	KH
	12:55 PM	Peter Baddiley, Rob Vertessey, Jim Stevenson from BoM visited FOC to liaise with the Duty Engineers.	Correspondence	NGA
	2:15 PM	Issued North Pine Directive #26. • Gate E: Close to increment 1 at 14:15	Directive	NGA
	2:45 PM	Issued North Pine Directive #27. • Gate C: Close to increment 1 at 14:45	Directive	NGA

DATE	TIME	ACTION	CATEGORY	INITIALS
	3:00 PM	**Situation Report 1500 Wed 12/01/2011** Rainfall Rainfall in the last 12 hours is generally below 5mm with a couple of 10mm falls in the Stanley and North Pine catchments. There is no significant rain expected fin the next 4 days. Somerset/Wivenhoe - Somerset Dam has peaked at 105.11 mAHD at 06:00 on 12 January 2011. One sluice was opened at 1030 12 January 2011 and the dam is discharging 1,440 m3/s. Sluice gates will be utilised to drain of the flood storage compartment during the next 5 days. - Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on 11 January 2011 with a corresponding discharge of 7,450 m3/s. Wivenhoe Dam was 74.81 m AHD at 15:00 and steady. - The releases from Wivenhoe Dam have been temporarily reduced to 2,500 m3/s at 07:30 12 January 2011 to allow the peak of Lockyer Creek to enter the Brisbane River. After the downstream peak in the lower Brisbane River has passed, releases will be increased to maximum of 3,500 m3/s. This release will then be maintained to drain the flood storage component within the required 7 days. - The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2 million megalitres. North Pine At 15:00 North Pine Dam was 38.74 mAHD falling with all gates open 1 increment, releasing about 80 m3/s. North Pine peaked at 41.11 mAHD at 14:00 on 11 January 1974 with peak release of 2,800 m3/s. The event h Strategy The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is maintaining close contact with v The next report will be issued at 18:00 12 January 2011.	Situation Report	TM
	4:20 PM	Ken Morris (BCC) called FOC and had phone conference with Duty Engs. He was seeking update for briefing with Lord Mayor.	Correspondence	NGA
	6:00 PM	**Situation Report 1800 Wed 12/01/2011** Rainfall Rainfall in the last 12 hours is generally below 5mm with a couple of 10mm falls in the Stanley and North Pine catchments. There is no significant rain expected fin the next 4 days. Somerset/Wivenhoe - Somerset Dam has peaked at 105.11 mAHD at 06:00 on 12 January 2011. One sluice was opened at 1030 12 January 2011. Somerset Dam was 104.87 mAHD at 1700 12 January 2011 and discharging 1,410 m3/s. Sluice gates will be utilised to drain of the flood storage compartment during the next 5 days. - Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on 11 January 2011 with a corresponding discharge of 7,450 m3/s. Wivenhoe Dam was 74.82 m AHD at 17:00 and steady. - The release from Wivenhoe Dam was reduced to 2,500 m3/s at 07:30 12 January 2011 to allow the peak of Lockyar Creek to enter the Brisbane River and this release has been maintained since. After the downstream peak in the lower Brisbane River has passed, releases will be increased to maximum of 3,500 m3/s. The release is expected to commence Thursday and then be maintained at this level to drain the flood storage	Situation Report	TM
13/01/11				

