IN THE MATTER OF
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY

A COMMISSION OF INQUIRY UNDER THE
COMMISSIONS OF INQUIRY ACT 1950

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

STATEMENT OF PETER CLARK BORROWS

On the 1st day of April 2011, I, Peter Clark Borrows of c/- 240 Margaret St, Brisbane state on oath:

Introduction

Current Role

1. I am the Chief Executive Officer of Queensland Bulk Water Supply Authority (***Seqwater***).

2. I have held this position since Seqwater was established in November 2007.

3. As Chief Executive Officer, I am ultimately responsible for the management of Seqwater's operations. I report to the Seqwater Board.

4. I have four Executive General Managers who report to me, one of whom is Jim Pruss.

5. Mr Pruss is Executive General Manager – Water Delivery.

6. The Water Delivery group (which Mr Pruss heads up) is responsible for the management and operation of all of Seqwater's dams and water treatment plant assets, infrastructure maintenance, land and water quality, water quality monitoring and catchment support services such as recreation.

Previous Role

7. Between about March 2002 and November 2007, I was the Chief Executive Officer of one of Seqwater's predecessors, South East Queensland Water Corporation Pty Ltd.

Qualifications

8. I hold a Bachelor of Engineering (Civil) from the University of Queensland, Brisbane (1973).

9. I also hold a Graduate Diploma in Business Administration from the Queensland Institute of Technology, Brisbane (1981).

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

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10. I am:

    (a) a Fellow of the Australian Institute of Company Directors;

    (b) a Member of the Australian Institute of Management; and

    (c) a Member of the Institution of Engineers, Australia.

Nature of this statement

11. This statement is provided to the Queensland Floods Commission of Inquiry pursuant to a "Requirement to Provide Statement" issued by the Commission dated 25 March 2011 (the ***Requirement***). The statements I make below are my best recollections of the significant matters referred to in the Requirement which I have been able to prepare in the short time since I received the Requirement. I believe I have had many hundreds of communications (for example, meetings, telephone discussions and correspondence) in respect of the matters referred to in the Requirement and I have not been able, in the short time provided to me, to recount in detail all of those communications in this statement.

Seqwater's role in the Water Grid

12. I refer to Seqwater's opening submission filed with the Commission on 11 March 2011.

13. To the best of my information and belief, the matters referred to in paragraphs 48 to 122 of Seqwater's opening submission dated 11 March 2011 are a correct statement of:

    (a) Seqwater's establishment and role in the South East Queensland Water Grid;

    (b) Seqwater's key water storage and treatment assets;

    (c) the regulatory framework governing Seqwater's operations; and

    (d) Seqwater's dam management.

Relevant Events Between October 2010 and December 2010

Weather forecasts

14. To the best of my recollection, I did not receive a briefing from the Bureau of Meteorology (***BoM***) in respect of seasonal outlooks or long range weather forecasts in the lead up to the 2010/2011 wet season or during the period from the commencement of the wet season to 31 December 2010.

15. I do not ordinarily receive briefings from BoM as to BoM's seasonal outlooks as part of Seqwater's flood preparations for each wet season.

16. I was generally aware from about the start of the 2010/2011 wet season that BoM had identified a La Nina weather pattern as being present and BoM expected South East Queensland to receive above median rainfall during the 2010/2011 wet season.

17. I have caused to be printed from the BoM website seasonal rainfall outlooks issued by BoM that were issued from 24 August 2010 to 20 January 2011. Exhibited to this statement and marked **PB-1** are those seasonal rainfall outlooks.

[redacted]

18. There was nothing in any of the BoM seasonal outlooks or long range forecasts of which I was aware which led me to believe:

    (a) a flood event of the size and scale of the January 2011 Flood Event would occur; or

    (b) that it was necessary for Seqwater to take action to seek to lower the lake levels within Wivenhoe dam, Somerset dam or North Pine dam. I explain below the issues relating to the Full Supply Level (***FSL***) of these dams.

Study into raising the FSL for Wivenhoe dam

19. As part of the South East Queensland Regional Water Supply Strategy, a study was to be undertaken to investigate options to raise the FSL of Wivenhoe dam. In the Strategy, the Queensland Water Commission and Seqwater are listed jointly as "Responsible Agency".

20. My recollection is that the planning work for this project commenced in mid to late 2010. Under the project governance arrangements, the QWC was to have the responsibility for the overall co-ordination and the yield studies while Seqwater would undertake the flood studies. As input would be required from other entities, it was proposed to have a steering committee comprising officers from the QWC, Seqwater, the Department of Environment and Resource Management (***DERM***), the South East Queensland Water Grid Manager (the ***Grid Manager***), Brisbane City Council, Ipswich City Council and certain independent experts.

21. Exhibited to this statement and marked **PB-2** is an exchange of correspondence between me and the QWC in respect of the QWC study pursuant to which the QWC engaged Seqwater to prepare a flood hydrology impact study for increasing the FSL of Wivenhoe dam by one metre.

Possible reduction in volume in dams

22. Exhibited to this statement and marked **PB-3** is a true copy of a letter from the Minister for Natural Resources, Mines and Energy and Minister for Trade (the ***Minister***) dated 25 October 2010 to the Grid Manager.

23. The Grid Manager sent the Minister's letter to me on 2 November 2010. Exhibited to this statement and marked **PB-4** is a true copy of the Grid Manager's letter.

24. My general understanding was that the focus of the Grid Manager in responding to the Minister's request was to seek to reduce the amount of time the bridges in the Brisbane Valley were inundated as a result of releases from Wivenhoe dam. When releases of water are made from Wivenhoe dam, there are a number of bridges in the Brisbane Valley which may be closed depending on the volume of the flow in the Brisbane River. Exhibited to this statement and marked **PB-5** is a copy of page 24 of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (the ***Wivenhoe Manual***), which shows the submergence flows for bridges in the Brisbane Valley.

25. Although Seqwater seeks to minimise these road closures, I am very aware that the closures cause inconvenience for residents in the Brisbane Valley.

26. Seqwater made a number of releases of flood water from Wivenhoe dam in the period from October 2010 to December 2010. These releases resulted in bridge closures during this period.

[redacted]

27. I remember at the time there were numerous calls from residents and Somerset Regional Council for the releases of flood water from Wivenhoe dam to cease.

28. By way of example, exhibited to this statement and marked **PB-6** is an email from Mr Bob Reilly of the Department of Environment and Resources Management (***DERM***) to me dated 22 December 2010.

29. I left the detail of the task of responding to the Grid Manager's request as referred to in paragraph 22 to Jim Pruss and his team. I was not involved in the preparation of the modelling work which Jim's team undertook, nor in the provision of the advice to the Grid Manager, but I was copied on some emails dealing with these issues.

30. Exhibited to this statement and marked **PB-7** is a true copy of emails from Seqwater to the Grid Manager dated 2 and 9 December 2010.

31. Exhibited to this statement and marked **PB-8** is a true copy of a letter from the Grid Manager to the Minister dated 24 December 2010. The first time I saw this letter was in January 2011.

32. Exhibited to this statement and marked **PB-9** is a copy of an email I received from the QWC which was sent to the Grid Manager on 24 December 2010. It was a reply to an email from the Grid Manager which I was not copied on.

33. Exhibited to this statement and marked **PB-10** is an exchange of emails between me and the Grid Manager on 24 December 2010. Following this exchange of emails Mr Dennien of the Grid Manager called me and said that the Grid Manager's letter was not a direction to release water below FSL.

34. My best recollection is that I read the Grid Manager's letter and subsequent email and formed the view that given:

    (a) releases were already being made from Wivenhoe dam due to rain in December 2010;

    (b) my understanding of the modelling Seqwater had performed indicated that the minor reductions referred to by the Grid Manager would have no real benefit in terms of flood mitigation;

    (c) I had confirmed with the Grid Manager that the Grid Manager was not directing Seqwater to release the water; and

    (d) Seqwater was not able to release water from Wivenhoe dam below FSL without the approval of the Chief Executive of DERM or an amendment of the Moreton Resource Operations Plan,

    I decided not to progress the issues referred to in the correspondence from the Grid Manager at that time.

January 2011 Flood Event

35. I worked throughout the Christmas 2010 / New Year period, other than on the public holidays.

36. I was informed that the Flood Operations Centre had been mobilised on Thursday, 6 January 2011 following rain in the catchment.

[redacted] [redacted]

37. Following mobilisation of the Flood Operations Centre, I received copies of technical situation reports which were regularly issued by Rob Drury, Seqwater's Dam Operations Manager, Water Delivery. My understanding is that Mr Drury prepared the technical situation reports based on situation reports issued by the Flood Operations Centre during the flood event.

38. Later in the flood event, I also received copies of the situation reports issued by the Flood Operations Centre.

Discussions with the Flood Operations Centre

39. I have reviewed the entries in the Flood Event Log contained in the "January 2011 Flood Event Report on the Operation of Somerset Dam and Wivenhoe Dam dated 2 March 2011" which appear to relate to me. I cannot now remember the detail of those telephone discussions.

40. My best recollection is that I called the Flood Operations Centre either via the Flood Operations Centre landline or on the mobile telephones of the two Seqwater duty engineers for one of the following purposes:

    (a) to clarify information I read in a technical situation report;

    (b) to seek a better understanding of what was happening during the flood event, where things might get to and what contingency plans needed to be activated;

    (c) to seek further information so as to be able to communicate internally to the Seqwater Board or externally to the Grid Manager.

41. The Log records a number of discussions between me and the Flood Operations Centre on Tuesday, 11 January 2011. I was informed by the duty engineers early in the morning on Tuesday that they had decided to move to a strategy involving the protection of the Wivenhoe dam. I knew that this would involve significant releases from Wivenhoe dam which would cause damage to urban areas of Brisbane. The purpose of my telephone discussions with the Flood Operations Centre that day was as I have outlined above and to ensure that the duty engineers were doing what they could to minimise the volume of the releases from Wivenhoe dam. I felt it was important that I understood the rapidly changing environment and as a result made a number of calls to the Flood Operations Centre that day. In doing so, I did not seek to direct the engineers in any way or to influence their decision-making. I am not an expert in the workings of the Wivenhoe Manual and I had (and have) every confidence in the duty engineers. They are highly experienced and highly trained.

42. The Flood Event Log refers to various emails sent by me. Exhibited to this statement and marked **PB-11** is a bundle of true copies of those emails.

Other discussions

43. Under a draft communication protocol which applied during the flood event, Seqwater provided information to the Grid Manager to enable the Grid Manager to brief government agencies. As a result, I made many calls to Mr Barry Dennien and Mr Daniel Spiller of the Grid Manager and they made many calls to me. I cannot now recall the details of those conversations but they generally related to me briefing Mr Dennien or Mr Spiller with information to assist them in briefing government agencies.

[redacted]

44. During the flood event, I also had a number of telephone discussions with the Chairman of Seqwater to provide him with information regarding the event.

45. I also spoke with a number of other people including the Dam Safety Regulator, the Chief Executive of DERM and numerous other Seqwater employees in relation to issues arising in the flood event.

Ministerial Briefing

46. Exhibited to this statement and marked **PB-12** is a bundle of true copies of documents comprising a brief prepared by the Grid Manager and provided to the Minister on 16 January 2011 in preparation for an emergency Cabinet meeting on 17 January 2011. I saw these documents prior to them being provided to the Minister and I generally agreed with their contents.

47. I attended a meeting with the Minister on 17 January 2011. My best recollection of this meeting is that we walked through the documents comprising exhibit **PB-12**.

Events Following Flood Event – FSL Issues

48. On 20 January 2011, the Minister sent a letter to the Chairman of Seqwater, with a copy to me. Exhibited to this statement and marked **PB-13** is a true copy of that letter.

49. The letter from the Minister requested Seqwater to consider, amongst other things, the appropriate FSL for Wivenhoe dam.

50. On 25 January 2011, I attended a meeting with representatives of DERM, the Grid Manager and the Queensland Water Commission. I cannot recall the detail of the discussions in that meeting. I have checked my day book and I believe the page from it which is exhibited to this statement and marked **PB-14** are my notes of the meeting. My best recollection is that the discussion generally focussed on the contents of the letter from the Minister comprising exhibit **PB-11** and what our collective response to that letter would be.

51. On 27 January 2011, the Chairman of Seqwater sent a letter to the Minister. Exhibited to this statement and marked **PB-15** is a true copy of that letter.

52. On 31 January 2011, I attended a meeting with the Minister and a number of others. Jim Pruss attended with me. Mr Pruss took notes during the meeting. Following the meeting, Mr Pruss provided me with a copy of his notes and I read them. I believed they were a fair reflection of the discussion in the meeting although I would not have described Seqwater as having been directed to hold a press conference – my recollection is that it was a request. Exhibited to this statement and marked **PB-16** is a true copy of the notes.

53. On 1 February 2011, I attended a meeting with representatives from DERM, the Grid Manager and the Queensland Water Commission. Mr Pruss took notes during the meeting. Following the meeting, Mr Pruss provided me with a copy of his notes and I read them. I believed they were a fair reflection of the discussion in the meeting. Exhibited to this statement and marked **PB-17** is a true copy of the notes.

54. My clear recollection of the above discussions is that the State (through the Minister and the Chief Executive of DERM) wanted Seqwater to provide recommendations to the State on the issue of a temporary reduction in the level of Wivenhoe dam following advice from the Grid Manager and the

[redacted]

QWC in relation to water supply security. My understanding was that there was general agreement between the parties to the discussions that given the extreme nature of the flood event and the significant urban damage that had been suffered, the public would not tolerate another flood event and that any step which could be reasonably taken to the mitigate further flooding risk should be taken.

55. I caused Seqwater to undertake modelling of the flood mitigation benefits associated with a temporary reduction in the FSL of Wivenhoe dam. I understood that the Grid Manager and the QWC were considering the water supply security issues associated with a temporary reduction. These issues are not within Seqwater's role.

56. A concern for me throughout the discussions was to identify to the other relevant parties that the FSL for Wivenhoe dam was contained in the Moreton Resource Operations Plan and any decision to lower to level in Wivenhoe dam below FSL required regulatory changes. My view was that it was not appropriate for these matters to occur under the Flood Manual. I remain of that view.

57. On 4 February 2011, the Chairman of Seqwater sent a letter to the Minister. Exhibited to this statement and marked **PB-18** is a true copy of that letter. I agreed with the contents of that letter.

58. On 7 February 2011, I sent a letter to Mr Bradley, Director-General of DERM. Exhibited to this statement and marked **PB-19** is a true copy of that letter. The letter refers to a memorandum entitled "Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges" and to modelling underlying the analysis contained in the memorandum. This modelling was peer reviewed by independent experts, Sinclair Knight Merz (***SKM***). While I was not involved in the detail of the modelling work undertaken and reviewed by SKM, I had a general understanding of the output of the modelling work. Exhibited to this statement and marked **PB-20** is a true copy of two emails I have been provided regarding the review undertaken by SKM.

59. On 8 February 2011, I attended a meeting with the Chief Executive of DERM and others. Mr Pruss also attended and he took notes during the meeting. Following the meeting, Mr Pruss provided me with a copy of his notes and I read them. I believed they were a fair reflection of the discussion in the meeting. Exhibited to this statement and marked **PB-21** is a true copy of the notes.

60. On 9 February 2011, I received a letter from Mr Dennien confirming that the Grid Manager had no objection from a water security perspective to a temporary reduction in the lake level in Wivenhoe dam to 75 per cent of its FSL. Exhibited to this statement and marked **PB-22** is a true copy of that letter.

61. On 10 February 2011, I sent a letter to Mr Bradley stating that in light of:

(a) the Grid Manager's confirmation that it had no objection from a water security perspective to a temporary reduction in FSL;

(b) the extreme nature of the January 2011 flood event; and

(c) the appreciable flood mitigation benefits revealed by modelling undertaken by Seqwater,

Seqwater recommended that Wivenhoe dam's storage level be temporarily reduced to 75 per cent of its FSL. Exhibited to this statement and marked **PB-23** is a true copy of that letter.

[redacted]

[redacted]

62. On 11 February 2011, I received a letter from Mr Bradley agreeing to implement the temporary reduction to 75 per cent of Wivenhoe dam's FSL. Exhibited to this statement and marked **PB-24** is a true copy of that letter.

63. As outlined in Mr Bradley's letter, the temporary reduction in the level of Wivenhoe dam to 75 per cent of its FSL was implemented by way of:

(a) an amendment to the Moreton Resource Operations Plan – the gazettal of this amendment is exhibited to this statement and marked **PB-25**. The actual amendment to the Resource Operations Plan is shown in the first page of exhibit **PB-26** (see below);

(b) a revised interim program – exhibited to this statement and marked **PB-26** is a true copy of the revised interim program submitted by Seqwater and approved by the Chief Executive; and

(c) a deed of indemnity – exhibited to this statement and marked **PB-27** is a true copy of the deed of indemnity.

64. Exhibited to this statement and marked **PB-28** is a true copy of my letter to DERM dated 17 February 2011 attaching the revised interim program for approval.

65. Exhibited to this statement and marked **PB-29** is a true copy of the response from the Chief Executive.

66. The decision to temporarily reduce the level in Wivenhoe dam was announced by the Minister and me on 13 February 2011. Exhibited to this statement and marked **PB-30** is a copy of the Minister press release and Seqwater's press release.

67. On 14 February 2011, the QWC also confirmed that it had no objection to the temporary reduction to 75 per cent but that but that any permanent reduction would need to be considered critically as it would have an impact on supply, may result in the need for new infrastructure being brought forward and there could be an impact on future bulk water through an increase in operational costs. Exhibited to this statement and marked **PB-31** is a true copy of the letter from the QWC.

68. Seqwater replied to the QWC on 22 March 2011. Exhibited to this statement and marked **PB-32** is a true copy of my letter to the QWC.

69. On the same day, I sent a letter to the Grid Manager requesting advice as to whether the Grid Manager would object to the temporary arrangement remaining in place until 30 June 2011. Exhibited to this statement and marked **PB-33** is a true copy of that letter.

70. I received responses from the QWC and the Grid Manager on 25 March 2011. Exhibited to this statement and marked **PB-34** and **PB-35** are true copies those letters.

71. Following these letters from the Grid Manager and the QWC on 30 March 2011 I wrote to the Director General of DERM. Exhibited to this statement and marked **PB-36** is a true copy of that letter.

72. The effect of my letter to the Director General is that the temporary reduction to 75 per cent of Wivenhoe dam's FSL has now ended and flood releases will not be made from Wivenhoe dam until the lake reaches EL67.25 (FSL is at EL67).

[redacted] [redacted]

Moving Forward – FSL Issues

73. I refer to paragraphs 214 to 217 of Seqwater's opening submission. I agree with the statements made in those paragraphs.

74. Consideration of a reduction in the FSL of Wivenhoe dam could be accommodated within the QWC study which had been planned to consider an increase in FSL (which I refer to above in paragraphs 19 - 21). The QWC would have the responsibility for the overall co-ordination and the yield studies while Seqwater would undertake the flood studies. It would also be important (given the matters in paragraph 217 of Seqwater's opening submission) that Brisbane City Council, Ipswich City Council and Somerset Regional Council be involved. As with the earlier QWC study, a steering committee comprising officers from the QWC, Seqwater, the Department of Environment and Resource Management (***DERM***), the South East Queensland Water Grid Manager (the ***Grid Manager***), the Councils and necessary independent experts could be established.

Notes

75. Exhibited to this statement and marked **PB-37** is a copy of notes I have made in my day book and in my diary which relate to the matters included within the Requirement.

SWORN by **PETER CLARK BORROWS** on 1 April 2011 at Brisbane in the presence of:

[redacted]

Deponent

Solicitor [redacted]

[redacted]

IN THE MATTER OF
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY

A COMMISSION OF INQUIRY UNDER THE COMMISSIONS OF INQUIRY ACT 1950

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

STATEMENT OF PETER CLARK BORROWS

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

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"PB-1"

Australian Government

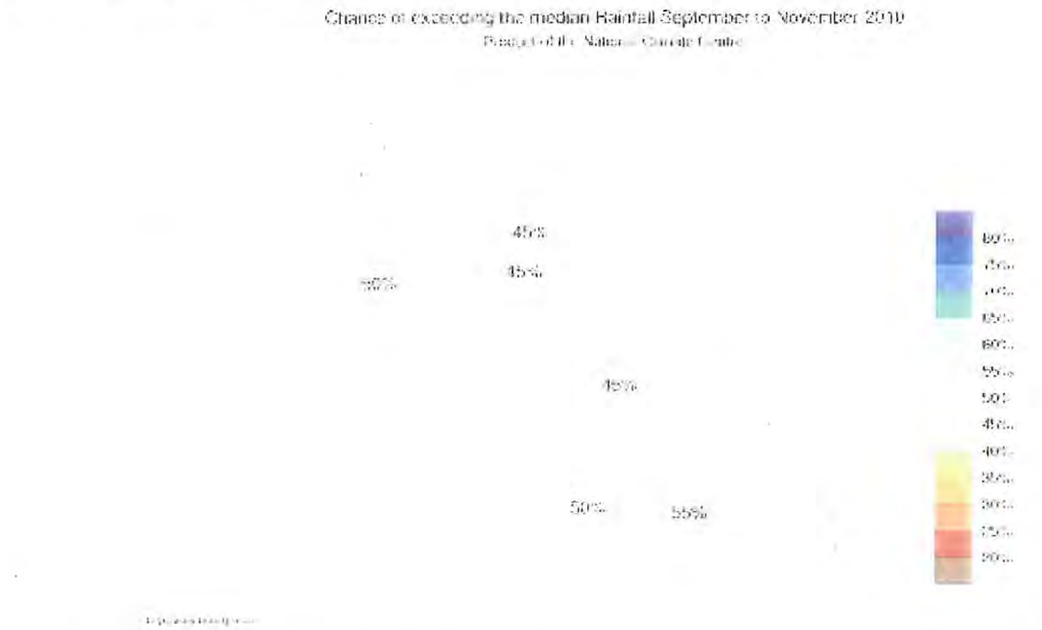
Bureau of Meteorology

Northern Aust Seasonal Rainfall Outlook: probabilities for Spring 2010, issued 24th August 2010

Neutral spring rainfall outlook for northern Australia

The north Australian outlook for total rainfall over spring (September to November) is neutral with the odds favouring neither drier nor wetter conditions.

The pattern of seasonal rainfall odds across Australia is dominated by the recent warm conditions in the Indian Ocean as well as a cooling trend in the equatorial Pacific Ocean associated with a La Niña.



For the September to November period, the chance of exceeding the median rainfall is between 45 to 55% across most of northern Australia. This means that for every ten years with ocean patterns like the current, about five years would be expected to be wetter than average in these parts of northeastern Australia during spring, with about five being drier.

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During spring, history shows this effect to be moderately consistent across most of the region (see background information).

Key Pacific Ocean and atmospheric indicators of ENSO remain at levels typical of a La Niña event. The majority of computer models indicate the central Pacific will continue to cool over the coming months, suggesting the La Niña will persist until at least the end of the year. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

More information on this outlook is available by contacting the Bureau's Climate Services sections in Queensland and the Northern Territory at the following numbers:

Brisbane - (07) 3239 8660

Darwin - (08) 8920 3813

July 2010 rainfall in historical perspective

May to July 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

This outlook is a summary. More detail is available from the contact people or from SILO (Seasonal Climate Outlook Products).

Probability outlooks should not be used as if they were categorical forecasts. More on probabilities is contained in the booklet *The Seasonal Climate Outlook - What it is and how to use it*, available from the National Climate Centre. These outlooks should be used as a tool in risk management and decision making. The benefits accrue from long-term use, say over 10 years. At any given time, the probabilities may seem inaccurate, but taken over several years, the advantages of taking account of the risks should outweigh the disadvantages. For more information on the use of probabilities, farmers could contact their local departments of agriculture or primary industry.

Model Consistency and Outlook Confidence: Strong consistency means that tests of the model on historical data show a high correlation between the most likely outlook category (above/below median) and the verifying observation (above/below median). In this situation relatively high confidence can be placed in the outlook probabilities. Low consistency means the historical relationship, and therefore outlook confidence, is weak. In the places and seasons where the outlooks are most skilful, the category of the eventual outcome (above or below median) is consistent with the category favoured in the outlook about 75% of the time. In the least skilful areas, the outlooks perform no better than random chance or guessing. The *rainfall* outlooks perform best in eastern and northern Australia between July and January, but are less useful in autumn and in the west of the continent. The skill at predicting seasonal *maximum temperature* peaks in early winter and drops off marginally during the second half of the year. The lowest point in skill occurs in early autumn. The skill at predicting seasonal *minimum temperature* peaks in late autumn and again in mid-spring. There are also two distinct periods when the skill is lowest - namely late summer and mid-winter. However, it must always be remembered that the outlooks are statements of chance or risk. For example, if you were told there was a 50:50 chance of a horse winning a race but it ran second, the original assessment of a 50:50 chance could still have been correct.

The *Southern Oscillation Index* (SOI) is calculated using the barometric pressure difference between Tahiti and Darwin. The SOI is one indicator of the stage of El Niño or La Niña events in the tropical Pacific Ocean. It is best considered in conjunction with sea-surface temperatures, which form the basis of the outlooks. A moderate to strongly negative SOI (persistently below −10) is usually characteristic of El Niño, which is often associated with below average rainfall over eastern Australia, and a weaker than normal monsoon in the north. A moderate to strongly positive SOI (persistently above +10) is usually characteristic of La Niña, which is often associated with above average rainfall over parts of tropical and eastern Australia, and an earlier than normal start to the northern monsoon season. The Australian impacts of past El Niño events since 1900 are summarized on the Bureau's web site (El Niño - Detailed Australian Analysis), and past La Niña events (La Niña - Detailed Australian Analysis)

Australian Government

Bureau of Meteorology

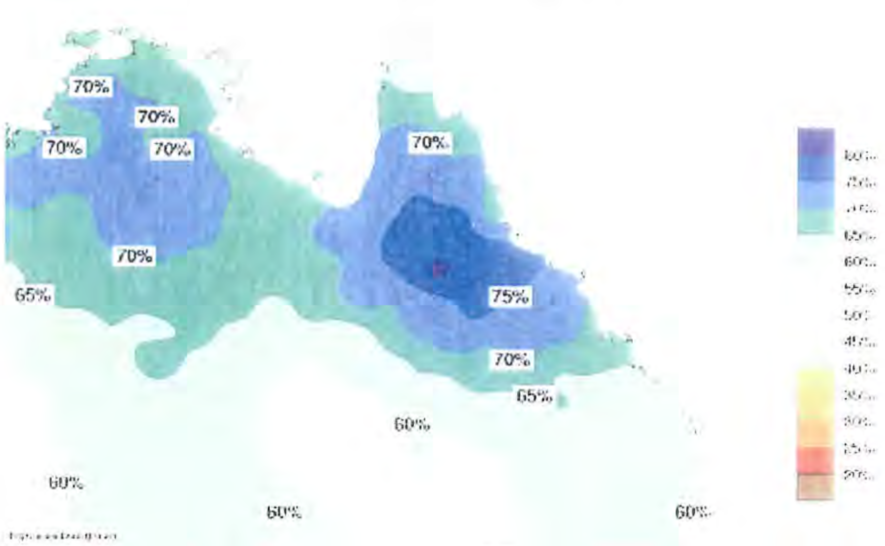
Northern Aust Seasonal Rainfall Outlook: probabilities for October to December 2010, issued 23rd September 2010

Wet start to season favoured for northern Australia

The northern Australian outlook for total rainfall over the start of the Wet Season (October to December), is favouring wetter conditions over all of Northern Territory and Queensland.

The pattern of seasonal rainfall odds across Australia is a result of recent warm conditions in the Indian Ocean as well as a cooling trend in the equatorial Pacific Ocean, both of which are associated with a La Niña event.

Chance of exceeding the median Rainfall October to December 2010



The chances of exceeding the median rainfall for October to December are over 60% over most of Queensland and the Northern Territory, with the odds increasing to over 70% in northern Queensland and NT (see map). This means that for every ten years with ocean patterns like the current, about seven years would be expected to be wetter than average over these areas, while about three years would be expected to be drier during the December quarter.

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During the October to December period, history shows this effect to be moderately consistent over much of northern Australia, the main exception being a part of southern Queensland where it is only weakly or very weakly consistent (see background information).

A La Niña event is now well established in the Pacific Ocean. Long-range models surveyed by the Bureau of Meteorology suggest the central Pacific will continue to exceed La Niña thresholds through spring, with the majority indicating the La Niña event will continue into at least early 2011. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

More information on this outlook is available by contacting the Bureau's Climate Services sections in Queensland and the Northern Territory at the following numbers

Brisbane - (07) 3239 8660

Darwin - [illegible]

3

THE NEXT ISSUE OF THE SEASONAL OUTLOOK IS EXPECTED BY 26[nd] October 2010

Corresponding temperature outlook

August 2010 rainfall in historical perspective

June to August 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

This outlook is a summary. More detail is available from the contact people or from SILO (Seasonal Climate Outlook Products).

Probability outlooks should not be used as if they were categorical forecasts. More on probabilities is contained in the booklet *The Seasonal Climate Outlook - What it is and how to use it*, available from the National Climate Centre. These outlooks should be used as a tool in risk management and decision making. The benefits accrue from long-term use, say over 10 years. At any given time, the probabilities may seem inaccurate, but taken over several years, the advantages of taking account of the risks should outweigh the disadvantages. For more information on the use of probabilities, farmers could contact their local departments of agriculture or primary industry.

Model Consistency and Outlook Confidence: Strong consistency means that tests of the model on historical data show a high correlation between the most likely outlook category (above/below median) and the verifying observation (above/below median). In this situation relatively high confidence can be placed in the outlook probabilities. Low consistency means the historical relationship, and therefore outlook confidence, is weak. In the places and seasons where the outlooks are most skilful, the category of the eventual outcome (above or below median) is consistent with the category favoured in the outlook about 75% of the time. In the least skilful areas, the outlooks perform no better than random chance or guessing. The *rainfall* outlooks perform best in eastern and northern Australia between July and January, but are less useful in autumn and in the west of the continent. The skill at predicting seasonal *maximum temperature* peaks in early winter and drops off marginally during the second half of the year. The lowest point in skill occurs in early autumn. The skill at predicting seasonal *minimum temperature* peaks in late autumn and again in mid-spring. There are also two distinct periods when the skill is lowest - namely late summer and mid-winter. However, it must always be remembered that the outlooks are statements of chance or risk. For example, if you were told there was a 50:50 chance of a horse winning a race but it ran second, the original assessment of a 50:50 chance could still have been correct.

The *Southern Oscillation Index* (SOI) is calculated using the barometric pressure difference between Tahiti and Darwin. The SOI is one indicator of the stage of El Niño or La Niña events in the tropical Pacific Ocean. It is best considered in conjunction with sea-surface temperatures, which form the basis of the outlooks. A moderate to strongly negative SOI (persistently below −10) is usually characteristic of El Niño, which is often associated with below average rainfall over eastern Australia, and a weaker than normal monsoon in the north. A moderate to strongly positive SOI (persistently above +10) is usually characteristic of La Niña, which is often associated with above average rainfall over parts of tropical and eastern Australia, and an earlier than normal start to the northern monsoon season. The Australian impacts of past El Niño events since 1900 are summarized on the Bureau's web site (El Niño - Detailed Australian Analysis), and past La Niña events (La Niña - Detailed Australian Analysis)

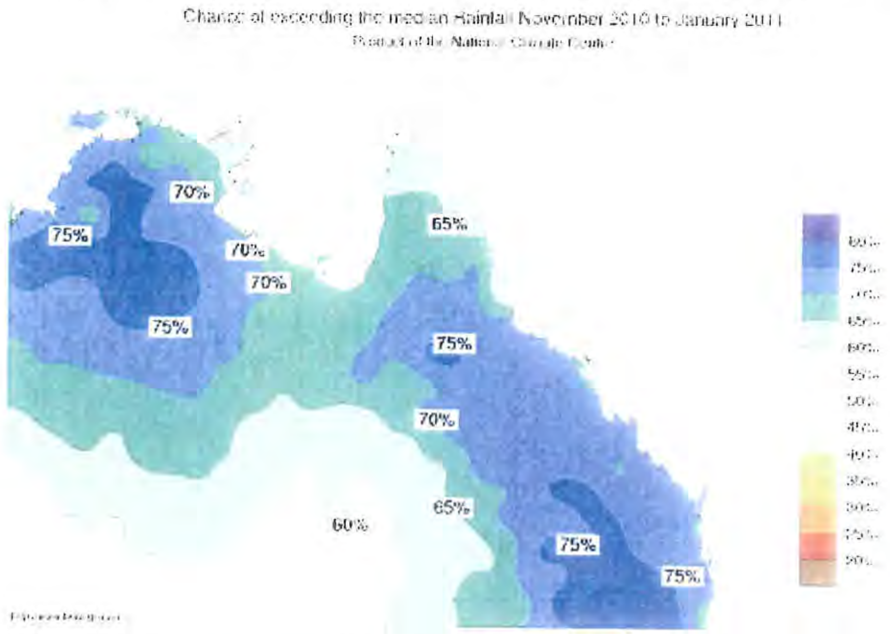
Australian Government
Bureau of Meteorology

Northern Aust Seasonal Rainfall Outlook: probabilities for November 2010 to January 2011, issued 26th October 2010

Wet conditions favoured for northern Australia

The north Australian outlook for total rainfall over the early Wet Season period (November-January), is favouring wet conditions throughout.

The pattern of seasonal rainfall odds across Australia is a result of warm conditions in the Indian Ocean, as well as cool conditions in the equatorial Pacific Ocean associated with the current La Niña event.



The chances of exceeding the median rainfall for November to January are over 60% for nearly all of northern Australia (see map). Odds increase to over 70% for the northern half of the NT, and the eastern parts of Queensland. This means that for every ten years with ocean patterns like the current, about seven years would be expected to be wetter than average over these areas, while about three years would be expected to be drier during the December quarter.

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During the November to January period, history shows this effect to be moderately consistent over much of Queensland and the Northern Territory (see background information).

A La Niña event remains well-established in the Pacific Ocean. All of the computer models indicate the central Pacific will remain at levels typical of a La Niña through the remainder of 2010, with the majority suggesting the La Niña event will persist at least into the first quarter of 2011. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

More information on this outlook is available by contacting the Bureau's Climate Services sections in Queensland and the Northern Territory at the following numbers:

Brisbane - (07) 3239 8660
Darwin - (08) 8920 3813

THE NEXT ISSUE OF THE SEASONAL OUTLOOK IS EXPECTED BY 23rd November 2010

Corresponding temperature outlook

September 2010 rainfall in historical perspective

July to September 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

This outlook is a summary. More detail is available from the contact people or from SILO (Seasonal Climate Outlook Products).

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Australian Government

Bureau of Meteorology

Northern Aust Seasonal Rainfall Outlook: probabilities for Summer 2010/2011, issued 23rd November 2010

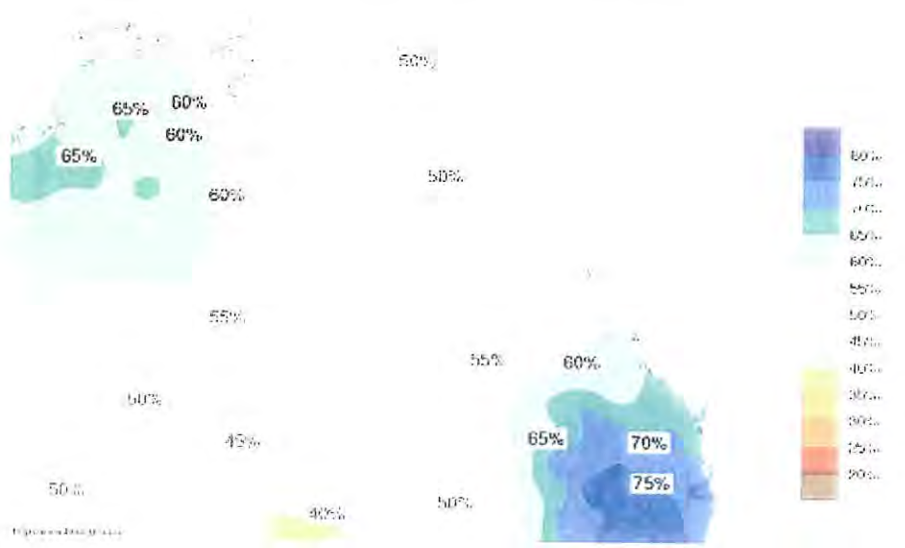
Wet conditions favoured for SE Queensland and northern NT

The north Australian outlook for total rainfall over the early to mid Wet Season period (December February), is favouring wet conditions in southeast Queensland and northern NT. Slightly drier conditions are favoured over southwest Queensland.

The pattern of seasonal rainfall odds across Australia is a result of warm conditions in the Indian Ocean, as well as cool conditions in the equatorial Pacific Ocean associated with the current La Niña event.

Chance of exceeding the median Rainfall December 2010 to February 2011

Product of the National Climate Centre



The chances of exceeding the median rainfall for December to February are over 60% for the northern NT and southeast Queensland. This means that for every ten years with ocean patterns like the current, about six years would be expected to be wetter than average over these areas, while about four years would be expected to be drier during summer.

In contrast, the outlook favours slightly drier conditions in southwestern Queensland with odds of exceeding the median rainfall below 45%.

For the southern NT and northern Queensland the outlook is neutral with odds around 50% of exceeding median rainfall. This means that the chance of a wetter than average summer are about as likely as the chance of below average conditions in these areas.

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During the November to January period, history shows this effect to be moderately consistent over much of Queensland and the Northern Territory (see background information).

A moderate to strong La Niña event remains well-established in the Pacific Ocean. All of the computer models indicate the central Pacific will remain at levels typical of a La Niña through the remainder of 2010 and will persist at least into the first quarter of 2011. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

Brisbane - (07) 3239 8660
Darwin - (08) 8920 3813

THE NEXT ISSUE OF THE SEASONAL OUTLOOK IS EXPECTED BY 17th December 2010

Corresponding temperature outlook

October 2010 rainfall in historical perspective

August to October 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

This outlook is a summary. More detail is available from the contact people.

Probability outlooks should not be used as if they were categorical forecasts. More on probabilities is contained in the booklet *The Seasonal Climate Outlook - What it is and how to use it*, available from the National Climate Centre. These outlooks should be used as a tool in risk management and decision making. The benefits accrue from long-term use, say over 10 years. At any given time, the probabilities may seem inaccurate, but taken over several years, the advantages of taking account of the risks should outweigh the disadvantages. For more information on the use of probabilities, farmers could contact their local departments of agriculture or primary industry.

Model Consistency and Outlook Confidence: Strong consistency means that tests of the model on historical data show a high correlation between the most likely outlook category (above/below median) and the verifying observation (above/below median). In this situation relatively high confidence can be placed in the outlook probabilities. Low consistency means the historical relationship, and therefore outlook confidence, is weak. In the places and seasons where the outlooks are most skilful, the category of the eventual outcome (above or below median) is consistent with the category favoured in the outlook about 75% of the time. In the least skilful areas, the outlooks perform no better than random chance or guessing. The *rainfall* outlooks perform best in eastern and northern Australia between July and January, but are less useful in autumn and in the west of the continent. The skill at predicting seasonal *maximum temperature* peaks in early winter and drops off marginally during the second half of the year. The lowest point in skill occurs in early autumn. The skill at predicting seasonal *minimum temperature* peaks in late autumn and again in mid-spring. There are also two distinct periods when the skill is lowest - namely late summer and mid-winter. However, it must always be remembered that the outlooks are statements of chance or risk. For example, if you were told there was a 50:50 chance of a horse winning a race but it ran second, the original assessment of a 50:50 chance could still have been correct.