DATE	TIME	ACTION	CATEGORY	INITIALS
	5:43 AM	Situation Report 0600 13 January 2011 Rainfall Rainfall in the last 12 hours is generally below 5mm with isolated falls of up to 15mm in the Stanley, Lockyer and Pine River catchments. There is no significant rain expected fin the next 4 days. Somerset/Wivenhoe - Somerset Dam peaked at 105.11 mAHD at 06:00 on Wednesday 12 January 2011. The current level is 104.34 mAHD. One sluice was opened at 10:30 on 12 January 2011 and the dam is currently discharging 1,130 m3/s. Sluice gates will be utilised to drain of the flood storage compartment during the next 5 days. - Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on Tuesday 11 January 2011 with a corresponding discharge of 7,450 m3/s. Wivenhoe Dam was 74.72 m AHD at 06:00 and commence to fall slowly. - The releases from Wivenhoe Dam have been temporarily reduced to 2,500 m3/s at 07:30 on Wednesday 12 January 2011 to allow the peak of Lockyer Creek to enter the Brisbane River. The Brisbane River has peaked at the Port Office Gauge early Thursday morning. Releases from Wivenhoe Dam will be managed to achieve a target flow of around 3,500 m3/s at Moggill. This release will then be maintained to drain the flood	Situation Report	RA
		North Pine At 06:00 North Pine Dam was 39.70 mAHD falling with all gates open 1 increment, releasing about 80 m3/s. North Pine peaked at 41.11 mAHD at 14:00 on Tuesday 11 January 2011 with peak release of 2,800 m3/s. The event has a volume of around 200,000 ML. It is expected that all gates will be closed on Friday. Strategy - The Flood Operations Centre is continuing to monitor rainfalls and water levels throughout the Brisbane and Pine River catchments and reviewing operating strategy. The FOC will continue to maintain close contact with warning agencies and local councils. - The next report will be issued at 18:00 on Thursday 13 January 2011.	Situation Report	
	12:30 PM	Wivenhoe directive #35 issued • Open Gate 2 from 4.0 metres to 4.5 metres at 1300. • Open Gate 4 from 4.0 metres to 4.5 metres at 1400.	Directive	JW
	12:30 PM	Somerset directive #10 issued • Fully Open Sluice K at 13:00.	Directive	JW
	2:15 PM	Phone call from Steve Roso, MBRC. Advice as follows: * damage to Gympie Rd abutments * No evacuations * No suburban flooding * Not aware of any over floor flooding. Pine Shire had 0.75m freeboard.	Correspondence	JW
	2:30 PM	Wivenhoe directive #36 issued • Open Gate 1 from 3.5 metres to 4.0 metres at 1500. • Open Gate 5 from 3.5 metres to 4.0 metres at 1600. • Open Gate 1 from 4.0 metres to 4.5 metres at 1700. • Open Gate 5 from 4.0 metres to 4.5 metres at 1800.	Correspondence	JW
	4:45 PM	Judy (MBRC) was advised that NPD gates will be closed at 0500 Friday	Correspondence	TM
	6:00 PM	Wivenhoe directive #37 issued • Open Gate 2 from 4.5 metres to 5.0 metres at 1830. • Open Gate 4 from 4.5 metres to 5.0 metres at 1900. • Open Gate 1 from 4.5 metres to 5.0 metres at 1930. • Open Gate 5 from 4.5 metres to 5.0 metres at 2000. • Open Gate 3 from 5.0 metres to 5.5 metres at 2030.	Directive	JW
	7:51 PM	Rob called Mal Lane (North Pine Dam) to discuss the current drainage strategy to close all gates by 5am tomorrow. Water level in North Pine Dam will be frequently monitored against the predictive model results, and gate opening will be adjusted accordingly if required.	Correspondence	DP
	8:15 PM	Wivenhoe directive #38 issued • Open Gate 2 from 5.0 metres to 5.5 metres at 2100. • Open Gate 4 from 5.0 metres to 5.5 metres at 2200. • Open Gate 1 from 5.0 metres to 5.5 metres at 2300. • Open Gate 5 from 5.0 metres to 5.5 metres at 2000. • Open Gate 3 from 5.5 metres to 6.0 metres at 0100 on 14/1/11 • Open Gate 3 from 5.5 metres to 6.0 metres at 0200 • Open Gate 3 from 5.5 metres to 6.0 metres at 0300	Directive	DP

DATE	TIME	ACTION	CATEGORY	INITIALS
	8:28 PM	Somerset directive #11 issued • Fully Open Sluice N at 21:00.	Directive	GP
14/01/11				
	2:10 AM	Rob Ayre called Shane Watson to advise commencement of shut down of gates in accordance with Directive #30: Please undertake the following gate operations commencing at 03:15 on Friday 14 January 2011. The interval between gate operations is to be 15 minutes. • Gate A: Close to 1 increment at 03:15 • Gate E: Close to 1 increment at 03:30 • Gate C: Close to 1 increment at 03:45 • Fully Close Gate B at 04:00 • Fully Close Gate D at 04:15 • Fully Close Gate A at 04:30 • Fully Close Gate E at 04:45 • Fully Close Gate C at 05:00	Directive	DP
	5:13 AM	Fax received from North Pine Dam confirming closure of all gates.	Correspondence	DP
	5:15 AM	Rob Ayre called MBRC to advise that North Pine Dam has closed the final gate at 5am.	Correspondence	DP
	5:16 AM	Malcom from North Pine Dam called to confirm that all gates are closed, and Young's Crossing should be passable within 2 hours. Lake Kurwongbah level is 20.43 m.	Correspondence	DP
		Murray Dunstan rang from North Pine. The dam ceased flood operations at 5:00am this morning and fish recovery and clean-up has been completed. Approx. 31 lung fish were rescued. Quite a number of dead lung fish and other species. Erosion damage downstream of the dam is severe with loss of vegetation, stripped and fallen trees, bank erosion, and many dead fish caught within the root ball of fallen trees. Murray is organising back hoes and front end loader machinery to clear the debris between the NP dam wall and Grant Street.	Correspondence	NGA
15/01/11	2:15 AM	Wivenhoe directive #40 issued • Open Gate 5 from 5.5 metres to 6.0 metres at 02:30.	Directive	KH

DATE	TIME	ACTION	CATEGORY	INITIALS
	10:20 AM	Wivenhoe directive #41 issued. Open Gate 3 from 6.0m to 6.5m at 10:30.	Directive	AN

DATE	TIME	ACTION	CATEGORY	INITIALS

CERTIFICATE OF EXHIBIT

Exhibit 11 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]

.....
Declarant

[redacted]

Solicitor

B:1377523_1 NMW

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) 3135 0500
Fax: (07) 3135 0599
Ref: TZB:11800005

8/2/11 @ 11o

Performance of RTFM

Introduction

The Real Time Flood Operations Model (RTFM) is known as FLOOD, which is a mnemonic for *Flood Level Observations and Operations of Dams*. The system was developed by the Department of Natural Resources in 1994 as part of the Brisbane River and Pine River Flood Study.

The system consists of two integrated modules:

- FLOOD-Col,
- FLOOD-Ops.

FLOOD-Col is the data capture module whilst FLOOD-Ops is the data analysis module. The system is accessed through a Graphical User Interface (GUI) that allows the operator flexibility in managing the system.

The modelling system was developed under a Unix operating environment using OSF/Motif GFUI under the X Window system. In 2008, the system was ported to a LINUX operating environment and is currently running on a DELL PowerEdge 1800 Server.

FLOOD performs the following tasks;

It automatically and continuously,

- Collects, filters and stores hydro-meteorologic data in real time,
- Evaluates the spatial and temporal distribution of antecedent catchment soil moisture conditions on a daily basis,

Upon operator initiation.

- Assigns temporal and spatial distributions of forecasted rainfall and forecasted rainfall for extension into the future,
- Generates files from databases suitable for use in hydrologic modelling,
- Performs hydrologic routing of stream flows in an integrated environment,
- Provides estimates of storage performance and resulting downstream releases,
- Prepares summary output in textual and graphical format for storage operation and resulting downstream flood flows/levels.

Radio Telemetry Stations

The primary source of raw data for the system is rainfall, river height and lake level sensors located within and around the relevant catchments. Rainfall sensors consist of standard tipping bucket rain gauges attached to a data logger. The river height and lake level sensors vary in type and model but include shaft encoders, wet pressure transducers and dry pressure transducers. Refer to Section xx for more details.