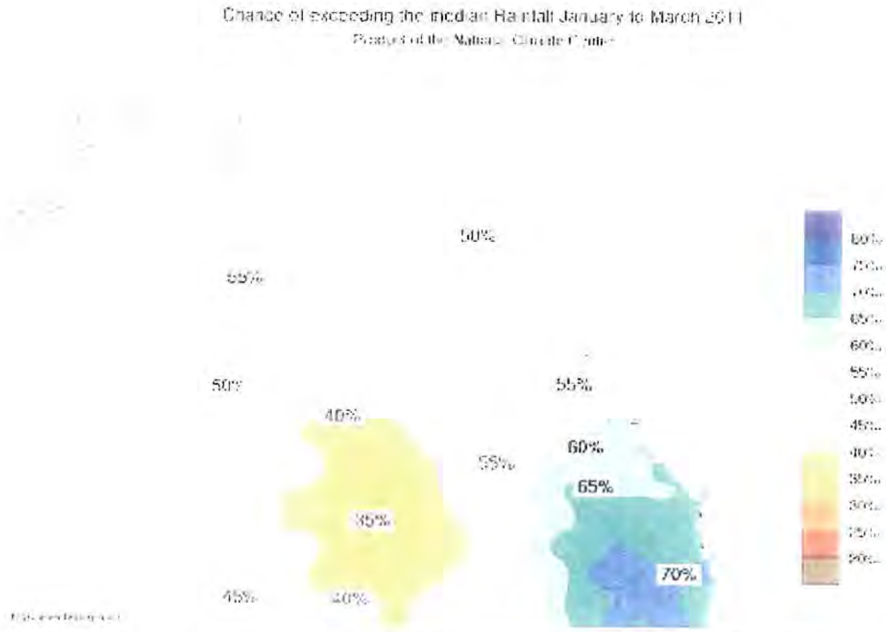
The *Southern Oscillation Index* (SOI) is calculated using the barometric pressure difference between Tahiti and Darwin. The SOI is one indicator of the stage of El Niño or La Niña events in the tropical Pacific Ocean. It is best considered in conjunction with sea-surface temperatures, which form the basis of the outlooks. A moderate to strongly negative SOI (persistently below −10) is usually characteristic of El Niño, which is often associated with below average rainfall over eastern Australia, and a weaker than normal monsoon in the north. A moderate to strongly positive SOI (persistently above +10) is usually characteristic of La Niña, which is often associated with above average rainfall over parts of tropical and eastern Australia, and an earlier than normal start to the northern monsoon season. The Australian impacts of past El Niño events since 1900 are summarized on the Bureau's web site (El Niño - Detailed Australian Analysis), and past La Niña events (La Niña - Detailed Australian Analysis)

Northern Aust Seasonal Rainfall Outlook: probabilities for January to March 2011, issued 17th December 2010

Wetter conditions favoured for SE Queensland

The north Australian outlook for the January to March period favours wetter conditions in southeastern Queensland.

The pattern of seasonal rainfall odds across northern Australia is a result of cool conditions in the central equatorial Pacific Ocean associated with the current La Niña; whilst recent warm conditions in the Indian Ocean have also contributed.



The chances of receiving above median rainfall during the January to March period are between 60 and 70% across southeastern Queensland. Such odds mean that for every ten years with similar ocean patterns to those currently observed, about six to seven years would be expected to be wetter than average over these areas, while about three to four years would be expected to be drier during this January to March period.

In contrast, the outlook favours drier conditions in southwestern Queensland with odds of exceeding the median rainfall below 40%, indicating an increased risk of drier conditions in these areas. However, this outlook should be used with caution in this area due to the low confidence levels (see below).

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During the March quarter, history shows the effect to be moderately consistent through eastern parts of Queensland, particularly in the southeastern parts. Elsewhere the effect is only weakly or very weakly consistent (see background information).

La Niña conditions continue to dominate across the tropical Pacific. Computer models surveyed by the Bureau suggest the current La Niña event will persist into at least the first quarter of 2011. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

More information on this outlook is available by contacting the Bureau's Climate Services sections in Queensland and the Northern Territory at the following numbers

Brisbane - (07) 3239 8660
Darwin - (08) 8920 3813

THE NEXT ISSUE OF THE SEASONAL OUTLOOK IS EXPECTED BY 20th January 2011

Corresponding temperature outlook

November 2010 rainfall in historical perspective

September to November 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

This outlook is a summary. More detail is available from the contact people.

Probability outlooks should not be used as if they were categorical forecasts. More on probabilities is contained in the booklet *The Seasonal Climate Outlook - What it is and how to use it*, available from the National Climate Centre. These outlooks should be used as a tool in risk management and decision making. The benefits accrue from long-term use, say over 10 years. At any given time, the probabilities may seem inaccurate, but taken over several years, the advantages of taking account of the risks should outweigh the disadvantages. For more information on the use of probabilities, farmers could contact their local departments of agriculture or primary industry.

Model Consistency and Outlook Confidence: Strong consistency means that tests of the model on historical data show a high correlation between the most likely outlook category (above/below median) and the verifying observation (above/below median). In this situation relatively high confidence can be placed in the outlook probabilities. Low consistency means the historical relationship, and therefore outlook confidence, is weak. In the places and seasons where the outlooks are most skilful, the category of the eventual outcome (above or below median) is consistent with the category favoured in the outlook about 75% of the time. In the least skilful areas, the outlooks perform no better than random chance or guessing. The *rainfall* outlooks perform best in eastern and northern Australia between July and January, but are less useful in autumn and in the west of the continent. The skill at predicting seasonal *maximum temperature* peaks in early winter and drops off marginally during the second half of the year. The lowest point in skill occurs in early autumn. The skill at predicting seasonal *minimum temperature* peaks in late autumn and again in mid-spring. There are also two distinct periods when the skill is lowest - namely late summer and mid-winter. However, it must always be remembered that the outlooks are statements of chance or risk. For example, if you were told there was a 50:50 chance of a horse winning a race but it ran second, the original assessment of a 50:50 chance could still have been correct.

The *Southern Oscillation Index* (SOI) is calculated using the barometric pressure difference between Tahiti and Darwin. The SOI is one indicator of the stage of El Niño or La Niña events in the tropical Pacific Ocean. It is best considered in conjunction with sea-surface temperatures, which form the basis of the outlooks. A moderate to strongly negative SOI (persistently below −10) is usually characteristic of El Niño, which is often associated with below average rainfall over eastern Australia, and a weaker than normal monsoon in the north. A moderate to strongly positive SOI (persistently above +10) is usually characteristic of La Niña, which is often associated with above average rainfall over parts of tropical and eastern Australia, and an earlier than normal start to the northern monsoon season. The Australian impacts of past El Niño events since 1900 are summarized on the Bureau's web site (El Niño - Detailed Australian Analysis), and past La Niña events (La Niña - Detailed Australian Analysis)

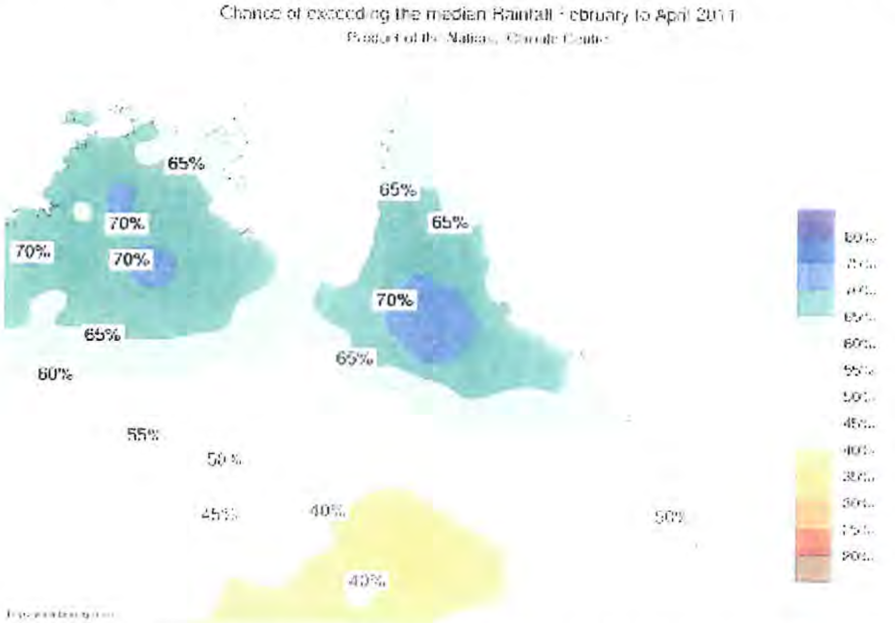
Australian Government
Bureau of Meteorology

Northern Aust Seasonal Rainfall Outlook: probabilities for February to April 2011, issued 20th January 2011

A wetter season favoured for northern Australia

The north Australian outlook for the end of the wet season (February to April) favours wetter conditions over most of the northern tropics.

The pattern of seasonal rainfall odds across northern Australia is mainly a result of cool conditions in the central equatorial Pacific Ocean, whilst recent warm conditions in the Indian Ocean have also contributed.



The chances of receiving above median rainfall during the February to April period are between 60 and 75% across the northern halves of the Northern Territory and Queensland (see map). Such odds mean that for every ten years with similar ocean patterns to those currently observed, about six to seven years would be expected to be wetter than average over these areas, while about three to four years would be expected to be drier during this February to April period.

However, over a small area in the far southwest of Queensland, the outlook favours drier conditions. The odds of exceeding the median rainfall is between 35 and 40% in this region. Such odds mean that for every ten years with similar ocean patterns to those currently observed, about six or seven February to April periods would be expected to be drier than average over this area, while about three or four years would be wetter.

An expanded set of seasonal rainfall outlook maps and tables, including the probabilities of seasonal rainfall exceeding given totals (e.g. 200 mm), is available on the "Water and the Land" (WATL) part of the Bureau's website.

Outlook confidence is related to how consistently the Pacific and Indian Oceans affect Australian rainfall. During the February to April period, history shows the effect to be moderately consistent across most of northern Australia, apart from southeastern Queensland where it is only weakly consistent (see background information).

Strong La Niña conditions persist across the tropical Pacific. Computer models surveyed by the Bureau suggest the current La Niña event will persist into the southern hemisphere summer. For routine updates and comprehensive discussion on any developments regarding El Niño and La Niña, please see the ENSO Wrap-Up.

Click on the map above for a larger version of the map. Use the reload/refresh button to ensure the latest forecast map is displayed.

More information on this outlook is available by contacting the Bureau's Climate Services sections in Queensland and the Northern Territory at the following numbers:

Brisbane (07) 3239 8660
Darwin (08) 8920 3813

THE NEXT ISSUE OF THE SEASONAL OUTLOOK IS EXPECTED BY 24th February 2011

Corresponding temperature outlook

December 2010 rainfall in historical perspective

October to December 2010 rainfall in historical perspective

Background Information

The Bureau's seasonal outlooks are general statements about the probability or risk of wetter or drier than average weather over a three-month period. The outlooks are based on the statistics of chance (the odds) taken from Australian rainfall/temperatures and sea surface temperature records for the tropical Pacific and Indian Oceans. They are not, however, categorical predictions about future rainfall, and they are not about rainfall within individual months of the three-month outlook period. The temperature outlooks are for the average maximum and minimum temperatures for the entire three-month outlook period. Information about whether individual days or weeks may be unusually hot or cold, is unavailable.

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"PB - 2"

seqwater
WATER FOR LIFE

10 January 2011

Karen Waldman
Chief Executive Officer
Queensland Water Commission
PO Box 15087
City East, Qld, 4002

Dear Karen,

Re: 'Flood Study by Seqwater on the raising of Wivenhoe Dam's full supply level' proposal

We refer to your letter of 17 December 2010 accepting our proposal to conduct a Flood Study on the raising of Wivenhoe Dam's full supply level under the terms outlined in your Terms of Reference for this project (both documents attached).

Seqwater are pleased to formally confirm and acknowledge that they will perform the services as outlined in the above documents and note that Seqwater will commence the project on 10 January 2011.

Should you have any further enquiries, please do not hesitate to contact Gareth Finlay, Senior Project Manager on [redacted]

Yours Sincerely

[redacted]

Peter Borrows
Chief Executive Officer

Queensland Bulk Water Supply Authority (trading as Seqwater) | ABN 75 450 239 876 | Corporate Office: Level 3, 240 Margaret Street Brisbane, Queensland | Ph 07 3035 5600 | www.seqwater.com.au

All correspondence to PO Box 16146 City East QLD 4002 Australia

Queensland Water Commission

Securing our water, together

Our ref: D/10/057763-1

17 DEC 2010

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr Borrows

I refer to the terms of reference 'Flood study by Seqwater on the raising of Wivenhoe Dam's full supply level', issued on 1 December 2010 and your response received on 15 December 2010.

The Queensland Water Commission accepts your proposal and seeks to enter into an agreement in accordance with the terms of reference and your proposal. This letter constitutes acceptance of your proposal and an agreement has now been formed. For the agreement to take effect, written acceptance is required.

A purchase order for the total value of $36 000 (GST exclusive) will be raised shortly. Please note the value of the purchase order, is for internal budgeting purposes only and does not reflect the payment that may be made to you under your agreement with the Queensland Water Commission.

Should you have any further enquiries, please do not hesitate to contact Mr Peter Sommer, Director Planning Projects on telephone [redacted]

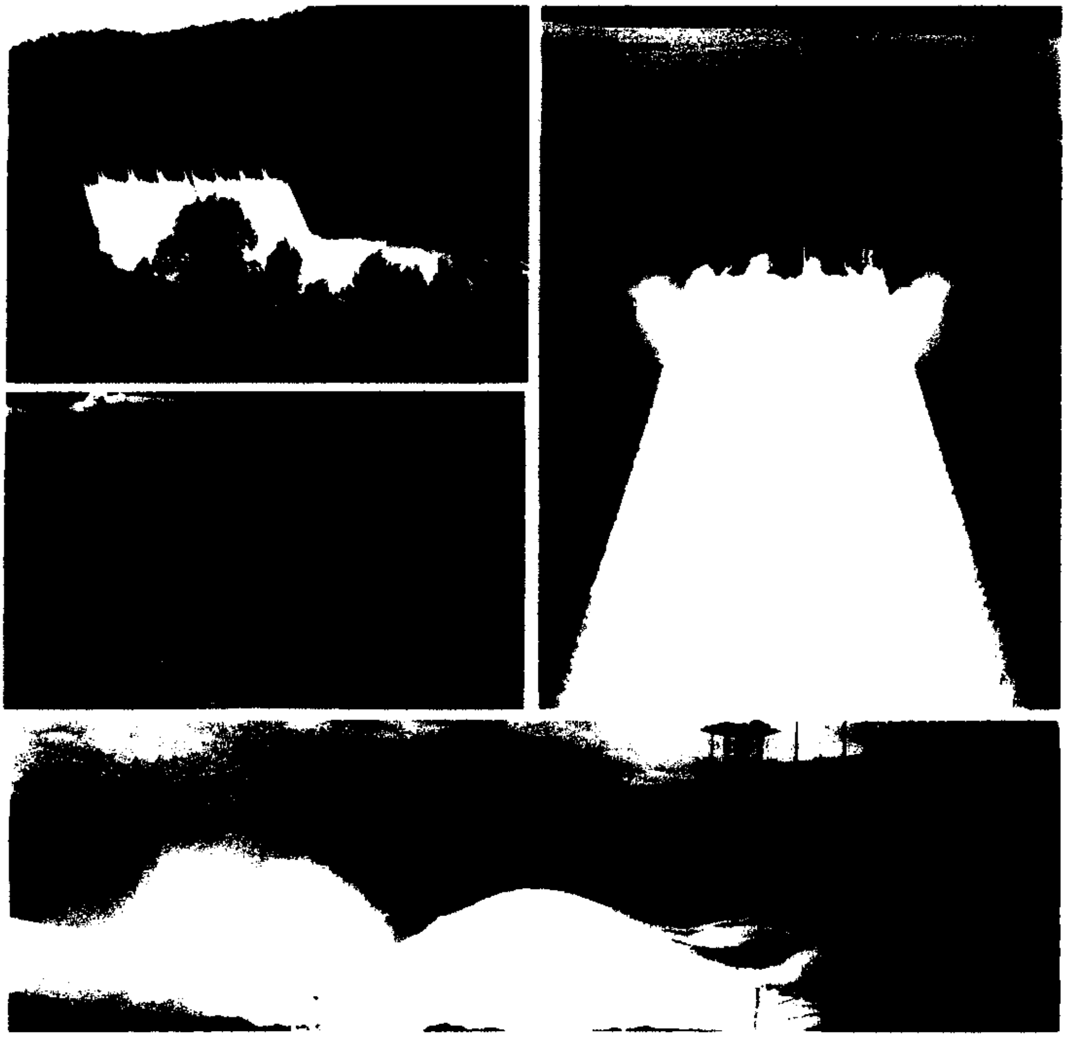
Yours sincerely

[redacted]

Ms Karen Waldman
Chief Executive Officer

Queensland Water Commission
PO Box 15087 City East Qld 4002
Ph. +61 7 3227 8207 Fax +61 7 3227 8227
ABN 65 242 908 036 **web: www.qwc.qld.gov.au**

Wivenhoe Dam Raising Operational Full Supply Level Study



Proposal

15 December 2010

Wivenhoe Dam Raising Operational Full Supply Level Study

Proposal

Queensland Bulk Water Supply Authority *trading as* Seqwater
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Ph (07) 3035 5500
Website | www.seqwater.com.au

Document Control					
Revision	Author	Reviewer	Approved for issue		
			Name	Signature	Date
A	Gareth Finlay	Robert Ientile			15 Oct. 10
B	Gareth Finlay	Robert Ientile			15 Dec. 10

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Introduction: Demonstrated Understanding of the Project Requirements

Queensland Water Commission (QWC) is project managing a holistic study into the feasibility of raising the operational Full Supply Level (FSL) for Wivenhoe Dam. QWC have requested a flood hydrology impact study from Seqwater for increasing the FSL by one metre. QWC intends to use the results as an input into a separate economic impact assessment study to quantify the annualised flood damages cost increase. These costs will be compared with the value of the additional water yield, which is the subject of another study being managed by QWC.

The Seqwater flood hydrology impact study will be conducted in two phases, with a decision hold point at the end of phase 1. The two phases being:

- Phase 1 – Prefeasibility Study – Wivenhoe Dam investigation of existing flood operating rules for operational full supply level 68 mAHD and run flood gate operations models
- Phase 2 – Prefeasibility Study – Wivenhoe Dam adjustment of Manual of Flood Mitigation flood gate operation rules for operational full supply level of 68 mAHD to minimise any potential adverse impacts

Seqwater will be using the design inflow hydrographs developed by the Wivenhoe Dam Alliance (2005) for both Phase 1 & 2. It is acknowledged that Brisbane City Council (BCC) completed the "Brisbane Valley Flood Damage Minimisation Study" in 2007. This study used different design inflows to the Wivenhoe Dam Alliance Study in 2005. This is likely to lead to differing results to BCC, notably the Q100 flood level in the urban areas downstream of Wivenhoe Dam. QWC will manage these differing results by:

- Being responsible for setting up the Steering Committee comprising key stakeholders. They have approached BCC and Ipswich City Council (ICC) to be part of Steering Committee to identify and clarify differences in the models and to provide assistance and feedback on the flood damage studies.
- Implementing a Phase 3 study if these Seqwater flood hydrology studies prove to be economically viable. The Phase 3 study will ensure the Dam Regulator, Seqwater, BCC and ICC sign off on the hydrological results before any decision to raise the operational FSL. It is anticipated this type of study and consensus will take at least 12 months to complete.

There is significant public relations and political pressure around raising the operational FSL. Public communication will be lead by QWC in consultation with Seqwater Manager Strategic Relations and Communications and the Councils.

Background

In March 2010 Wivenhoe Dam was approaching the drinking water storage full supply level (FSL) for the first time in over 9 years.

On the 10 March 2010 the media and LNP water spokesman Jeff Seeney questioned why 1450 GL of Wivenhoe Dam storage is set aside for flood mitigation storage. The Courier Mail quoted Jeff Seeney saying "if Wivenhoe filled in coming days, no water should be released until a review of storage policy was undertaken, as a 2 m increase in the dam FSL is the equivalent to the Tugan Desalination plant" (http://www.couriermail.com.au/news/plan-to-raise-wivenhoe-dam-storage-level-for-drinking-water/story-e6freon6-1225839328569).

On the 11 March 2010, Peter Borrows (Seqwater CEO) sent an External Memorandum to Dan Spiller (QWC Acting CEO) explaining the background work already completed around raising the Wivenhoe Dam Operational FSL and that Seqwater is best placed to project manage a study into the practicality of increasing the Operational FSL.

A project start up meeting was held on 19 March 2010 to begin the Wivenhoe Dam Raising Operational Full Supply Level Study. Subsequent meetings were held on 8 April, 13 April (Gareth Finlay (Seqwater) and Rolf Rose (QWC)), 22 April and 6 May.

QWC took on the role of Project Manager, initially appointing Rolf Rose and then Ian Pullar in a 2 day/week part time role. Gareth Finlay was appointed Seqwater's Project Coordinator.

Seqwater submitted a "Wivenhoe Dam Operational FSL Raising Flood Hydrology Working Group Terms of Reference" to QWC on the 28 April 2010.

QWC project managed the Yield Hydrology Group, lead by their consultant Owen Droop. On the 14 May 2010 QWC organised a presentation from Owen Droop. The basic conclusion from that presentation was that the yield could be increased ~1,000 ML p.a. Any larger increase would reduce the End of System flow to less than 67.2%, due to increases in evaporation in Wivenhoe with the larger surface area storage. As the yield fell well short of the desired 20,000 ML p.a. (Dan Spiller 10 March 2010, http://www.couriermail.com.au/news/plan-to-raise-wivenhoe-dam-storage-level-for-drinking-water/story-e6freon6-1225839328569) the project was considered unfeasible. The 67.2% End of System figure had been derived after extensive stakeholder consultation and it is unlikely to be reviewed for several years.

At the Queensland Government Estimates Committee June 2010 Hearings the Opposition Party asked, "why the operational level of the dam can't be increased?" The Government responded saying that QWC were investigating this option.

QWC sent a "DRAFT Raising Wivenhoe Dam Full Supply Level Progress Report version 1" on 24 June 2010, which indicated the increase in yield would be 5,000 ML p.a. for a one metre increase in FSL.

The QWC project management team recommended in there Commission Brief "undertaking the pre-feasibility study to determine if it is worth undertaking a detailed study. This was the desktop study of the flooding with no contact with land owners but to see if there is any benefit. There is only a limited amount that can be included in the report and ultimately the proposal needs assessment to determine its viability once and for all." (Rolf Rose email 5:30 pm 24 June 2010)

On the 19 July 2010 Seqwater forwarded comments on the "DRAFT Raising Wivenhoe Dam Full Supply Level Progress Report version 1" to QWC. The main comment was that QWC need to be aware that the project timelines for the flood hydrology that were developed for the 28 April 2010 Terms of Reference were no longer valid.

A Commission Brief for the Wivenhoe Dam FSL Raising Investigation was tabled at the Commission Meeting on 5 August 2010 and a number of minor changes were requested.

The report was approved out of session circa. 18 August and QWC requested an upper limit cost to complete Stage 1 & 2 of the 28 April 2010 Flood Hydrology Terms of Reference.

QWC organised a meeting on the 17 September with Seqwater and the Dam Safety Regulator, Peter Allen to define the scope more precisely for the flood hydrology brief.

Statutory Authority Details

Seqwater

The Queensland Bulk Water Supply Authority (QBWSA) was formed on the 30 September 2007. On the 2 May 2008, the QBWSA trading name was changed to Seqwater. Seqwater was set up by the Queensland State Government to own and operate the key urban and irrigation bulk water supplies infrastructure for South East Queensland.

On the 1 July 2008, fourteen State and Local Government entities transferred the ownership of their bulk water assets over to Seqwater.

The existing infrastructure Seqwater is taking responsibility for are 46 WTP, 24 Dams including Somerset and Wivenhoe Dams, and a range of related facilities and equipment across the region.

Contact Person: Mr Gareth Finlay

Position: Senior Project Manager

Postal Address: Seqwater
PO Box 16146
City East QLD 4002

Telephone: [redacted]

E-mail: [redacted]

Key Personnel and Availability

Gareth Finlay is the Seqwater point of contact for this project, with the key personnel and communication plan is as follows:

Project Steering Committee

Chair:	Peter Sommer
Members:	Rolf Rose
	Troy Kasper
	Rob Drury

Project Manager

Ian Pullar (Tue & Wed)
Rolf Rose (If Ian unavailable)

Seqwater Project Coordination

Gareth Finlay

Seqwater Project Director

Robert Ientile

Seqwater Project Team Members

Barton Maher
John Tibaldi
Terry Malone

Flood Hydrology Expert Panel

Chair: Seqwater – John Tibaldi
Members:

- Seqwater - Terry Malone, Cynthia Crane, Robert Drury and Barton Maher
- DERM - Dam Safety Regulator - Peter Allen and Ron Guppy
- DERM - Surface Water Group - John Ruffini
- Bureau of Meteorology - Peter Baddiley and James Stewart
- Brisbane City Council - Ken Morris
- Existing Operator, SunWater - Rob Ayre
- Independent Expert - John Mulheron
- QWC - Owen Droop

The key personnel for Seqwater for this project are listed below. All personnel are based in Brisbane or Karalee.

Gareth Finlay

Gareth Finlay is a Senior Project Manager with 13 years professional experience in the dam safety, hydrology modelling and project management of planning projects. His experience includes project managing dam safety and acceptable flood capacity hydrology modelling studies.

Robert Ientile

Robert Ientile is the Manager Project Delivery with 37 years experience in Electrical, Mechanical and Civil Engineering. His experience includes Senior Project Management and Project Director roles.

Troy Kasper

Troy Kasper is the Manager Integrated Asset Planning with 22 years professional experience in the water industry. His background has been in planning and delivery of water, wastewater and waste management infrastructure.

Rob Drury

Rob Drury is the Manager Dam Operations with 33 years professional experience in the water supply industry. His experience includes 10 years working for the Office for Water Supply (DERM) and 6 years Operations Manager for SEQWater and Seqwater, being responsible for Wivenhoe and Somerset Dam operations.

Barton Maher

Barton Maher is Principal Dams and Weirs Planning with 15 years professional experience in Dam Engineering, including dam design and dam safety planning, working with the NSW Public Works and Services Dams & Civil Group. In 2003, he moved to Brisbane to work on the Wivenhoe Alliance from 2003 – 2006 as the Design Manager for the Flood Security Upgrade of the Dam. Following completion of the Wivenhoe Upgrade he joined the South East Queensland Water Corporation as Operations Engineer from 2006 – 2008, before commencing with Seqwater in 2008.

John Tibaldi

John Tibaldi is a Civil Engineer with 30 years experience in the Queensland Water Industry. John has held roles in design, construction and operations working on major bulk water supply projects throughout Queensland, including Burdekin Dam, Wivenhoe Dam and most of Queensland's major irrigation and bulk water supply projects. John is one of Australia's most experienced civil engineers in relation to the management of flood operations at gated dams, having at various times been responsible for managing flood operations at eight major gated dams in Queensland and interstate.

For the last 15 years John has had responsibilities in flood management and operations at Wivenhoe and Somerset dams and is currently a Flood Operations Engineer for these dams as defined under the Water Supply Act 2008, one of a team of four. In 2009, John drafted the updated Manual of Flood Mitigation for Wivenhoe and Somerset Dams and this Manual was gazetted under the Water Supply Act 2008 in January 2010. As well as being an experienced civil engineer, John holds complementary tertiary qualifications in environmental impact assessment, infrastructure management, operations management, electrical engineering and computing.

John is currently responsible for Seqwater's dam safety management programs which include responsibilities for flood operations management at Seqwater's 25 dams and 52 weirs, responsibilities for water management and regulatory reporting in accordance with the Water Act 2000 and the Water Supply Act 2008 and management of Seqwater's hydrographic and seismic networks.

Terry Malone

Terry Malone is Principal Hydrologist, Dam Safety, and has over 25 years experience in operational and design hydrology in several states in Australia, working with the Bureau of Meteorology and SunWater before joining Seqwater in February 2009. He has also provided technical expertise in the development of flood forecasting systems for the Yangtze and Mekong Rivers.

Seqwater Hydrologist and Dam Safety Engineers are available to complete these studies. However, the personnel who will be completing the majority of this work are in Operations and may not be able to give the project adequate time if it is a wet summer and the dams are overflowing frequently. Their first priority is dam operations.

Methodology

Phase 1– Prefeasibility Study – Wivenhoe Dam Investigation of Existing Flood Operating Rules for Operational Full Supply Level 68 mAHD and Run Flood Gate Operations Models

The hydrological study will be conducted as follows:

- Base investigations on Wivenhoe Dam raised RL of 68.0 mAHD only, no other as QWC have advised this meets Resource Operation Plan Environmental Flow Objectives (ROP EFO's) and gives about 5,000ML extra yield as shown in the QWC document "Raising Wivenhoe Dam Full Supply Level Progress Report (June 2010, Version 1)"
- Utilise the same inflows as derived in the Wivenhoe Alliance Study 2005
- Utilise the existing gate operation model (based on Manual of Flood Mitigation formally gazetted in January 2010)
- Investigate incremental effects of frequent floods as well as the major floods as the frequent minor floods may be more relevant. Investigate modelling runs including but not limited to:
  - BCC Q100 development level flood
  - 1893, 1974, 1999
  - Maximum events
  - Events that impact fuse plugs, etc
  - Smaller recurrence interval floods

The pre-feasibility study will:

- Determine impacts on flows and levels downstream and upstream of various floods
- Identify impact on other areas, e.g. upstream inundation, rural landholders and urban impact
- Investigate Manual of Flood Mitigation (Jan 2010) operating rules to allow for FSL of 68.0 mAHD.
- Inform Flood Expert Panel (includes Dam Safety Regulator and BCC) of scope & results, this will include up to a maximum of two meetings

The following is outside the scope of Phase 1:

- Changes to Manual of Flood Mitigation (formally gazetted in January 2010)
- Hydrology modelling will not use BCC inflow hydrographs, which are different to Seqwater.
- Economic modelling for the flood impacts
- More than two meetings with the Flood Expert Panel

Output

The output from Phase 1 will be a "Preliminary Wivenhoe Dam Operating FSL EL68 mAHD Flood Impacts Report."

Format of the report will be similar to "SunWater Assessment of Wivenhoe Dam Full Supply Level on Flood Impacts (Dec 2007)."

A monthly progress report will be provided throughout this phase.

Decision Hold Point

QWC will assess the impacts and damage outcomes downstream compared to the benefits of the extra yield gained by the one metre FSL increase.

The decision to proceed with Phase 2 will be made by QWC in consultation with the Project Steering Committee.

QWC is responsible for authorising the commencement of Phase 2.

Seqwater reserve the right to reassess the Phase 2 pricing and timeframe, if the decision hold point is longer than 30 days.

Phase 2 - Prefeasibility Study - Wivenhoe Dam Adjustment of Flood Gate Operation Rules for Operational Full Supply Level of 68 mAHD to Minimise Any Potential Adverse Impacts

Phase 2 will build upon the work of Phase 1, by completing the following:

- Investigate options for adjusting the Manual of Flood Mitigation (Jan 2010) operating rules to reduce impacts downstream
- Evaluate possible impacts upstream of varying rules to minimise downstream impacts
- Inform Flood Expert Panel (includes Dam Safety Regulator and BCC) of scope & results, this will include up to a maximum of one meeting

The following is outside the scope of Phase 2:

- Hydrology modelling will not use BCC inflow hydrographs, which are different to Seqwater.
- Economic modelling for the flood impacts
- More than one meeting with the Flood Expert Panel

Output

The output from Phase 2 will be a "Preliminary Wivenhoe Dam Operating FSL EL68 mAHD Flood Impacts with Adjusted Flood Gate Operations Report."

Format of the report will be similar to "SunWater Assessment of Wivenhoe Dam Full Supply Level on Flood Impacts (Dec 2007)."

A monthly progress report will be provided throughout this phase.

Timeframe

The following timeframes are anticipated once formal engagement has been finalised by an exchange of letters between Seqwater and QWC:

- Phase 1 – 19 weeks
- Phase 2 – 8 weeks

The above timeframes include 3 weeks from Monday 20 December 2010 to Friday 7 January 2011, when no work is scheduled on this project.

Timeframe Risk

The following risks should be noted for the proposed timeframe:

- Seqwater Hydrologist and Dam Safety Engineers completing the studies work in Operations and may not be able to give the project adequate time if it is a wet summer and the dams are overflowing frequently. Their first priority is dam operations.
- If consultant hydrologists are required, they may divert there time to flood hydrology if it is a wet summer anywhere in Australia. They respond to floods when they happen, not in a long term schedule. Insurance companies are a common client.
- Peter Allen (Dam Safety Regulator) doesn't have confidence in consultants producing models/reports of sufficient quality to be signed off by the Dam Safety Regulator. Therefore it will be difficult to engage additional resources to complete the project in a shorter timeframe or control slippage if it is a wet summer and the dams are overflowing frequently.

Pricing Schedules

There are some ancillary benefits to Seqwater in completing Phase 1 & 2 of the project, so Seqwater will not be charging QWC for their internal employees' time.

The administration of compiling the reports and independent reviews may require consultancy support and their costs are as follows:

Table 1 – Administration Support and Independent Review of Flood Hydrology Study Costs

Position	Hours	Cost	
		$/hr	$
Phase 1 – Senior Hydrologist	50	$200/hr	$10,000
Phase 1 – Hydrologist Administration Support	36	$140/hr	$5,040
Phase 2 – Senior Hydrologist	50	$200/hr	$10,000
Phase 2 – Hydrologist Administration Support	36	$140/hr	$5,040
Contingency – 20% (Rounded Off)			$5,920
Total			**$36,000**

Seqwater will pass on the costs directly it is charged by the consultancies.

"PB-3"

Queensland Government

Ref CTS 19311/10

25 OCT 2010

Office of the
Minister for Natural Resources,
Mines and Energy and
Minister for Trade

Mr Gary Humphrys
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

Dear Mr Humphrys

I write in relation to seeking advice regarding options to and benefits of releasing water from key storages in anticipation of major inflows over the coming summer.

I understand that the key Water Grid storages are at 100 per cent of storage capacity going into the traditional wet season, with forecasts of higher than median rainfall and the prospect of multiple flood events.

I am also advised that our water supply is more secure than ever before, due to storages being full, key Water Grid projects completed and ongoing water efficiency.

I seek your urgent advice about whether this water security provides an opportunity to reduce the volume stored in key dams as a means of reducing the severity, frequency and duration of flooding in downstream areas.

In doing so, I note that recent releases from Wivenhoe Dam have resulted in significant inconvenience and isolation for residents in some downstream areas. With the catchments saturated, I understand that even quite minor rainfall events will result in further water releases and further inconvenience for these residents.

By end November 2010, I would appreciate your advice as to the available options and the likely benefits. At a minimum, you should review the operation of Wivenhoe, North Pine and Leslie Harrison dams. At least for Leslie Harrison Dam, this would be a return to standard operating procedures prior to the drought, when the dam was routinely drawn down to 95 per cent of capacity to minimise the impacts of storms on downstream residents.

I also seek your confirmation that these options would not significantly impact upon our current water security, measured as the probability of needing to reintroduce Medium Level Restrictions over the next five to ten years.

Level 17
61 Mary Street Brisbane 4000
PO Box 15216 City East
Queensland 4002 Australia
Telephone +61 7 3225 1861
Facsimile +61 7 3225 1828
Email nrmet@ministerial.qld.gov.au
ABN 65 959 415 158

Queensland Government

Office of the
Minister for Natural Resources,
Mines and Energy and
Minister for Trade

I emphasise that this is only a temporary measure, reflecting that dams are full prior to the commencement of the traditional wet season. I expect that your advice will include a clear date or trigger beyond which dams will be allowed to fill to their full supply level.

Thank you in advance for your assistance.

Should you have any further enquiries, please feel welcome to contact Mr John Bradley, Director General, Department of Environment and Resource Management on [redacted]

Yours sincerely

STEPHEN ROBERTSON MP

Level 17
61 Mary Street Brisbane 4000
PO Box 15216 City East
Queensland 4002 Australia
Telephone +61 7 3225 1861
Facsimile +61 7 3225 1828
Email nrmet@ministerial.qld.gov.au
ABN 65 959 415 158

"PB-4"

Completed For file.

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/10/7049

2 November 2010

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Peter

I write to seek your advice about options to, and benefits of, releasing water from key storages in anticipation of major inflows over the coming summer.

The Minister has sought our urgent advice about whether current water security provides an opportunity to reduce the volume stored in key dams as a means of reducing the severity, frequency and duration of flooding in downstream areas. I have attached a copy of his request for your information. You will note that he has highlighted that this is a temporary measure only.

To meet this deadline, I would appreciate your advice about options by 19 November 2010. We can then undertake an assessment of the impact of these options on water security, before jointly preparing advice to the Minister with you.

I understand that Mr Daniel Spiller, Director Operations, has already advised your officers of this request and that investigations have commenced. However, please advise if you have concerns about your ability to meet the above timeframes.

Please do not hesitate to call Dan on [redacted] if you have any queries or require any further information.

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

Enclosed: Letter from Stephen Robertson MP regarding release of water from key storages

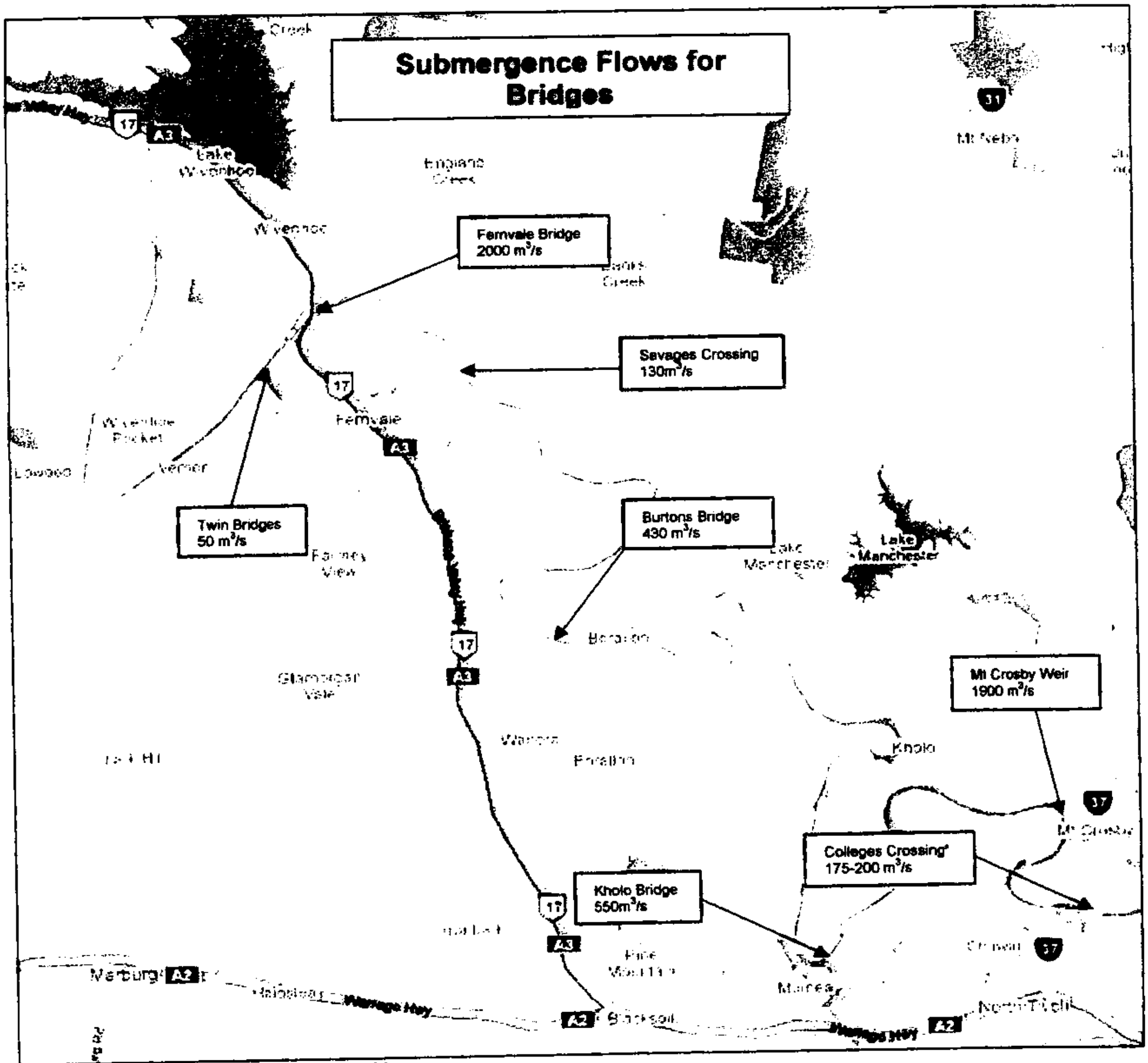
PO Box 16205, City East QLD 4002 [redacted] www.seqwgm.qld.gov.au
ABN: 14 783 317 630

"PB-5"

Strategy W1 - The Primary Consideration is Minimising Disruption to Downstream Rural Life

Conditions	• **Wivenhoe Storage Level predicted to be less than 68.50 m AHD** • **Maximum release predicted to be less than 1,900 m^3/s** • **The primary consideration is minimising disruption to downstream rural life**

The intent of Strategy W1 is to not to submerge the bridges downstream of the dam prematurely (see Appendix I). The limiting condition for Strategy W1 is the submergence of Mt Crosby Weir Bridge that occurs at approximately 1,900 m^3/s.