The sensors are attached to encoder/radio transmitters that send radio signals containing an accumulated value using a standard Automated Local Evaluation in Real Time System (ALERT) style radio signal. This has become the adopted standard for flood warning networks adopted by the Bureau of Meteorology. A system of repeater stations is installed within the catchment to ensure the signals reach the base station located on top of the building housing the Flood Operations Centre.

System Architecture

FLOOD was designed as two major sub-systems; data collection and data analysis. The FLOOD modelling system was developed as a fully integrated system as it automatically associates data collected and process models with catchment spatial information.

Data Collection

Data collection is completely independent to data analysis within the FLOOD system. Data collection is performed on a sensor by sensor basis. Signals sent form the field arrive randomly at the FOC base station and are relayed to the computer hardware platforms serial port via a decoder. The system enables the serial port to receive the incoming sensor information which consists of a sensor identification number and an accumulated sensor value. The signal is read, decoded, accepted or rejected, filtered, validated and then stored in a sensor database. All information is stored in the data base even if it is considered 'trash' data.

A sensor details database contains details of each sensor, including:

- Sensor name
- Identification number
- Type of sensor
- Calibration information
- Alarm thresholds
- And rating curve information if applicable.

Filtered data obtained from the sensors can be viewed in a textual or graphical format. Facilities for viewing groups of sensors are available. The types of information that can be viewed or edited include height, discharge, rainfall pluviographs, rainfall hyetographs, lake levels and dam volumes.

No issues where observed with the RTFM data collection module during this event. Some sensors stopped reporting during the course of the event, but this related to issues with the field sensors and not the data collection module. Some sensors also required re-calibration during the event as they where repaired or the data started 'drifting'.

Data Analysis

The data analysis system has been developed around the concepts of regions, processes and cases.

Regions

Regions are spatial areas such as catchments located above a stream gauging station, which can be assigned various input definitions and process modules depending upon the nature of the region. For example, a sub-catchment is assigned a soil moisture accounting process and a runoff-routing model process, whereas a reservoir region is assigned only a reservoir routing process. A region's relationships with neighbouring regions are defined for each process associated with the region.

The regions database contains the following information;

- Extent and location of sub-areas within regions, and regions within catchments,
- Connectivity of sub-areas within regions, and regions within catchments,
- Processes associated with each region,
- Process module input definitions.

Figure X shows the region layout adopted in the FLOOD system.

Process

A Process is a computational model of a physical mechanism. Examples as stated include soil moisture accounting, runoff-routing, reservoir routing and hydraulic routing.

Soil Moisture Accounting Model

The Soil Moisture Accounting Model is used to provide an indication of the catchment wetness at the commencement of a flood event. Relationships have been derived which relate conceptual soil moisture storage volumes with rainfall loss rates.

The FLOOD system contains a number of different process models which perform similar functions. For example the Soil Moisture Accounting Module consists of several different model types which are:

- Antecedent Precipitation Index (API)
- Resdiual Baseflow Index
- SACRAMENTO Model

In this event the API model was used to derive initial estimates of rainfall loss rates during the early period of the flood event. These estimates were then modified as initial stream rises were detected and event loss rates could be then assessed by matching the timing and rate of rise.

Table xx Loss Rate Estimates of Regions - 5 January 2011

Region	API Initial Loss (mm)	Sacramento Initial Loss (mm)	Sacramento Continuing Loss (mm/hr)
Upper Brisbane River			
COO	28.0	26.5	3.5
LIN	22.6	13.6	3.3
EMU	30.7	25.2	2.1
CRE	33.3	29.6	3.3
GRE	29.2	23.7	3.9
Middle Brisbane River			
WDI	31.8		2.8
Stanley River			
SDI	22.2	12.3	2.5
Lockyer Creek			
HEL	30.4	25.0	4.0
TEN	24.1	0.0	3.5
LAI	14.8	0.0	4.3
GAT	29.3	21.8	3.6
LYO	28.8	20.9	4.2
Bremer River			
WAL	27.8	28.1	2.9
KAL	24.1	0.0	2.0
AMB	27.6	0.0	2.0
PUR	34.3	0.0	2.1
IPS	33.4	0.0	2.0
Lower Brisbane River			
SAV	34.2	37.3	3.0
MTC	33.1	33.0	3.8
JIN	33.5	34.0	3.8
POG	33.6	33.4	3.8
ENO	30.3	25.2	1.2
BUL	33.2	26.6	4.2

Relationships derived by the Bureau of Meteorology that link API and initial loss rate have been utilised. These equations are of the following form:-

Somerset Dam

IL = ????

Wivenhoe Dam

IL = ????

North Pine Dam

IL = ????

The continuing loss rates were varied throughout the event to ensure that the overall shape and volume of the flood event was being matched to an acceptable level.

Runoff-routing Models

An event based runoff-routing model similar to that described by Mein, Laurensen and McMahon (1974) was used to model the surface runoff from a region. The model consists of concentrated storages distributed over the region which have a non-linear storage-discharge relationship. The implementation of the model originated as WT42 (Shallcross, 1987) but was re-written in ANSI C for the inclusion of in the FLOOD system and to accommodate improved data structures required to access data in real time. The model was also modified to operate in a manner which allowed separate regions to be run as a series of linked cascading models. This formulation of the models allows for more effective use of spatially varying data.

The runoff-routing models were calibrated to up to ten historical flood events and have been used to successfully simulate operational floods in February 1999, March 1999, February 2001, February 2010 and March 2010.

Table xx Region Runoff-Routing Model Parameters

Region	Kc	m
Upper Brisbane River		
COO	43.6	0.8
LIN	20.6	0.8
EMU	37.2	0.8
CRE	34.3	0.8
GRE	20.1	0.8
Middle Brisbane River		
WDI	108.5	0.8
Stanley River		
SDI	60.3	0.8
Lockyer Creek		
HEL	15.0	0.8
TEN	19.0	0.8
LAI	42.1	0.8
GAT	61.9	0.8
LYO	53.9	0.8

Bremer River		
WAL	44.0	0.8
KAL	34.0	0.8
AMB	35.0	0.8
PUR	49.0	0.8
IPS	15.7	0.8
Lower Brisbane River		
SAV	40.0	0.8
MTC	47.0	0.8
JIN	29.4	0.8
POG	19.3	0.8
ENO	9.1	0.8
BUL	10.5	0.8

Base-flow Models

During the February and March 2010 flood events, a base flow 'model' was introduced to assist in the assessment of the timing of release closure sequences. This was done to add some consistency to the assessment and provide a catalogue of recession constants applicable to the various dam catchments.

The base flow model has the form:-

Base Flow = ((Base Flow at t-1)xBR) + (BCx(ModelCatchment Inflow at t)^BM))

Where:

t= Current Time Step
BR = Base Flow Recession Constant (~0.90 or less than unity)
BC = Surface Runoff Factor (~0.004)
BM = Power (~1.0)

Reservoir Routing Models

The reservoir routing models incorporated into the FLOOD system are based on level pool routing algorithims. The models for Somerset Dam and Wivenhoe Dam are complicated by the fact the dams are operated conjunctively to maximise the flood mitigation benefits of the overall system and so therefore they have been adapted to reflect the gate configurations of each particular dam.

The gate operations module incorporated into FLOOD is an adaptation of a stand alone computer program known as WIVOPS that incorporates the flood operation objectives described in the October 2004, Version 6 of the 'Manual of Operational Procedures for Flood Mitigation for Wivenhoe Dam and Somerset Dam'.

WIVOPS was modified in May 2005 to incorporate the Stage I auxiliary spillway works as defined in the Wivenhoe Dam Alliance Report entitled,' Design Discharges and Downstream Impacts of Wivenhoe Dam Upgrade', Report Number Q1091, June 2004.