* Note: Colleges Crossing is affected by tides

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"PB-6"

From: Reilly Bob [redacted]
Sent: Wednesday, 22 December 2010 9:27 AM
To: Peter Borrows
Cc: Dennien Barry [redacted] Lyons Michael [redacted] Rob Drury; Best Debbie
Subject: Wivenhoe floodwater releases: impacts on access arrangements for people

Hi Peter

The nature of the flood releases is such that a certain number of low level crossings are submerged for a longer period of time, than would be the case in the absence of the releases.

For many of the people whose access may be affected by the floodwater releases, alternative (albeit with longer travel times) access arrangements, are available.

However, are their people who do not have alternative access arrangements? If so, roughly how many, and in what locations? Has Council/Seqwater provided them with some support arrangements to deal with these access issues?

The reason I ask is that is one thing to ask for such people to be inconvenienced (in the absence of some support arrangements) for a few days once every 5 to 10 years, but it is another matter if these events occur on a monthly (or more frequent basis) basis—as may well happen over the next few months.

If you could give me a ring to discuss the matter later this week, then that would be appreciated.

Thanks

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au

"PB-7"

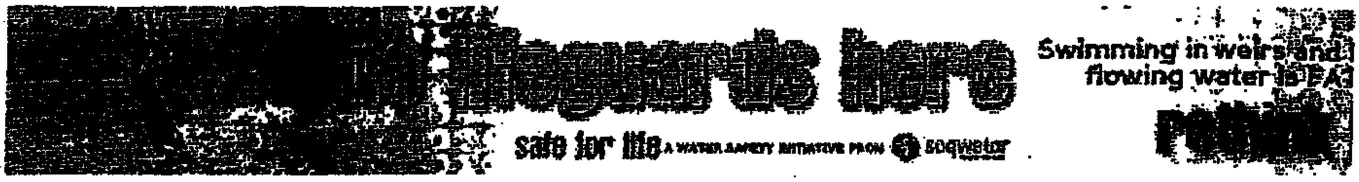
Brooke Foxover

From: Rob Drury
Sent: Thursday, 2 December 2010 3:11 PM
To: 'Barry Dennien'; Jim Pruss
Cc: Peter Borrows
Subject: RE: Dam levels - Investigation

Barry,
Attached is our DRAFT reply on possibility and impact of lowering dam levels on floods for your review and any comments.

Rob

Robert Drury
Dam Operations Manager
Water Delivery
·eensland Bulk Water Supply Authority *trading as* Seqwater



Ph [redacted]
Wivenhoe Dam, Brisbane Valley Highway, via Fernvale Q4306 Australia
PO Box 37, Fernvale QLD 4306
Website | www.seqwater.com.au

From: Barry Dennien [redacted]
Sent: Wednesday, 1 December 2010 11:56 AM
To: Jim Pruss; Rob Drury
Subject: Dam levels - Investigation

Jim Rob

Hope all is well.

Just following up on our discussions with regards dam levels and flood impacts. Anything I can do to help?

We are due to get back to the Minister by the end of November.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street; Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Summary of comments

The attached paper summarises an analysis that changing the initial storage level of dams has on downstream flood impacts.

Wivenhoe/Somerset System

The analysis shows that for some minor floods similar to October 2010, reducing the starting volume of Wivenhoe Dam by 5% or 10% has minimal impacts on impacts downstream. The main benefit being that inundation times for downstream bridges will be reduced but only by around15%. However peak water levels are not affected. There are minimal potential benefits to downstream bridge until dam levels are reduced down to about 50% of capacity.

These results are not unexpected as Wivenhoe has such a large flood storage. Adding say 100,000ML to the flood storage (equates to reducing the storage volume by 10%) does not appreciably increase this available flood storage.

It should also be noted that in many cases, Wivenhoe flood releases will be made following the peaks of inflows into the Brisbane River from the Lockyer and Bremer Catchments. Certainly during many events, Lockyer Creek could already have inundated most or all of the road crossings downstream of Wivenhoe Dam. In these instances, a small amount of additional flood storage in the dam provides minimal benefit.

Another option considered was pre-releasing Wivenhoe water in anticipation of a flood event. This is not considered a viable option for the following reasons:

- Regardless of forecast, there is never any certainty on the amount of rain that will fall within a dam catchment. For example, on 29 November 2010, the quantitative forecast from BOM for the Wivenhoe Catchment was 25 to 50 millimetres. Actual rainfall received was in the order of 10 millimetres. On a saturated catchment this could equate to a runoff discrepancy of hundreds of thousands of megalitres. A pre-release of anticipated flood water based on forecast could result in major embarrassment.
- Any significant pre-release of water would result in bridge inundation below Wivenhoe Dam.
- Any pre-release of water from Wivenhoe Dam will take at least 24 hours to reach the lower end of the Brisbane River system. Rains occurring in the catchments below the dam over this period could potentially worsen downstream flood impacts.

The Bureau of Meteorology has been contacted and they have confirmed the above forecast reliability assessment. They advised that, whilst weather prediction models are steadily improving, the forecast of rainfall amounts over catchment time/space scales is recognised as one of the most challenging/difficult tasks. Detailed rainfall forecasting is not deterministic - the uncertainties involved are often expressed in probablistic forecasts and whilst there is often the ability to forecast the potential for a significant rain event to occur in the southeast Qld-northern NSW region, it is difficult (if not impossible) to predict the actual location of the heaviest rain, even with only a few hours notice.

The Queensland Director of Dam Safety (Mr Peter Allen) was contacted and he confirmed the assessment that minor reductions in the stored volume of Wivenhoe Dam would have minimal impacts on floods downstream and concurred with the risks involved in any pre release of significant volumes of water from dams prior to an event.

North Pine and Leslie Harrison Dams

Lowering the normal FSL for North Pine and Leslie Harrison Dams will have minimal impact on major floods and may not decrease releases depending on the size of even minor events. However lowering the level of North Pine Dam after a flood release to between 95% and 100% may reduce the frequency of operations in some rain events although the main benefit is in operational efficiency as it provides more time for response and may reduce making releases in a minor storm event.

Similarly reducing Leslie Harrison level to around 95% after or before an event could assist in reducing call out of staff and manning the storage for minor releases and even the timing of releases.

Normally both dams are returned to just under 100% after an event based on base inflows still occurring and possible further rain. Allowing the dams to reduce to around 95% improves the operational leeway. However this could best be provided by an operational arrangement where the WGM simply agrees Seqwater has the operational latitude to reduce both storages to between 95% and 100% after an event or when there is some inflow and Seqwater can decide the exact level based on ongoing inflows and possible predicted rainfall, but not going below 95%.

DAM FULL SUPPLY LEVEL (FSL) INVESTIGATIONS
SEQWATER GATED STORAGES

INTRODUCTION

The following short paper examines the issues associated with temporary lowering the full supply levels of Seqwater's gated dams to improve short term flood mitigation benefits. The paper considers Wivenhoe Dam, Somerset Dam, North Pine Dam and Leslie Harrison Dam.

WIVENHOE DAM AND SOMERSET DAM

Wivenhoe Dam and Somerset dam control only 50% of the Brisbane River catchment (Bremer River and Lockyer Creek catchments are not controlled), therefore the Flood Mitigation benefits provided by the dam will depend on the rainfall distribution experienced during a flood event. This makes it difficult to quantify exactly the benefits of lowering the storage in anticipation of possible flood rains.

There are primarily two types of flood events that may occur in the Brisbane River Catchment. There are the smaller events that impact primarily on the rural bridges upstream of Moggill and the larger events that impact on urban areas in Brisbane. The threshold that separates these two events is a river flow of around 3500 cubic metres per second at Moggill. To understand the possible benefits of lowering the storage to reduce flooding impacts, it makes sense to discuss these two types of events separately.

Events Impacting on Bridges (Moggill Flow < 3500m^3/s) – Limited Urban Impacts

In recent history, flood events of this nature occurred in April 1989, February 1999 and October 2010. The flow characteristics of events of this type are shown in the following table.

Event	Wivenhoe Dam					
	Starting Level		Volume Of Inflow	Volume Of Outflow	Peak Outflow	Peak Water Level
	m AHD	%	ML	ML	m3/s	m AHD
Early April 1989	67.06	>100	690,000	690,000	1,620	69.78
Late April 1989	67.00	100	870,000	820,000	1,490	71.45
February 1999	63.92	<100	1,220,000	900,600	1,800	70.45
October 2010	67.03	>100	640,000	640,000	1,300	69.65

The October 2010 event was examined to determine the benefits of lowering the storage level. This event commenced with the dam at FSL. The event was examined with the dam at 95% capacity, 90% capacity, 80% capacity, 50% capacity and empty at the commencement of the event. The results are shown in the following table. When reading the table it is important to understand that the bridges are impacted not just by outflows from Wivenhoe, but also by flows from the uncontrolled areas of the river catchment. Accordingly, the location of a bridge within the system will dictate the size of catchment area that will impact on the bridge. All inundation times shown in the table are approximations only, made for the purposes of this investigation.

Dam Percentage Full at Event Commencement	Approximate Duration of Wivenhoe Radial Gate Releases/ Twin Bridges Inundation (hours)	Approximate Duration of Savages Crossing and Colleges Crossing Inundation (hours)	Approximate Duration of Burtons Bridge and Kholo Bridge Inundation (hours)	Peak Flow at Moggill (m^3/s)
100%	230	247	183	1848
95%	187	214	183	1848
90%	185	214	183	1841
80%	172	214	183	1786
50%	130	214	153	1722
0%	0	189	38	940

The table shows that the reduction in FSL won't have a large impact on Bridge inundation times. A reduction in the order or 36 hours or 15% of the total inundation time may be possible for the low level bridges only. The reductions are generally caused by the delay in release commencement associated with the lower starting FSL. However, the bridges can often already inundated at this time anyway due to flood inflows into the Brisbane River from the 50% of the catchment not controlled by Wivenhoe Dam. Lowering the FSL of the dam has no impact on such inundations as shown in the table.

For events smaller than those considered above, it should be noted that the Manual of Flood Mitigation allows a trigger level buffer of 27500 megalitres above FSL and this has the effect of protecting Twin Bridges and the lower level bridges from inundation as a result of minor events. Twin Bridges is essentially a low level causeway that is inundated following any radial gate release. This inundation could possibly be prevented by raising the bridge deck level. Regardless, the areas accessed using this bridge can also be accessed using the Fernvale Bridge. It is acknowledged however that the closing of Twin Bridges causes inconvenience to local residents, as it adds approximately another five kilometres to the journeys to and from their residences. Approximately 40 residences and several businesses (primarily turf farms) are impacted.

Events Impacting on Urban Areas (Moggill Flow > 3500m^3/s) – All rural bridges inundated

Events of this nature have not been experienced since the construction of Wivenhoe Dam was completed in 1984, with the last event of this nature being experienced in 1974. The inflow volume into Wivenhoe Dam associated with the 1974 event has been estimated to be in the order of 1.5 million megalitres. However during the 1974 event, an additional 1.5 million megalitres of flood flow impacting of the urban areas of Brisbane originated from catchment areas that are not controlled by Wivenhoe Dam.

For events of this nature, it is unlikely that peak water levels in Brisbane would be significantly impacted by minor reductions in the level of Wivenhoe Dam. Certainly reductions in dam volume in the order of at least 250000 megalitres would be needed to provide any significant reduction in water level peaks experienced in urban areas. Additionally, reductions in the FSL of this order would not necessarily guarantee reductions in urban flood levels, as the effectiveness of Wivenhoe Dam in reducing urban flood levels is directly dependant on the distribution of rainfall in the Brisbane River catchment during a flood event (Wivenhoe Dam controls only 50% of the total Brisbane River catchment) and the spacing between individual flood events.

NORTH PINE DAM

North Pine Dam has no flood mitigation potential. Unlike Wivenhoe Dam, once the dam has reached FSL, all water flows into the dam must be released to protect the structural safety of the dam.

Any radial gate operation at North Pine Dam to release flood water, results in inundation of Youngs Crossing Road, so lowering the FSL is problematic and may best be achieved by increasing the daily water diversion to the North Pine Dam Water Treatment Plant. There are river release valves that allow some water to be drained from North Pine Dam without inundating Youngs Crossing. These valves have been operated continuously since the recent gate releases to manage residual inflows into the dam. However outflows from these valves are restricted to flows in the order of several hundred megalitres per day as larger flows will adversely impact on Youngs Crossing. Certainly a small reduction in the level of North Pine Dam is potentially beneficial in preventing closures of Youngs Crossing Road associated with small storm events.

It should be noted however that Youngs Crossing Road is also impacted by uncontrolled flood flows from Lake Kurwongbah and local storm run-off. In recent times Youngs Crossing Road has been closed by flood water during times when no water releases were being made from North Pine Dam, but when storm rains resulted in flood flows from uncontrolled areas of the catchment.

The table below gives an indication of the rainfall required to operate for NPD:

Level	Capacity			Rainfall Required to Operate	
				Wet Conditions	Dry Conditions
	m AHD	%	ML	mm	mm
FSL	39.60	100.0%	214,302	5	60
Reduced FSL	39.10	95.0%	203,618	35	100

Recent changes to the Manual of Flood Mitigation for North Pine Dam allows for some ability to retain up to 2500 megalitres of water to reduce impacts on Youngs Crossing Road, provided favourable weather forecasts are experienced. However the preferred option to reduce public inconvenience associated with storm events would be to raise the flood immunity of the river crossing on Youngs Crossing Road. This crossing is primarily a low level causeway that is potentially unsuitable given the volume of traffic that now uses this crossing on a daily basis.

LESLIE HARRISON DAM

Similar to North Pine Dam, Leslie Harrison Dam has no flood mitigation potential. Once the dam has reached FSL, all water flows into the dam must be released to protect the structural safety of the dam.

The dam is relatively small with a total full supply storage volume of only 24800 megalitres, against an inflow volume during a 72 hour 1 in 50 year storm event of over 30000 megalitres. Flood gate operations at Leslie Harrison Dam do not impact on public roads and generally only inconvenience the general public during large flood events. Reductions in this inconvenience cannot be achieved by small reductions in dam storage level.

Message: RE:

Case Information:

Message Type:	Exchange
Message Direction:	External, Outbound
Folder:	AAR Urgent Request
Capture Date:	28/03/2011 1:11:25 PM
Item ID:	1717505
Policy Action:	Not Specified

Mark History:
No reviewing has been done

Policies:
No Policies attached

RE:

From Rob Drury **Date** Thursday, 9 December 2010 12:11 PM
To Barry Dennien; Jim Pruss
Cc Dan Spiller; Peter Borrows

image001.jpg (69 Kb HTML) **image002.png** (7 Kb HTML)

Barry,

To question 1, no it wasn't modelled mainly because the bigger the event, the much less impact of the reduced FSL. But yes to Question 2 in that this was considered. However the following may help summarise and also offer a way to give the proposal a more detailed analysis in the future.

Basically, there are an unlimited number of scenarios containing an infinite number of rainfall patterns and distributions producing flood events in the Brisbane River for flows both above and below 3500 cumecs. Seqwater has not attempted to model each scenario in the discussion paper or even a variety of scenarios. A major study would be required to undertake this exercise and the study that Seqwater has been commissioned to undertake for the Water Commission relating to raising the Wivenhoe Dam Full Supply Level will consider these issues. This study is scheduled to commence in the new year and take in the order of six months.

The main point to be noted from the discussion paper is that having a relatively small volume of water to fill below the dam FSL provides only limited benefits and the larger the flood, the smaller these benefits will potentially be (although unusual rainfall patterns could produce exceptions). The reason for the reducing potential benefit as flood size increases is due to the reducing proportion of the available volume below FSL to the total flood volume. The other factor is that the available storage volume below FSL is generally only a very small proportion of the total flood storage unless the dam is below around 50% capacity.

Generally although the lower Wivenhoe Dam is at the commencement of the event, the smaller the downstream impacts, as the events get bigger the impact reduction will generally decrease and may be insignificant. And during smaller events, the impact is less significant anyway. Quantifying the exact size of the potential benefit for a range of scenarios will take a major study and as previously discussed, this work will commence in the new year.

Hence to gain any significant benefit, Wivenhoe would have to be considerably lower at the start of an event and assuming the dam would not be kept at 50% or 75% continually, the point to really consider is how does Seqwater lower the storage below FSL before an event. Once rain commences it will generally be too late, as a release strategy may already be optimised to control downstream flood impacts, so increasing releases to lower the storage level will likely worsen those downstream flood impacts. That is, if there are significant flows downstream, it is already too late to pre-release.

The other option is to pre-release based on forecast and before the rain event is underway. However, as seen in recent events, lowering storage levels based on forecast and before the event initiates, is a strategy containing many risks including:

- Causing unnecessary downstream impacts when rainfall below forecast levels is experienced.
- Standing accused of wasting precious water resources when rainfall below forecast levels is experienced.
- Unnecessarily extending bridge inundation times and disrupting irrigation activities downstream of Wivenhoe Dam.
- Unnecessarily increasing river turbidity downstream of Wivenhoe Dam.

In summary, much thought and investigation by many people has gone into developing the current Manual of Flood

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Mitigation for Wivenhoe and Somerset dams. The Manual should not be modified lightly and certainly not without suitable engineering investigations being undertaken. Seqwater will undertake extensive investigations for the Water Commission in the new year to examine the possibility of raising the full supply level of Wivenhoe Dam. At this stage it is suggested that the scope of this work be widened to consider not just raising the water level in the dam, but also examining in detail the costs and benefits of modifying the manual of Flood Mitigation to allow "pre-lowering" of storage levels based on forecast rainfall at the onset of potential flood events.

Rob

Robert Drury
Dam Operations Manager
Water Delivery
Queensland Bulk Water Supply Authority *trading as* Seqwater

[x] Seqwater_No-Lifeguards-Here_email_strap

[x] cid:image001.png@01CA24E1.BC

Ph [redacted]
Wivenhoe Dam, Brisbane Valley Highway, via Fernvale Q4306 Australia
PO Box 37, Fernvale QLD 4306
Website | www.seqwater.com.au

From: Barry Dennien [redacted]
Sent: Wednesday, 8 December 2010 8:23 AM
To: Jim Pruss; Rob Drury
Cc: Dan Spiller; Peter Borrows
Subject:

Hi Jim Rob

The Minister is attending our Board meeting this Monday and given the public debate on Wivenhoe levels is very much front of mind (attached) he will ask on the status of the modelling work. I received your update the other day thankyou, I had a few extra questions, is there any chance on your thoughts before Monday, not necessarily any new model runs before then.

Regards

Barry

Rob

Thanks for the report. Thanks for the additional BOM advice.

I note the good work on modelled sensitivities for flows below 1900m3/sec – W1 strategy (flood manual)

The report then jumps to greater than 3500m3/sec (W4 strategy) and comments how peak water levels would unlikely be impacted and it comments that dam volume reductions of 250,000 megalitres (reduction 20% dam level) would be needed for any significant reduction in water level peaks.

Q1. Was the >3500m3/sec modelled like the October event < 1900M3/sec to draw the above conclusions.

Q2. Was the flow between 1900 and 3500 m3/sec modelled (Strategy W2 W3) with various dam levels to ascertain benefits to peak levels or bridge outage durations

Q3. If no to 1 and 2 is it worth doing considering we make the comments above about maybe a benefit if we have 250,000 ML extra storage.

Regards

Barry

45

"PB-8"

TRIM ref: D/10/7953

24 December 2010

Hon Stephen Robertson MP
Minister for Natural Resources, Mines and Energy
and Minister for Trade
PO Box 15216
Brisbane Qld 4001

Dear Minister

I am pleased to respond to your letter of 25 October 2010 regarding options to and benefits of releasing water from key storages in anticipation of major inflows over the current wet season. Our advice follows, based on discussions with Seqwater.

Only four of the dams in South East Queensland region are gated, with the ability to release significant amounts of water in anticipation of major inflows. These are Wivenhoe, Somerset, North Pine and Leslie Harrison dams.

Detailed operational procedures have been approved for each of the gated dams. The dams will continue to be operated in accordance with these procedures. These procedures generally relate to the management of the dams and should be managed above Full Supply Level. This advice relates to the water security aspect of the management of the dams below Full Supply Level.

Based on information currently available, Seqwater has advised that releasing water to below Full Supply Level may provide some benefits in terms of reduced community and operational impacts during minor inflow events, such as has occurred over the past month. For medium and major flood events, it considers that pre-emptive releases will provide negligible benefits.

Informed by this advice, the SEQ Water Grid Manager has advised Seqwater that, from a water security perspective, it has no in-principle objection to minor releases from Wivenhoe, Somerset and North Pine dams to minimise the operational and community impacts of gate releases. Specifically, it has advised that it has no in-principle objection to:

- Wivenhoe and Somerset dams being drawn down to 95 per cent of their combined Full Supply Level
- North Pine Dam being drawn down to 97.5 per cent of its Full Supply Level.

The SEQ Water Grid Manager has assessed the water security implications of the release to be negligible, having no impact on our ability to meet the risk criteria specified in the System Operating Plan or our ability to meet our supply obligations to Grid Customers. From a water security perspective, the Queensland Water Commission has also confirmed that it does not have any objections to the potential release.

Please note that these arranges are intended to apply for the current wet season only, taking into account the level of storages and the rainfall forecasts over coming months.

For future wet seasons, the SEQ Water Grid Manager will continue to work with Seqwater to investigate the optimal arrangements. In particular, we propose to further investigate options that may reduce the frequency or duration of intermediate level flows (between 1,900 and 3,500 cubic metres per second). In addition, we recommend that the investigations with the Queensland Water Commission to examine the opportunity of raising the full supply level of Wivenhoe Dam for water supply be expanded to include options involving the release of the additional water once major inflows are forecast.

I trust that this advice is sufficient. If you have any questions, please do not hesitate to contact Mr Dan Spiller, Director Operations, by telephone on [redacted] or by email on [redacted]

Yours sincerely

[redacted]

Gary Humphrys
Chair

ATTACHMENT

Wivenhoe and Somerset dams

Wivenhoe Dam can store up to 1.15 million litres (ML) of drinking water. In addition, it has the capacity to store an additional 1.45 ML of flood water.

While large, the flood compartment can be filled within days. For example, following heavy rainfall in October 2010 Wivenhoe Dam received inflows equivalent to almost half of the flood storage compartment capacity in just a few days.

Several factors influence flood release strategies for Wivenhoe and Somerset dams.

First, rain events that have caused flooding have historically been prolonged events over several days, often with a second event occurring several days to a week after the first. As a result, the operational procedures for the dam are designed to ensure that all water held in the flood compartments is released within seven days of a rain event, ensuring that the flood compartment is available for any future inflows.

Secondly, the dam only controls flood waters from part of the Brisbane River catchment area. About 50 per cent of the catchment area of the Brisbane River is upstream of the Wivenhoe Dam wall, and can be potentially controlled by it. No flood mitigation structures exist for most of the potential run-off from the other 50 per cent of the catchment area.

Third, the Bureau of Meteorology has had limited success in plotting rainfall distribution accurately to assess where most flooding risk lies above or below the dam wall. Historical floods have demonstrated that flooding can occur from both. For example, the 1974 flood flows primarily occurred below the dam wall whilst the 1890's event occurred above the dam wall. As a result, when releasing water from Wivenhoe Dam it is very important to predict and monitor below the dam wall flows so as to understand combined river flows that cause flood impacts.

Taking these factors into account, the flood release strategy for Wivenhoe and Somerset dams has a hierarchy of objectives:

- Ensure the structural safety of the dam
- Provide optimum protection of urbanised areas from inundation
- Minimise disruption to rural life
- Retain full supply level after a flood event
- Minimise impacts to flora and fauna during the drain down phase.

Within this framework, flood releases from Wivenhoe Dam typically fall into two categories of flood events based on the impact they cause when combined with below the dam wall catchment runoff:

- Larger events typically involving combined river flows greater than 3,500 cubic meters per second measured at Moggill. These events would have flood impacts on urban areas in Brisbane. This scale of release has not been required since Wivenhoe Dam was completed.

- Smaller events with combined river flows of less than 1,900 cubic meters per second measured at the Mt Crosby weir which can inundate up to seven rural bridges isolating up to 50 households and causing inconvenience to many more. There has been six of these events since 1984, when Wivenhoe Dam was completed.

Our assessment of the benefits of lowering dam storage levels to reduce flooding impacts is below for these two event types.

Large events

Seqwater has advised that releases of greater than 3,500 cubic metres per second (m3/s) from Wivenhoe Dam are likely to impact on urban areas in Brisbane. Events of this nature have not been experienced since Wivenhoe Dam was completed in 1984.

Seqwater has advised that:

- pre-emptive releases are likely to have negligible impacts on the extent of these impacts
- any impacts would require releases of at least 250,000 ML. This is equivalent to a release of about 16 per cent of the combined storage capacity of Wivenhoe and Somerset dams.

A pre-emptive release of this scale is not recommended, based on information currently available. The potential water security impacts are considered to be more significant than the negligible benefits. These potential security impacts include costs associated with the earlier or avoidable operation of the desalination facility at capacity, as well as the increased probability of triggering the implementation of a drought response plan.

More detailed investigation of opportunities to actively manage flood storage is recommended, including options to increase flood supply level on a temporary basis. These investigations need to be led by Seqwater, and involve the Bureau of Meterology, Councils and the SEQ Water Grid Manager.

In particular, t has been identified that it is worth investigating the impacts on downstream flooding for intermediate level flows (flows between 1900 and 3500 cm^3/s).

Seqwater will undertake extensive investigations for the Queensland Water Commission in early 2011 to examine the opportunity of raising the full supply level of Wivenhoe Dam for water supply. We will recommended that the scope of this work be widened to consider the benefits of pre-lowering storage levels based on mid range rainfall events and the reduced impacts to river levels and subsequent property impacts. It is noted that predicting rainfall intensity and location, even as events are about to occur has not been accurate, however the Bureau of Meteorology is improving its methods.

Smaller events

Pre-emptive releases from Wivenhoe Dam may reduce the impacts of minor gate releases (strategies W1A to W1E in the operational procedures).

Minor gate releases may result in the closure of up to six bridges, isolating up to 50 dwellings and inconveniencing many more. As stated in existing flood management plans, releases should be managed to minimise the impacts on these residents. Over the immediate term, Councils have requested that bridge closures be avoided over the Christmas to New Year period, if at all possible. In addition:

- There are resource implications involved in the activation of the flood control centre. Under flood management plans, the centre must be staffed by suitability qualified officers at all times during gate releases. There are currently only four quality duty engineers, who have staffed the flood centre for much of period since the initial release in October.
- Gate releases during the Christmas holiday period would result in closure of dams to water based activities, impacting on up to 150,000 people who are expected to use the recreational facilities over the holiday period.

The Water Grid Manager has advised Seqwater that, from a water security perspective, it would not object to water being released from Wivenhoe and Somerset dams to 95 per cent of storage capacity at any time until end March 2010.

Under this recommendation, storage levels could potentially be reduced by up to about 77,250 ML. This is equivalent to the amount of water released between 13 and 16 December 2010, through a single gate.

Pre-emptive releases will be managed so as to minimise the likelihood of gate releases due to small storms and local rainfall. Storage capacity will usually be reduced through a combination of:

- Extended gate releases, especially for strategy W1C. For comparison, up to 130,000 ML/day was released during in November and mid December 2010. At this rate, the additional releases could occur in about half a day.
- Ongoing gate releases of up to 30,000 ML/day, which do not isolate any residents but can inundate some lower bridges that cause inconvenience.
- Ongoing valve release of up to about 4,300 ML/day, which can be maintained without inundate any bridges.

Actual releases would be decided by Seqwater based on operational considerations and in accordance with its statutory and regulatory obligations.

Water security impacts

The water security impacts of releases will be zero if the dams fill over the remainder of the wet season. Current forecasts indicate that there is a high probability of this occurring:

- Heavy rainfall is forecast over the Christmas holiday period, as noted above.
- Over the remainder of the wet season, advice from the Bureau of Meteorology is that sea surface temperatures are likely to remain at levels typical of a La Niña event into the first quarter of 2011, with the majority of the models indicating the event will gradually weaken over the coming months.

The water security impacts will be minimal, even if there were no further inflows to the dams. Modelling indicates that the reduction would have a minimal impact on the probability of key water Grid storages falling to 40 per cent of capacity over the next five years.

North Pine and Leslie Harrison dams

North Pine and Leslie Harrison dams do not have flood mitigation potential. Once the dams have reached Full Supply Level, all water flows into the dam must be released to protect the structural safety of the dam.

Seqwater has advised that, without major releases, there are negligible benefits to reducing volumes stored in North Pine or Leslie Harrison dams for the purposes of reducing the extent or duration of any downstream flooding impacts.

For North Pine Dam, there may be some operational and community benefits to minor releases to below Full Supply Level in some circumstances. Any gate operation at North Pine Dam results in inundation of Youngs Crossing Road, which isolates a number of residents. These impacts are currently being minimised by releasing from North Pine Dam at night. With further rainfall forecast, Seqwater may choose to reduce the level to below Full Supply Level in order to reduce the frequency of night releases or the likelihood of releases being required during the day.

For this dam, the SEQ Water Grid Manager has advised Seqwater that, from a water security perspective, it would not object to water being released to 97.5 per cent of storage capacity at any time until end March 2010.

For Leslie Harrison Dam, gate operations do not impact on public roads and generally only inconvenience the general public during large flood events. There is no scope to reduce this inconvenience through small pre-emptive releases. Accordingly, no in-principle approval be made for pre-emptive releases from this dam.

"PB-9"

QWC-4

Karve Supriya

From: Waldman Karen
Sent: Friday, 24 December 2010 11:56 AM
To: Dennien Barry [redacted]
Cc: Sommer Peter; Wong Wai Tong; Bagdon Tad; [redacted]
Subject: FW: URGENT
Importance: High

Hi Barry

The QWC has considered the request by the SEQ Water Grid Manager to comment on the proposed drawdown of:

- Wivenhoe and Somerset dams to 95% of their combined full supply level
- North Pine Dam being drawn down to 97.5% of it's full supply level

The Commission note that the Water Grid Manager has no concerns and advises that the drawdown will not infringe the risk criteria stipulated in the SEQ System Operating Plan or the interim operating strategy. The Water Grid Manager has also stated that this drawdown will not impact on their ability to meet supply obligations to the Water Grid customers. Based on this advice, the Commission has no objection to the proposed release.

It is noted also that such releases are an operational matter for Seqwater, within the context of the Resource Operations Plan, where there is no condition in the SEQ System Operating Plan that regulates releases from the dams concerned.

It is however recommended that Seqwater liaise with the Department of Environment and Resource Management to confirm their understanding of any conditions that apply, particularly in relation to dam safety matters.

Regards, Karen
==========================

From: Barry Dennien [redacted]
Sent: Friday, 24 December 2010 10:17 AM
To: Bagdon Tad; Wong Wai Tong
Cc: Waldman Karen; spiller daniel [redacted]
Subject: URGENT

Wiatong Tad

See attached a letter we are planning to send to Seqwater giving our permission to lower Wivenhoe below full supply level down to 95% and North Pine to 97.5% for flood mitigation purposes. The is only for the current wet season.

We request the QWC note this proposed strategy and reply appropriately by midday today.

We apologise in advance for the short turnaround period. Current weather events have made us progress this issue.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email:
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Please consider the environment before printing this email. It takes 10 litres of water to make one sheet of A4 paper.

"PB-10"

Peter Borrows

From: Barry Dennien [redacted]
To: Peter Borrows
Cc: Dan Spiller [redacted]; Rob Drury
Sent: Fri Dec 24 13:37:45 2010
Subject:

Peter

Please see attached letter with regards lowering Wivenhoe and North Pine Dams operating levels below full supply level to assist in flood mitigation.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Trim Ref: D/10/8129

24 December 2010

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East Qld 4002

Dear Mr Borrows

I refer to our letter of [illegible] regarding the request from Minister Stephen Robertson to consider options to, and the benefits of releasing water from key storages in anticipation of major inflows over the coming summer period.

As you are aware, your officers have since provided advice about options and benefits.

I advise that, from a water security perspective, the SEQ Water Grid Manager has no in principle objection to minor releases from Wivenhoe, Somerset and North Pine dams to minimise the operational and community impacts of gate releases. Specifically, we have no in principle objection to:

- Wivenhoe and Somerset dams being drawn down to 95 per cent of their combined full supply level
- North Pine Dam being drawn down to 97.5 per cent of its full supply level.

Any specific releases to below Full Supply Level should be notified to myself or, if I am not available, the Director of Operations, SEQ Water Grid Manager.

Any releases should be managed by Seqwater in accordance with any statutory and regulatory obligations, such as the flood operations manuals and Resource Operations Plan. We recommend that you liaise with the Department of Environment and Resource Management to confirm any conditions that apply.

I acknowledge that these releases would have a negligible impact on the extent and duration of flooding during a major flood event. However, they may provide the ability to minimise the community and operational impacts of minor releases.

From a water security perspective, I am advised that the Queensland Water Commission also does not have any objections to the proposed release.

Please note that these arrangements are intended to apply for the current wet season only, taking into account the level of storages and the rainfall forecasts over coming months.

I am keen to continue to work with you to investigate the optimal arrangements for future wet seasons. In particular, I am keen to work with you to further investigate options that may reduce the frequency or duration of intermediate level flows (between 1,900 and 3,500 cubic metres per second). In addition, we recommend that the investigations with the Queensland Water Commission to examine the opportunity of raising the full supply level of Wivenhoe Dam for increased water supply be expanded to include options to lower the full supply level for managing flood events.

Thank you for your assistance in this matter. If you have any questions, please do not hesitate to contact Mr Dan Spiller, Director of Operations, by telephone on (07) [redacted] or via email at [redacted]

Yours sincerely

Barry Dennien
Chief Executive Officer

Peter Borrows

From: Peter Borrows
Sent: Friday, 24 December 2010 4:31 PM
To: [redacted]
Cc: [redacted] Jim Pruss; Rob Drury; Peter Borrows
Subject: Fw: Wivenhoe Dam levels
Attachments: Seqwater letter re Min s request on options for release of water.docx; ATT13094.txt

Hello Barry.

My reading of your letter is that you have no objection to Seqwater releasing water from Wivenhoe/Somerset and NP to levels below full water supply level (FSL). As you are aware, our operating procedures are to release to FSL.

To be clear, is your letter dated 24 December meant to be a direction to release to levels below FSL for these storages?

Regards Peter

From: Barry Dennien [redacted]
To: Peter Borrows; Rob Drury
Sent: Fri Dec 24 14:38:32 2010
Subject: FW: Wivenhoe Dam levels

From: Barry Dennien
Sent: Friday, 24 December 2010 2:32 PM
To: [redacted]
Cc: Dan Spiller
Subject: FW: Wivenhoe Dam levels

Rob

Sorry not sure what happened there.

See document with regards lowering the levels of Wivenhoe and North Pine Dams below full supply level over this coming wet season to assist in flood mitigation.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Please consider the environment before printing this email. It takes 10 litres of water to make one sheet of A4 paper.

"PB-11"

Kelaher, Mark

From: Duty Engineer [redacted]
Sent: Tuesday, 11 January 2011 10:00 AM
To: Peter Borrows
Cc: Rob Drury; [redacted] John Tibaldi; [redacted] Terry Malone
Subject: Possible Wivenhoe Release Strategy
Importance: High

Peter

Somerset/Wivenhoe

Our 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 increase the gate outflow to protect it. In this case, we could adopt this scenario. Sluices have been closed at Somerset and this will result in high upstream water levels affecting Kilcoy.

1. With no further rainfall, Wivenhoe will get to about 74.7 m AHD and we will be trying to limit the outflow will be about 3,700 to 4,500m3/s.
2. With 50mm rainfall in the Stanley and Upper Brisbane in the next 12 to 24 hours, we will need to significantly increase the release via the gates to as much as 7,500 to 9,000m3/s to prevent fuse plug initiation.

It should be noted that the flow in the lower Brisbane R in 1974 was about 9,500m3/s

Wivenhoe has lost incoming power and are on backup power and Energex are flying in personnel to rectify.

North Pine

Inflows and outflows are increasing very rapid but are still not extreme.

Terry Malone
Duty Engineer
Flood Operations Centre

Phone [redacted]

Fax: [redacted]

Kelaher, Mark

From: Duty Engineer [redacted]
Sent: Wednesday, 12 January 2011 4:22 PM
To: [redacted] 'Robert Drury'
Subject: Operation of Wivenhoe Dam

Peter Baddiley (BoM) is off to the afternoon conference with the Premier to advise that the Brisbane peak is going to be slightly lower than the expected 5.5m.

This will be attributed to the sharp decrease in the outflow from the dam from 7,400 m3/s at 19:00 Tuesday 2011 to 2,500 m3/s at 08:00 Wednesday 12 January 2011. As a result the volume in the flood peak was very sharp and has been attenuated with volume loss into the floodplain storage adjacent to the river.

Terry Malone

Duty Engineer
Flood Operations Centre

Phone: [redacted]

Fax: [redacted]

Kelaher, Mark

From:	Peter Borrows
Sent:	Tuesday, 18 January 2011 4:34 PM
To:	Rob Drury; Duty Seq
Cc:	[redacted] John Tibaldi; Jim Pruss; Terry Malone; Peter Borrows
Subject:	FW: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011
Attachments:	Wivenhoe release and Issues at Lowood

FYI.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph (07) [redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

[redacted]

From: Reilly Bob [redacted]
Sent: Tuesday, 18 January 2011 4:29 PM
To: Peter Borrows
Cc: Hennessy, Phil A; Allen Peter; Dennien Barry [redacted] spiller daniel [redacted]
Subject: RE: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Hi Peter

I confirm my verbal approval at approximately 3 pm this afternoon as indicated in your email below. Please note that this approval only covers the Flood Mitigation Manual-related approval, and not any other approval that you may require from DERM.

Regards

Bob

From: Peter Borrows [redacted]
Sent: Tuesday, 18 January 2011 4:18 PM
To: Reilly Bob
Cc: Hennessy, Phil A
Subject: RE: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Bob, this E Mail is to confirm that Seqwater requested you to approve a variation to the flood release regime prescribed in the Flood Mitigation Manual for Wivenhoe/Somerset dams, and that you had verbally approved this.

I recommended this variation to enable a constant flow for the Lowood WTP off-take as we have been having difficulties in supplying water from this off-take to the Lowood treatment plant. The plan is to maintain the current releases for a further 12 hours to 'stabilize' the off take for the treatment plant, and to then enable a reasonable 'final close down', to minimise bank slump issues. This close down proposal is consistent particularly with the Brisbane City Council request associated with concerns at Coronation Drive. I note that the WGM's letter to me dated 24 December 2011, advised that the WGM had no in principle objection to Wivenhoe and Somerset dams being drawn down to 95 per cent of their combined full supply level.

When we verbally discussed this, we discussed a final level of 95% FSL at Wivenhoe, and the assumption was 100%FSL at Somerset. Please note that this scenario has now been calculated, and the resulting FSL will be 94.6% at Wivenhoe and 97.3% at Somerset.

Could you please confirm your approval.

Thanks.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

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Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

[redacted]

From: Duty Engineer [redacted]
Sent: Tuesday, 18 January 2011 3:36 PM
To: [redacted] John Tibaldi; Rob Drury; [redacted] Terry Malone; Peter Borrows
Subject: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Rob/Peter

Revised shutdown sequence applied at 15:00 on Tuesday 18 January 2011 to accommodate a 12 hour hold at current gate settings (Release is 1,450 cumecs)) This will equate to a volume of 62,640 ML resulting in a lake level of around EL 66.85 mAHD by 03:00 on Wednesday 19 January 2011.

If release is then ramped down using 45 minute gate closure intervals the volume released is estimated to be 52,630 ML resulting in a lake level of EL 66.40 mAHD or 94.6% of capacity at 06:00 on Thursday 20 January 2011. This assumes no further runoff from rainfall and that Somerset regulator continues until Thursday morning as well leaving, Somerset dam at EL98.75 mAHD or 97.3%

The closedown sequence could be modified, but I am concerned we get bank slumping if we push too much harder.

Regards

Rob Ayre

Duty Engineer
Flood Operations Centre

Phone: [redacted]

Fax:

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Your Anti-virus Service scanned this email. It is safe from known viruses.
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ATTACHMENT.

Kelaher, Mark

From: Rob Drury
Sent: Tuesday, 18 January 2011 4:29 PM
To: Peter Borrows
Cc: Jim Pruss; Duty Seq
Subject: Wivenhoe release and issues at Lowood

Peter,
Currently Wivenhoe is in the process of the closedown sequence.

The original plan was to start closing 2pm Monday 17.1.11 and shutting off early Wednesday morning. Based on BCC's request, final closure was extended to early Thursday morning to minimise potential impacts on Coronation Drive and still be closed well before high tides in Brisbane towards the weekend. Although this risk seems less after discussions with BCC, however it doesn't affect decisions from here on in.

However the Lowood WTP is running on emergency diesel pumps to supply the townships connected to the plant (predominantly Lowood, Fernvale, Laidley and Gatton). The diesel pumps rely on accessing the water directly from the river and as the level drops due to the reduction in Wivenhoe releases, the pumps are having difficulty. If the level in the river drops further, the pumps will not be able to supply water until the submersible pumps are operational.

At this stage, it appears that if the levels remain stationary for the next 12 hours, there will be time to get the alternate pumps operational or the diesels moved. If not, there is a real chance of loss of supply.

Hence an alternative closing strategy has been requested of the Flood Centre. The releases can be maintained as is (1,450cumecs) until 3am tomorrow morning and then a closing sequence recommenced. See below advice from the Flood Centre.

This however means that the level in Wivenhoe may drop to around 95% or just below. Faster closing sequences may impact on banks.

However, there will be a rebound in the dam level due to base flow that is hard to predict accurately but may bring the lake up a percent or two. Also, there is some rainfall occurring around Wivenhoe this afternoon that may result in some water entering the dam.

The consideration is then the risk to losing supply to Lowood WTP versus reducing Wivenhoe to around 95% (but with some rebound and the chance of inflow).

Reducing Wivenhoe to the lower level and still closing on Thursday morning also provides a closing time that has less impact on bank stability than if it was shut down quickly.

Can you please confirm the preferred strategy?

Comments from the FOC.

Revised shutdown sequence applied at 15:00 on Tuesday 18 January 2011 to accommodate a 12 hour hold at current gate settings (Release is 1,450 cumecs)) This will equate to a volume of 62,640 ML resulting in a lake level of around EL 66.85 mAHD by 03:00 on Wednesday 19 January 2011.

If release is then ramped down using 45 minute gate closure intervals the volume released is estimated to be 52,630 ML resulting in a lake level of EL 66.40 mAHD or 94.6% of capacity at 06:00 on Thursday 20 January 2011. This assumes no further runoff from rainfall and that Somerset regulator continues until Thursday morning as well leaving, Somerset dam at EL98.75 mAHD or 97.3%

The closedown sequence could be modified, but I am concerned we get bank slumping if we push too much harder.

Rob

Robert Drury
Dam Operations Manager

Water Delivery
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph[redacted]
Wivenhoe Dam, Brisbane Valley Highway, via Fernvale Q4306 Australia
PO Box 37, Fernvale QLD 4306
Website | www.seqwater.com.au

"PB-12"

Moore, Rhiannon

From: Peter Borrows [redacted]
Sent: Monday, 17 January 2011 2:03 AM
To: Rob Drury; Duty Seq; Jim Pruss
Cc: Peter Borrows
Subject: Fw: Cabinet in confidence - Ministerial brief - Flood event and Wivenhoe Dam
Attachments: Letter_from_Stephen_Robertson_MP_RE__Release_of_Water_from_Key_Storages [1].pdf; Letter_to_Minister_-_flood_management[1].docx; BrianCooperCV09122010.pdf; Brian Cooper - final report.docx; Brian Cooper - final report attachment.xlsx; Seqwater Ministerial_Briefing_Note_January_17_2011_Final_Draft_for_distribution[1].docx; Seqwater Jan_2011_Flood_Event_Ver_1_draft_for_distribution[1].docx; FINAL Ministerial_Brief_-_Wivenhoe_Operations[3].docx; Talking points_Wivenhoe Dam releases.docx

Jim, John & Rob

Please keep confidential I.E don't distribute.

Rob or Jim, can you get me that letter we sent to the WGM about pre-emptive releases and also the Request we received from the grid. I'd need this by 8.30 Monday.

Thanks Peter

From: Elaina Smouha [redacted]
To: [redacted]
Cc: [redacted] Peter Borrows
Sent: Sun Jan 16 22:13:42 2011
Subject: Cabinet in confidence - Ministerial brief - Flood event and Wivenhoe Dam

John

Attached is the Ministerial Brief and accompanying attachments for the Emergency Cabinet meeting scheduled on 17 January 2011.

Regards

Elaina

Elaina Smouha
Director, Governance and Regulatory Compliance
SEQ Water Grid Manager
Phone [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street Brisbane
Post: PO Box 16205, City East QLD 4002
ABN: 14783 317 630

67A

CTS No. xxxxx/10

Advisor ....€Ok
Dated / /
€Approved €Not Approved €Noted
€Further information required
Minister....................................
Dated / /

SEQ Water Grid Manager and Seqwater
MINISTERIAL BRIEFING NOTE

TO: **Minister for Natural Resources, Mines and Energy and Minister for Trade**

SUBJECT: **January 2011 flood event and Wivenhoe Dam operations**

REQUESTED BY

- The Ministers Office requested this brief by 16 January 2011.

TIMEFRAME

- Noting of this brief is required prior to the Emergency Cabinet meeting to be held on 17 January 2011.

RECOMMENDATION

It is recommended that the Minister:

- **note** Seqwater's Ministerial briefing note setting out background information on Wivenhoe Dam, the January 2011 flood event and Seqwater's Flood Mitigation Manual.
- **note** the advice on the benefits of pre-emptive releases from Wivenhoe Dam in response to the Minister's request.
- **note** Mr Brian Cooper's independent compliance review of the operation of Wivenhoe Dam against the Flood Mitigation Manual for the January 2011 flood event.
- **approve** key media responses on the flood event and Wivenhoe Dam.
- **approve** that Mr Barry Dennien, Chief Executive Officer, SEQ Water Grid Manager, speak to the media in accordance with the key media responses.

BACKGROUND

- From 13 December 2010 to 11 January 2011, South East Queensland experienced unprecedented rainfall, which resulted in the January 2011 flood event. Wivenhoe Dam played a significant role in mitigating the downstream flood peak.
- **Attachment A** contains Seqwater's Ministerial briefing note setting out background information on Wivenhoe Dam, Wivenhoe Dam's flood mitigation and operations, Seqwater's Flood Mitigation Manual, the regulatory context of the Flood Mitigation Manual and Seqwater's proposed procedure for the preparation of its comprehensive Flood Mitigation Manual report to the Chief Executive, Department of Environment and Resource Management, on Wivenhoe Dam operations for the January 2011 flood event.
- After the Wivenhoe Dam release in October 2010, by way of a letter dated 25 October 2010 at **Attachment B,** the Minister requested the SEQ Water Grid Manager to procure urgent advice as to whether South East Queensland's water security situation would provide *"an opportunity to reduce the volume stored in key dams as a means of reducing the severity, frequency and duration of flooding in downstream areas."*
- The Minister also sought the SEQ Water Grid Manager's *"confirmation that these options would not significantly impact upon our current water security, measured as the probability of needing to reintroduce Medium Level Restrictions over the next five to ten years."*
- As a result, the SEQ Water Grid Manager requested that Seqwater provide a report assessing the options requested by the Minister.

Author	Cleared by	Cleared by	Recommended:
Name: Barry Dennien Position: Chief Executive Officer, SEQ Water Grid Manager Tel No: [redacted] Date: 16 January 2011	Name: Position: Tel No: Name: Position: Tel No:	Name: Position: Tel No: Name: Position: Tel No:	Name: John Bradley Director-General, DERM Tel No: [redacted] Date:

- **Attachment C** contains the SEQ Water Grid Manager's letter to the Minister dated 24 December 2010, in response to the pre-emptive Wivenhoe Dam release advice sought, based on Seqwater's advice. This letter stated that "*Seqwater has advised that releasing water to below Full Supply Level may provide some benefits in terms of reduced community and operational impacts during minor inflow events, such as has occurred over the past month. For medium and major flood events, it considers that pre-emptive releases will provide negligible benefits...Informed by this advice, the SEQ Water Grid Manager has advised Seqwater that, from a water security perspective, it has no in-principle objection to minor releases from Wivenhoe, Somerset and North Pine dams to minimise the operational and community impacts of gate releases.*"
- It should be noted that while seeking advice from Seqwater on pre-emptive dam releases, the SEQ Water Grid Manager continued to provide the Department of Environment and Resource Management with progress reports.
- On 11 January 2011, the Minister requested the SEQ Water Grid Manager to procure an urgent independent review of Seqwater's operation of Somerset and Wivenhoe Dams in accordance with the Flood Mitigation Manual, for the period 13 December 2010 to 11 January 2011.
- Mr Brian Cooper was engaged to conduct the independent review and his report and curriculum vitae are contained in **Attachment D.**
- Mr Brian Cooper concludes that the "*strategies as set out in the Flood Mitigation Manual have been followed, allowing for the discretion given to making variations in order to maximise flood mitigation effects. The actions taken and decisions made during the Flood Event appear to have been prudent and appropriate in the context of the available knowledge available to those responsible for flood operations and the way events unfolded.*"

CURRENT ISSUES

- The purpose of this Ministerial brief is to provide the Minister with background information on the January 2011 flood event and the operation of Wivenhoe Dam, in preparation for an Emergency Cabinet meeting scheduled on 17 January 2011.
- This Ministerial brief provides information that may assist in responding to questions raised, or anticipated to be raised, by the public and media.
- **Attachment E** contains key media responses based on factual information from Seqwater's Ministerial briefing note.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- Any recommendations regarding the Flood Mitigation Manual, improvements to the structure or operation of Wivenhoe Dam, resourcing etc. will arise after any relevant flood event debriefs and Seqwater's Flood Mitigation Manual report to the Chief Executive, Department of Environment and Resource Management.

PROPOSED ACTION

- In accordance with the Flood Mitigation Manual, Seqwater will submit a comprehensive report to the Chief Executive, Department of Environment and Resource Management, containing details of the procedures used, the reasons for such and other pertinent information for the operation of Wivenhoe Dam during the January 2011 flood event.
- This report is required to be submitted within six weeks of completion of the flood event.

Author	**Cleared by**	**Cleared by**	**Recommended:**
Name: Barry Dennien Position: Chief Executive Officer, SEQ Water Grid Manager Tel No: [redacted] Date: 16 January 2011	Name: Position: Tel No: Name: Position: Tel No:	Name: Position: Tel No: Name: Position: Tel No:	Name: John Bradley Director-General, DERM Tel No: [redacted] Date:

File Ref:

OTHER INFORMATION

- *Consultation:* In preparing the Ministerial briefing note at **Attachment A**, Seqwater consulted with Mr Peter Allen and Mr Bob Reilly from the Office of the Water Supply Regulator, Department of Environment and Resource Management. The SEQ Water Grid Manager provided information on the Minister's request for advice on pre-emptive releases from Wivenhoe Dam and the independent compliance review from Mr Brian Cooper.
- *Legislation:* The Flood Mitigation Manual is a requirement of, and approved by the Chief Executive, Department of Environment and Resource Management, under the *Water Supply (Safety and Reliability) Act 2008.*
- *Key Communication Messages:* The information contained in this Ministerial brief may be used to formulate public messaging regarding the flood event and the operation of Wivenhoe Dam. Communicating the benefits of Wivenhoe Dam for flood mitigation may present positive communication opportunities.

MINISTER'S COMMENTS

PLEASE LEAVE THIS SPACE BLANK SO THE MINISTER CAN ADD COMMENTS

ATTACHMENTS

- **Attachment A: Seqwater Ministerial briefing note**
- **Attachment B: Letter from Minister Robertson to the SEQ Water Grid Manager dated 25 October 2010**
- **Attachment C: Letter from the SEQ Water Grid Manager to Minister Robertson dated 24 December 2010**
- **Attachment D: Flood Mitigation Manual compliance review report by Mr Brian Cooper and curriculum vitae of Mr Brian Cooper**
- **Attachment E: Key media responses**

Author	**Cleared by**	**Cleared by**	**Recommended:**
Name: Barry Dennien	Name:	Name:	Name: John Bradley
Position: Chief Executive Officer, SEQ Water Grid Manager	Position:	Position:	Director-General, DERM
	Tel No:	Tel No:	Tel No: [redacted]
	Name:	Name:	Date:
Tel No: [redacted]	Position:	Position:	
Date: 16 January 2011	Tel No:	Tel No:	

70

File Ref:

Ministerial Briefing Note

17 January 2010

Flood Event January 2011

1 BACKGROUND INFORMATION ON WIVENHOE DAM

Wivenhoe Dam was completed in 1984 and has two main functions;

- A 1,165,000 ML storage providing an urban water supply for Brisbane;
- Flood mitigation in the Brisbane River by providing a dedicated flood storage volume of 1,450,000 ML (this flood storage was increased in 2005 to 1,966,000 ML with the dam at the point of failure).

In accordance with the Queensland Regulatory program for dam spillway upgrades, a further upgrade of Wivenhoe Dam is scheduled to occur prior to 2035 but only for dam safety reasons in the event of a probable maximum flood and has no impact on the current event.

Wivenhoe Dam is in excellent condition with four Comprehensive Dam Safety reviews undertaken in the last 14 years, the latest in 2010.

2 WIVENHOE DAM FLOOD MITIGATION AND FLOOD OPERATIONS

2.1 What were the benefits provided by Wivenhoe Dam during the current event?

The following graphs demonstrate the significant benefits of Wivenhoe Dam in mitigating the current flood event, with reductions in flood peak from Wivenhoe Dam not existing of up to 2.5 metres in the City area and up to 5.5 metres in the Moggill area further upstream.

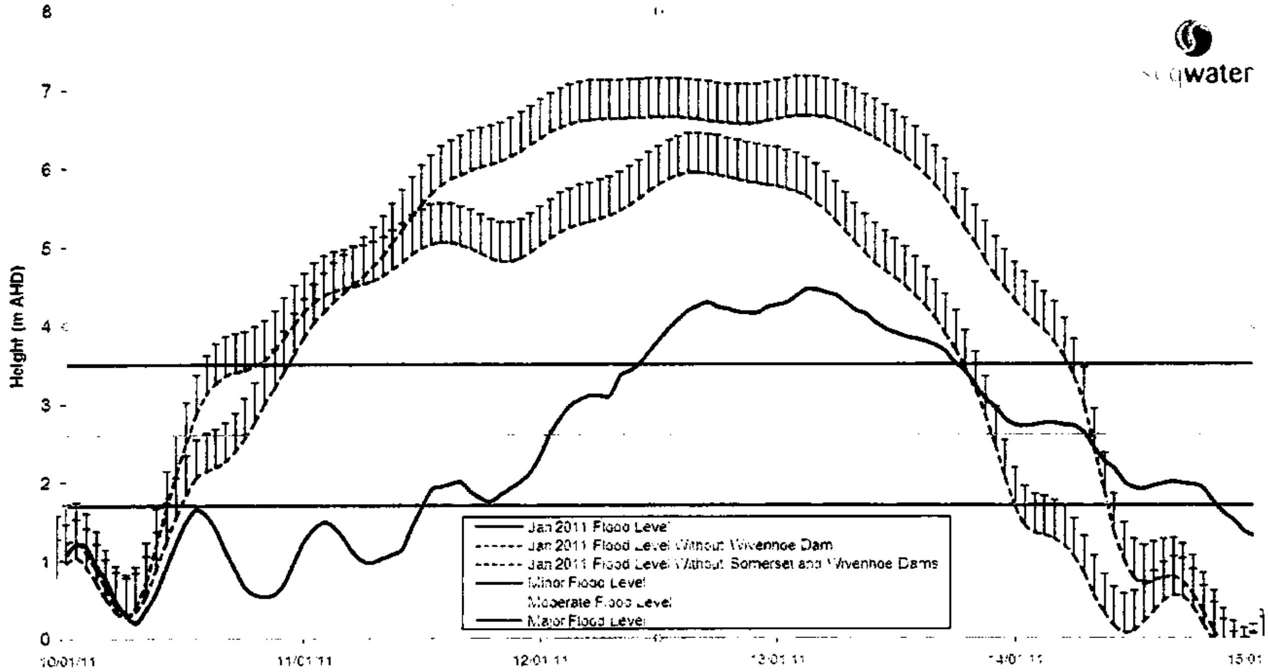
This equates to significant reduction in the potential for loss of life as well as saving in damages in the order of up to $1.6 billion based on current damage curves. Up to 13,000 more properties would have been impacted by the event without the Dam. (Source: Flood Damage Tables provided to Seqwater by the Brisbane City Council).

The time at which flood levels remained elevated above major levels has also been reduced by up to 3 days by the dam. This has significant benefits to impact on the population of the city, property damage and the recovery operation.

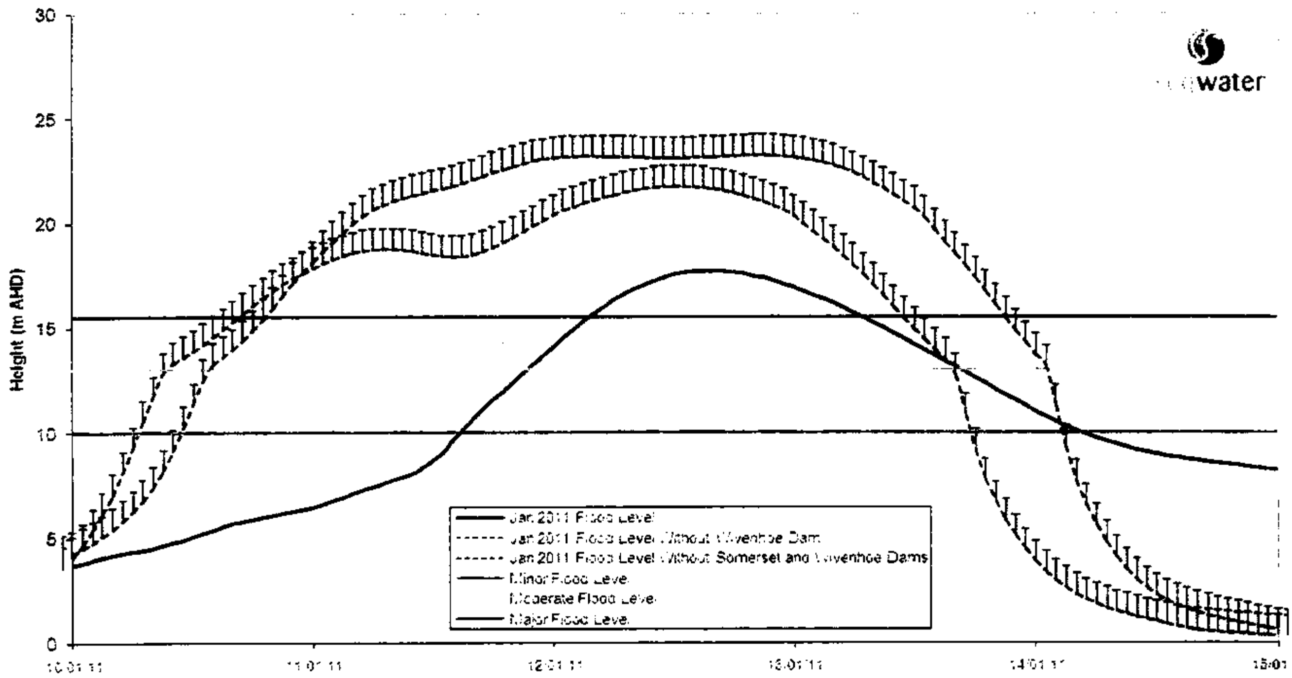
Depending on the nature of the event, the presence of Wivenhoe Dam could also potentially increase flood warning times to impacted areas. How these times may have been increased during the current event is presently difficult to quantify, but discussions will be held with BOM on this issue at a later date.

In addition, the strategy adopted to quickly close off releases once the peak in the dam had been reached and rain stopped falling certainly reduced the predicted flood peak by at least one metre in the lower Brisbane River area. This was carried out because the releases had stopped the dam from rising and careful monitoring allowed rapid reduction of releases while ensuring fuse plug initiation did not occur.

JANUARY 2011 BRISBANE FLOOD
Assessment of Flood Levels at Brisbane City



JANUARY 2011 BRISBANE FLOOD
Assessment of Flood Levels at Moggill



2.2 Why was Wivenhoe Dam only allowed to rise up to 191% and not 230%?

Wivenhoe Dam mitigates downstream flooding by storing incoming flood water during a rainfall event and releasing these waters at a reduced flow rate downstream to reduce flood impacts. The timing of the releases is also manipulated so that the aim is for outflows from the dams to impact on downstream areas only after the peak inflows from the downstream major tributaries have passed. However this aim cannot always be achieved in practice. This is because some large floods, such as the one currently being experienced, have the potential to overflow the dam's flood storage compartment. **Should this occur, the dam would fail and the resulting damage and loss of life would be at least 100 to 1000 times greater than that currently being experienced.**

Therefore the basis of all flood operation decision making is to ensure the dam never fails. This is the reason that the dam's flood storage compartment would never be intentionally fully filled as any additional inflows after this point would result in a dam failure. At any one time, there will always be uncertainty about what rain is going to occur. Hence, we cannot use all of the flood capacity as we would not be able to release sufficient water to cater for large inflows.

2.3 What is the role of the erodible fuse plug embankments?

Another factor that impacts on flood release decision making in large events are the levels at which the erodible fuse plugs are triggered. The fuse plugs act as a safety valve to rapidly increase dam outflows if the structural safety of the dam is in danger. Loss of one or more fuse plugs severely limits the ability of the dam to mitigate the effects of future flood events that may occur prior to the fuse plug or plugs being reinstated. Reinstatement of a fuse plug following an event would take a minimum of 4 to 6 months and would require an extended period of relatively dry weather.

2.4 Why weren't pre-emptive releases undertaken prior to the start of the flood event?

In the 25 days leading up to the current event, three flood events impacting on Wivenhoe Dam were experienced, with gate releases being made on all but five of those days. The total outflow from these events was around 700,000ML.

During these events, requests were received from Councils and residents impacted by bridge closures downstream of the dam to curtail releases as soon and as quickly as possible. Additionally the 2 January end date of the flood event prior to the current event meant that significant drain down of the dam prior to the onset of the current event that commenced on 6 January 2011, was not possible without major bridge inundation downstream of the dam and without exceeding minor flood levels in the lower Brisbane River.

Additionally, a flood event was also experienced in October 2010 that resulted in a release of 750,000ML from the dam. Accordingly drain down below the dam full supply level prior to the start of the first December event would not have been possible without significant bridge inundation and without exceeding minor flood levels (as defined by BOM and BCC) in the lower Brisbane River.

Regardless, significant drain down prior to the current event would have had little impact on the peak level in Wivenhoe Dam as shown in the table below. The reason for this is that this total event inflow volume of 2,600,000 ML is well in excess of the useable flood storage combined with the available water supply storages shown in the table.

The specific impact on the Lower Brisbane River of these reduced dam levels requires the use of a complex hydraulic model. The results of this modelling would still contain a degree of uncertainty as illustrated by the difficulties in estimating the final flood peak in Brisbane during the event. This is because the rapid closure of the gates after peak inflow was achieved resulted in significant water level reductions downstream and this is difficult to model accurately.

JANUARY 2011 FLOOD			
Starting Level		Peak Height	Capacity
%	m AHD	m AHD	%
100	67.0	74.97	191
95	66.5	74.93	191
90	65.8	74.88	190
75	64.0	74.63	187
50	60.0	74.11	180

It should be noted that the possible reductions shown above are based up a unique dual peaked flood hydrograph with a volume of about 2,600,000 ML which occurred during this event. A hydrograph with the same volume but a different distribution could result in a significantly lower reduction in peak water levels.
Flood operations at the dam are also highly dependent upon the flood inflow volume and a slight variation in the flood volume could significantly reduce the benefits associated with draining down the dam prior to a flood event.

2.5 Is there a detailed record of the events associated with the current flood?

A preliminary report has been prepared and is attached to this briefing.

1.
2.

3 THE MANUAL OF FLOOD MITIGATION AT WIVENHOE DAM AND SOMERSET DAM

3.1 What is the Manual of Flood Mitigation and how was it developed?

The Manual of Flood Mitigation for Wivenhoe and Somerset dams in its current form was developed in 1992 during an extensive hydrological study of the Brisbane and Pine Rivers catchments by DPI, Water Resources. The final reports were subject to extensive internal review by the Water Resources Group before being reviewed by an independent review panel comprising Professor Colin Apelt, Head of Department, Department of Civil Engineering, University of Queensland and Mr Eric Lesleighter, Principal Hydraulic Engineer and Chief Engineer Water Resources, Snowy Mountains Engineering Corporation. Subsequently, the Manual was extensively reviewed during the Brisbane Valley Flood Damages Minimisation Study in 2006, with the latest comprehensive review of the Manual undertaken in 2009. Both of these reviews have included expert review panels comprising key stakeholders, with the most recent review involving representatives from DERM, BOM, BCC and SunWater.

The Manual of Flood Mitigation is prepared by Seqwater as the owner of the dam and approved and gazetted by the Chief Executive of DERM in accordance with the Water Supply Act 2008. The manual defines flood objectives procedures; roles and responsibilities; and staffing and operational requirements for flood events impacting on Wivenhoe and Somerset dams.

3.2 What is contained in the Manual?

The primary objectives of the procedures contained in the Manual are, in order of importance:

- Ensure the structural safety of the dams;
- Provide optimum protection of urbanised areas from inundation;
- Minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers primarily, this involves minimising inundation of the seven bridges below the dam upstream of Moggill);
- Retain the storage at Full Supply Level at the conclusion of the Flood Event.

- Minimise impacts to riparian flora and fauna during the drain down phase of the Flood Event.

During an event, the operation of the dam transitions between the following four operating strategies depending of the circumstances at the time. These procedures associated with these strategies are explained in detail in the Manual.

- **Strategy W1** – Primary consideration is given to Minimising Disruption to Downstream Rural Life.
- **Strategy W2** – Transition Phase moving from Minimising Disruption to Protecting Downstream Urban Areas.
- **Strategy W3** – Primary consideration is to Protect of Urban Areas from Inundation.
- **Strategy W4** – Primary consideration is to protecting the structural safety of the Dam.

In addition to these strategies, historical records show that there is a significant probability of two or more flood producing storms occurring in the Brisbane River system within a short time of each other. Accordingly for each flood event, the aim is always to empty stored floodwaters within seven days after the flood peak has passed through the dams.

4 REGULATORY CONTEXT

Operational procedures for flood mitigation for a dam are contained in the Flood Mitigation Manual approved under sections 370 to 374 of the *Water Supply (Safety and Reliability) Act 2008* (Water Supply Act). Under section 370 of the Water Supply Act, Seqwater as the owner and operator of Wivenhoe and Somerset Dams is required to prepare a Flood Mitigation Manual. The Chief Executive (CE) of DERM (or his delegate) approves the Flood Mitigation Manual, and the approval is notified in the Queensland Government Gazette. Approval can be for a period of up to five years, after which the approval needs to be renewed. There are no decision-making criteria specified in the Water Supply Act for the CE to take into account when approving the Flood Mitigation Manual.

The Flood Mitigation Manual requires, amongst other matters:

1. Flood operations to be conducted in accordance with manual's provisions, unless Seqwater considers that it is necessary to depart from the procedures of the Flood Mitigation Manual to meet the flood mitigation objectives of the Flood Mitigation Manual. The Flood Mitigation Manual sets out a consultation and approval process through Seqwater's Chair and the CE for departures from the Flood Mitigation Manual. This discretion was not exercised in the January 2011 flood event.
2. Flood operations to be under the control of CE-approved engineers (who are highly qualified and experienced)
3. Annual reporting on the preparedness and status of the flood control system for flood operations, and the training of the personnel who manage the flood events.
4. Reporting on the flood operations during flood events.
5. Reviews after flood events such as the January 2011 event, and a Seqwater report containing details of the procedures used, the reasons for such and other pertinent information. Seqwater must forward this report to the CE within six weeks of the completion of a flood event.

Section 374 of the Water Supply Act protects the CE and Seqwater from liability for complying with the Flood Mitigation Manual. It states:

> *(1) The chief executive or a member of the council does not incur civil liability for an act done, or omission made, honestly and without negligence under this part.*
>
> *(2) An owner of a dam who observes the operational procedures in a flood mitigation manual, approved by the chief executive, for the dam does not incur civil liability for an act done, or omission made, honestly and without negligence in observing the procedures.*

During November 2010, Commonwealth, State and local government agencies developed a *Protocol for Communication of Flooding Information for the Brisbane River Catchment – including Floodwater Releases from Wivenhoe and Somerset Dams* to "*ensure the provision of consistent and robust information to the community*". This is separate from the Flood Mitigation Manual, is not legally binding and is not subject to regulatory approval/review.

Some DERM staff, because of their specialist skills, work in the Flood Operations Centre that Seqwater activates to manage such events in accordance with the Flood Mitigation Manual. The Flood Operations Centre is not involved in any of the regulatory decisions concerning the dams or are members of the Office of the Water Supply Regulator, Department of Environment and Resource Management, which undertakes the CE's regulatory functions.

5 SEQWATER REPORT

It is recommended that the process and content for reports required for this event be:

- In the short term, utilise this report attached to this briefing note as the basis for communications and discussion.
- Prepare any Interim Reports as agreed to provide information and input as required.
- Seqwater prepare a Comprehensive Report as per the existing regulatory requirements of the Act and the gazetted manual and any requirements of the Dam Safety Regulator. This would be done within 6 weeks of the closure of the current event as per the manual. This timeframe is subject to any new mobilisation of the Flood Operations Centre. The Table of Contents would include:
    - Introduction
    - Flood Event Summary
    - Mobilisation and Staffing
    - Event Rainfall
    - Inflow and Release Details
    - Data Collection System Performance
    - Data Analysis Performance
    - Communication
    - Flood Management Strategies and Manual Compliance
    - Improvements in data collection systems, practices and processes.
    - improvements by interacting agencies
    - Review of factors impacting on the protection of urban areas
    - Recommendations & Conclusions
- The report would then be reviewed by the Dam Safety Regulator in conjunction with any peer review they require. The review should cover:
    - Were the provisions of the manual complied with?
    - What improvements to either facilities e.g. stream gauges, or work practices, are desirable to improve Sewater's ability to predict inflows into the dams.
    - Are improvements to either Seqwater's facilities or work practices desirable to improve Seqwater's ability to manage events? For example, investigations to raise the dam to improve its flood storage capacity, If so, what are they and their implications

- Are changes to the facilities or work practices of other organisations desirable to improve Seqwater's abilities to manage these events?
- whether it is worth investigating increasing the flood capacity of Wivenhoe
- whether the Brisbane River crossings which act, under some situations as a constraint on the releases from Wivenhoe, should be replaced by bridges. For example if the smallest could pass , for example, 2,500 cumecs, then this could enable higher releases under some circumstances.
- Whether the policy of draining the flood compartment within 7 days should be modified.
- Given the manual's order of priorities i.e. protection of the dam etc, are any changes in the flood release strategies for either dam desirable? If so, what are they, and their implications

- Based on this review, a review of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam would occur utilising an expert panel of review including representatives of DERM, Seqwater, BoM, affected Local Governments and other stakeholders as necessary.

seqwater
WATER FOR LIFE

JANUARY 2011 FLOOD EVENT

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1 INTRODUCTION

Wivenhoe Dam was constructed by the Queensland Government between 1977 and 1984. The dam is a 56 m AHD high and 2.3 kilometre long earth and rock embankment separated into two parts by a concrete gravity spillway. The spillway is controlled by 5 radial gates, each 12.0 metres wide by 16.0 m AHD high. Two saddle dam embankments are located on the left side of the reservoir.

The dam spillway capacity was upgraded in 2005. This was done primarily through the construction of a 164 metre wide secondary spillway through the right abutment of the existing dam. This spillway contains three erodible earth fill fuse plug embankments that are initiated at different dam levels in excess of EL 75.6.

The dam has two main functions by providing:

- A 1,165,000 ML storage at full supply level (FSL EL 67.0) providing an urban water supply for Brisbane and surrounding areas;

- Flood mitigation in the Brisbane River by providing a dedicated flood storage volume of 1,450,000 ML up to EL77 (this flood level was increased as part the 2005 upgrade to allow a water level of EL80m and a temporary flood storage volume of 1,966,000 ML with all fuse plugs initiated and the dam at the point of failure).

The dam has an EXTREME hazard classification under ANCOLD guidelines because of the significant development downstream in the Brisbane and Ipswich metropolitan areas, with the population at risk in the event of a dam failure numbering in the hundreds of thousands.

In accordance with the Queensland Regulatory program for dam spillway upgrades, a further upgrade of Wivenhoe Dam for dam safety reasons only is scheduled to occur prior to 2035 to enable the dam to safely pass the Probable Maximum Flood. This work will involve the reconstruction of Saddle Dam 2 as a fuse plug spillway.

Wivenhoe Dam is in excellent condition. Comprehensive Dam Safety reviews undertaken in accordance with ANCOLD guidelines have been undertaken in 1997 (Gutteridge, Haskins & Davey Pty Ltd), 2003 (Wivenhoe Alliance), 2006 (NSW Department of Commerce), 2009 (GHD) and September 2010 (Seqwater). The reports concluded that the design of the dam is in accordance with modern day standards and that there are no significant outstanding design or construction issues that require investigation.

2 WIVENHOE DAM FLOOD MITIGATION AND FLOOD OPERATIONS

2.1 Flood Mitigation

The Brisbane River catchment covers an area of approximately 14,000 square kilometres of which about half is below Wivenhoe Dam. Maximum overall flood mitigation effect is achieved by operating Wivenhoe Dam in conjunction with Somerset Dam. Although Somerset and Wivenhoe Dam reduce flooding in Brisbane City, major flooding can still occur. The Lockyer-Laidley Valley drains into the Brisbane River through Lockyer Creek that enters the Brisbane River just downstream of Wivenhoe Dam near Lowood. Another major tributary, the Bremer River, flows into the Brisbane River at Moggill. Wivenhoe Dam has no control over inflows into the Brisbane River from both these major tributaries.

Wivenhoe Dam mitigates downstream flooding by storing incoming flood water during a rainfall event and releasing these waters at a reduced flow rate downstream to minimise flood impacts. The timing of the releases is also manipulated so that the aim is for outflows from the dams to impact on downstream areas only after the peak inflows from the downstream major tributaries have passed. However, this aim cannot always be achieved in practice. This is because some large floods, such as the one currently being experienced, have the potential to overflow the dam's flood storage compartment. **Should this occur, the dam would fail and the resulting damage and loss of life would be at least 100 to 1000 times greater than that currently being experienced.**

Therefore the basis of all flood operation decision making is to ensure the dam never fails. This is the reason that the dam's flood storage compartment would never be intentionally fully filled as additional inflows after this point would result in a dam failure. Similarly, there will be uncertainty on future rainfall that could occur which could not be releases if there was insufficient flood storage which could not be stored or released.

Another factor that impacts on flood release decision making in large events are the levels at which the erodible fuse plugs are triggered. Loss of one or more fuse plugs severely limits the ability of the dam to mitigate the effects of future flood events that may occur prior to the fuse plug or plugs being reinstated. Reinstatement of a fuse plug following an event would take a minimum of 4 to 6 months and would require an extended period of relatively dry weather.

2.2 Flood Operations

A real time flood monitoring and forecasting system has been established in the Wivenhoe and Somerset Dam catchments. This system employs radio telemetry to collect, transmit and receive rainfall and stream flow information. The system consists of around 230 field stations that automatically record rainfall and/or river heights at selected locations in the dam catchments. Most of these field stations are owned by Seqwater with the remainder belonging to other agencies.

The rainfall and river height data is transmitted to Seqwater's Flood Operations Centre in real time. Once received in the Flood Operations Centre, the data is processed using a Real Time Flood Model (RTFM) to estimate likely dam inflows and evaluate a range of possible inflow scenarios based on forecast and recorded rainfall in the dam catchments. The RTFM is a suite of hydrologic computer programs that utilise the real time data to assist in the operation of the dams during flood events.

Seqwater engineers use the RTFM for flood monitoring and forecasting during flood events to operate the dams in accordance with a Manual of Flood Mitigation (the origin of and objectives and procedures contained in the Manual of Flood Mitigation are explained in the following section of this document). Releases of water from the dams are optimised to minimise the impacts of flooding in accordance with the objectives and procedures contained in a Manual of Flood Mitigation.

The RTFM and data collection network performed well During the January 2011 event, with no failures experienced that compromised the ability of Seqwater to operate the dam.

3 MANUAL OF FLOOD MITIGATION FOR WIVENHOE AND SOMERSET DAMS

The Manual of Flood Mitigation for Wivenhoe and Somerset Dams, in its current form, was developed in 1992 during an extensive hydrological study of the Brisbane and Pine Rivers catchments by DPI, Water Resources. The final reports were subject to extensive internal review by the Water Resources Group before being reviewed by an independent review panel comprising Professor Colin Apelt, Head of Department, Department of Civil Engineering, University of Queensland and Mr Eric Lesleighter, Principal Hydraulic Engineer and Chief Engineer Water Resources, Snowy Mountains Engineering Corporation.

Subsequently, the Manual was extensively reviewed during the Brisbane Valley Flood Damages Minimisation Study in 2006, with the latest comprehensive review of the Manual undertaken in 2009. Both of these reviews have included expert review panels comprising key stakeholders, with the most recent review involving representatives from DERM, BOM, BCC and SunWater.

The Manual of Flood Mitigation is prepared by Seqwater as the owner of the dam and approved and gazetted by the Chief Executive of DERM in accordance with the Water Supply Act 2008. The manual defines flood objectives procedures; roles and responsibilities; and staffing and operational requirements for flood events impacting on Wivenhoe and Somerset dams.

The primary objectives of the procedures contained in the flood manual are, in order of importance:

- Ensure the structural safety of the dams;
- Provide optimum protection of urbanised areas from inundation;
- Minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers primarily, this involves minimising inundation of the seven bridges below the dam upstream of Moggill);
- Retain the storage at Full Supply Level at the conclusion of the Flood Event.
- Minimise impacts to riparian flora and fauna during the drain down phase of the Flood Event.

During an event, the operation of the dam transitions between the following four operating strategies depending of the circumstances at the time. These procedures associated with these strategies are explained in detail in the Manual.

- **Strategy W1** – Primary consideration is given to Minimising Disruption to Downstream Rural Life. Under this strategy, the predicted water level is below 68.50 m AHD and the maximum release is 1,900m3/s.

- **Strategy W2** – Transition Phase moving from Minimising Disruption to Protecting Downstream Urban Areas. Under this strategy, the water level is predicted to be between 68.5 and 74.0 m AHD and the maximum release is less than 3,500m3/s.

- **Strategy W3** – Primary consideration is to Protect of Urban Areas from Inundation. Under this strategy, the water level is predicted to be between 68.5 and 74.0 m AHD but the maximum release is less than 4,000m3/s.

- **Strategy W4** – Primary consideration is to protecting the structural safety of the Dam. Under this strategy, the water level is predicted to exceed 74.0 m AHD and there is no limit to the maximum release. Consideration is given to managing flood releases to avoid fuse plug initiation if at all possible as this would compromise flood mitigation capacity in the short to medium term.

In addition to these strategies, historical records show that there is a significant probability of two or more flood producing storms occurring in the Brisbane River system within a short time of each other. Accordingly for each flood event, the aim is always to empty stored floodwaters within seven days after the flood peak has passed through the dams.

4 JANUARY 2011 FLOOD EVENT

4.1 Background

In the 25 days leading up to the current event, three flood events impacting on Wivenhoe Dam were experienced, with gate releases being made on all but five of those days. The total outflow from these events was around 700,000ML. The details of these events are as follows:

EVENT	EVENT START DATE	EVENT END DATE	VOLUME RELEASED (ML)
1	13/12/2010	16/12/2010	70,000
2	17/12/2010	24/12/2010	150,000
3	26/12/2010	02/01/2010	470,000

During these events, requests were received from Councils and residents impacted by bridge closures downstream of the dam to curtail releases as soon and as quickly as possible. Additionally the 2 January end date of the flood event prior to the current event meant that significant drain down of the dam prior to the onset of the current event that commenced on 6 January 2011, was not possible without major bridge inundation downstream of the dam and without exceeding minor flood levels in the lower Brisbane River.

Additionally, a flood event was also experienced in October 2010 that resulted in a release of 750,000ML from the dam. Accordingly drain down below the dam full supply level prior to the start of the first December event would not have been possible without significant bridge inundation and without exceeding minor flood levels (as defined by BOM and BCC) in the lower Brisbane River.

Regardless, significant drain down prior to the current event would have had little impact on the peak level in Wivenhoe Dam as shown in the table below. The reason for this is that this total event inflow volume of 2,600,000 ML is well in excess of the useable flood storage combined with the available water supply storages shown in the table.

The specific impact on the Lower Brisbane River of these reduced dam levels requires the use of a complex hydraulic model. The results of this modelling would still contain a degree of uncertainty as illustrated by the difficulties in estimating the final flood peak in Brisbane during the event. This is because the rapid closure of the gates after peak inflow was achieved resulted in significant water level reductions downstream and this is difficult to model accurately.