The WIVOPS configuration incorporated into the FLOOD system does not fully reflect the revised operational strategies of the current Version 9 of the Manual which considers the latest revision of design flood hydrology of Somerset Dam.

Therefore, inflow estimates have to be extracted from the FLOOD system and imported into customised gate operation spreadsheets for use in determining appropriate gate operation strategies in accordance with the latest manual.

Case

A Case is an event based sequence of processes applied to a number of regions. Generally, all regions are included in a case, which is identified by a unique case name. The following items are required to define a Case and are entered through the case edit mode:

- Name and description of Case,
- Simulation start time, time_now, simulation finish time and computational time step,
- Rainfall to time_now,
- Rainfall loss model type and required rainfall loss rates and spatial distribution,
- Forecast rainfall duration, depth, spatial and temporal distribution,
- Regions included in Case,
- Hydrologic model routing parameters,
- Reservoir start volume and operating procedure.

CERTIFICATE OF EXHIBIT

Exhibit 12 to statutory declaration of **ROBERT AYRE** affirmed and declared 30 January 2012.

[redacted]

Declarant

[redacted]

Solicitor

Holding Redlich
Level 1, 300 Queen Street
Brisbane Q 4000
Tel: (07) [redacted]
Fax: (07)
Ref: TZB:11800005

Performance of RTFM

Introduction

The Real Time Flood Operations Model (RTFM) is known as FLOOD, which is a mnemonic for *Flood Level Observations and Operations of Dams*. The system was developed by the Department of Natural Resources in 1994 as part of the Brisbane River and Pine River Flood Study.

The system consists of two integrated modules:

- FLOOD-Col,
- FLOOD-Ops.

FLOOD-Col is the data capture module whilst FLOOD-Ops is the data analysis module. The system is accessed through a Graphical User Interface (GUI) that allows the operator flexibility in managing the system.

The modelling system was developed under a Unix operating environment using OSF/Motif GFUI under the X Window system. In 2008, the system was ported to a LINUX operating environment and is currently running on a DELL PowerEdge 1800 Server.

FLOOD performs the following tasks;

It automatically and continuously,

- Collects, filters and stores hydro-meteorologic data in real time,
- Evaluates the spatial and temporal distribution of antecedent catchment soil moisture conditions on a daily basis,

Upon operator initiation.

- Assigns temporal and spatial distributions of forecasted rainfall and forecasted rainfall for extension into the future,
- Generates files from databases suitable for use in hydrologic modelling,
- Performs hydrologic routing of stream flows in an integrated environment,
- Provides estimates of storage performance and resulting downstream releases,
- Prepares summary output in textual and graphical format for storage operation and resulting downstream flood flows/levels.

Radio Telemetry Stations

The primary source of raw data for the system is rainfall, river height and lake level sensors located within and around the relevant catchments. Rainfall sensors consist of standard tipping bucket rain gauges attached to a data logger. The river height and lake level sensors vary in type and model but include shaft encoders, wet pressure transducers and dry pressure transducers. Refer to Section xx for more details.

The sensors are attached to encoder/radio transmitters that send radio signals containing an accumulated value using a standard Automated Local Evaluation in Real Time System (ALERT) style radio signal. This has become the adopted standard for flood warning networks adopted by the Bureau of Meteorology. A system of repeater stations is installed within the catchment to ensure the signals reach the base station located on top of the building housing the Flood Operations Centre.

System Architecture

FLOOD was designed as two major sub-systems; data collection and data analysis. The FLOOD modelling system was developed as a fully integrated system as it automatically associates data collected and process models with catchment spatial information.

Data Collection

Data collection is completely independent to data analysis within the FLOOD system. Data collection is performed on a sensor by sensor basis. Signals sent form the field arrive randomly at the FOC base station and are relayed to the computer hardware platforms serial port via a decoder. The system enables the serial port to receive the incoming sensor information which consists of a sensor identification number and an accumulated sensor value. The signal is read, decoded, accepted or rejected, filtered, validated and then stored in a sensor database. All information is stored in the data base even if it is considered 'trash' data.