JANUARY 2011 FLOOD			
Starting Level		Peak Height	Capacity
%	m AHD	m AHD	%
100	67.0	74.97	191
95	66.5	74.93	191
90	65.8	74.88	190
75	64.0	74.63	187
50	60.0	74.11	180

It should be noted that the possible reductions shown above are based on a dual peaked flood hydrograph with a volume of about 2,600,000 ML which occurred during this event. A hydrograph with the same volume but a different distribution could result in a significantly lower reduction in peak water levels.
Flood operations at the dam are also highly dependent upon the flood inflow volume and a slight variation in the flood volume could significantly reduce the benefits associated with draining down the dam prior to a flood event.

4.2 Event Decision Making

The following table contains a summary of the key decisions points associated with the current event. As at 16 January 2011, the event remains in progress.

DATE AND TIME	FLOOD EVENT MILESTONE
07:00 06/01/2011 (Thursday)	Rainfall is experienced in the dam catchments that will result in flood releases, however Wivenhoe releases are delayed for 24 hours to allow Lockyer Creek flood flows to pass downstream and prevent the isolation of the community dependent of Burtons Bridge. The forecast is for 150mm over the next 24 hours.
15:00 07/01/2011 (Friday)	Wivenhoe releases commence, with operational strategy W1 in use. Rainfall for the next four days is estimated to be between 140mm and 300mm, with a forecast for rain easing on Tuesday 11 January 2011. All bridges downstream of the dam with the exception of Fernvale Bridge and Mt Crosby Weir Bridge are expected to be inundated for a number of days.

06:00 09/01/2011 (Sunday)	Moderate to heavy rain periods forecast until Tuesday, but both Wivenhoe and Somerset dam levels were falling slowly, with Somerset at 1.27 m AHD above FSL and Wivenhoe 1.58 m AHD above FSL.
15:30 09/01/2011 (Sunday)	Following significant rain during the day a meeting of Duty Engineers is held. The QPF issued at 16:00 indicates 50mm to 80mm over the next 24 hours. Based on this forecast, it is anticipated that dam levels can be held to a maximum of 3.50 m AHD above FSL in Somerset and 5.5 m AHD above FSL in Wivenhoe. However, by 19:00 it was apparent that both Fernvale Bridge and Mt Crosby Weir Bridge would be inundated by the combined dam releases and Lockyer Creek flows and that the operational strategy had progressed to W2.
06:30 10/01/2011 (Monday)	Rainfall continued during the night and based on rainfall on the ground it was apparent the operational strategy had progressed to W3.
06:30 10/01/2011 (Monday)	Rainfall continued during the day but based on rainfall on the ground, operational strategy W3 remained in use. However it was apparent that any further heavy rain would result in progression of the operational strategy to W4.
08:00 11/01/2011 (Tuesday)	Rainfall continued during the night with isolated heavy falls in the Wivenhoe Dam catchment area and based on rainfall on the ground it was apparent the operational strategy would soon progress to W4 with Wivenhoe Dam exceeding 8.00 m AHD above FSL. The objective now was to limit outflows and subsequent flood damage to urban areas, while ensuring the structural safety of the dam.
11:00 11/01/2011 (Tuesday)	Rapid inflows were experienced in Wivenhoe Dam, with the dam rising almost a metre in eight hours. Releases were increased until the dam level stabilised in accordance with Strategy W4. Computer models were not reflecting actual dam inflows due to intense point rainfalls in the immediate catchment around the dam. Falls are estimated to be similar to those experienced at both Toowoomba and Upper Lockyer the previous day and are falling outside and between existing rain gauges.
21:00 11/01/2011 (Tuesday)	Wivenhoe Dam peaked. Peak release of 7450 cumecs with a level of 0.7 metres below fuse plug trigger.

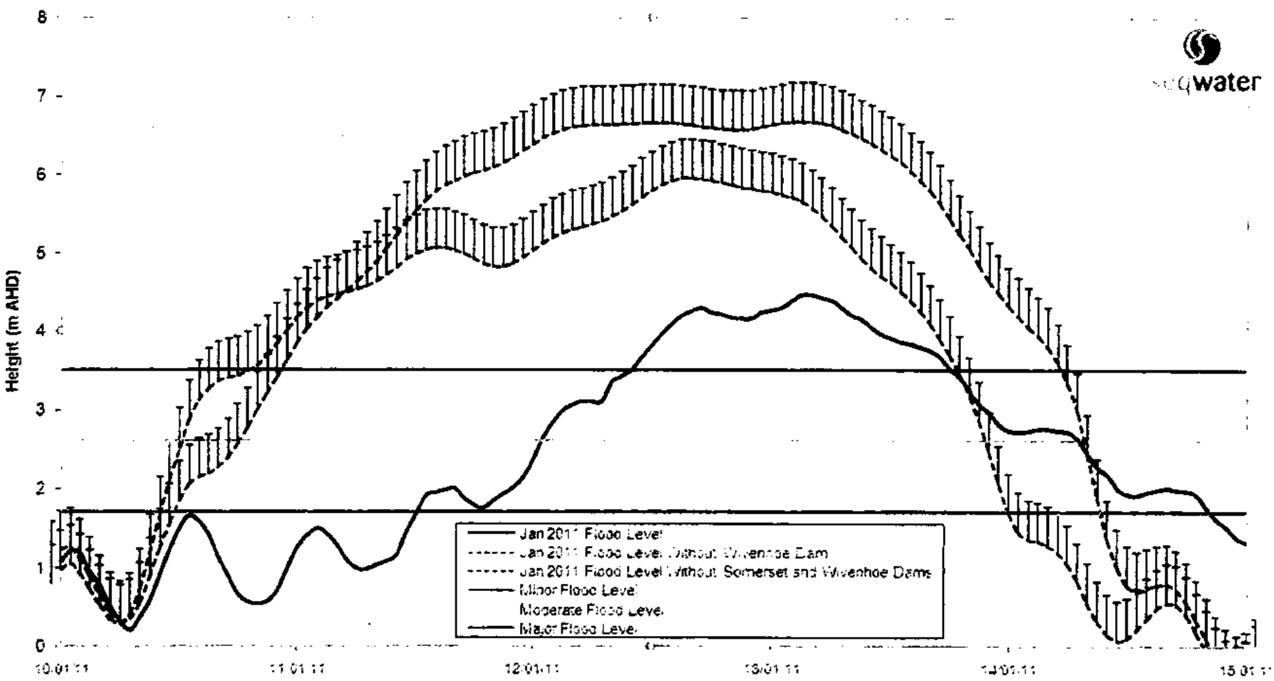
4.3 Flood Mitigation Benefits of Wivenhoe Dam

The following graphs demonstrate the significant benefits of Wivenhoe Dam in mitigating the current flood event, with reductions in flood peak of up to 2.5 metres in the City area and up to 5.5 metres in the Moggill area further upstream.

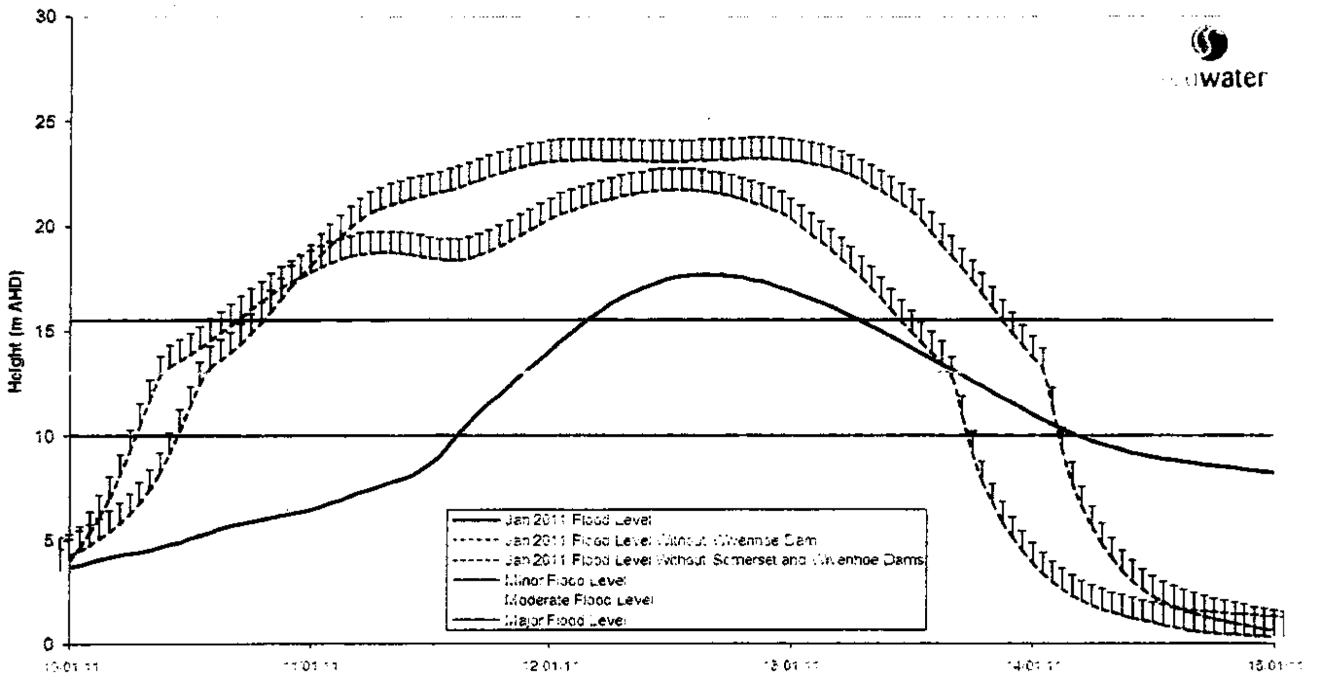
This equates to significant reduction in the potential for loss of life as well as saving in damages in the order of up to $1.6 billion based on current damage curves. Up to 13,000 more properties would have been impacted by the event without the Dam.

The time at which flood levels remained elevated above major levels has also been reduced by up to 3 days by the dam. This has significant benefits to impact on the population of the city, property damage and the recovery operation.

JANUARY 2011 BRISBANE FLOOD
Assessment of Flood Levels at Brisbane City



JANUARY 2011 BRISBANE FLOOD
Assessment of Flood Levels at Moggill



The strategy adopted to quickly close off releases once the peak in the dam had been reached and rain stopped falling certainly reduced the predicted flood peak by at least one metre in the lower Brisbane River area. This was carried out because the releases had stopped the dam from rising and careful monitoring allowed rapid reduction of releases while ensuring fuse plug initiation did not occur.

This notion is supported by BOM.

5 EVENT REVIEW

Under the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam that are approved and gazetted by the Department of Environment and Resource Management, there is a regulatory requirement that a report must be prepared as per the below wording:

"Seqwater must prepare a report after each Flood Event. The report must contain details of the procedures used, the reasons therefore and other pertinent information. Seqwater must forward the report to the Chief Executive within six weeks of the completion of the Flood Event."

Such a report was prepared for the flood events of February and March 2010 and copies are available. A copy of the Table of Contents of that report is included as Appendix 1. For this event, the report would be a comprehensive summary of all procedures, actions, outcomes and processes during the event.

It is recommended that the process and content for reports required for this event be:

- In the short term, utilise this report attached to this briefing note as the basis for communications and discussion.
- Prepare any Interim Reports as agreed to provide information and input as required.
- Seqwater prepare a Comprehensive Report as per the existing regulatory requirements of the Act and the gazetted manual and any requirements of the Dam Safety Regulator. This would be done within 6 weeks of the closure of the current event as per the manual. This timeframe is subject to any new mobilisation of the Flood Operations Centre. The Table of Contents would include:
    - Introduction
    - Flood Event Summary
    - Mobilisation and Staffing
    - Event Rainfall
    - Inflow and Release Details
    - Data Collection System Performance
    - Data Analysis Performance
    - Communication
    - Flood Management Strategies and Manual Compliance

  - Improvements in data collection systems, practices and processes.
  - improvements by interacting agencies
  - Review of factors impacting on the protection of urban areas
  - Recommendations & Conclusions
- The report would then be reviewed by the Dam Safety Regulator in conjunction with any peer review they require. The review should cover:
  - Were the provisions of the manual complied with?
  - What improvements to either facilities e.g. stream gauges, or work practices, are desirable to improve Sewater's ability to predict inflows into the dams.
  - Are improvements to either Seqwater's facilities or work practices desirable to improve Seqwater's ability to manage events? For example, investigations to raise the dam to improve its flood storage capacity, If so, what are they and their implications.
  - Are changes to the facilities or work practices of other organisations desirable to improve Seqwater's abilities to manage these events?
  - whether it is worth investigating increasing the flood capacity of Wivenhoe
  - whether the Brisbane River crossings which act, under some situations as a constraint on the releases from Wivenhoe, should be replaced by bridges. For example if the smallest could pass , for example, 2,500 cumecs, then this could enable higher releases under some circumstances.
  - Whether the policy of draining the flood compartment within 7 days should be modified.
  - Given the manual's order of priorities i.e. protection of the dam etc, are any changes in the flood release strategies for either dam desirable? If so, what are they, and their implications
- Based on this review, a review of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam would occur utilising an expert panel of review including representatives of DERM, Seqwater, BoM, affected Local Governments and other stakeholders as necessary.

Appendix A

FINAL REPORT – FLOOD EVENTS AT WIVENHOE, SOMERSET AND NORTH PINE DAMS FOR FEBRUARY AND MARCH 2010

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TRIM ref: D/10/7953

24 December 2010

Hon Stephen Robertson MP
Minister for Natural Resources, Mines and Energy
and Minister for Trade
PO Box 15216
Brisbane Qld 4001

Dear Minister

I am pleased to respond to your letter of 25 October 2010 regarding options to and benefits of releasing water from key storages in anticipation of major inflows over the current wet season. Our advice follows, based on discussions with Seqwater.

Only four of the dams in South East Queensland region are gated, with the ability to release significant amounts of water in anticipation of major inflows. These are Wivenhoe, Somerset, North Pine and Leslie Harrison dams.

Detailed operational procedures have been approved for each of the gated dams. The dams will continue to be operated in accordance with these procedures. These procedures generally relate to the management of the dams and should be managed above Full Supply Level. This advice relates to the water security aspect of the management of the dams below Full Supply Level.

Based on information currently available, Seqwater has advised that releasing water to below Full Supply Level may provide some benefits in terms of reduced community and operational impacts during minor inflow events, such as has occurred over the past month. For medium and major flood events, it considers that pre-emptive releases will provide negligible benefits.

Informed by this advice, the SEQ Water Grid Manager has advised Seqwater that, from a water security perspective, it has no in-principle objection to minor releases from Wivenhoe, Somerset and North Pine dams to minimise the operational and community impacts of gate releases. Specifically, it has advised that it has no in-principle objection to:

- Wivenhoe and Somerset dams being drawn down to 95 per cent of their combined Full Supply Level
- North Pine Dam being drawn down to 97.5 per cent of its Full Supply Level.

The SEQ Water Grid Manager has assessed the water security implications of the release to be negligible, having no impact on our ability to meet the risk criteria specified in the System Operating Plan or our ability to meet our supply obligations to Grid Customers. From a water security perspective, the Queensland Water Commission has also confirmed that it does not have any objections to the potential release.

Please note that these arranges are intended to apply for the current wet season only, taking into account the level of storages and the rainfall forecasts over coming months.

For future wet seasons, the SEQ Water Grid Manager will continue to work with Seqwater to investigate the optimal arrangements. In particular, we propose to further investigate options that may reduce the frequency or duration of intermediate level flows (between 1,900 and 3,500 cubic metres per second). In addition, we recommend that the investigations with the Queensland Water Commission to examine the opportunity of raising the full supply level of Wivenhoe Dam for water supply be expanded to include options involving the release of the additional water once major inflows are forecast.

I trust that this advice is sufficient. If you have any questions, please do not hesitate to contact Mr Dan Spiller, Director Operations, by telephone on [redacted] or by email on [redacted]

Yours sincerely

[redacted]

Gary Humphrys
Chair

ATTACHMENT

Wivenhoe and Somerset dams

Wivenhoe Dam can store up to 1.15 million litres (ML) of drinking water. In addition, it has the capacity to store an additional 1.45 ML of flood water.

While large, the flood compartment can be filled within days. For example, following heavy rainfall in October 2010 Wivenhoe Dam received inflows equivalent to almost half of the flood storage compartment capacity in just a few days.

Several factors influence flood release strategies for Wivenhoe and Somerset dams.

First, rain events that have caused flooding have historically been prolonged events over several days, often with a second event occurring several days to a week after the first. As a result, the operational procedures for the dam are designed to ensure that all water held in the flood compartments is released within seven days of a rain event, ensuring that the flood compartment is available for any future inflows.

Secondly, the dam only controls flood waters from part of the Brisbane River catchment area. About 50 per cent of the catchment area of the Brisbane River is upstream of the Wivenhoe Dam wall, and can be potentially controlled by it. No flood mitigation structures exist for most of the potential run-off from the other 50 per cent of the catchment area.

Third, the Bureau of Meteorology has had limited success in plotting rainfall distribution accurately to assess where most flooding risk lies above or below the dam wall. Historical floods have demonstrated that flooding can occur from both. For example, the 1974 flood flows primarily occurred below the dam wall whilst the 1890's event occurred above the dam wall. As a result, when releasing water from Wivenhoe Dam it is very important to predict and monitor below the dam wall flows so as to understand combined river flows that cause flood impacts.

Taking these factors into account, the flood release strategy for Wivenhoe and Somerset dams has a hierarchy of objectives:

- Ensure the structural safety of the dam
- Provide optimum protection of urbanised areas from inundation
- Minimise disruption to rural life
- Retain full supply level after a flood event
- Minimise impacts to flora and fauna during the drain down phase.

Within this framework, flood releases from Wivenhoe Dam typically fall into two categories of flood events based on the impact they cause when combined with below the dam wall catchment runoff:

- Larger events typically involving combined ~~river flows~~ greater than 3,500 cubic meters per second measured at Moggill. These events would have flood impacts on urban areas in Brisbane. This scale of release has not been required since Wivenhoe Dam was completed.

- Smaller events with combined river flows of less than 1,900 cubic meters per second measured at the Mt Crosby weir which can inundate up to seven rural bridges isolating up to 50 households and causing inconvenience to many more. There has been six of these events since 1984, when Wivenhoe Dam was completed.

Our assessment of the benefits of lowering dam storage levels to reduce flooding impacts is below for these two event types.

Large events

Seqwater has advised that releases of greater than 3,500 cubic metres per second (m3/s) from Wivenhoe Dam are likely to impact on urban areas in Brisbane. Events of this nature have not been experienced since Wivenhoe Dam was completed in 1984.

Seqwater has advised that:

- pre-emptive releases are likely to have negligible impacts on the extent of these impacts
- any impacts would require releases of at least 250,000 ML. This is equivalent to a release of about 16 per cent of the combined storage capacity of Wivenhoe and Somerset dams.

A pre-emptive release of this scale is not recommended, based on information currently available. The potential water security impacts are considered to be more significant than the negligible benefits. These potential security impacts include costs associated with the earlier or avoidable operation of the desalination facility at capacity, as well as the increased probability of triggering the implementation of a drought response plan.

More detailed investigation of opportunities to actively manage flood storage is recommended, including options to increase flood supply level on a temporary basis. These investigations need to be led by Seqwater, and involve the Bureau of Meterology, Councils and the SEQ Water Grid Manager.

In particular, t has been identified that it is worth investigating the impacts on downstream flooding for intermediate level flows (flows between 1900 and 3500 cm^3/s).

Seqwater will undertake extensive investigations for the Queensland Water Commission in early 2011 to examine the opportunity of raising the full supply level of Wivenhoe Dam for water supply. We will recommended that the scope of this work be widened to consider the benefits of pre-lowering storage levels based on mid range rainfall events and the reduced impacts to river levels and subsequent property impacts. It is noted that predicting rainfall intensity and location, even as events are about to occur has not been accurate, however the Bureau of Meteorology is improving its methods.

Smaller events

Pre-emptive releases from Wivenhoe Dam may reduce the impacts of minor gate releases (strategies W1A to W1E in the operational procedures).

Minor gate releases may result in the closure of up to six bridges, isolating up to 50 dwellings and inconveniencing many more. As stated in existing flood management plans, releases should be managed to minimise the impacts on these residents. Over the immediate term, Councils have requested that bridge closures be avoided over the Christmas to New Year period, if at all possible. In addition:

- There are resource implications involved in the activation of the flood control centre. Under flood management plans, the centre must be staffed by suitability qualified officers at all times during gate releases. There are currently only four quality duty engineers, who have staffed the flood centre for much of period since the initial release in October.
- Gate releases during the Christmas holiday period would result in closure of dams to water based activities, impacting on up to 150,000 people who are expected to use the recreational facilities over the holiday period.

The Water Grid Manager has advised Seqwater that, from a water security perspective, it would not object to water being released from Wivenhoe and Somerset dams to 95 per cent of storage capacity at any time until end March 2010.

Under this recommendation, storage levels could potentially be reduced by up to about 77,250 ML. This is equivalent to the amount of water released between 13 and 16 December 2010, through a single gate.

Pre-emptive releases will be managed so as to minimise the likelihood of gate releases due to small storms and local rainfall. Storage capacity will usually be reduced through a combination of:

- Extended gate releases, especially for strategy W1C. For comparison, up to 130,000 ML/day was released during in November and mid December 2010. At this rate, the additional releases could occur in about half a day.
- Ongoing gate releases of up to 30,000 ML/day, which do not isolate any residents but can inundate some lower bridges that cause inconvenience.
- Ongoing valve release of up to about 4,300 ML/day, which can be maintained without inundate any bridges.

Actual releases would be decided by Seqwater based on operational considerations and in accordance with its statutory and regulatory obligations.

Water security impacts

The water security impacts of releases will be zero if the dams fill over the remainder of the wet season. Current forecasts indicate that there is a high probability of this occurring:

- Heavy rainfall is forecast over the Christmas holiday period, as noted above.
- Over the remainder of the wet season, advice from the Bureau of Meteorology is that sea surface temperatures are likely to remain at levels typical of a La Niña event into the first quarter of 2011, with the majority of the models indicating the event will gradually weaken over the coming months.

The water security impacts will be minimal, even if there were no further inflows to the dams. Modelling indicates that the reduction would have a minimal impact on the probability of key water Grid storages falling to 40 per cent of capacity over the next five years.

North Pine and Leslie Harrison dams

North Pine and Leslie Harrison dams do not have flood mitigation potential. Once the dams have reached Full Supply Level, all water flows into the dam must be released to protect the structural safety of the dam.

Seqwater has advised that, without major releases, there are negligible benefits to reducing volumes stored in North Pine or Leslie Harrison dams for the purposes of reducing the extent or duration of any downstream flooding impacts.

For North Pine Dam, there may be some operational and community benefits to minor releases to below Full Supply Level in some circumstances. Any gate operation at North Pine Dam results in inundation of Youngs Crossing Road, which isolates a number of residents. These impacts are currently being minimised by releasing from North Pine Dam at night. With further rainfall forecast, Seqwater may choose to reduce the level to below Full Supply Level in order to reduce the frequency of night releases or the likelihood of releases being required during the day.

For this dam, the SEQ Water Grid Manager has advised Seqwater that, from a water security perspective, it would not object to water being released to 97.5 per cent of storage capacity at any time until end March 2010.

For Leslie Harrison Dam, gate operations do not impact on public roads and generally only inconvenience the general public during large flood events. There is no scope to reduce this inconvenience through small pre-emptive releases. Accordingly, no in-principle approval be made for pre-emptive releases from this dam.

[redacted]

brian cooper

12 January 2011

Mr. Barry Dennien
CEO, SEQ Water Grid Manager
PO Box 16205
City East QLD 4002

Dear Barry,

This letter report:

- presents my final findings on a review of the operation of Wivenhoe Dam (including controlled releases) for compliance against the Flood Mitigation Manual for the period 12 December 2010 to date (Flood Event), and;
- provides advice on the prudence and appropriateness of the decisions and actions taken during the Flood Event regarding the operation of Wivenhoe Dam in light of the Flood Mitigation Manual's requirements and the circumstances of the Flood Event.

The report follows on from my preliminary report sent to you earlier today. The findings and advice are provided on the basis of information provided by SEQ Water Grid Manager which comprised the Flood Mitigation Manual and Technical Situation Reports. The latter were daily (sometimes twice daily) reports for the subject period. They gave a log of rainfall over the dam catchments and the downstream river (Lockyer Ck. and Bremer R.) catchments; inflows to Somerset and Wivenhoe Dams; storage levels; releases from the dams; details of the operation of gates and other outlets (gate openings/discharges); proposed changes in operating strategies and impacts on the various access crossings downstream of Wivenhoe Dam. In reviewing the Technical Situation Reports, I prepared a spreadsheet (see separate attachment of Excel spreadsheet *Tech Reports – Summary*, summarising the reports so that a timeline of the Flood Event could be seen at a glance. This provided a good overview of the Flood Event as it unfolded and showed what information may or may not have been included in a particular report. The Queensland Director Dam Safety (Water Supply) informed me that the Flood Operation Logs contain much more detailed information including details of the communications that were carried out and some of the more detailed information that is not necessarily included in the Technical Situation Reports. I have been provided with a draft of the "*Protocol for the Communication of Flooding Information for the Brisbane River Catchment – Including Floodwater Releases from Wivenhoe and Somerset Dams*" developed in October/November last year and currently being used. The Technical Situation Reports appear to have been an outcome of that Protocol.

The various requirements and required actions detailed in the Flood Mitigation Manual are summarised in the Table given in Attachment A. The Table also gives my comments (where appropriate) on whether there is evidence from the information presented to me, that there is satisfactory compliance with these requirements and actions.

The main aspects of the Flood Mitigation Manual are the various strategies for operating Wivenhoe Dam and Somerset Dam as well as a number of requirements relating to flood operations personnel, flood preparedness and flood training.

At Wivenhoe Dam there are four main strategies for operating the dam (W1 to W4) and at Dam there are three (S1 to S3). These strategies are hierarchical and are based on a number of flood objectives. These in descending order of importance, are:

- Ensure the structural safety of the dams;
- Provide optimum protection of urbanised areas from inundation;
- Minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers;
- Retain the storage at Full Supply Level (FSL) at the conclusion of the Flood Event, and;
- Minimise impacts to riparian flora and fauna during the drain down phase of the Flood Event.

Normal procedures require a return to FSL within 7 days of the flood event peak passing through the dams so that the potential effects of closely spaced Flood Events can be allowed for.

It is apparent from the Technical Situation Reports that emphasis has been given to communicating changes in flood operations strategies with local authorities and the Bureau of Meteorology (BOM).

Until the last day or so, Wivenhoe Dam has been below EL74.0 and accordingly, would be operating under Strategy W1 i.e. make releases such that bridges downstream of the dam do not have to be closed prematurely. For a few days at the end of December and for the last day or so before yesterday's big rise, Strategy W2 would be in place (restrain releases from Wivenhoe Dam such that Brisbane River flows are maintained within the upper limit of non-damaging floods at Lowood (3,500 m3/s)). At various times during the Flood Event some of the downstream bridges have been closed. However, it is evident that action has been taken to vary dam releases such that various bridges could be re-opened as soon as possible. This appears to have been done in accordance with the flood operating strategies. The operations then moved onto Strategy W4 when the storage in Wivenhoe Dam reached about EL 73.5 (before the W4 trigger level of EL 74) when yesterday's heavy rain came on and it was assessed that there was a chance that the first (central) fuse plug could be triggered. It was then a matter of juggling the radial gate openings in an attempt to circumvent any fuse plug triggering. A graph of storage levels for Wivenhoe and Somerset Dams (from information taken from the Technical Situation Reports) showing the limits for the various Wivenhoe Dam flood strategies is given in Attachment A. It is apparent from this graph, that the appropriate flood operation strategies were adopted. The Technical Situation Reports indicate that proposed changes in strategy were appropriately communicated with appropriate authorities in accordance with the new Communication Protocol.

Summary:

The Technical Situation Reports comply with the requirements of the new Communication Protocol. However, I feel that there could be more consistency in the information presented. There seem to be gaps in information presented such as storage levels (see spreadsheet and graph in Attachment A). It would be useful to specify the minimum information required to be presented in the Technical Situation Reports (storage levels, inflows, recent/current rainfall, forecast rainfall, releases from dams, estimated flows from downstream tributaries, current flood operating strategy for each dam and proposed change in strategy, gate and regulator operations, state of downstream road crossings etc). Most of the minimum information is already given, but not in a consistent manner. As a means of reviewing processes followed during a flood, it would be useful to present a timeline of the flood event showing graphs of storage levels and other data that can be easily presented in a graphical manner.

I am informed by the Queensland Director Dam Safety (Water Supply) that the various requirements of the Flood Mitigation Manual relating to requirements for flood operations personnel, flood preparedness and flood training have been adhered to. There are a number of other requirements however, that I am not able to say whether they were satisfied as I had insufficient information. These requirements (see Table in Attachment A) should be subject to a separate audit.

It appears to me that the decision to implement Strategy W4 was a prudent one. While it would cause some damage in the Brisbane River downstream, its implementation, considering forecast rainfalls and projected flows in Lockyer Ck. And the Bremer River, would allow reduction of the storage level in

Wivenhoe Dam. This reduction in storage level would hopefully provide a sufficient buffer that would minimise the chance of a fuse plug triggering in the auxiliary spillway. Triggering of the first (central) fuse plug would cause a sudden increase of flow of some 2,000m^3/s from Wivenhoe Dam. This increase in flow would cause significantly more flooding in the lower Brisbane River than that caused by early implementation of Strategy W4.

Conclusions:

The strategies as set out in the Flood Mitigation Manual have been followed, allowing for the discretion given to making variations in order to maximise flood mitigation effects. The actions taken and decisions made during the Flood Event appear to have been prudent and appropriate in the context of the available knowledge available to those responsible for flood operations and the way events unfolded.

There are a number of requirements where there was insufficient time given the urgency of this review, to source the necessary information for me to demonstrate compliance. However, satisfaction or otherwise of these requirements would have had little impact on the operation of the two dams during this particular Flood Event. It is intended that they be audited when time permits, after the Flood Event.

There are aspects of the Technical Situation Reports that could be improved and these have been discussed above.

Regards,

[redacted]

Brian Cooper

ATTACHMENT A

Action Requirements extracted from the Flood Mitigation Manual:

Action	Comment
The Flood Mitigation Manual contains the operational procedures for Wivenhoe Dam and Somerset Dam for the purposes of flood mitigation and must be used for the operation of the dams during flood events.	Appears to have been done
Sufficient numbers of suitably qualified personnel are available to operate the dams if a Flood Event occurs.	Director of Dam Safety is satisfied
The level of flooding as a result of emptying stored floodwaters after the peak has passed is to be less than the flood peak unless accelerated release is necessary to reduce the risk of overtopping.	See Note 1
A regular process of internal audit and management review must be maintained by Seqwater to achieve improvements in the operation of the RTFM.	See Note 1
Seqwater must maintain a log of the performance of the data collection network. The log must include all revised field calibrations and changes to the number, type and locations of gauges. Senior Flood Operations and Flood Operations Engineers are to be notified of all significant changes to the Log.	See Note 1
Seqwater must maintain a log of the performance of the RTFM. Any faults to the computer hardware or software are to be noted and promptly and appropriately attend to.	See Note 1
Seqwater must ensure that all available data and other documentation is appropriately collected and catalogued for future use.	See Note 1
Seqwater must ensure that information relevant to the calibration of its field stations is shared with appropriate agencies.	See Note 1
Seqwater must liaise and consult with these agencies with a view to ensuring all information relative to the flood event is consistent and used in accordance with agreed responsibilities: • Bureau of Meteorology (issue of flood warnings for Brisbane River basin); • Department of Environment and Resource Management (review of flood and discretionary powers); • Somerset Regional Council (flood level information for upstream of Somerset Dam and upstream and downstream of Wivenhoe Dam); • Ipswich City Council (flood level information for Ipswich), and; • Brisbane City Council (flood level information for Brisbane City).	Required also by draft of Communications Protocol. Technical Situation Reports infer compliance
Seqwater must report to the Chief Executive by 30 September each year on the training and state of preparedness of operations personnel.	See Note 1
Seqwater must provide a report to the Chief Executive by 30 September each year on the state of the Flood Monitoring and Forecasting System and Communication Networks.	See Note 1

Action	Comment
After each significant flood event, Seqwater must report to the Chief Executive on the effectiveness of the operational procedures contained in this manual.	It is too early for this action to be implemented. Will be implemented when the Flood Event is finished
Prior to the expiry of the approval period, Seqwater must review the Manual pursuant to provisions of the Act.	It is too early for this action to be implemented
Strategies are changed in response to changing rainfall forecasts and stream flow conditions to maximise the flood mitigation benefits of the dams.	Technical Situation Reports indicate that this is done
When determining dam outflows within all strategies, peak outflow should generally not exceed peak inflow.	Information from Seqwater indicates that the requirement was satisfied
Protocol for use of discretionary powers (i.e. who gets told)	Director of Dam Safety is satisfied – I don't know whether Seqwater CEO or Chairperson approved – See Note 1

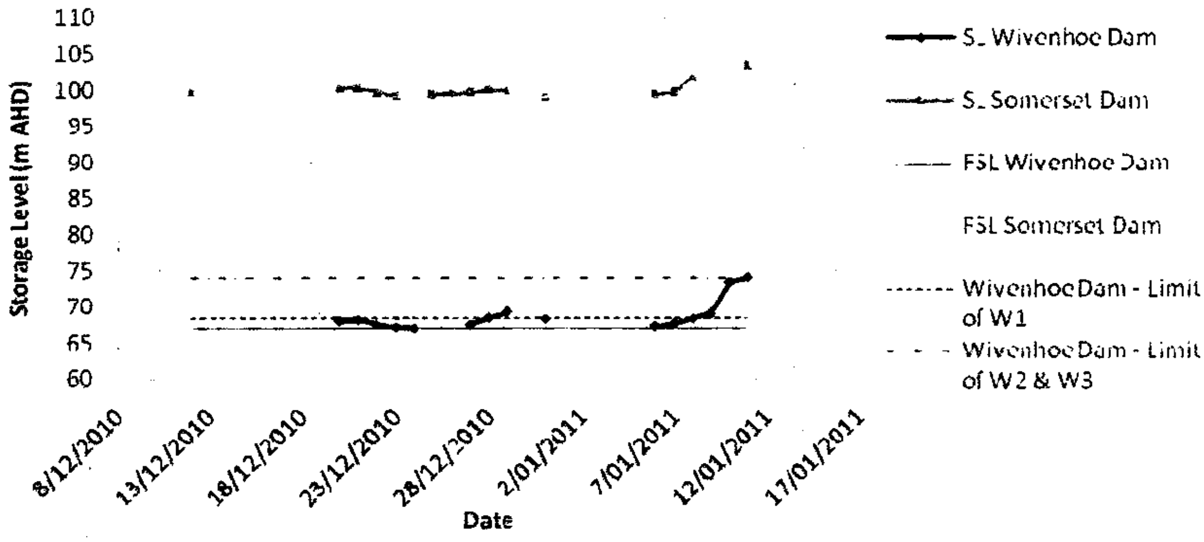
Note1: For a number of the above actions, given the short time frame for the review on compliance of actual flood operations with the Flood Mitigation Manual, it was not possible to source some of the information required to confirm that requirements had been fulfilled. These actions will be audited separately, when time permits.

Action	Comment
Flood Strategies for Wivenhoe Dam:	
The intent of Strategy W1 is to not to submerge the bridges downstream of the dam prematurely (see Appendix I). The limiting condition for Strategy W1 is the submergence of Mt Crosby Weir Bridge that occurs at approximately 1,900 m^3/s . For situations where flood rains are occurring on the catchment upstream of Wivenhoe Dam and only minor rainfall is occurring downstream of the dam, releases are to be regulated to limit, as much as appropriate in the circumstances, downstream flooding.	Technical Situation Reports indicate that every attempt was made to keep the specified road crossings open
The intent of Strategy W2 is limit the flow in the Brisbane River to less than the naturally occurring peaks at Lowood and Moggill, while remaining within the upper limit of non-damaging floods at Lowood (3,500 m^3/s). In these instances, the combined peak river flows should not exceed those shown in the following table: The intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4000 m^3/s, noting that 4000 m^3/s at Moggill is the upper limit of non-damaging floods downstream. The combined peak river flow targets for Strategy W3 are shown in the following table. In relation to these targets, it should be noted that depending on natural flows from the Lockyer and Bremer catchments, it may not be possible to limit the flow at Moggill to below 4000 m^3/s. In these instances, the flow at Moggill is to be kept as low as possible.	Technical Situation Reports indicate that Wivenhoe Dam releases were made considering concurrent flows in the Bremer River & Lockyer Ck. To delay damaging floods as long as possible
The intent of Strategy W4 is to ensure the safety of the dam while limiting downstream impacts as much as possible. This strategy normally comes into effect when the water level in Wivenhoe Dam reaches EL74.0 m AHD. However the Senior Flood Operations Engineer may seek to invoke the discretionary powers of Section 2.8 if earlier commencement is able to prevent triggering of a fuse plug. There are no restrictions on gate opening increments or gate operating frequency once the storage level exceeds EL74.0 AHD, as the safety of the dam is of primary concern at these storage levels.	Technical Situation Reports indicate that Wivenhoe Dam releases were such as to delay adopting this strategy as long as possible
Where possible, total releases during closure should not produce greater flood levels downstream than occurred during the flood event.	Technical Situation Reports indicate that this requirement was satisfied
The aim should always be to empty stored floodwaters stored above EL 67.0m within seven days after the flood peak has passed through the dams.	Technical Situation Reports indicate that

Action	Comment
	emphasis was given to satisfying this requirement
Flow in the spillway to be as symmetrical as possible with the centre gates opened first.	Technical Situation Reports indicate that this was done
The bottom edge of the radial gates must always be at least 500mm below the release flow surface.	See Note 1 above

Action	Comment
Flood Strategies for Somerset Dam:	
The intent of Strategy S1 (Somerset Dam Level expected to exceed EL 99.0 and Wivenhoe Dam not expected to reach EL 67.0 (FSL) during the course of the Flood Event) is to return the dam to full supply level while minimising the impact on rural life upstream of the dam. Consideration is also given to minimising the downstream environmental impacts from the release.	Technical Situation Reports indicate that this was done
The intent of Strategy S2 (Somerset Dam Level expected to exceed EL 99.0 and Wivenhoe Dam level expected to exceed EL 67.0 (FSL) but not exceed EL 75.5 (fuse plug initiation) during the course of the Flood Event). This to maximise the benefits of the flood storage capabilities of the dam while protecting the structural safety of both dams. The Flood Mitigation Manual contains a graph that shows the intended interaction of the Wivenhoe Dam and Somerset Dam storage levels.	Technical Situation Reports indicate that this was done – little information on the operation of the radial gates at Somerset Dam. How the graph was followed not really demonstrated
The intent of Strategy S3 (Somerset Dam Level expected to exceed EL 99.0 and Wivenhoe Dam level expected to exceed EL 75.5 (fuse plug initiation) during the course of the Flood Event) is to maximise the benefits of the flood storage capabilities of the dam while protecting the structural safety of both dams.	Not relevant at this stage
The safety of Somerset Dam is the primary consideration and cannot be compromised and its peak level cannot exceed EL 109.7.	Maximum level only EL103.3

Wivenhoe & Somerset Dams – Storage Level Behaviour (as presented in Technical Situation Reports)



Date	Time	TSR	Wivenhoe Dam Release (m³/s) Regulators	Hydro	Gates	Total	Gate No.	Opening (m)	Storage Level	Rainfall (mm)
12/12/2010	1400	W1								
13/12/2010	1300	W2		10	290	300				
15/12/2010	1800	W3								
16/12/2010	1600	W4			0					
17/12/2010	1200	W5								Large storms yesterday pm and night; 20-50 forecast tonight
17/12/2010	1800	W6	Closed		Opening Op. Initiated					20-50 forecast o/n
	1830			13	50	63	3	0.5		
18/12/2010	0700	W7								40-50 since 16/12/2010
19/12/2010	0700	W8			350	350	3	3.5		20-30 upper Brisbane R.
19/12/2010	1800	W9			300	300	3	3		
20/12/2010	0700	W10								
20/12/2010	0900	W11							68 expected this afternoon	
20/12/2010	0900	W12								
21/12/2010	0730	W13				peak 1,280 (0500)			peak 68.24 (0400); currently 68.22 (112% cap.) falling slowly	
22/12/2010	0830	W14							currently @ 67.61 (107% cap.) falling slowly	none since 300 on 20/12/2010
22/12/2010	1600	W15			Closing sequence				to finish just>FSL	
23/12/2010	0800	W16			All gates expected to be closed by 1500				When gates closed, will be 67.2 (0.2m > FSL) & 50mm <gate opening trigger level	
23/12/2010	1430	W17			350		3	3.5	67.23	10-30 in CA over last 24 hrs.; further heavy rain expected to start on 29/12/2010
24/12/2010	0630	W18			All gates expected to be closed by 1300				67.07 expected when all gates closed	little or no rainfall
24/12/2010	1330	W19	4,200Ml/day from reg. & Hydro		Radial gate ops ceased @ 1300		3	zero		
25/12/2010	0930	W20								10-20 over last 24 hrs

26/12/2010	0800 W21				Rel. minor over last 24 hrs.
27/12/2010	0800 W22				40-50 over dam CA last 24 hrs.
28/12/2010	0700 W23	347 (initially) then back to 46			20-40 over dam CA's ;ast 24 hrs
29/12/2010	0700 W24			69.26 (@ 0600) - aim is to return to FSL by 2/1/2011	No/very little in last 24 hrs.
30/12/2010	0700 W25	Wivenhoe+Lockyer = 1,600m³/s		69.33 peak yesterday @ 1200 (2.3m > FSL) 69.07 this am	No/very little in last 24 hrs.
31/12/2010	0700 W26 W27	Wivenhoe+Lockyer = 1,600m³/s		68.4 @ 0500	No/very little in last 24 hrs.
6/01/2011	1200 W28	Commence opening RG @ 1800 & ramp up to 300m³/s by 2200		67.31 @ 0700	20-30 widespread with up to 50 on dam CA's
7/01/2011	0700 W29			67.64 @ 0600	30-50 with isolated falls up to 75; signif. Rain on Lock. Ck.
7/01/2011	1500 W30	Release started 1500 to be incr. slowly to ~1,200m³/s by 1400 tomorrow			
8/01/2011	0700 W31	~890	All (5) RG's open	68.45 @ 0600 rising steadily	Widespread rain 20-40 over dam CA's since 0900 yesterday; further high rainfall predicted for next 4 days
9/01/2011	0700 W32 W33	1,343		Currently 68.58 (falling slowly)	For last 12 hrs. av. of 40 for Somerset CA & <10 for Wivenhoe CA
9/01/2011	2100 W34	1,400		Currently @ 69.1;	Very heavy rainfall -totals for 24 hrs 100 - 300; Severe weather warning for heavy rainfall

		W35					
		W36					
		W37					
11/01/2011	0630	W38	2,750 since 1930 on 10/1/2011		All (5) gates	73.51 rising @ 25mm/hr.	20-60 last 12 hrs in Lockyer CA; 30 in Bremer R.; Isol. Falls of 125 in upper Brisbane R. & widespread falls of 40 - 70 in Somerset CA
11/01/2011	1200	W39		3,970		74.1 (179.5% cap.) rising @ 25mm/hr.	