A sensor details database contains details of each sensor, including:

- Sensor name
- Identification number
- Type of sensor
- Calibration information
- Alarm thresholds
- And rating curve information if applicable.

Filtered data obtained from the sensors can be viewed in a textual or graphical format. Facilities for viewing groups of sensors are available. The types of information that can be viewed or edited include height, discharge, rainfall pluviographs, rainfall hyetographs, lake levels and dam volumes.

No issues where observed with the RTFM data collection module during this event. Some sensors stopped reporting during the course of the event, but this related to issues with the field sensors and not the data collection module. Some sensors also required re-calibration during the event as they where repaired or the data started 'drifting'.

Data Analysis

The data analysis system has been developed around the concepts of regions, processes and cases.

Regions

Regions are spatial areas such as catchments located above a stream gauging station, which can be assigned various input definitions and process modules depending upon the nature of the region. For example, a sub-catchment is assigned a soil moisture accounting process and a runoff-routing model process, whereas a reservoir region is assigned only a reservoir routing process. A region's relationships with neighbouring regions are defined for each process associated with the region.

The regions database contains the following information;

- Extent and location of sub-areas within regions, and regions within catchments,
- Connectivity of sub-areas within regions, and regions within catchments,
- Processes associated with each region,
- Process module input definitions.

Figure X shows the region layout adopted in the FLOOD system.

Process

A Process is a computational model of a physical mechanism. Examples as stated include soil moisture accounting, runoff-routing, reservoir routing and hydraulic routing.

Soil Moisture Accounting Model

The Soil Moisture Accounting Model is used to provide an indication of the catchment wetness at the commencement of a flood event. Relationships have been derived which relate conceptual soil moisture storage volumes with rainfall loss rates.

The FLOOD system contains a number of different process models which perform similar functions. For example the Soil Moisture Accounting Module consists of several different model types which are:

- Antecedent Precipitation Index (API)
- Resdiual Baseflow Index
- SACRAMENTO Model

In this event the API model was used to derive initial estimates of rainfall loss rates during the early period of the flood event. These estimates were then modified as initial stream rises were detected and event loss rates could be then assessed by matching the timing and rate of rise.

Table xx Loss Rate Estimates of Regions - 5 January 2011

Region	API Initial Loss (mm)	Sacramento Initial Loss (mm)	Sacramento Continuing Loss (mm/hr)
Upper Brisbane River			
COO	28.0	26.5	3.5
LIN	22.6	13.6	3.3
EMU	30.7	25.2	2.1
CRE	33.3	29.6	3.3
GRE	29.2	23.7	3.9
Middle Brisbane River			
WDI	31.8		2.8
Stanley River			
SDI	22.2	12.3	2.5
Lockyer Creek			
HEL	30.4	25.0	4.0
TEN	24.1	0.0	3.5
LAI	14.8	0.0	4.3
GAT	29.3	21.8	3.6
LYO	28.8	20.9	4.2
Bremer River			
WAL	27.8	28.1	2.9
KAL	24.1	0.0	2.0
AMB	27.6	0.0	2.0
PUR	34.3	0.0	2.1
IPS	33.4	0.0	2.0
Lower Brisbane River			
SAV	34.2	37.3	3.0
MTC	33.1	33.0	3.8
JIN	33.5	34.0	3.8
POG	33.6	33.4	3.8
ENO	30.3	25.2	1.2
BUL	33.2	26.6	4.2

Relationships derived by the Bureau of Meteorology that link API and initial loss rate have been utilised. These equations are of the following form:-

Somerset Dam

IL = ????

Wivenhoe Dam

IL = ????

North Pine Dam

IL = ????

The continuing loss rates were varied throughout the event to ensure that the overall shape and volume of the flood event was being matched to an acceptable level.