Comments	Crossing Closures
45,000Ml from Somerset; WL|Somerset to peak at 99.7 on 13/12/2010; 150m³/s expected through Brisbane; 30,000Ml expected into Wivenhoe from upper Brisbane R.; peak WL in Wivenhoe expected to be 67.6; Releases expected from Wivenhoe on afternoon of 13/12/2010 ramping up to 300m³/s; Reg. will be closed & Gate 3 opened to 3m to get WL back to 67.25; Incr. release will impact on 3 crossings; Dam Regulator informed	
138m³/s from Somerset;	Gate release will impact on 3 crossings
Releases from Wivenhoe will cease on 16/12/2010; Hydro will continue during fish recovery ops.	
Gate closed 1000	
Decision to commence a release tonight was made this am by Duty Flood Engineers to provide as much notice to impacted Councils as possible; 60,000Ml needs to be released from Wivenhoe & Somerset to maintain FSL	
Need to release >60,000Ml from Wivenhoe & Somerset to achieve FSL	
Releases could increase to 300m³/s;	Would impact Twin Bridges, Savages Crossing, Colleges Crossing
100,000Ml to be drained in next 4 days; Q|Brisbane R. to be maintained at 300-350m³/s;Transfer from Somerset via 2 reg.; Wivenhoe Q incr. to 150m³/s o/n; Will incr. further to 300m³/s as Q|Lock.Ck. Subside over next 24 hrs.; Q|Lock.Ck. Currently 130m³/s	Twin Bridges & Savages Crossing currently closed; Colleges Crossing to be impacted in afternoon
12,000Ml/day from Somerset; Release expected until 22/12/2010;	Twin Bridges, Savages Crossing, Colleges Crossing currently closed
Somerset rel. steady (Q|reg.=140m³/s); Q|Wivenhoe to be maintained at 300m³/s (Lock.Ck. Permitting) to allow Burtons Bridge to remain open; WL|Wivenhoe expected to incr. to 67.4 over next 2 days;	Twin Bridges, Savages Crossing and Colleges Crossing are closed; closing of Burtons Bridge and Kholo Bridge will be considered if more rain or inflows
Somerset risen to 100.2 - sluice gate releases to be made until am of 22/12/2010 when FSL expected; WL|Wivenhoe at 68 expected this pm; Q|Wivenhoe expected to be >1,200m³/s - discuss with impacted Cncls.- strategy decision by 10000; Wivenhoe inflows excl. Q|Somerset peak tomorrow at 1800m³/s	Both Burtons and Kholo bridges likely to be inundated
Inflow to Somerset to peak today at 700m³/s; Somerset & Wivenhoe currently storing 140,000Ml above FSL; further inflows occurring; releases to be incr. o/n to ~1,200m³/s; various Cncls. Given heads up; BOM advised	Wivenhoe releases reduced slightly to keep Burtons Bridge open - then incr. releases after Somerset RegnlCncl inform residents affected by Burtons Bridge
Same as W11	
410m³/s from Somerset sluice gates; Somerset peaked @100.43 (1300 on 20/12/2010), currently @ 100.23 (114% of cap.); 110,700Ml inflow to Somerset,67,500Ml discharged into Wivenhoe; Wivenhoe inflow (excl. Somerset releases) = 157,900Ml, 103,000Ml released; Total inflow to both dams ~310,000Ml; Continued gate operations may be necessary if forecast rainfall results in subsequent river rises	Kholo Bridge is also expected to be inundated by mid-morning ; In accordance with the adopted operational strategy these bridges should be back in service by late Thursday and all bridges (with the possible exception of Twin Bridges) should be trafficable for Christmas providing no further rainfall occurs.
410m³/s from Somerset sluice gates; Somerset currently @ 99.68 (108% cap.); 121,500Ml inflow to Somerset, 103,000Ml released to Wivenhoe; Gate Ops. @ Wivenhoe; High tides expected to coincide with peak levels in Brisbane R.	Burtons Bridge & Kholo Bridge expected to be back in service by 23-24/12/2010; All bridges expected to be trafficable by Xmas provided no further rain
BOM aware of all releases	Gate closing sequence to allow bridges to be accessible
1 sluice open @ Somerset to be closed @ 0900 - WL will be 0.1m> FSL; Est. inflow to Somerset 135,000ML, majority discharged into Wivenhoe; Gate closure ops @ Wivenhoe in progress; Wivenhoe inflow (excl. Somerset inflow) = 204,000Ml; A total of 324,000Ml has been released; Contd. gate ops may be necessary if forecast rain results in river rises; Gate closure ops sequence to be reviewed	Projected crossing openings: Burtons Bridge – 18:00 Thursday 23 December 2010. Savages Crossing – 19:00 Thursday 23 December 2010 Kholo Bridge – 21:00 Thursday 23 December 2010 Colleges Crossing – 08:00 Friday 23 December 2010
Somerset gate ops ceased @ 0900, WL @ 99.1; Gate closure sequence extended to pm of 24/12/2010; Contd. Gate ops may be necessary if forecast rainfall gives incr. river levels	Projected crossing openings: Burtons Bridge – 18:00 Thursday 23 December 2010, Kholo Bridge - 21:00 Thursday 23 December 2010; Other bridges expected to remain closed until Xmas Day
Gate ops @ Somerset ceased yesterday, reg. to be opened to bring lake to FSL; Gate ops continuing @ Wivenhoe -1 gate incr. every 5-6 hrs to ensure Brisbane R. Q not incr. due to incr. Lock. Ck. Outflows & maintain Burtons Bridge open;	Twin Bridges, Savages Crossing and Colleges Crossing are currently closed and should remain so for some time due in part to current outflows into the Brisbane River from Lockyer Creek that will peak in excess of 200 cumecs late today.
Flood Centre to monitor o/n & consider options tomorrow am based on inflows & rainfall; further gate ops may be necessary in coming days	Twin Bridges, Savages Crossing and Colleges Crossing may still be affected by flows from the Lockyer.
Somerset WL incr. from 99.18 yesterday @ 0600 to 99.33 @ 0730 today; 99.5 tomorrow if no gate ops.; Wivenhoe currently 4,200Ml through hydro & reg.; 15,00Ml expected just from upper Brisbane R. in next few days; WL cont. to fall in Lock. Ck; Small rises expected in Bremer & Warrill systems; WL in Wivenhoe incr. to 67.28 @ 600	Twin Bridges, Savages and Colleges Crossing remain impacted by Wivenhoe releases and Lockyer and local runoff. Burtons and Kholo Bridges would be currently unaffected. Kholo will no doubt still be closed by Council regarding repairs.

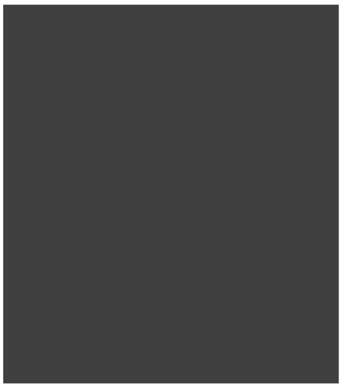
BOM issued severe weather warning @ 0 445; Somerset WL incr. to 99.46 (0.46m> FSL) - 2 regs. To be opened today (140m^3/s); Wivenhoe WL incr. to 67.37 (0.37m > FSL); RG to be opened later today following discussions with local authorities; further gate ops may be necessary if rainfall incr. river levels	Crossings downstream of the dam are currently impacted primarily by non-controlled river flows only (no RG releases from Wivenhoe). Lockyer Creek outflows into the Brisbane River are currently in the order of 60m^3/s. Twin Bridges, Savages and Colleges Crossings will be inundated but the plan is to release around 300-350m^3/s depending on flows downstream so as to not impact Burtons Bridge.
BOM continues with severe weather warning & widespread rainfall over dam CA's; 2 regs. @ Somerset giving 139m^3/s release, lake contd. To rise to 99.6 (0.6m> FSL); RG ops @ Wivenhoe commenced yesterday @ 0900, WL contd. To rise to 67.57 (0.57m > FSL);Q|Wivenhoe reduced o/n because of incr. Q|Lockyer to ensure Burtons Bridge remains open; RG @ Wivenhoe wound back as Q|Lockyer incr. > 250m^3/s; Q|Lockyer expected to peak>500m^3/s later today/tomorrow - will innundate Burtons Bridge;When this happens, Q|Wivenhoe will be incr. to get WL back to FSL; further gate ops may be necessary in coming days	Twin Bridges, Savages Crossing and Colleges Crossing currently closed; Burtons Bridge is currently open, but will be closed later today/tomorrow; Kholo Bridge remains unserviceable due to flood damage; No current expectation that either Mt Crosby Weir Bridge or Fernvale Bridge will be impacted by the current event; An updated estimate of the time of closure of Burtons Bridge this afternoon will be provided to Council
Sever weather warning no longer current; Somerset release through regs' ~ 208m^3/s;WL|Somerset incr. to 99.96 (0.96m>FSL) - inflows decreasing; RG opening dependent on Q|Lockyer; Wivenhoe WL currently @ 68.55 (1.55m > FSL); inflows to Wivenhoe decr.	RG discharge dropped back to 46m3/s to ensure Burtons Bridge can remain open; Twin Bridges, Savages Crossing, Colleges Crossing, Burtons Bridge and Kholo Bridge are currently closed; No current expectation that either Mt Crosby Weir Bridge or Fernvale Bridge will be impacted by the current event; Lockyer Creek outflows being closely monitored and may come close to impacting upon the Mt Crosby Weir Bridge; England Creek access is not impacted yet
Further 2 sluices opened @ Somerset; WL @ Somerset 99.83 & falling slowly, 2 sluices to be closed @ 1200; intended to incr. Wivenhoe releases so Q|Wivenhoe+Q|Lockyer maintained @ 1,600m^3/s (similar Q to mid Oct &mid Dec 2010)	Twin Bridges, Savages Crossing, Colleges Crossing, Burtons Bridge and Kholo Bridge are currently closed; no current expectation that Mt Crosby Weir Bridge or Fernvale Bridge will be impacted by current event. At this stage, estimated that the flow at Burtons Bridge will fall below the bridge deck on Sunday morning.
2 sluices @ Somerset remain open (405m^3/s) - FSL expected by 6/1/2011; RG closing sequence expected to start mid tomorrow- RG expected to be closed on 2/1/2011	Twin Bridges, Savages Crossing, Colleges Crossing, Burtons Bridge and Kholo Bridge are currently closed
WL @ Somerset 99.01 (falling from peak of 100.0 - 1200 28/12/2010) - currently 2 regs;	Twin Bridges, Savages Crossing, Colleges Crossing, Burtons Bridge and Kholo Bridge are currently closed due to inundation
	Not included
Somerset @ 99.34 (0.34m > FSL) & rising slowly; Wivenhoe 67.31 (0.31m > FSL) & rising slowly; Gates will be opened in next 24 hrs; Lockyer Ck peak of about 100m3/s Friday afternoon	Lockyer Ck peak of about 100m3/s Friday afternoon. This will take out Twin Bridges and nearly inundate Savages Crossing. Colleges Crossing could be taken out by a combined Lockyer and local runoff. Current strategy is to keep Burton Bridge free. Gate release would limit mid-Brisbane Q to 400m^3/s ((Burtons capacity 450m^3/s).
100-200mm rain forecast for SE Qld next 5 days; Somerset WL @ 99.58 (0.59m > FSL) rising slowly - currently releasing 35m^3/s; Wivenhoe WL @ 67.64 (0.64m > FSL & > gate trigger level) rising slowly; u/s of dam river levels peaked @ Linville and Gregors Ck gauges; A peak of about 470 cumecs is expected from Lockyer Creek by mid-afternoon; 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 Q|Wivenhoe may be as high as 1,200m^3/s	Q|Lockyer may be of sufficient magnitude to inundate Burtons Bridge; 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, may also later impact upon Burtons Bridge & Kholo Bridge; not expected to be any adverse impacts upon Fernvale Bridge or Mt Crosby Weir Bridge; Councils have been advised of this strategy and are contacting residents
Somerset releasing 35m^3/s; 50,000Ml into Somerset; Gate release @ Wivenhoe - strategy to be reviewed tomorrow (dependent on further rainfall)	All of the crossings downstream of Wivenhoe with the exception of Fernvale and Mt Crosby Weir Bridge will be adversely impacted; Councils have been advised of this strategy and are contacting residents
Somerset WL @100.42 & rising (0500) - 1 open sluice gate; Water temp. held in Wivenhoe - strategy may need to be reviewed (depend. On confidence in estimates of Wivenhoe inflows); Intended to ramp Wivenhoe up to 1,200m^3/s by 1200 - likely to be incr. next week; since 2/1/2011, ~200,000Ml has flowed into Wivenhoe (incl. Somerset releases), further 180,000Ml expected based on recorded rainfall; ~ 50,000Ml released via reg. & hydro (@50m^3/s)	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 Colleges Crossing) will be adversely impacted for several days. At this stage Fernvale and Mt Crosby Weir Bridge are not expected to be affected but they could potentially be affected if the predicted rainfall totals eventuate.
Somerset currently @ 100.27 - 60mm rain in last 2 hrs will cause significant inflow later today; 405m^3/s being released into Wivenhoe; maintain combined Q of 1,600m^3/s in mid-Brisbane R.	The current Wivenhoe Dam release combined with Lockyer flows and local runoff will mean that all low level crossings downstream of Wivenhoe (Twin Bridges, Savages Crossing, Burtons Bridge, Kholo Bridge and Colleges Crossing) will be adversely impacted until at least Wednesday 12 January. At this stage Fernvale and Mt Crosby Weir Bridge are not expected to be affected, but this may be revised if the predicted rainfall totals eventuate and higher releases from Wivenhoe Dam are considered necessary. Cncls advised of Wivenhoe op. strategy
Not included	
Somerset @ 101.68 rising quickly; 5 sluice gates open releasing ~1,100m^3/s; WL expected to reach 103.5 by am 11/1/2011; River levels u/s Wivenhoe rising fast; Q|Brisbane R. @ Gregors Ck @ 6,700m^3/s; Wivenhoe expected to reach 73.0 by 11/1/2011 - need to incr. Q|Wivenhoe am of 10/1/2011 - crank up to 2,600m^3/s by am 11/1/2011; Attempt to keep combined Q < 3,500m^3/s - < limit of urban damages in the City	The projected Wivenhoe Dam releases combined with Lockyer flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Bridge, Mt Crosby Weir and Colleges Crossing) will be adversely impacted until at least Saturday 15 January in varying degrees; Water levels in the lower Brisbane R will be impacted by the combined flows of Lockyer Ck, Bremer River, local runoff and releases from Wivenhoe Dam

Not Included
Not Included
Not Included

Somerset WL @ 103.27 & falling slowly ; currently 1,400m^3/s released to Wivenhoe- to be reduced to 500m^3/s later in the day - to ensure flood mitigation of Somerset & Wivenhoe are maximized; BOM provided advice on flash flooding in Lockyer Ck.; WL in Wivenhoe will reach 74 by evening; May need to increase Q further - may result inQ|lower Brisbane R. >5,000m^3/s

Somerset @ 103.3 & rising; Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing; If no further rain, can hold @ 74.8 - aim is to prevent fuse plug triggering, situation assessed every 3 hrs.; 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 six hours until the situation stabilizes.

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 Bridge, Mt Crosby Weir and Colleges Crossing) will be adversely impacted; 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.



Brian Cooper

Dams Engineer

Qualifications & Affiliations

Short courses on finite element analysis, embankment dam engineering, earthquake engineering. Published technical papers – ICOLD. ANCOLD and I.E. Aust. Attended dam safety course at USBR (Denver, USA) in 2002

Bachelor of Engineering (B.E. Hons), 1968 and Master of Engineering Science (M.Eng.Sc.), 1971

University of New South Wales

Graduate Diploma of Engineering Management, 1994 Deakin University

F.I.E. Aust.,C.P.Eng. RPEQ

Expertise

Brian has approximately 40 years experience in investigation and design of major dams, weirs and hydraulic structures, having started his career designing farm dams and small irrigation schemes. He retired from NSW Department of Commerce in 2005. Brian now works as a private consultant specialising in dams engineering and fish passage at dams and weirs. He has a special interest in risk assessment and computer modelling in general and the seismic analysis of dams in particular. Engineering software (concrete dam stability analysis and flood routing) written by Brian is still used extensively in the Dams & Civil Group of the Department of Commerce. He also has particular experience with concrete dams and the use of post tensioned ground anchors for strengthening those dams. He was a member of the Australian National Committee on Large Dams (ANCOLD) Working Group that developed guidelines for 'Design of Dams for Earthquakes' and a member of the Working Group that revised the guidelines for 'Risk Assessment for Dams'. He has been a guest lecturer for a number of years (most recently in 2009) on concrete dam engineering for the University of NSW post graduate Embankment Dam Engineering Course, and on the history of dams in NSW at Sydney University.

He has been the project director and project manager for a number of feasibility studies, design reviews, site investigations and detail design consultancies for major dams and weirs including the direction and co-ordination of all specialist services including dambreak studies, preparation of dam safety emergency plans and risk assessments. He is currently an expert reviewer for a number of Australian water authorities and consultants (State Water Corporation (NSW), Hydro Tasmania, SunWater (Queensland), Brisbane City Council, Goulburn-Murray Water, Goulburn Valley Water, WA Water Corporation, Southern Rural Water (Victoria), URS, GHD, Hobart Water, NT PowerWater, and TrustPower (NZ)). He has also worked as a sub-consultant for a number of consulting firms (URS, MWH, GHD).

Brian is the Engineers Australia representative for the NSW Dams Safety Committee (the dam safety regulator in NSW) and is currently the Chairman of that organisation. He has been a member of the Murray Darling Basin Authority's Fish Passage Task Force which advises inter alia on the installation of fishways on the Murray River as part of the Living Murray Program.

Brian is a registered engineer in Queensland (RPEQ No. 6819). He started his own consulting business in 2008, advising on dam safety, dam design and analysis, dam risk assessments and dam upgrades as well as fish passage for dams. He is providing specialist advice through *Brian Cooper Consulting* as a sole trader.

Professional Experience

2008 to Present: Principal of Brian Cooper Consulting

2010

Five yearly comprehensive dam safety inspection of Carcoar Dam (double curvature arch dam).
Internal reviewer to URS (Melbourne) on concept design of regulator structures and associated fishways for the Hipwell Road project for watering the Gunbower Forest
Specialist adviser to Melbourne Water – valve behaviour on Sugarloaf Dam pipeline, structural behaviour of pumping station floor slab and pump bases at Cardinia Dam Pumping Station
Commenced work as member of ANCOLD working group re-writing the Earthquake Guidelines – responsible for re-writing sections relating to concrete dams.
Continuing involvement with Alluvium in the design of the weir upgrade and the new fishway for Booligal Weir.
Continuing external peer review services to State Water Corporation for the detail design of new auxiliary fuse plug spillways for Copeton and Chaffey Dams, detail design of raising and post tensioned strengthening of Keepit Dam, detail design of upgrade works for Wyangala Dam, finite element analysis of Carcoar Dam (double curvature arch dam).
Further work with GHD (Perth) on risk assessment for Serpentine Dam.
Continuing involvement with Hydro Tasmania, as Chair of external review panel for Catagunya Dam.

2009

Part of URS' comprehensive inspection team for Melbourne Water's Maroondah Dam.
Part of URS' business risk assessment team for Southern Rural Water's Cowwarr and Maffra Weirs.
Part of Alluvium's design team upgrading Booligal Weir and providing a fishway at the weir, for State Water Corporation.
Part of GHD's design team for Lower Fitzroy River Infrastructure Project designing fishways for Rookwood and Eden Bann Weirs near Rockhampton in Queensland.
Project Manager on behalf of SA Water and reviewer for study into vibration of a crane rail beam at Lock 5 on the River Murray.
Expert reviewer for State Water Corporation for 3D finite element analysis of Carcoar Dam (double curvature arch dam).
Internal reviewer for URS on Laanecoorie Dam Upgrade.
Expert reviewer for State Water Corporation for risk assessments for Oberon and Rydal Dams.
Member of GHD's Serpentine Dam risk assessment team for WA WaterCorp.
Expert reviewer for SunWater in Queensland for the comprehensive risk assessment undertaken for Fairbairn Dam and Coolmunda Dam.
Expert reviewer for State Water Corporation for major upgrade works at Keepit, Copeton, Chaffey and Wyangala Dams.
Appointed as Chairman of the NSW Dams Safety Committee (the dam safety regulator in NSW).
Provided external peer review for Goulburn Valley Water, on Nine Mile Creek Dam Upgrade.
Internal reviewer for URS (Adelaide) for Lake Victoria Outlet Regulator options studies.
Provided advice to URS (Melbourne) on the Mildura Weir Fishway design.
Member of expert panel advising State Water Corporation on revised dam surveillance regime.
Part of Ecosmart bid team - prepared concept designs for fish passage facility at proposed Wyaralong Dam in Queensland.
Continuing expert review role for Catagunya Dam upgrade.

2008

Started as a private specialist dams consultant - *Brian Cooper Consulting.*
Worked through the URS Corporation for the USBR and the USACE in developing a risk toolbox for lined spillways.
Advised TrustPower in New Zealand on replacement of post tensioned anchors at Mahinerangi No. 1 Dam.
Adviser to State Water Corporation and to URS on further upgrade works for Hume Dam.
Provided specialist advice to WA Water Corporation on Wellington Dam post tensioning.
Peer reviewer on behalf of URS for Warren Dam in South Australia.
Part of URS team carrying out portfolio risk assessment of Melbourne Water's dams.
Member of Expert Review Panel for Darwin River and Manton Dams for NT PowerWater.

1987 to 2008: Dams & Civil Section of NSW Department of Public Works and Services/NSW Department of Commerce.

2008	Carried out detailed 3D finite element analysis of radial gate at Wyangala Dam spillway for State Water Corporation. Continuing review role for Tillegra Dam. Continuing review role for Hinze and Lake Manchester Dams in Queensland and Catagunya Dam in Tasmania. Prepared options report on Burrendong Dam spillway modifications for State Water Corporation.
2007	Continuing roles on Lake Manchester, Hinze, Catagunya and Redbank Ck. Dams. Internal peer reviewer for NSW Dept. of Commerce regarding design of Tillegra Dam. Advised State Water on feasibility of fish passage facilities at a number of their major irrigation dams. Expert reviewer for GHD on a flood retarding basin in south west Sydney. Part of expert panel for River Murray Water risk assessments for Hume and Dartmouth Dams, Torrumbarry and Yarrowonga Weirs and Lake Victoria. Re-elected as Deputy Chairman of the Dams Safety Committee
2006	Project director for 3D finite element analysis of Bendora Dam (double curvature arch dam) Chair of external peer review panel for upgrading of Lake Manchester Dam (concrete gravity dam) in Queensland Internal peer reviewer and senior consultant for the raising of Hinze Dam (earth and rockfill embankment) in Queensland Project director for preliminary and detailed design of Redbank Creek Dam (single curvature arch dam) upgrading Project director for Keepit Dam fish passage investigations Part of expert panel for URS undertaking portfolio risk assessment for dams owned by River Murray Water External peer reviewer for Hydro Tasmania for Catagunya Dam (concrete gravity dam) upgrading; Project director for 3D finite element analysis of Upper Cordeaux No. 2 Dam (single curvature arch dam owned by SCA) for BHP Billiton
2005	Project design engineer for dam related aspects of Nepean Dam Deepwater Access Project: Pipeline crossing end of spillway; outlet works for end of pipeline Project design engineer for Avon Dam Deepwater Access Project: tunnel design through rockfill buttressing; new low level outlet works
2004	Internal reviewer to URS Australia for Pykes Ck Dam Investigations (Southern Rural Water, Victoria) Internal reviewer to URS Australia for Lower Reservoir Dam (Hobart Water, Tasmania) Member of expert review panel for the Melton Dam upgrade design (Southern Rural Water, Victoria)
2003/04	Designer for retrofitting multi-level offtake for Tallowa Dam (Sydney Catchment Authority). Member of the Independent Technical Expert Panel for the Eildon Dam Upgrading in Victoria for Goulburn-Murray Water. Currently the design director for the Wivenhoe Dam Alliance carrying out the flood capacity upgrading for Wivenhoe Dam in Queensland – included directing major computational fluid dynamics modelling investigations of existing spillway
2003	Carried out options study for environmental upgrading works at Keepit Dam (selective withdrawal facility, additional outlet works and fish passage) Carried out assessment of spillway capacity for Hume Dam using computational fluid dynamics modelling (by a sub-consultant) Carried out detail design for anchoring Bellfield Dam (Victoria) Intake Tower Carried out detailed finite element analysis of Keepit Dam radial gates
2002	Carried out review of large farm dam with seepage problems. Directed computational fluid dynamics modelling of drum gate and radial gates at Warragamba Dam together with structural analysis of gates (modelling carried out by sub-consultant) to ensure gates can handle more

rigorous operating conditions
Adviser to the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) on civil engineering matters related to the replacement reactor project at Lucas Heights
Expert reviewer for Goulburn-Murray Water for remedial works at Cairn Curran Dam in Victoria
Project Director for Lerderderg Weir safety review and risk assessment for Southern Rural Water (Victoria). Carried out finite element analysis of radial gate

2001

Project Director for design of further remedial works at Hume Dam.
Technical director on behalf of NPWS for quantitative risk assessment for Snowy Mountains roads
Chairman of the committee producing a geotechnical response plan for the Alpine Way in the Snowy Region for NPWS
Carried out non-linear finite element analysis (earthquake loading) for outlet tower at Bellfield Dam for Wimmera-Mallee Water (Victoria)
Joined the MDBC's Fish Passage Reference Group and reviewed fishway designs
Consultant to DLWC for their portfolio risk assessment of thirty dams
Provided advice on the post tensioning system at Waitakere Dam in New Zealand.

Director of Dam Surveillance Group responsible for the surveillance of DLWC dams and participant of a number of 5 yearly surveillance inspections
Project Director of review of DLWC Intake Towers Earthquake Stability Review
Directed DPWS input into the Earthquake Stability of the structural elements of Yarrawonga Weir as sub-consultant to URS Australia – included detail design of anchoring system for the weir. Also provided design advice on design of stone columns to provide protection against liquefaction of alluvial foundations.
Member of the expert panel for the risk assessment studies being undertaken for Goulburn-Murray Water
Project Director for safety review and preliminary design of remedial options for Blowering Dam (DLWC)
Acted as reviewer for a number of projects carried out by URS (incl. Cardinia Dam outlet tower, Bellfield Dam embankment/spillway)
Directed functionality study (including business risk assessment) for Yallourn Weir for Southern Rural Water (Victoria)

2000

Project Director for design of further investigations and remedial works at Hume Dam.
Safety reviews for Bamarang and Flat Rock Dams
Director of Dam Surveillance Group responsible for the surveillance of DLWC dams and participant of a number of 5 yearly surveillance inspections.
Project Director for earthquake studies on intake towers and appurtenant works at DLWC dams
Consultant to DLWC to manage their portfolio risk assessment
Project Director for a number of dambreak studies and preparation of dam safety emergency plans
Member of the consulting team carrying out risk assessments for Goulburn-Murray Water (Victoria) for Eppalock Dam
Carried out review of Earthquake Stability Review of the Outlet Tower at Eppalock Dam in Victoria for G-MW.
Reviewed URS Australia designs for Alpine Way remedial works

1999

Project Director of earthquake studies on Wyangala Dam
Project Director for design of further remedial works at Hume Dam. Included design of ground improvement works (stone columns) for protecting alluvial foundations against liquefaction
Peer reviewer of Leslie Dam (Queensland) Safety Report.
Peer reviewer of DLWC's Screening Level Risk Assessment

1998

Project Director for portfolio risk assessment for six dams owned by a Southern Rural Water in Victoria.
Directed structural analysis of spillway gates on Narracan Dam for Southern Rural Water
Project Director for concept design and DD&C contract documentation for Warragamba Dam auxiliary spillway. Dam to be upgraded the dam to cater for increased inflow flood estimates. Upgrading works estimated to cost \$135M. An auxiliary spillway is to be constructed adjacent to the existing dam - involves excavating some 2,000,000m³ of rock and constructing concrete lining, training walls, fuse plug embankments, large scale cement stabilised sandstone fill, a multi

span bridge across the spillway, post tensioned ground anchors for dissipator/training walls, modifications of existing spillway gates. Design involved extensive physical hydraulic model testing.

1997 Feasibility options study for remediation of Redbank Ck. Dam near Mudgee (NSW) Karapiro Dam, New Zealand - Part of international consulting team reviewing this concrete arch dam's security and determining appropriate remedial options (mass concrete buttressing). Director of risk assessment studies for Tenterfield Dam

1993-1997 Hume Dam Investigations - Project Manager of Investigation and Design Studies for the embankments at the dam. Work involves:

- review of the stability of the embankments under static and earthquake loadings
- investigation of liquefaction
- potential of embankments' foundations
- development of stabilising options
- development of options to provide increased flood security including provision of new auxiliary spillways and modifications to existing works

- detail design and documentation of stabilising works for the embankments including a key trench into the dam's foundations, stabilising berms, slurry wall cut-offs, drainage/filter curtains and strengthening of critical gravity training walls with both horizontal and vertical post tensioning.

- part of advisory and review team for the risk assessment of the dam and its components.

1990-1996 Warragamba Dam Upgrading for Sydney Water Corporation - Project Manager of Investigation Concept Design Studies for upgrading the dam to cater for increased inflow flood estimates and provide substantial flood mitigation. Upgrading works estimated to cost $280M. The existing dam was to be strengthened with mass concrete buttressing – some 600,000m³.

1996 Project Director for Safety Review (including Finite Element Analysis) of Wellington Dam

1993-1996 Hume Dam Gates for Department of Water Resources - Project Manager for the design of new maintenance baulks and emergency closure gates. Involves development of proposals for underwater installation.

1995 Redbank Creek Dam and Lithgow No. 2 Dam for NSW Public Works Dams Surveillance - Project Manager for safety reviews and finite element analysis of two 15m high arch dams. Clarrie Hall Dam for NSW Public Works Dams Surveillance - Project Manager for dambreak studies.

1994 Burrinjuck Dam Gates for NSW Department of Water Resources - Project Manager for the design of new control and emergency closure gates. Involves underwater installation. Karangi Dam for Coffs Harbour City Water Project - Project Manager for dambreak studies.

1993 Mardi Dam for Wyong Council - Project Manager for safety review of earth embankment.

1988-1990 Nepean Dam Remedial Works for Sydney Water Corporation - Project Manager for investigation studies, design development and detail design. Work involved:

- initial flood security studies and development of options
- co-ordination of hydraulic model studies
- detail design and contract documentation for modified spillway, large size post-tensioned ground anchors and rockfill buttressing.

1987-1989 Boggabilla Weir for NSW Department of Water Resources - Project Manager for detail design and contract documentation of a large gated re-regulation weir with fishway. Involved liaison with fisheries expert in developing optimum geometry for fish ladder.

Chaffey Dam for NSW Department of Water Resources - Project Manager for upgrading of dam. Work involved:

- development of options and preliminary design
- finite element analyses for raised morning glory spillway
- stability analyses for raised earth/rockfill embankment
- co-ordination of hydraulic model studies for raised spillway.

1969-1987: ***Water Resources Commission of NSW (WRC) (now Department of Land and Water Conservation).***

1986-1987 Flood Security studies for WRC - Project Design Engineer for investigation into flood security of Chaffey and Glennies Creek Dams. Involved co-ordinating dambreak studies, development of remedial options, economic risk studies.

1985-1987 Hume Dam Strengthening for WRC - Project Design Engineer for detail design and contract documentation. Work included:

- design of large size post-tensioned ground anchors including development of appropriate grouting procedures
- design of structural modifications to the concrete gravity dam
- design of a new road bridge over the dam.
- establishing the rationale for replacing the existing post tensioning system

Contact

Tel: [redacted]
Mobile [redacted]
Email: [redacted]

Queensland Government

Ref CTS 19311/10

25 OCT 2010

Office of the
Minister for Natural Resources, Mines and Energy and Minister for Trade

Mr Gary Humphrys
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

RECEIVED
28 OCT 2010
Water Grid

Dear Mr Humphrys

I write in relation to seeking advice regarding options to and benefits of releasing water from key storages in anticipation of major inflows over the coming summer.

I understand that the key Water Grid storages are at 100 per cent of storage capacity going into the traditional wet season, with forecasts of higher than median rainfall and the prospect of multiple flood events.

I am also advised that our water supply is more secure than ever before, due to storages being full, key Water Grid projects completed and ongoing water efficiency.

I seek your urgent advice about whether this water security provides an opportunity to reduce the volume stored in key dams as a means of reducing the severity, frequency and duration of flooding in downstream areas.

In doing so, I note that recent releases from Wivenhoe Dam have resulted in significant inconvenience and isolation for residents in some downstream areas. With the catchments saturated, I understand that even quite minor rainfall events will result in further water releases and further inconvenience for these residents.

By end November 2010, I would appreciate your advice as to the available options and the likely benefits. At a minimum, you should review the operation of Wivenhoe, North Pine and Leslie Harrison dams. At least for Leslie Harrison Dam, this would be a return to standard operating procedures prior to the drought, when the dam was routinely drawn down to 95 per cent of capacity to minimise the impacts of storms on downstream residents.

I also seek your confirmation that these options would not significantly impact upon our current water security, measured as the probability of needing to reintroduce Medium Level Restrictions over the next five to ten years.

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Queensland Government

Office of the
Minister for Natural Resources, Mines and Energy and Minister for Trade

I emphasise that this is only a temporary measure, reflecting that dams are full prior to the commencement of the traditional wet season. I expect that your advice will include a clear date or trigger beyond which dams will be allowed to fill to their full supply level.

Thank you in advance for your assistance.

Should you have any further enquiries, please feel welcome to contact Mr John Bradley, Director General, Department of Environment and Resource Management on [redacted]

Yours sincerely

STEPHEN ROBERTSON MP

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SEQ Water Grid

Talking Points

TRIM reference: D/11/	Enquiry received:
Purpose: Wivenhoe Dam release	

Impacts of Wivenhoe and Somerset dams

- Wivenhoe and Somerset dams reduced the flood peak by 2.5 metres in the City and 5.5 metres at Moggill.
- Without the dams, up to 13,000 more houses would have been flooded. They prevented up to $1.6 billion of damages.
- Without the dams, major flooding would have lasted for three days.
- Wivenhoe and Somerset dams controlled 2.6 million megalitres of floodwater. This is 1.1 million megalitres more than in 1974.
- The dams controlled these floodwaters, providing time for peak flows from the Lockyer and Bremer to pass.
- Total flow in the Brisbane River in 1974 was 9,500 cubic metres per second. The estimated flow from this event would have been 13,000 cubic metres per second if Wivenhoe did not exist.

Operation of Wivenhoe and Somerset dams

- The dams were operated strictly in accordance with the approved Operational Procedures.
- The Operational Procedures were developed by Australia's best hydrologists, including:
    - Professor Colin Apelt, Head of Department, Department of Civil Engineering, University of Queensland
    - Mr Eric Lesleighter, Principal Hydraulic Engineer and Chief Engineer Water Resources, Snowy Mountains Engineering Corporation.
- Professor Apelt is Chair of the Brisbane City Council flood taskforce.

Rainfall forecasts

- Dam operations were based on forecasts provided by the Bureau of Meteorology.
- The rainfall during the event exceeded all forecasts.

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- Rainfall was local and intense, as demonstrated by the tragic events in Toowoomba.
- It is unreasonable to expect that dam operators could foresee these events.

Pre-emptive releases

- The dam has been designed for both water supply and flood mitigation.
- Detailed Operational Procedures have been developed by leading hydrologists over many years, with a review as recently as 2009. The procedures are based on the current full supply level.
- Water was released from the dam on 20 of the 25 days leading up to this event.
- A total of 1,450 million megalitres was released between October 2010 and this event.
- These releases isolated some residents and inconvenienced many more.
- The clear decision making process in the Manual was set down since 1992 and was reviewed in 2009 to reflect the installation of the Wivenhoe Spillway upgrade. That review included independent experts from the Bureau of Meteorology, Sunwater, Brisbane City Council and the Department of Environment and Resource Management.
- It is a manual which reflects safe operating practices based on detailed hydrological analysis and technical assessments of dam safety.

Peak releases

- Outflows from Wivenhoe Dam peaked on Tuesday 11 January 2011 at 397,000 ML.
- The impact of these releases was minimised by closing down releases quickly once inflows into the dam had peaked.
- The release rate was higher for three hours, but not sustained.
- These releases accounted for only part of the increase in river levels. The Bureau of Meteorology has stated that, even at their peak, outflows from Wivenhoe Dam contributed slightly more than half the flood arriving in Brisbane (Courier Mail, 14 January).

Large releases earlier

- Releasing large volumes of water over the weekend would have had major impacts on the rural communities of the Brisbane Valley. Bridges would have been cut and communities would have been isolated with little notice.
- Over the weekend, neither rainfall forecasts nor the rain on the ground indicated with certainty that urban areas would be impacted.

Increases to above 200% (level of fuse plugs)

- Wivenhoe Dam is not designed to overtop. If it did, the dam would fail and the resulting damage and loss of life would be at least 100 to 1,000 times greater than that currently being experienced.
- To ensure that this never occurs, the dam has been designed with plugs that automatically open when it reaches more than 200% of full supply volume.
- Once opened, the rate of release through these plugs cannot be varied.
- The plugs continue to release water at this rate until the dam reaches full supply level.
- The plugs would take four to six months of dry weather to repair, rendering the flood storage compartment useless.

Changes to dam operations

- The upgrade required to meet ANCOLD standards would have had no impact on this event. It will be completed for even bigger floods.
- Options to increase the full supply level have been investigated. Had they been implemented, these options would have reduced the flood compartment, resulting in higher releases earlier.

"PB-13"

Hon Stephen Robertson MP
Member for Stretton

Queensland Government

Minister for Natural Resources, Mines and Energy and Minister for Trade

20 JAN 2011

Ref CTS 00433/11

CC: Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
CITY EAST QLD 4002

CC: Ms Mary Boydell
Commissioner
Queensland Water Commission
PO Box 15087
CITY EAST QLD 4002

CC: Mr Gary Humphrys
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

Mr Phil Hennessy
Chair
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr Hennessy

You will be aware that the Premier recently announced a Commission of Inquiry into Queensland Floods which will consider among other things, compliance with, and the suitability of the operational procedures relating to flood mitigation and dam safety.

The Commission is required to deliver an interim report by 1 August 2011 (on matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season); and its final report by 17 January 2012.

However, I am also aware that Seqwater is currently managing the releases from the flood compartment of Wivenhoe and Somerset Dams in South East Queensland, in the context of the company's current Flood Mitigation Manual for those dams. There are three matters I wish to raise with you in this letter:

(1) I note that under the Flood Mitigation Manual for Wivenhoe and Somerset Dams, Seqwater is required to prepare a report on the recent flood event (see clauses 2.9 and 7.4 of the Manual). It is essential that a report (covering the requirements of both clauses 2.9 and 7.4 of the Manual) to the Department of Environment and Resource Management (DERM) is completed within the required timeframe of six weeks from the date of the incident. However in view of the fact that we remain in the middle of the wet season and further significant inflows are possible, I would urge you to complete this review, which should include consideration of the appropriate Full Supply Levels, as a matter of priority and urgency.

Any other changes you propose to the Flood Mitigation Manual, or related matters, eg improved data collection, should be clearly identified in the Review report, along with a timetable to implement them.

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Email nrmet@ministerial.qld.gov.au

(2) Furthermore, while this review of factors relevant to the operating release strategy and the Full Supply Levels is underway, I would request that you develop a contingency protocol which would ensure that if rainfall, that is likely to result in a flood release from Wivenhoe Dam, is forecast for the catchment then Seqwater will immediately convene a discussion with the Chief Executive Officer of DERM, his dam safety regulatory staff, and other appropriate parties.

(3) I note that the recent preliminary report by Mr Cooper identified a number of improvements that Seqwater could implement to achieve a better outcome in the application of the Draft Communication Protocol between government agencies and local governments. I request that you contact Mr Bob Reilly, General Manager, Office of the Water Regulator of the department on 3224 2898, to progress these as a matter of urgency.

I have also written to the Chair of the Water Grid Manager and the Water Commissioner requesting all necessary assistance be afforded to SEQ Water to ensure the matters raised in this letter are responded to as a matter of priority and with urgency.

Should you have any further enquiries, please do not hesitate to contact Mr John Bradley, Chief Executive of the Department, on [redacted]

Yours sincerely

STEPHEN ROBERTSON MP

"PB-14"

YELLOW TAB

DERM

Marry John B Phil H Sedan Jacin
Karen Fenny Doyle Peter B Barry
Bob Reilly
Rua A

BoM
- next 5 days => not much rainy weather.
- no threat of pressure to Qld coast.

-> Sequater -> flood mitigation
-> release

- long time
- Short time.

(Tuggun -> as well)

Man Actions => Cont.

- Tues or Wed

-> Flood manual change to 2000 man

Phil
TBB When did 100's come from.

137

"PB-15"

seqwater
WATER FOR LIFE

27 January 2011

The Honourable Stephen Robertson MP
Minister for Natural Resources, Mines and Energy
and Minister for Trade
PO Box 15216
CITY EAST QLD 4002

Dear Minister,

In response to your letter dated 20 January 2011, I am pleased to be able to provide you with the following update.

Work has commenced on the full Seqwater report on the recent flood event at Wivenhoe Dam, as required under the Flood Mitigation Manual for Wivenhoe and Somerset Dams. I also note your request for the report to be completed as a matter of priority and earlier than the required timeframe of 6 weeks if achievable.

On Tuesday, 25 January 2011, Seqwater convened a meeting involving the Director-General of the Department of Natural Resource Management (DERM), senior Board and Chief Executive representatives from the Water Grid Manager (WGM), Queensland Water Commission (QWC) and senior officers from DERM, including the Dam Safety Regulator and the Water Supply Regulator, to discuss the range of issues raised in your letter.

As a result of that meeting, Seqwater is undertaking the following scope of work, which will be available for discussion with the above group next Tuesday, 1 February 2011:

- Further modelling to provide an indicative assessment of the benefits or otherwise of undertaking a pre-release strategy to pre-emptively reduce the Full Supply Level (FSL) of Wivenhoe Dam for the next 12 months, reflecting the current La Nina weather patterns.
- The development of a contingency protocol, should rainfall result in flood gate releases in the next few weeks, is already being progressed, including input from DERM, WGM and QWC.
- Improvements to the Technical Situation Report, identified by Mr Brian Cooper as part of his preliminary report, recommending more consistency in the information presented. The improvements are being undertaken with input from the Office of the Water Supply Regulator.

In addition, at the request of the WGM and the QWC, Seqwater will also be providing the above modelling data this week to both authorities to assist them to ascertain the impact of any pre-release strategy on the region's water supply security.

I will provide an update on the above work following next Tuesday's meeting.

Seqwater remains committed to providing the State Government with timely and considered advice on the operation of the region's dams, and co-operating fully with the Commission of Inquiry.

Yours sincerely,

Phil Hennessy
Chairman

... Water Supply Authority (trading as Seqwater) | ABN 75 450 239 876 | Corporate Office Level 3 240 Margaret Street Brisbane Queensland ...

All correspondence to PO Box 16146 City East QLD 4002

"PB-16"

Meeting with Minister 31/1/11

Min, tim, PB, JP, Peter A, Barry D, Dan S, Bob R, Penny, Debbie Best,

- Min - Media interest in what we may or may not do with the dams
- Risk from Cyclones Anthony/Yasi
- May need to meet later on in the week
- Still expecting to cross the N QLD coast
- PB – rainfall update for Seq next 8 days is 5-10mm BOM forecast shows cyclone tracking west south west and being driven strongly in that direction. No indication at all that it is tracking toward South East (handed copy of forecast to Ministers aide)
- Therefore no imminent danger and no need to make immediate decision
- Have a meeting with all parties tomorrow (1/2/11) to go over modelling, legal advice etc etc
- Went thru current numbers on what might be feasible and what we are looking at
- Best scenario is sunny day releases as opposed to wait and see and it has to be around the 75% number. Big punt to wait and see as rainfall might hit a swollen Brisbane area and therefore flooding could be worse
- What we have works fine for 1:200 (ie 74) event but after that more mitigation would of necessity make the situation better
- BD asked about a combination of pre releases and accelerated strategies
- Min – raised map that Steve Jacobi did and asked if the levels could be modelled on the map
- BR- problem as it might imply a level of accuracy that doesn't exist but we can look and see just be careful about its use
- Min – will take rainfall predictions to Cabinet and media but stay away from modelling predictions in the cabinet
- What warnings are there on road closures – answer was councils do it
- Min asked if we could think about at a more centralised system that the state runs
- Min also advised hydro makes little difference to the water level as it is too small
- Min requested Seqwater take the lead on comms not his office or the Grid manager
- After meeting we were directed to call a press conference with a line around we are looking at, modelling review is a significant piece of work but we are doing contingency stuff now
- Process is we provide advice on what is possible in terms of flood mitigation, QWC looks at long term water supply arrangements, WGM prices up the option
- PB – we can provide ~~advice on what it might be but not make a policy decision~~
- Min- be clear i am not making operational decisions here it is a process of government

"PB-17"

Meeting with Broader group **1/2/11**

Mary B., Karen W., Peter Allen, Phil Hennessy, Peter B, Jim P, John Bradley (phone), Barry D, Greg Claydon, Penny, Debbie Best, Gordon Jardine

- PB – here to talk about work done on modelling and legal advice but Phil will frame meeting
- PH – Govt wants to investigate the dual operation of the dams for water supply and flood mitigation to see if there can be more significance given to the flood mitigation v water supply
- We are to provide advice on changing this and what it may mean to water security
- In fact we have started and PB will run through these in a minute
- Lot of structure around this type of decision with insurers and lawyers and any release strategy has to be put to the insurers as any advice or the reasons for will be squarely in the teeth of the commission and we need expert review of the modelling before we go anywhere near insurers or advice on release from this organisation
- JB had to leave discussion for a minute to answer call from Premier
- DB said at this juncture the ROP rules releases and there are provisions in the ROP for early releases confirmed by Greg Claydon
- PB some challenge to this later that if that were the safety clauses the advice we have is that this clause cannot be used in this type of instance
- JB back
- PB ran thru the broad scenarios outlined
- Model runs give us a range of options
- Advice from legal is we cannot table until peer reviewed and approved by various parties
- JB – being blunt – Minister has written to us in accordance with the manual and needs the answers as a matter of urgency but it is in the context of the regulatory advice and asks if we have committed to the response – etc
- PB – once advice received what does DERM do with it
- JB- DERM stands ready to activate response and doesn't see any impediments to taking action
- PB – wants to clarify that we are not at cross purposes here. States Clause 2.9 and 7.4 DO NOT invite comment from operators on the policy question you raise. The questions are outside the review as it stands
- JB – that is not his reading of it and asks for Peter Allen's comments on the difference of opinion
- Peter Allen – The clause request a report on what happened and an operational analysis of the manual – NOT traditionally asked for any analysis on pre- releases or questioning of FSL) These areas are 'OUT –OF- BOUNDS' for the operators as the levels are set by State instruments
- PB – we have always seen 2.9 as 'what happened and how was manual used' and 7.4 as the improvement to procedures. FSL question is a Policy call of govt to split volumes between drinking water and flood storage ie. you are asking for a change in protection from a 1:200

Letter as it stands can't usefully use but appreciate your position.

Also need the contingency plan as described in the ministers letter

JB then asked about the history of FSL and how it was set and where it lives

PB reflected Tom's historical position of the construction of the dam and how a flood compartment was built into the dam and what it was and was not supposed to do. The 74 flood was instrumental in sizing the flood compartment.

This locked down the number in various subsequent instruments and has not been questioned since

ROP/Manual states but does not set FSL

JB then asked how can Manual be changed

GC replied Seqwater can request or DERM can direct

MB – if flood manual is changed what changes are needed for ROP?

JB – we need the full modelling/scenario work so we can stew over. ASAP and protocol ASAP(hopefully by this afternoon)

"PB-18"

4 February 2011

seqwater
WATER FOR LIFE

The Honourable Stephen Robertson MP
Minister for Natural Resources, Mines and Energy
and Minister for Trade
PO Box 15216
CITY EAST QLD 4002

Dear Minister,

I refer to my 27 January 2011 letter and I am pleased to be able to relay to you the following further update, which has been provided to me by Seqwater's officers.

Work is continuing on the full Seqwater report on the recent flood event at Wivenhoe Dam, as required under the Flood Mitigation Manual for Wivenhoe and Somerset Dams. That report will address the requirements of sections 2.9 and 7.4 of the Manual and will be completed within the stipulated six week timeframe.

On Tuesday, 1 February 2011, Seqwater held a further meeting involving the Director-General of the Department of Environment and Resource Management (DERM), senior Board and Chief Executive representatives from the Water Grid Manager (WGM), Queensland Water Commission (QWC) and senior officers from DERM, including the Dam Safety Regulator and representatives from the Water Supply Regulator, to discuss the progress of works tasked to Seqwater on 25 January to address the issues raised in your letter of 20 January.

In your letter of 20 January 2011, you requested that Seqwater assist DERM in the consideration of the appropriate Full Supply Levels (*FSLs*) for Wivenhoe and Somerset Dams. Given that:

(a) Wivenhoe and Somerset Dams fulfil dual water supply and flood mitigation functions;
(b) the dams are the primary urban water supply for South East Queensland and their current FSLs are enshrined within the Moreton Resource Operations Plan and underpin the system yields adopted for the South East Queensland Water Strategy;
(c) Seqwater is obliged under its Flood Mitigation Manual to ensure that all opportunities to fill the dams are taken and therefore there should be no reason why the dams are not at their respective FSLs following a flood event,

it is noted that DERM is considering, from a policy perspective, whether the FSLs for the dams should be changed.

To assist DERM in formulating that policy position, Seqwater is continuing further modelling to provide an indicative assessment of the benefits or otherwise of undertaking a pre-release strategy to pre-emptively reduce the FSL of Wivenhoe Dam and the mechanisms by which any change to the FSL might best be implemented. However, given that this technical information will be of critical importance to:

(a) DERM in the formulation of its long term water supply and flood mitigation policies; and
(b) the Commission of Inquiry investigating the January 2011 flood events,

great care must be taken to ensure that the technical information is both accurate and comprehensive. Seqwater also notes that DERM will want to take into account the Inquiry's findings.

Compiling this technical information entails the following tasks:

(a) modelling the water outflows from Wivenhoe Dam for design flood events;
(b) calculating Brisbane River levels resulting from these various water outflow events; and
(c) determining the extent of inundation based on those Brisbane River levels.

In respect of task (a), Seqwater has completed modelling of approximately 90 permutations in respect of 3 previous flood events (including January 2011) and 6 design flood events (ranging between a 1 in 200 and a 1 in 5000 flood event) and our modelling has been peer reviewed by independent external experts.

Task (b) requires Seqwater to work with the Bureau of Meteorology (BOM) or Brisbane City Council (BCC), both of which have developed models for determining Brisbane River levels for various flow events. Seqwater is anxious to progress this task as a matter of priority but you should be aware that –

(i) BOM is unable to assist Seqwater at this point; and
(ii) BCC does not wish to assist until its model has been updated to take into account the January 2011 flood event.

If BCC is unable to assist promptly, Seqwater will need to utilise other modelling alternatives.

BCC has also developed the models which will need to be utilised to complete task (c). Task (c) can only be completed accurately when Seqwater and BCC have finalised task (b). Furthermore, Seqwater will need to have independently validated the input provided by BCC.

All of these tasks should be completed by 31 March 2011.

However, DERM may be satisfied, based on advice from QWC and the WGM from a water supply security perspective, that Wivenhoe Dam 's FSL could be reduced in the short term to, say, 75% of its current FSL. If that is the case, Seqwater can confirm (from its modelling undertaken in respect of task (a) to date) that, in respect of a flood event beyond Wivenhoe Dam's current flood mitigation design capability, such a reduced FSL will provide flood mitigation benefits for such an extreme rainfall event occurring in the Wivenhoe and Somerset catchments. For example, for a 1 in 500 probability flood event, the water outflows under Wivenhoe Dam's existing FSL are approximately 5,000 cubic metres of water per second (cumecs), whereas those water outflows would be approximately 3,400 cumecs in the case of a 75% FSL (assuming releases under the flood mitigation manual are triggered only at the reduced 75% FSL; by contrast, the water outflows would be approximately 3,700 cumecs if releases under the manual are triggered at the current FSL).
For your information, Wivenhoe Dam's current flood mitigation design enables it to contain a 1 in 100 probability flood event and substantially reduce the impacts of up to a 1 in 500 probability flood event.

Should a decision to reduce the FSL be made:

(a) Seqwater will need to work urgently with the Dam Safety Regulator to finalise any necessary changes to the flood mitigation manual;
(b) if requested, Seqwater can provide assistance to DERM following DERM's determinations regarding the Moreton Resource Operations Plan and the appropriate mechanism by which such a pre-release strategy would be implemented.

Seqwater has also developed a draft contingency protocol, should further rainfall result in the need for floodgate releases from Wivenhoe Dam in the next few weeks, and is currently finalising it with DERM.

Seqwater has sought input from the Office of the Water Supply Regulator to enable Seqwater to finalise improvements to the Technical Situation Report format identified by Mr Brian Cooper to enhance communication between government agencies and local governments during future flood events. Seqwater is currently finalising those improvements with DERM.

Seqwater remains committed to providing the State Government with timely and considered advice on the operation of the region's dams and co-operating fully with the Commission of Inquiry.

Yours sincerely,

Phil Hennessy
Chairman

"PB-19"

seqwater
WATER FOR LIFE

7 February 2011

Mr John Bradley
Director General
Department of Environment and Resource Management
Level 13
400 George Street
BRISBANE QLD 4000

Dear John,

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

I refer to correspondence from The Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, dated 20 January 2011. I confirm that, as requested, Seqwater has undertaken further simulation modelling to assist DERM in its consideration of the appropriate Full Supply Level (*FSL*) for Wivenhoe Dam. The purpose of the modelling is to provide information to assist DERM in formulating a policy position by providing an indicative assessment of a range of FSLs and pre-release strategies to pre-emptively reduce the FSL of Wivenhoe Dam.

I enclose a memorandum *Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges*, which provides a summary of Seqwater's preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. A number of scenarios are presented in the memorandum for consideration by DERM in determining, from a policy perspective, whether the FSLs for Wivenhoe Dam should be changed.

The scenarios presented in the memorandum provide an approximate analysis to help inform discussion and for further consideration by DERM. The review is intended only to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose. More accurate estimates would require a detailed investigation and analysis of the entire river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models.

The analysis is based upon computer modelling of simulated gate opening sequences specified in the Flood Mitigation Manual during a "loss of communications" scenario. For the reasons noted in section 2 of the enclosed memorandum, while this scenario provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event. The model utilised adopts flood inflows that have been derived from an analysis of past historic events, in combination with design hydrographs developed previously for design and planning purposes by the Wivenhoe Alliance (2005).

The applicable assumptions for the modelled options, presented in section 2 of the memorandum, apply equally to the scenario set out in the correspondence from Seqwater's Chairman, Phil Hennessy, to Minister Robertson, dated 4 February 2011.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Encl.

seqwater
WATER FOR LIFE

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

1 Introduction

This memo provides a summary of a preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. Information is provided on the impacts of reducing the Wivenhoe Dam initial storage level to 95%, 90%, 85%, 75% and 50% of the normal full supply level (EL67.0M AHD).

2 Assumptions and Caveats

The analysis was undertaken using a computer model to simulate the gate opening sequence as provided in the Flood Manual during a "loss of communications" situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be noted that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

Flood inflows to the model were derived from an analysis of past historic events (1974, 1999, and 2011), in combination with "design hydrographs" developed previously for design and planning purposes (Wivenhoe Alliance, 2005[1]). These "design hydrographs" are obtained from models of both the rainfall and flood generation process, whereby floods of a given magnitude are assigned a specified probability of exceedance (eg a "1 in 200" event).

It should be stressed that the information presented here is based on approximate analyses to help inform discussion. More accurate estimates would require a detailed investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models. This review should thus be seen as providing an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

[1] Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

3 Options Considered

Five options are explored in this paper, as summarised in the following table:

There are five options considered going forward.

Option	Description	Comments
0 "Do nothing"	Continue with the current approved flood operation rules – that is, maintain the status quo and continue to utilise the dam as originally designed.	This option has utilised the existing strategies that have been implemented and refined over several flood events and the manual was developed by a comprehensive study.
1 "Early release"	Change the flood operating rules to ignore the early strategies designed to minimise disruption to the rural communities	Increase the release from the dam up to 1600 m³/s as soon as practicable after gate operations commence; it is assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.
2 "Pre-release"	Implementing a significant release of water once the notification of a major rainfall event has been received.	The reliability of forecasts by the Bureau of Meteorology are such that they do not allow the reservoir to be drawn down in a timely manner without potentially causing appreciable "artificial" flooding downstream.
3 "75% FSL"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level, and operate the dam under the current operating rules.	To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater. Once the storage level reached EL67 gate operations would commence as per the current flood manual.
4 "85% FSL amended"	Lower the storage level in Wivenhoe Dam to 85% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL65.25	The amended flood operating rules would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.
5 "75% FSL amended"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL64.00	Same comment as for Option 4.

4 Results

The results of this analysis is summarised in Table 1 and Table 2.

Flood Event			Option 0 - Existing Rules		Option 1			Option 4			Option 5		
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Maximum Lake Level	Flow Reduction	Maximum Outflow	Maximum Lake Level	Flow Reduction	Maximum Outflow	Maximum Lake Level	Flow Reduction
	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	(m AHD)	%	(m^3/s)	(m AHD)	%	(m^3/s)	(m AHD)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6%	2,639	70.66	32%	1,971	70.24	49%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4%	4,028	71.53	21%	3,446	71.17	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3%	5,031	72.16	17%	4,504	71.83	26%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,994	74.66	1%	8,535	74.37	6%	8,217	74.17	10%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.1	1%	7,821	73.92	5%	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	2%	7,135	73.49	5%	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	4%	6,751	73.25	7%	6,635	73.17	9%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,452	74.95	1%	5,746	74.62	24%	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.31	3,159	73.26	4%	2,737	72.91	16%	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	2,251	72.504	3%	1,814	71.89	22%	1,561	71.48	32%

Table 1 – Option Results

* Design events taken from the Wivenhoe Alliance (2005)

Flood Event			Option 0 - Existing Rules (Storage Level 100%)		Storage Level 95%		Storage Level 90%		Storage Level 85%		Storage Level 75% (Option 3)		Storage Level 50%	
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction
	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,579	7%	3,237	16%	2,965	23%	2,356	39%	1,134	71%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,863	5%	4,531	12%	4,271	17%	3,693	28%	2,213	57%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,795	4%	5,478	9%	5,235	13%	4,705	22%	3,329	45%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,949	1%	8,779	3%	8,645	5%	8,339	8%	7,397	19%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,111	1%	7,995	3%	7,902	4%	7,689	6%	7,071	14%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,447	1%	7,325	3%	7,233	4%	7,017	7%	6,404	15%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	7,098	2%	6,911	5%	6,829	6%	6,702	8%	6,360	12%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,453	1%	6,756	10%	5,876	22%	5,748	24%	4,209	44%
1974 historic	5,953	1,410,000	3,275	73.31	3,153	4%	2,974	9%	2,810	14%	2,618	20%	2,067	37%
1999 historic	6,358	1,220,000	2,312	72.23	2,132	8%	2,003	13%	1,920	17%	1,687	27%	1,007	56%

Table 2 – Routing Results for Storage Levels using the current Flood Manual Rules

5 Conclusions

Reductions in outflow flood can be achieved by the adoption of different storage levels and release strategies. However, due to the large volumes of water associated with major flood events, it is necessary to consider large changes to the full supply level to achieve appreciable reductions in flood magnitude. The impact of different initial storage levels reduces as the magnitude of the event increases.

"PB-20"

[redacted]

From: Jim Pruss [redacted]
Sent: Thursday, 24 March 2011 8:23 AM
To: McCredie, Bill
Subject: FW: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V2 070211.docx
Attachments: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V2 070211.docx; Pages from Wivenhoe Dam Design Report Volume 1 Text.pdf

Bill

Here is an email exchange between Barton and Rory from SKM. Rory and Peter Hill from SKM was both involved in the peer review of the assessment work done by Barton

Jim

From: Barton Maher
Sent: Monday, 7 February 2011 11:06 AM
To: Rory Nathan[redacted]
Cc: Jim Pruss; Rob Drury; Alex Fisher
Subject: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V2 070211.docx

Hi Rory,

As discussed, I have updated the report to reflect your comments from Friday. The inconsistency in the discharges was from my error in transferring the numbers from the spreadsheet. I have checked them and updated the table to reflect the real data as sent to you. I have also added in the additional information as requested.

The only thing I am short of is the 1 in 100 AEP design event as the Alliance started with the 1 in 200 event.

I have also added background data to assist in understanding the source of the flood events and provide some context on the design of the spillway.

If you have any questions please give me a call on my mobile.

Regards,

Barton Maher
Principal Dams & Weirs Planning
QLD Bulk Water Supply Authority *trading as* Seqwater

seqwater

Ph[redacted]
Karalee Office: 68 Junction Rd Karalee QLD 4306 Australia
PO Box 2437, North Ipswich QLD 4305
Website | www.seqwater.com.au

Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges

1 Contents

2 Introduction

Seqwater staff have been asked to investigate the impact of reducing the storage level of Wivenhoe Dam on the downstream discharges for major flood events. This memo details the investigations carried out and provides a preliminary assessment of the reduction in flood flows that could be achieved by reducing the Wivenhoe Dam storage level to 95%, 90%, 75% and 50% of the normal water supply volume.

The comments in this report are provided to give an indication of the impacts of a reduced storage level of Wivenhoe Dam on discharges during major flood events. It must be noted that it is very preliminary, as to get accurate results a full investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models would be required. This review was requested to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

3 Definitions

For the purposes of this report the following definitions have been adopted as per the Wivenhoe – Somerset Flood manual:

Fresh	This causes only very low-level bridges to be submerged.
Minor Flooding	This causes inconvenience such as closing minor roads and the submergence of low-level bridges. Some urban properties are affected.
Moderate Flooding	This causes inundation of low-lying areas and may require the evacuation of some houses and/or business premises. Traffic bridges may be closed.
Major Flooding	This causes flooding of appreciable urban areas. Properties may become isolated. Major disruption occurs to traffic. Evacuation of many houses and business premises may be required.
Extreme Flooding	This causes flooding well in excess of floods in living memory and general evacuation of whole areas are likely to be required.
"m^3/s"	Means an instantaneous flow rate expressed as cubic meters of water per second.
"AEP"	Means annual exceedance probability, the probability of a specified event being exceeded in any year;
"AHD"	Means Australian Height Datum;
"EL"	Means elevation in metres from Australian Height Datum;
"ML"	Means a million litres of water

4 Background

4.1 Previous Flood Studies

The original design of Wivenhoe Dam was to provide both water supply for South East Queensland and flood mitigation for the city of Brisbane. There have been several flood studies prepared for the dam as discussed below.

Wivenhoe Dam has a catchment area of about 7,048 km^2. The current spillway capacity of Wivenhoe Dam is based on a PMF inflow of 15,090 m^3/s made by the Queensland Water Resource Commission (WRC) in 1977 (Hausler and Porter, 1977). This estimate was based on a 48-hour duration probable maximum precipitation (PMP) estimate of 480 mm and synthetic unit graphs using the Clarke Johnson method.

WRC revised the design flood estimates in 1983 when the dam was in its final phase of construction. This revision was brought about because the Commonwealth Bureau of Meteorology (BOM) had revised their estimate of the PMP for the Wivenhoe catchment.

In addition, better rainfall-runoff-routing techniques were available at that time to derive design flows. The revised PMF inflow estimated in 1983 was 48,000 m^3/s, which is some 220% above the 1977 estimate. The increase was mainly attributed to the changes in the PMP, which increased to 1,000 mm for the 48-hour duration storm.

The Department of Natural Resources (DNR) (formally WRC) revised the design flows again as part of a comprehensive safety review of the dam undertaken between 1990 and 1994. Rainfall-runoff-routing models of the catchment were developed together with a dam flood routing model used to derive outflows from Somerset and Wivenhoe Dams taking into account the flood operating procedures used at that time. Somerset Dam, which has a catchment area of 1,331 km^2 drains into Wivenhoe Dam.

As part of the review, the BOM was requested to update the PMP estimates for the catchment (BOM, 1991). The revised PMP estimates were used in the 1994 analysis to estimate PMF. DNR estimated the PMF inflow to be 39,880m^3/s, which is lower than the 1983 estimate but still substantially higher than the 1977 estimate. The lower PMF estimate were mainly attributed (again) to changes in the PMP, which was revised down to 870 mm for the 48-hour duration storm. The development and calibration of the rainfall runoff routing model was also much more comprehensive than previous studies. Flood operating procedures were also incorporated into the models to estimate design outflows.

A detailed review of the previous studies is provided in Report No. 8a of the DNR flood study reports (1994).

The BOM updated the PMP estimates in 2002/2003 for the Wivenhoe catchment using the revised Generalised Tropical Storm Method (BOM, 2003). This report also provides the latest information on temporal patterns and spatial rainfall weightings to be used with the new PMP data. The 2003 PMP estimates are some 20% higher than PMP estimates used by DNR in the 1994 study. As a result, the new PMF estimate for the catchment using this data is significantly higher than the 1994 estimate. The new estimate was used for the upgrade of the dam in 2004/2005 by the Wivenhoe Alliance. The DNR models (1994) were used to estimate design flows for Wivenhoe Alliance.

For the purposes of this study design hydrographs from the Wivenhoe Alliance have been used along with recorded data from three historic flood events.

4.2 Flood Mitigation

The Design Report for Wivenhoe Dam (DPI 1994) provides a summary on the design of the flood mitigation component of the dam. The report indicates that *the estimated PMF was used to assess the safety of the dam against overtopping. In additon, inflow hydrographs from various historical floods (eg the 1893 and the 1974 floods) and for floods synthesised from storm frequency data were developed in order to provide data for the benefit – cost analysis for the flood mitigation component of the dam.*

For the flood mitigation benfit – costs studies, the historic and synthesised floods were routed through the dam and the ouflow routed down the Brisbane River. The objectives were to limit outflow below a damaging level for Brisbane with the available storage and to empty the dam within a reasonable time, say 5 or 6 days, after the reservoir had reached the maximum level.

The results of the flood routing for the economic studies are summarised in a report by Grigg. The 1974 flood, which reached 5.45m on the Brisbane City Gauge, would have been lowered by 2.6m if Wivenhoe Dam had then been in existence. The damage caused by the 1974 flood was estimated at $178M, and the savings produced by the lowering the flood level would have been $140M.

The flood mitigation studies indicated that all major historical floods could be controlled with outflows not exceeeding 3,200m3/s. If no other inflows occur below the dam, prolonged outflow of this magnitude would cause little or no damage to Brisbane. The dam would then be able to be emptied in a reasonable time frame after a major flood such as the 1893 flood.

An extract of the design report detailing the design of the spillway is presented as Attachment 2.

5 Assessment of the Impact of Lowering the Full Supply Level

Lowering the full supply level was assessed to determine the impact on the peak flood levels and discharges.

5.1 Analysis Methodology

The analysis was undertaken using a spreadsheet developed to model the gate opening sequence as provided in the Flood Manual during a loss of communications situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be stressed that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

A history of floods in the Brisbane River is presented in Table 1.

Table 1 – Summary of Significant Flood Events in the Brisbane River

Event	Somerset Dam			Wivenhoe Dam		
	Peak Elevation	Inflow Volume	Outflow Volume	Peak Elevation	Total Inflow Flood Volume	Outflow Flood Volume
	m AHD	ML	ML	m AHD	ML	ML
Jan 1974#	106.57	620,000	450,000	73.31	1,410,000	1,410,000
Jun 1983	101.58	260,000	280,000	69.49	1,080,000	470,000
Mar 1989	102.59	370,000	380,000	69.78	690,000	660,000
Apr 1989	102.69	340,000	350,000	71.45	870,000	820,000
Feb 1999	102.96	450,000	280,000	70.45	1,220,000	900,000
May 2009	99.62	110,000	110,000	62.19	235,000	0
Mar 2010	99.41	210,000	200,000	66.43	390,000	0
Oct 2010	101.37	250,000	270,000	69.61	630,000	630,000
Mid Dec 2010	100.42	150,000	140,000	67.50	360,000	330,000
Late Dec 2010	99.98	120,000	130,000	69.35	500,000	460,000
Jan 2011	105.11	825,000	820,000	74.97	2,650,000	2,650,000

Presence of Wivenhoe Dam simulated

The assessment has investigated the impacts of the lowered storage level on the three largest events – the 1974 flood, the 1999 flood and the 2011 flood.

Plots of the inflow and estimated outflow for these events are presented in Figure 1.

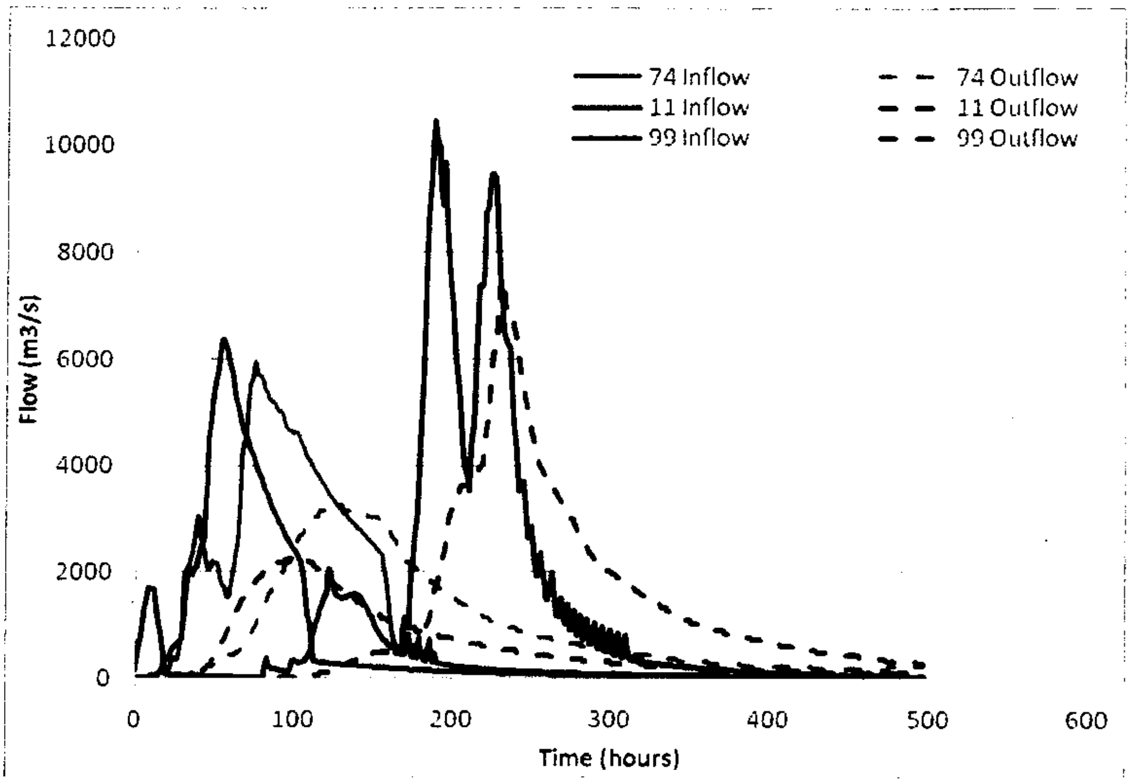

Figure 1 - Plots of Historic Events with Simulated Outflows

5.2 Analysis Results

A summary of the results of the modelling is presented in Table 2.

Table 2 – Reduction in flood peak due to adoption of different initial storage levels

		Wivenhoe Dam		Somerset Dam		Lockyer Creek	Lowood	Bremer River	Moggill	Reduction at Moggill
Storage Level at Start	**% of Full Supply Volume**	**Peak Inflow (m^3/s)**	**Peak Outflow (m^3/s)**	**Peak Inflow (m^3/s)**	**Peak Outflow (m^3/s)**	**Peak Flow (m^3/s)**	**Peak Flow (m^3/s)**	**Peak Flow (m^3/s)**	**Peak Flow[1] (m^3/s)**	**%**
1974 Flood										
67.0	100	5,953	3,275	5,019	3,548	3,260	5,110	4,241	7,948	
66.5	95	5,953	3,153	5,019	3,480	3,260	4,799	4,241	7,910	0.5%
65.8	90	5,953	2,974	5,019	3,419	3,260	4,524	4,241	7,897	0.6%
64.0	75	5,953	2,618	5,019	3,302	3,260	4,117	4,241	7,683	3.3%
60.0	50	5,953	2,067	5,019	3,040	3,260	3,342	4,241	7,423	6.6%
1999 Flood										
67.0	100	6,358	2,312	7,540	3,837	663	2,556	308	2,593	
66.5	95	6,358	2,132	7,540	3,662	663	2,434	308	2,479	4.4%
65.8	90	6,358	2,003	7,540	3,470	663	2,284	308	2,319	10.6%

[1] Note the flows quoted for Moggill are based on the addition of outflows from the dam and the measured flows at Lockyer Creek and the Bremer River. They do not have any allowance for routing of the flows through the river system and the subsequent reduction in flows that were observed during the actual flood events.

64.0	75	6,358	1,687	7,540	3,214	663	1,906	308	1,936	25.3%
60.0	50	6,358	1,007	7,540	2,798	663	1,186	308	1,214	53.2%
2011 Flood										
67.0	100	10,470	7,528	3,824	2,814	3,040	10,495	2,793	13,104	
66.5	95	10,470	7,453	3,824	2,798	3,040	10,445	2,793	13,004	0.8%
65.8	90	10,470	6,756	3,824	2,815	3,040	9,791	2,793	12,302	6.1%
64.0	75	10,470	5,748	3,824	2,680	3,040	8,788	2,793	11,110	15.2%
60.0	50	10,470	4,209	3,824	1,595	3,040	7,249	2,793	9,582	26.9%

The preliminary work done by Seqwater before Christmas 2010 showed that for the October 2010 event, reducing the level of Wivenhoe by small amounts would have had minimal impact on the flood releases. From the Table 2 the following comments are applicable:

- Similarly to work completed previously, reducing levels by small amounts prior to the January 2011 Event (if it was feasible) would have had little impact on the peak level in Wivenhoe Dam as shown in the Table 2. The reason for this is that the total event inflow volume of 2,600,000 ML is well in excess of the useable flood storage combined with the available water supply storages shown in the table. Large reductions to the storage level of the dam (25 to 50%) would be required if significant impacts on flooding are to be achieved.
- For the 1999 flood, where most of the flooding occurred upstream of the Wivenhoe Dam, there is a dramatic reduction in the peak outflow if the storage is lowered. However, this is of little benefit as the flood would not have resulted in damaging flows downstream of the dam even if the storage was full.
- The 1974 flood simulation is based on the recorded flows being routed through the both Somerset and Wivenhoe. The presence of Wivenhoe would have reduced the flooding damage in Brisbane during the 1974 event, however there is very little change to the flood mitigation benefits by varying the storage level in Wivenhoe. As most of the flood flows in 1974 were downstream of the dam and the flood in the Brisbane River was relatively small compared to the downstream flooding the event is insensitive to the starting level in Wivenhoe.
- It should be noted that the increasing early releases from Wivenhoe was investigated during the Brisbane Valley Flood Damages Study as part of a review of the operation of the dam. Releasing more water earlier on from Wivenhoe dam was shown to lessen the flood mitigation benefits compared with the existing flood manual release strategies.

The key point being that each flood event is unique and presents varying opportunities to mitigate flows through Brisbane.

5.3 Downstream Water Level Changes

To evaluate the specific impact on the Lower Brisbane River of these reduced dam outflows from lowering the storage requires the use of a complex hydraulic model. The results of this modelling would still contain a degree of uncertainty as illustrated by the difficulties in estimating the final flood peak in Brisbane during the event. The uncertainty was partly due to the rapid closure of the Wivenhoe gates after the peak inflow of the flood and the attenuation achieved in the downstream river system. It is extremely difficult to model accurately.

Given the timeframe of this report it is not possible to generate any reliable estimate of the changes to the water level at the Port Office Gauge due to tidal influences, the need to interpolate between previously modelled results that vary markedly between differing events, the availability of verified data, and the uncertainty surrounding the timing of peak flows for the differing scenarios.

Table 3 shows a comparison of the peak water level for each of the various starting levels for the 2011 Flood Event. It should be noted that each scenario results in the storage level exceeding EL74 requiring the gates to be opened until the storage rise is stopped. These estimates of flood levels at the Port Office are based on the interpolation and scaling of previously modelled results – these estimates should thus be regarded as indicative only.

Table 3 - Preliminary Estimate of Brisbane Levels Changes due to Lowering Wivenhoe for the 2011 flood

Wivenhoe Dam				Approximate reduction in level
Starting Level		**Peak Height**	**Capacity at Peak Height**	**Brisbane Port Gauge**
%	m AHD	m AHD	%	m
100	67.0	74.98	191.1	0
95	66.5	74.93	190.6	0 to 0.1
90	65.8	74.88	189.9	0.1 to 0.3
75	64.0	74.63	186.5	0.2 to 0.6
50	60.0	74.11	179.6	0.4 to 0.9

It is seen that appreciable reductions could only have been achieved when the storage is drawn down towards the lowest levels considered.

It should also be noted that to accurately calculate the impacts of reducing the storage levels of Wivenhoe Dam at the start of a major flood event requires considerable study as rainfall events of different intensity, duration, peak, location and spread will give very different outcomes. In addition, there is the need to do detailed hydraulic analysis of the river system for each scenario to more accurately determine impacts.

5.4 Summary

Due to the large volumes of water associated with major flood events in the Brisbane River (that is with events with annual exceedance probabilities rarer than 1 in 100), to effectively reduce flood peak discharges significantly would require the storage level of Wivenhoe Dam to be lowered by at least 25 to 50%.

6 Contingency Options

There is the possibility of further flood events in the South East Queensland during the 2010/2011 wet season. To reduce the risk of flooding in Brisbane should a major rainfall event be predicted it has been requested that lowering of the storage level of Wivenhoe Dam be investigated to determine if this is a feasible option to further mitigate flood flows.