Runoff-routing Models

An event based runoff-routing model similar to that described by Mein, Laurensen and McMahon (1974) was used to model the surface runoff from a region. The model consists of concentrated storages distributed over the region which have a non-linear storage-discharge relationship. The implementation of the model originated as WT42 (Shallcross, 1987) but was re-written in ANSI C for the inclusion of in the FLOOD system and to accommodate improved data structures required to access data in real time. The model was also modified to operate in a manner which allowed separate regions to be run as a series of linked cascading models. This formulation of the models allows for more effective use of spatially varying data.

The runoff-routing models were calibrated to up to ten historical flood events and have been used to successfully simulate operational floods in February 1999, March 1999, February 2001, February 2010 and March 2010.

Table xx Region Runoff-Routing Model Parameters

Region	Kc	m
Upper Brisbane River		
COO	43.6	0.8
LIN	20.6	0.8
EMU	37.2	0.8
CRE	34.3	0.8
GRE	20.1	0.8
Middle Brisbane River		
WDI	108.5	0.8
Stanley River		
SDI	60.3	0.8
Lockyer Creek		
HEL	15.0	0.8
TEN	19.0	0.8
LAI	42.1	0.8
GAT	61.9	0.8
LYO	53.9	0.8

Bremer River		
WAL	44.0	0.8
KAL	34.0	0.8
AMB	35.0	0.8
PUR	49.0	0.8
IPS	15.7	0.8
Lower Brisbane River		
SAV	40.0	0.8
MTC	47.0	0.8
JIN	29.4	0.8
POG	19.3	0.8
ENO	9.1	0.8
BUL	10.5	0.8

Base-flow Models

During the February and March 2010 flood events, a base flow 'model' was introduced to assist in the assessment of the timing of release closure sequences. This was done to add some consistency to the assessment and provide a catalogue of recession constants applicable to the various dam catchments.

The base flow model has the form:-

Base Flow = ((Base Flow at t-1)xBR) + (BCx(ModelCatchment Inflow at t)^BM))

Where:

t= Current Time Step
BR = Base Flow Recession Constant (~0.90 or less than unity)
BC = Surface Runoff Factor (~0.004)
BM = Power (~1.0)

Reservoir Routing Models

The reservoir routing models incorporated into the FLOOD system are based on level pool routing algorithims. The models for Somerset Dam and Wivenhoe Dam are complicated by the fact the dams are operated conjunctively to maximise the flood mitigation benefits of the overall system and so therefore they have been adapted to reflect the gate configurations of each particular dam.

The gate operations module incorporated into FLOOD is an adaptation of a stand alone computer program known as WIVOPS that incorporates the flood operation objectives described in the October 2004, Version 6 of the 'Manual of Operational Procedures for Flood Mitigation for Wivenhoe Dam and Somerset Dam'.

WIVOPS was modified in May 2005 to incorporate the Stage I auxiliary spillway works as defined in the Wivenhoe Dam Alliance Report entitled,' Design Discharges and Downstream Impacts of Wivenhoe Dam Upgrade', Report Number Q1091, June 2004.

The WIVOPS configuration incorporated into the FLOOD system does not fully reflect the revised operational strategies of the current Version 9 of the Manual which considers the latest revision of design flood hydrology of Somerset Dam.

Therefore, inflow estimates have to be extracted from the FLOOD system and imported into customised gate operation spreadsheets for use in determining appropriate gate operation strategies in accordance with the latest manual.

Case

A Case is an event based sequence of processes applied to a number of regions. Generally, all regions are included in a case, which is identified by a unique case name. The following items are required to define a Case and are entered through the case edit mode:

- Name and description of Case,
- Simulation start time, time_now, simulation finish time and computational time step,
- Rainfall to time_now,
- Rainfall loss model type and required rainfall loss rates and spatial distribution,
- Forecast rainfall duration, depth, spatial and temporal distribution,
- Regions included in Case,
- Hydrologic model routing parameters,
- Reservoir start volume and operating procedure.