The assessment carried out by Seqwater has indicated that to have any significant impact on releases downstream of Wivenhoe Dam during a major flood event it would be necessary to lower the storage level by 25 to 50%.

There are five options considered going forward:

- "Option 0" - Continue with the current approved flood manual strategies
- "Option 1" - Commence drawing down the storage at a safe rate to bring it down to say 75%.
- "Option 2" - Pre-release water from the dam following the prediction of a major rainfall event
- "Option 3" - Change the flood manual strategies to ignore the early strategies designed to minimise disruption to the rural communities.
- "Option 4" - Temporarily reduce the full supply of Wivenhoe Dam and amend the flood releases to commence flood operations from the lowered full supply level.

6.1 Do Nothing Option – Continue with the Current Flood Manual

This option maintains the status quo and continues to utilise the dam as originally designed. This option has the least risks associated with it as the Strategies have been implemented and refined over several flood events and the manual was developed by a comprehensive study. The strategies in the flood manual have proved adequate for more frequent flood events.

6.2 Option 1 – Vary the early strategies for the Flood Manual

It has been proposed that increasing the releases from the dam up to 1,600m^3/s as soon as practicable after gate operations commence may deliver reduced peak flood levels. This has been investigated to assess the impact of attempting to release more water at the very start of an event.

This option has been assessed using a range of design events from the Wivenhoe Alliance Design hydrology. To model the impacts of increasing releases up to 1,600 m^3/s as soon as practicable a range of design flood events from the Wivenhoe Alliance were compared using the program FLROUTE. . It was assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.

The results for the model runs are presented in Table 4.

Table 4 - Comparison of Release Strategies

Flood Event			Existing Rules		Amended Rules		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,994	74.66	1%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.10	1%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	2%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	4%

January 2011 historic	10,470	2,650,000	7,528	74.98	7,452	74.95	1%
1974 historic	5,953	1,410,000	3,275	73.31	3,159	73.26	4%
1999 historic	6,358	1,220,000	2,312	72.23	2,251	72.504	3%

It should be noted that predicted flood levels greater than EL 74 require the gates to be opened until the water level stabilises. This is fundamental to the dam's safety. In addition, any reduction in starting level, which does not achieve a peak lower than EL 74, is unlikely to have any impact upon peak release rate.

It can be clearly seen from Table 4 that changes to the early releases adopted for the flood manual strategies have minimal impact on the maximum outflow for the dam. The influence of reduced initial starting level decreases with increasing flood magnitude. For the major flood events investigated the reduction in peak outflow for the dam is negligible. Note that this analysis does not consider the downstream flooding in the Lockyer and Bremer Rivers.

However, it should be noted that there is the real risk that the release of additional water from the dam early in the flood event may make local flooding impacts in Brisbane worse. Due to the travel time of releases, uncertainty in forecast rainfall, and the low lying local catchment areas between Wivenhoe Dam and the urban areas of Brisbane, it is likely that for some events the increased early releases will exacerbate local flooding in Brisbane. This is potentially a significant risk as this flooding is directly attributable to the dam releases and could be avoided if the dam was operated according to the current strategy.

The flood strategies for Wivenhoe and Somerset are based on holding back flood waters until the rain has occurred and downstream flooding has peaked. Releasing early in an event compromises some of the flood mitigation capacity for the intermediate flood events.

6.3 Option 2 – Pre-release water when a major event is forecast

This option involves implementing a significant release of water once the notification of a major rainfall event has been received. This option is reliant on the accuracy of forecasts and having predefined approval processes in place.

The Bureau of Meteorology was approached by the SEQWater Corporation in 2006 to discuss the ability of the provision of short term forecasts of large rainfall events. Their response is included in Attachment A. The summary of their advice from the meeting was:

"In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist."

There are also physical constraints on the amount of water that can be released. To reduce Wivenhoe to 75% in 48 hours requires water to be released at a rate that would close all of the road crossings over the Brisbane River between the dam and the Jindalee Bridge (peak flow of over 1,900 m^3/s) and result in a final volume in Wivenhoe of around 66.8% during the third day if the gates were closed down using the established closure sequence after the 48 hours. If the high rainfall did occur, then the gates would no doubt remain open.

It is not possible to lower Wivenhoe to 50% within 3 days due to the incremental opening of the gates required for safety, the reduction in discharge through the gates with the dropping dam level, and the need to limit discharges below damaging flows through Brisbane.

In light of the above comment, pre-releases (i.e. releasing water prior to an event based on predicted rainfall) has significant risks associated with the strategy in terms of:

- The difficulty in actually releasing significant volumes of water,
- The potential impacts downstream if rainfall doesn't eventuate (disrupting the downstream community, causing minor damage to low lying areas, creating a "sunny day" flood event totally attributable to the dam, someone could be injured or washed away in such a release).
- The risk of exacerbating flooding by making releases that then add to flood levels downstream occurring after the pre-release. (i.e. the predicted rainfall occurs downstream of the dam while the river level is elevated due to the pre-release's from the dam combining to create a damaging flood).
- Predicting rainfall 2 days before an event is highly variable even according to the Bureau of Meteorology and 3 days is problematic.

6.4 Option 3 – Lower the Storage Level by Sunny Day Releases to 75% and operate under the current flood manual

This option involves effectively lowering the Full Supply Level of Wivenhoe Dam to increase the flood mitigation storage at the commencement of a flood event. As discussed previously, the storage would need to be lowered by 25 to 50% to provide a significant reduction in peak flows for a major flood event. Once the storage level reached EL67 gate operations would commence as per the current flood manual.

To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater.

In the 25 days leading up to the January 2011 Flood event, three flood events impacting on Wivenhoe Dam were experienced, with gate releases being made on all but five of those days. The total outflow from these events was around 790,000ML.

During these events, multiple requests were received from Councils and residents impacted by bridge closures downstream of the dam to curtail releases as soon and as quickly as possible. Additionally, the 2 January end date of the flood event prior to the January 2011 Flood event meant that significant draw down of the dam prior to the onset of the January 2011 Flood event that commenced on 6 January 2011, was not possible without major bridge inundation downstream of the dam and without exceeding minor flood levels in the lower Brisbane River.

Additionally, a flood event was also experienced in October 2010 that resulted in a release of 640,000ML from the dam. Accordingly, to draw down the dam below full supply level prior to the start of the first December event would not have been possible without significant bridge inundation and without exceeding minor flood levels (as defined by BOM and BCC) in the lower Brisbane River.

In other words, preceding rainfall events to the January 2011 Major Flood event had created flooding that would have maintained the storage at the current FSL and prevent drawdown of the storage if such a strategy was proposed.

Risks to this strategy are:

- Compromising water security for South East Queensland by lowering the storage at the end of the each event. The impact on yield needs to be quantified.
- Having preceding rainfall events fill up the dam and prevent it from being lowered before a major flood event. Effectively compromising any effectiveness associated with this strategy.
- The limited discharges that can be utilised during sunny day flows in the river system. To reduce levels prior to summer would take some time without inundating any bridges and without any further inflows. To reduce from 100% to 50% and only impact on Twin Bridges and Savages Crossings and keep Colleges Crossing open could take some 5 to 6 weeks. Even if levels are reduced in Wivenhoe prior to summer, as occurred this summer, multiple rain events can fill the dam and would require significant releases to keep the storage level down.

6.5 Option 4 - Temporarily Lower the Full Supply Level to 85% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 85% of the current storage capacity (for this option make EL65.25 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL65.5. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

This amended change would result in flow reductions similar to that obtained from Option 3.

Table 5 - Impact of temporarily Lowering FSL to 85%

Flood Event			Existing Rules		Temporarily Reducing FSL.		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.4	2,639	70.66	32%
36 hours 1 in 500 design	10,455	1,624,119	5,983	72.2	4,028	71.53	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,010	72.78	5,031	72.16	16%
48 hours 1 in 5000 design	14,278	2,562,553	9,066	74.7	8,535	74.37	6%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.15	7,821	73.92	5%

96 hours 1 in 5000 design	11,870	2,948,032	7,534	73.74	7,135	73.49	5%
120 hours 1 in 5000 design	12,727	3,005,136	7,227	73.55	6,751	73.25	7%
January 2011 historic	10,470	2,650,000	7,528	74.98	5,746	74.62	24%
1974 historic	5,953	1,410,000	3,275	73.305	2,737	72.91	16%
1999 historic	6,358	1,220,000	2,312	72.23	1,814	71.89	22%

* Design event characteristics obtained from WA (2005)

6.6 Option 5 - Temporarily Lower the Full Supply Level to 75% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 75% of the current storage capacity (for this option make EL64 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL64. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

As can be seen in Table 6 lowering the FSL to EL64 (75% of the current FSL) and commencing flood operations at this level has a profound impact on the discharges for the shorter duration flood events with smaller flood volumes. However, once the flood volume exceeds the 2,000,000ML mark the effectiveness of this change in the operating level is diminished resulting in only a 10% reduction in the peak outflows for the dam.

Given the January 2011 Event had a volume of over 2,500,000Ml the benefits from lowering the storage level would not have resulted in any major change to the extent of flood inundation. It would however have reduced the depth of inundation with a corresponding reduction in the number of house and commercial properties flooded.

Table 6 - Impact of temporarily Lowering FSL to 75%

Flood Event				**Existing Rules**		**Temporarily Reducing FSL.**	
Event description	**Maximum Inflow (m³/s)**	**Flood Volume (ML)**	**Maximum Outflow (m³/s)**	**Maximum Lake Level (m AHD)**	**Maximum Outflow (m³/s)**	**Maximum Lake Level (m AHD)**	**Flow Reduction %**
36 hour 1 in 200 design*	8,214	1,544,119	3141	71.4	1,971	70.24	94%
36 hours 1 in 500 design	10,455	1,624,119	5983	72.2	3,446	71.17	42%
36 hours 1 in 1000 design	12,031	1,772,752	6010	72.78	4,504	71.83	25%
48 hours 1 in 5000 design	14,278	2,562,553	9066	74.7	8,217	74.17	9%
72 hours 1 in 5000 design	13,181	2,880,602	8190	74.15	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7534	73.74	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7227	73.55	6,635	73.17	8%
January 2011 historic	10,470	2,650,000	7,528	74.98	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.305	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	1,561	71.48	33%

* Design event characteristics obtained from WA (2005)

It can be seen from the comparison of Table 5 and Table 6 that the reduction of the storage level to 75% can provide a significant reduction on the outflows from the dam when combined with an amended release strategy, but again this impact reduces as the magnitude of the event increases. This is consistent with the previous observations that reductions of at least 25% of the storage volume are required to significantly alter the outflows from the dam.

It is also important to note that even with the reduction of the storage level to 75% and the amended flood operation rules, the storage level still exceeds EL74 for the January 2011 Flood Event. The changes would result in reduced flood levels downstream but would not prevent damaging flows through Brisbane.

7 References

DPI (1995) Department of Primary Industries Qld, Water Commercial, "Wivenhoe Dam Design Report – Volume 1 – Text", WS094, September 1995

WA (2005) Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

WRM (2006) WRM Water and Environment, "Brisbane Valley Flood Damage Minimisation Study – Brisbane City Flood Damage Assessment, Brisbane City Council City Design, October 2006

8 Attachment A

Rainfall Forecasting for the Wivenhoe Dam Catchment

Background

1. On 6 July, Chris Russell, of Connell Wagner, met with Mike Bergin and Peter Baddiley seeking advice regarding the predictability of significant rain events over the Wivenhoe Dam catchment. Connell Wagner has been engaged by SEQWCo to provide advice on the feasibility of maintaining the water level in the Wivenhoe storage at one metre above Full Supply Level. As a part of the dam operations under that scenario, it would be required that the additional storage above FSL be released ahead of a major inflow into Wivenhoe Dam. This would require some 24 to 48 hour advance prediction of catchment average rainfalls in the order of 300mm in 24 hours; 375mm in 36 hours and/or 430mm in 48 hours.

2. Wivenhoe Dam catchment is located to the north-west of Brisbane and has an area of about 7,000 square kilometres. For meteorological forecasting, the catchment is broadly about 100 km in the north-south direction, and 70 kilometres wide (east-west); bounded in the west by the Dividing Range with its eastern boundary varying from about 40 to 80 kilometres inland from the coast. The distribution of rainfall over the catchment is significantly influenced by the topography in major events.

Discussion

3. As discussed at the meeting, the experience of Meteorologists and Hydrologists in the Brisbane office of the Bureau is that the short to medium term (0 to 48 hour) prediction of rainfall for the purpose of objective use in flood forecasting models is a difficult task. Quantitative Precipitation Forecasts (QPF) are available from the Australian and international Numerical Weather Prediction (NWP) models and have been used subjectively in the Brisbane office for many years. Whilst the NWP models have shown improvement in the accuracy of QPF over the past decade or so, there is still at times considerable error or uncertainty, in the prediction of the location, amount and timing of rainfall events at the catchment scale.

4. The improved skill of NWP models in recent years has particularly been in forecasting the development and movement of broad-scale synoptic features that would be likely to produce the threshold rainfall amounts in question. These large-scale features include decaying tropical cyclones, east coast low pressure systems and significant upper level troughs. However while these systems maybe well forecast on a time scale of 2 to 3 days the very heavy rainfall concentrations are dependent on finer scale (mesoscale) and convective features. Whilst there is often the ability to forecast the potential for a significant rain event to occur in the southeast Qld-northern NSW region, it is difficult (if not impossible) to predict the actual location of the heaviest rain, even with only a few hours notice.

5. Examples of high rainfall events that have occurred in the past 10 to 15 years in this region, some of which had little to no advance prediction of the "precise" location and/or magnitude of resulting rainfall, include Feb 1991, Dec 1991, Feb 1992, May 1996, Feb 1999, Mar 2001 and June 2005. Several of these events were not produced by large-scale features but by slow moving convergence zones which the current modelling capability cannot adequately predict. The two most recent events in 2001 and 2005 were relatively short-lived events and occurred at different times of the day – 2001 in the afternoon and 2005 overnight. While one could reasonably expect that most really significant rainfall events are most likely through the warmer months, winter extreme events are by no means rare.

6. Considerable effort is being applied to derive improved deterministic and probabilistic QPFs from NWP models. In the near future, the Bureau will be providing a publicly available rainfall forecasting service via a website. The rainfall predictions will be generated automatically by combining the outlooks from a suite of Australian and international. Forecast rainfall amounts for 24 hour periods will be given for 4 days ahead, together with the chance of exceeding various amounts from 1mm to 50mm. The latter is a "pseudo" measure of probability based on the consistency in the forecast rain amounts given by up to eight NWP models used in deriving the rainfall forecast. Whilst it is not considered that this will provide a sufficiently accurate method for objective decision making for pre-releases from Wivenhoe Dam, the probabilistic rain forecasts may provide a basis for a risk management approach. There may need to be further studies on risk quantification for prediction of high to extreme rainfall events to support this approach. Given that there are large levels of uncertainty in rainfall forecasts, the forecasting of hydrological response may require an ensemble of future rain scenarios to be considered for the Wivenhoe Dam application.

7. As for a potential service provided by the Bureau an alert type product would seem to be the best alternative where the potential for an extreme rainfall event in the following 2 to 3 days across southeast Queensland was given a rating on say a 3 level scale. If that rating was high then a second phase could be activated which could provide more detailed forecast of expected rainfall amounts and location. However I emphasise that this type of service can be expected to not provide the required 2 days advice of an event on some occasions and may fail to provide anything more than a few hours notice, such is the nature of the predictability of the mesoscale components of these events.

8. Currently the Bureau provides a QPF service for the dams in Southeast Queensland. This twice-daily service predicts the average rainfall across the catchments in the following 24-hour period. We have not undertaken any verification of the service. However it is likely that verification would show reasonable skill in identifying rainfall events but quite poor skill in predicting extreme events. This service is to be reviewed in the next few months and we may commence charging for the product as it is essentially not a basic service and should not be publicly funded. We have yet to commence discussions with the client so these comments should be kept confidential. This issue is raised because any future customized product provided in support of dam operations will certainly be on a fee for service basis. There is also the issue of whether the Bureau would have the capacity to provide such a service at all and that would have to be part of any future discussions.

Summary

9. In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist.

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Manager Weather Services,
Bureau of Meteorology, Queensland.

Peter Baddiley
Supervising Engineer Hydrology
Bureau of Meteorology, Queensland

24 July 2006

9 Attachment 2 – Extracts from the Wivenhoe Design Report

14.0 SPILLWAY DESIGN

14.1 Spillway - General

The general arrangement of the spillway is shown in Figure 56 (Drawing A1-50771C). The principal dimensions of the spillway and gates and relevant elevations are as follows:-

Number and Size of Radial Gates	5-12 m wide x 16.6 m high
Storage Capacity	1 150 000 ML
Flood Storage	1 450 000 ML *
Design Flood Maximum Outflow	11 700 m^3/s *
Total Volume of Spillway Excavation	1 962 766 m^3
Total Volume of Concrete in Spillway	124 984 m^3
Level of Fixed Concrete Crest	EL 57.0
Fully Supply Level for Optimum Operation of Wivenhoe Hydro-Electric Power Station	EL 67.0
Design Full Supply Level	EL 68.5
Maximum Water Level	EL 77.0 *
Embankment Crest Level	EL 79.0
Embankment Crest Level with Concrete Crash Barrier	EL 79.7

(*In 1993 the flood hydrology of Somerset Dam and Wivenhoe Dam was revised as part of the Brisbane River and Pine River Flood Study. The 48 hour Probable Maximum Flood produced the largest outflow from Wivenhoe Dam under existing normal gate operation procedures. Adoption of temporal patterns from Australian Rainfall and Runoff (1987), for events with a Average Recurrence Interval (ARI) of 100 years or less, led to the 72 hour duration storm producing the largest discharge from Wivenhoe Dam for more frequently occuring events. For these revised design flood estimates of peak inflows and outflows, flood volumes and peak lake levels for various return periods see Table 3.1 of Report 24 of Appendix B attached to this report. Levels in the table do not include allowances for wind set up or wave run up. These estimated extreme floods are of such a magnitude that they would cause overtopping of the embankment. The Imminent Failure Flood (IFF) has therefore been assessed as the flood event which, when routed through the storage under existing operational procedures, would just threaten to overtop the embankment. The estimated rainfall depth for the IFF is 75% of the Probable Maximum Precipitation which has an ARI of 14 300 years. For the IFF the peak inflow to Wivenhoe Dam is estimated to be 21 990 m^3/s; the peak outflow is estimated to be 14 080 m^3/s; and the flood volume is estimated to be 3 794 180 ML. However if the IFF is defined as the flood which will just reach the top of the dam wall including the wave wall it has an ARI of 100 000 years. For full details refer to Report 24 of Appendix B attached to this report.)

The excavated channel for the spillway has a total length of approximately 1100 m. It has a low level channel to serve the outlet works, which was also used for diversion during construction, and a higher approach channel serving the other four overflow monoliths. Downstream of the spillway flip, the discharge channel was excavated an additional 11 m where the spillway jet impinges, to form a plunge pool, which is designed to dissipate the energy and control scouring (Reference 23).

Bays on the spillway overflow crest are five in number, each 12 m wide. A high level spillway flip, of uniform radius directs an overflow jet well away from the crest structure. Steel radial gates of 86 t mass are mounted off piers supported on the crest, lifting winches being located behind each gate leaf. Each pier is a constant 3.5 m width for 12 m from its nose and then tapers to 2 m at its downstream end. At the base of each pier an extension is provided to reduce unsteady flow conditions in the spillway flip.

Twin bridges cross the spillway. One carries the highway and is supported on cantilevers off the piers. A second bridge supports a 79 t gantry crane provided to install the bulkhead gate during maintenance of any radial gate.

An intake structure for the outlet works is slotted into the left bank spillway retaining wall just upstream of the spillway crest. Outlet pipes of 1900 mm and 3600 mm diameter, one above the other, connect the intake to the discharge valves adjacent to the spillway flip. The 3600 mm dia pipe was providing as a possible power station penstock as described in Sections 22 and 29.

Training walls, upstream of the crest, direct flow fairly uniformly towards the spillway thereby maximising its performance. A combination of rockfill groynes and mass concrete walls constitute these training walls.

14.2 Geology of Site and Excavation of Spillway

14.2.1 Geology of Site and Excavation of Spillway - General

The damsite lies on the Helidon Sandstone, formerly known as the Wivenhoe Sandstone. This rock is a massive, thickly bedded, fine to coarse grained argillaceous sandstone of varying hardness, commonly showing current bedding. Bedding is approximately horizontal. Shale, claystone and coal are also present in occasional seams and lenses.

Possible spillway sites existed on both abutments but the existence of a thick shale layer, 4 m to 9 m thick, on the right bank and economic advantages favoured the left bank location.

At the spillway site weathering extended to depths of about 25 m, but it was only in the top two or three metres that the rock was completely to highly weathered so that the bulk of the excavated material was suitable for embankment fill in the outer zones of the dam. The moderately weathered zones were generally excavated by ripping with large bulldozers and loaded by scrapers assisted by bulldozers whereas the fresh rock was drilled, shot and loaded into off-highway rear dump trucks. Drilling was fast and economical in this type of rock. Because jointing was predominantly vertical and horizontal, the spillway excavation was designed for vertical drilling in approximately 12m steps with benches of 6 m to 8 m width, except where concrete was to be placed directly against the rock wall, where no benches were provided. Instead, the contractor was allowed to drill slightly off vertical to undercut the required theoretical line of excavation to accommodate his drillhead. On the left wall of the excavation the existence of weak joints, inclined unfavourably, caused some falls which necessitated the installation of prestressed anchors. The permanent near-vertical faces of the spillway cut and excavation for the overflow monoliths, where shaped to receive concrete, were presplit by line blasting with holes at 750 mm centres, before any bulk excavation was done.

At various levels, continuous weak nearly horizontal joints existed, fortunately at very wide spacing. The weak material filling these joints varied in thickness and composition - in thickness from about a few millimetres to one metre, and in composition from clay to a weak sandstone or shale, coal seams and claystone. On the left side of the spillway, the lowest such seam was at about EL 36, and the foundation of the main spillway blocks was taken to this level to avoid this feature.

14.2.2 Geological Mapping of Spillway Foundations and Side Walls

Following excavation of the spillway the foundations and side walls were geologically mapped prior to the placing of concrete. Figure 57 (Drawing A1-71363) lists the individual drawings covering the foundations and side walls of the spillway. None of the drawings listed in this key plan have been included in this report, but have been supplied to the South East Queensland Water Board under separate cover.

14.3 Flood Routing

The dam was assumed full with the reservoir level at EL 67.0 at the beginning of a flood for all flood routing studies except those involving the Probable Maximum Flood, where the reservoir level at the start was taken at EL 68.5 to allow for a possible future increase in full supply level.

As inflows into the dam are unable to be predicted accurately, the gate controller cannot be expected to utilise 100% of the available flood storage. To allow a margin for error, 85 percent of the available storage between EL 67.0 and EL 77.0 was used when routing floods other than the Probable Maximum Flood through the dam.

For the Probable Maximum Flood, the waterlevel was allowed to come to the maximum, with all gates open since it is a very rare flood.

Flood routing studies were divided into two categories, (i) the flood mitigation value of the dam for the benefit-cost analysis, and (ii) the dam safety for which the Probable Maximum Flood was used.

The adopted Probable Maximum Flood (PMF) is shown in Figure 58. It was derived by maximising the 1893 storm in situ (Reference 24). The 1893 storm was responsible for the largest flood on record in the Brisbane River.

The adopted PMF had a peak of 15 000 cumecs and a volume of 4.21 million ML, equivalent to 600 mm of runoff over the catchment area. By comparison, the flood storage of Wivenhoe Dam between the full supply level (FSL) of EL 67 and the maximum water level of EL 77 is 1.4 million ML.

This PMF was used to assess the safety of the dam against overtopping. In addition, inflow hydrographs for various historical floods (e.g. the 1893 and 1974 floods) and for floods synthesized from storm frequency data were developed in order to provide data for a benefit - cost analysis for the flood mitigation component of the dam.

For the flood mitigation benefit-cost studies, the historic and synthesised floods were routed through the dam and the outflow routed down river to Brisbane. The objectives were to limit outflow below a damaging level for Brisbane consistent with the available storage and to empty the dam within a reasonable time , say 5 or 6 days , after the reservoir has reached maximum level.

The results of flood routing for the economic studies are summarised in a report by Grigg (Reference 25). The 1974 flood, which reached 5.45 metres on the Brisbane City Gauge, would have been lowered by 2.6 metres if Wivenhoe Dam had then been in existence. The damage caused by the 1974 flood was estimated at $178 million, and the savings produced by lowering the flood would have been $140 million.

The flood mitigation studies indicated that all major historical floods could be controlled with outflows not exceeding 3 200 cumecs. If no other inflow occurs below the dam a prolonged outflow of this magnitude would cause little or no damage to Brisbane. The dam would then be able to be emptied in a reasonable time after a major flood such as the 1893 flood.

The above data with respect to the PMF applied at the time of the design of Wivenhoe Dam. Since then design flood estimates for Somerset Dam and Wivenhoe Dam have been revised under the Brisbane River and Pine River Flood Studies. Details of the revised flood estimates are included in reports Nos 8 and 24 of Appendix B of this report.

14.4 Spillway Gates

14.4.1 Gate Arrangement

The number and size of gates were determined mainly by economic considerations. Certain operational requirements also influenced the size of the gates and concrete crest level. For instance, one requirement laid down was a large outflow capacity with the reservoir at FSL so that large volumes of water could be released in the early stages of a major flood. A desirable feature was the ability to hold back a substantial flood volume with little or no release so that coincidence of releases with downstream tributary inflow could be avoided. This last requirement made it necessary to have the top of the gates considerably higher than FSL and EL 73 was adopted for the top of the gates. The reservoir volume between the FSL of EL 67 and the top of the gates is 800 000 ML. This height of gates was also checked by routing historical and synthetic floods with various modes of gate operation.

The height of the gates was checked by flood routing calculations. It was found that, if the most likely type of operation was adopted, as set out in Cossins (Reference 3) with respect to the criteria of emptying the dam quickly, the major floods like the 1893 and the 1974 floods could be controlled by a gate with its top at EL 70. However, in order to achieve lower initial outflow levels and to give flexibility of operation, as described earlier, it was decided to have higher gates.

Economic comparisons led to the adoption of 5 radial gates each 12 metres wide by 16.6 high with a fixed concrete crest of EL 57. The savings of this arrangement compared to 6 gates and a crest level of EL 58 was $1.2 million (August 1979). The five gates chosen gave a width of spillway cut providing sufficient excavated material to balance the fill required in the embankment. The design of the gates is covered in Section 23.0.

14.4.2 Gate Operation

The aspects of gate operation in this section is based on hydrological data available at the time of the design of Wivenhoe Dam (Reference 6).

During a major flood, the outflow from Wivenhoe Dam will normally be controlled with the gates partly opened during the whole period of the flood. It is only in the event of a very large flood that the gates will be fully open and then only in the later stages of the flood. The following considerations would apply during a major flood control operation:

(a) Safety of the dam.
(b) Outflows must be kept to non-damaging levels for as long as possible.
(c) Outflows should generally be less than the corresponding natural flood flow.
(d) The rate of increase of outflow should be limited to allow adequate warning downstream.
(e) To avoid coincidence of the outflows from the dam with peaks arriving at Brisbane from tributaries downstream of the dam, it may be desirable to severely cut back the dam outflow for short periods.
(f) The outflow should be high enough so that the reservoir may be emptied in time to receive inflow from a possible subsequent flood event.
(g) The rate of increase and decrease in outflow from the dam should be kept to within limits so as to avoid possible danger to people and damage to river banks downstream.

For the PMF, various modes of operation were considered, and cases with a varying number of gates inoperable (i.e. not able to be opened) were examined. When 3 gates or less out of the 5 were operable, it was assumed that the operating rules would force the operator to open gates to match outflow to inflow until the gates were fully open. It was found that the PMF could be passed with this rule as long as at least 2 gates remained operable, with no freeboard remaining.

Figure 58 shows one method of routing the PMF through the dam with five gates operating. The reservoir level at the start of the flood was at EL 68.5. The gates remained closed until the reservoir reached EL 70.5 when the gates were opened incrementally until the discharge equalled the non damaging outflow of 3200 cumecs where it was held as long as possible. When the water level reached EL 73.5, gate opening resumed until the gates were fully open with the reservoir level at EL 75.5 and a discharge of 10,350 cumecs. As the inflow continued the reservoir reached a maximum level of EL 76.9 where the discharge was 11780 cumecs. (This example does not apply to the current operation of Wivenhoe Dam. Operating procedures are included in Reference 26).

In the unlikely event that the controller kept the gates shut during the PMF and the reservoir level reached the top of the gates, it was found that as long as the subsequent rate of opening was at least 300 cumecs per hour then the dam would not be overtopped. This method of operation would not be recommended for very large floods. Calculations have proved the safety of the design. The aim of the design was to provide as much flexibility as possible for future controllers of the spillway gates.

The current procedures for operating the gates at Wivenhoe Dam are detailed in the Manual of Operational Procedures for Flood Mitigation for Wivenhoe Dam and Somerset Dam (Reference 26).

14.5 Hydraulic Model Studies

14.5.1 Hydraulic Models

Most of the hydraulic data for the spillway design was obtained by testing of two physical hydraulic models (Reference 23). A 'pilot' model of 1 to 200 scale was used to determine the feasibility of a flip bucket spillway and to assess overall hydraulic behaviour of the spillway, the approach flow conditions and discharge back to the river. The section of the river from AMTD 152.0 km to AMTD 148.9 km was reproduced in this model.

A 1 to 80 scale 3-dimensional model of the spillway termed the Main Spillway Model, was tested to determine the spillway structure geometry, hydraulic loading data, gate discharge ratings, proposed sequencing of gate openings for flood discharge, and dissipation performance in the flip bucket plunge pool. Only part of the approach channel, the spillway structure, and part of the discharge channel were reproduced in this model.

14.5.2 Pilot Model

The initial spillway approach arrangement tested was a conventional vertical training wall layout with a radiused transition on the upstream ends. This layout produced a concentration of flow towards the left of the spillway. Large vortices were shed from the end of the right approach wall and considerable vortex motion occurred in front of the two gates on the right. This behaviour would have resulted in poor discharge control and asymmetric flip bucket and plunge pool conditions. The major reason for the asymmetric approach condition was that the higher natural surface levels on the left of the spillway approach channel forced a skewing of flow from the right. Various arrangements of approach groynes and long-radiused training walls were tested to produce a final approach layout as shown in Figure 59 (Drawing A1-50782C). A reasonably uniform approach velocity distribution was obtained across the face of the spillway with this layout. Detailed velocity measurements were taken on the face of the groynes to determine riprap protection requirements. Results of these measurements are shown in Figure 60.

The flip bucket appeared to be satisfactory in the pilot model with a number of improvements which were tested on the main spillway model. The spillway flip was originally the same width as the discharge channel (74.0 m) but convergence of the sidewalls downstream to a width of 68.0 m was necessary to ensure that the overflowing jet from the spillway did not impact on the berms above the discharge channel. The initial piers were parallel sided with square ends. The waves generated from the pier ends were unstable and relatively high, intermittently forcing a high velocity jet to impact on the discharge channel berm. This problem was alleviated by tapering of the piers and was further investigated in the main spillway model.

The chosen flip bucket exit angle of 25° was based on current world practice with a compromise between the distance the jet is projected downstream and the angle of incidence of the jet on the floor of the plunge pool. The resulting scour hole developed a sufficient distance downstream not to endanger the stability of the spillway. The lip level of the flip bucket was some 8.0 m below the tailwater level for the Probable Maximum Flood but the flip bucket was not drowned.

It was virtually impossible to reproduce in the model the scour of the rock material in the discharge channel. If the discharge channel had a non-erodible bed at EL 28.0 supercritical flow was possible with a hydraulic jump being formed at the downstream end. This was considered undesirable as massive scour could develop in the less resistant rock at the downstream end of the discharge channel and uncontrollably progress back upstream. For this reason, a pre-excavated scour hole was experimented with to ensure energy dissipation occurred in the region where the jet impacted the bed of the discharge channel and thus controlled the location of the major scour. This concept was further tested in the main spillway model.

To give some guidance to the range of possible scour depths, a number of approaches were used. Several scour 'formulae' are presented in the literature based on model and prototype measurements but the diversity of the results obtained would indicate some unreliability in predicting stable scour depths. Scour tests were performed in the pilot model using vertical non-erodible sidewalls in the discharge channel with an erodible bed. Granular beds ranging from fine sand to graded mixtures were tested. Loosely packed concrete cubes were also tested in an attempt to reproduce the behaviour of hard but jointed rock where the scour could be caused by the high dynamic pressures of impact penetrating the joints and lifting blocks of rock into the flow.

The maximum bed velocities in the order of 4 m/s were encountered in the discharge channel downstream of the plunge pool. There was little tendency for strong circulation currents in the river between the embankment and the end of the spillway discharge channel.

14.5.3 Main Spillway Model

The approach channel flow distribution of the pilot model was reproduced in the main spillway model. Water surface profiles were measured against the approach walls to determine design loadings. The necessity for the convergence of the spillway side-walls, as shown on the plan of the spillway, Figure 56 (Drawing A1-50771C), was confirmed and the overall behaviour of the two models was similar.

The crest section of the spillway profile consisted of a standard USBR ogee crest shape for a design head of 15.0 m. The radial gates were located downstream of the crest so that the jet trajectory from small gate openings more closely approximated to the ogee shape. A 15.0 m radius was initially used for the flip bucket with a sloping apron and 17.0 m radius to connect to the crest shape. Pressures measured along the spillway profile indicated pressure peaks on the two radii but with subatmospheric pressures on the sloping apron for some flow cases. Also at higher discharges, flow concentric with the circular flip bucket surface was not maintained with consequent poor jet trajectory. The two radii and sloping apron were substituted by a single radius of 41.8 m with the same location and exit angle of the flip and improved performance was obtained.

Water surface profiles were measured for various flows to determine the height of the spillway side walls. Pressures on the crest and flip bucket were measured for various uncontrolled and gate controlled discharges. Figure 61 shows a comparison of water surface profiles and pressures for the gate controlled design discharge of 5000 m^3/s and an uncontrolled discharge of 11 700 m^3/s. Pressures were also measured for the case of the bulkhead gate used as an emergency flow control. A maximum subatmospheric pressure of 3.6 m was developed which gave a reasonable margin against cavitation on a smooth concrete surface. Maximum velocities on the face of the spillway were in the order of 22 m/s.

Waves from square ended piers and tapered piers were generated in the main spillway model similar to those in the pilot model. An extension of the tapered pier by 7.0 m downstream and approximately 5 m high, further improved the uniformity of the jet as well as controlling its spread for single gate operation. Mitre, semi-circular, triangular, parabolic and rounded mitre pier nose shapes were tested. A rounded mitre nose was selected, giving the best compromise between discharge performance and lateral loading on the piers. The lateral water loads on the piers were determined by pressure tappings located in the piers. Further details on the design of the piers are given in Section 18.0.

The pre-excavated plunge pool was considered necessary to initiate the scour hole downstream of the flip bucket in a controlled manner. The basic consideration in the development of the pre-excavated plunge pool shape was that the large scale turbulence should be concentrated away from the unprotected sidewalls of the spillway discharge channel. Various shapes were tested with the shape shown on Figure 56 regarded as a practical solution. The side benches protect the sidewalls from undermining, and sloping the downstream bench faces reduced the possibility of deflecting the jet laterally.

The radial gates were rated over the complete range of operation. A recommended gate opening procedure was developed from the model. The major considerations were to produce symmetrical jet energy dissipation in the plunge pool, keep high velocity jet impact away from the sidewalls for as great a discharge as possible, and to have the jet impact into the greatest tailwater depth. The recommended procedure is to open only the middle gate for small discharges then open adjacent gates for larger discharges with symmetric flow about the middle gate. For discharges greater than 3000 m^3/s all gates would be opened equally. Operating procedures were developed for the emergency case of a gate stuck either open or shut. These procedures were developed in an attempt to produce near-symmetrical conditions for as great a discharge as possible.

14.6 ROCK PROPERTIES OF THE SPILLWAY AREA

14.6.1 Rock Properties of the Spillway Area - General

In addition to the detailed geological investigation, testing of the mechanical properties of the rock was carried out to establish design parameters for both the spillway walls and over-flow monoliths. For this purpose vertical and horizontal cores were available from 75 mm and 100 mm drill holes at the site of the 1050 mm exploratory shaft. Unconfined compression tests of the core, both saturated and dry, indicated a general increase in strength and stiffness of the rock with depth. Also, the strength and stiffness in the plane of bedding was only marginally greater than that normal to the bedding. The strength of saturated samples was in general less than half that for dry samples. Typical compressive strength for saturated samples at about foundation level was 20 MPa with Youngs modulus in the range 5 - 10 GPa.

Hughes, James

From: Jim Pruss [redacted]
Sent: Thursday, 24 March 2011 8:23 AM
To: McCredie, Bill
Subject: FW: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V1 SKM Review.docx
Attachments: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V1 SKM Review.docx

And another one

From: Barton Maher
Sent: Monday, 7 February 2011 10:00 AM
To: Jim Pruss; Rob Drury
Subject: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V1 SKM Review.docx

Hi Jim and Rob,

Report as it stands at the moment. Have sent to Rory Nathan for a review at lunch time. He has already reviewed twice.

Regards,
Barton

Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges

1 Contents

2 Introduction

Seqwater staff have been asked to investigate the impact of reducing the storage level of Wivenhoe Dam on the downstream discharges for major flood events. This memo details the investigations carried out and provides a preliminary assessment of the reduction in flood flows that could be achieved by reducing the Wivenhoe Dam storage level to 95%, 90%, 75% and 50% of the normal water supply volume.

The comments in this report are provided to give an indication of the impacts of a reduced storage level of Wivenhoe Dam on discharges during major flood events. It must be noted that it is very preliminary, as to get accurate results a full investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models would be required. This review was requested to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

3 Definitions

For the purposes of this report the following definitions have been adopted as per the Wivenhoe – Somerset Flood manual:

Fresh	This causes only very low-level bridges to be submerged.
Minor Flooding	This causes inconvenience such as closing minor roads and the submergence of low-level bridges. Some urban properties are affected.
Moderate Flooding	This causes inundation of low-lying areas and may require the evacuation of some houses and/or business premises. Traffic bridges may be closed.
Major Flooding	This causes flooding of appreciable urban areas. Properties may become isolated. Major disruption occurs to traffic. Evacuation of many houses and business premises may be required.
Extreme Flooding	This causes flooding well in excess of floods in living memory and general evacuation of whole areas are likely to be required.
"m^3/s"	Means an instantaneous flow rate expressed as cubic meters of water per second.
"AEP"	means annual exceedance probability, the probability of a specified event being exceeded in any year;
"AHD"	means Australian Height Datum;
"EL"	means elevation in metres from Australian Height Datum;
"ML"	Means a million litres of water

4 Background

4.1 Previous Flood Studies

The original design of Wivenhoe Dam was to provide both water supply for South East Queensland and flood mitigation for the city of Brisbane. There have been several flood studies prepared for the dam as discussed below.

Wivenhoe Dam has a catchment area of about 7,048 km^2. The current spillway capacity of Wivenhoe Dam is based on a PMF inflow of 15,090 m^3/s made by the Queensland Water Resource Commission (WRC) in 1977 (Hausler and Porter, 1977). This estimate was based on a 48-hour duration probable maximum precipitation (PMP) estimate of 480 mm and synthetic unit graphs using the Clarke Johnson method.

WRC revised the design flood estimates in 1983 when the dam was in its final phase of construction. This revision was brought about because the Commonwealth Bureau of Meteorology (BOM) had revised their estimate of the PMP for the Wivenhoe catchment.

In addition, better rainfall-runoff-routing techniques were available at that time to derive design flows. The revised PMF inflow estimated in 1983 was 48,000 m^3/s, which is some 220% above the 1977 estimate. The increase was mainly attributed to the changes in the PMP, which increased to 1,000 mm for the 48-hour duration storm.

The Department of Natural Resources (DNR) (formally WRC) revised the design flows again as part of a comprehensive safety review of the dam undertaken between 1990 and 1994. Rainfall-runoff-routing models of the catchment were developed together with a dam flood routing model used to derive outflows from Somerset and Wivenhoe Dams taking into account the flood operating procedures used at that time. Somerset Dam, which has a catchment area of 1,331 km^2 drains into Wivenhoe Dam.

As part of the review, the BOM was requested to update the PMP estimates for the catchment (BOM, 1991). The revised PMP estimates were used in the 1994 analysis to estimate PMF. DNR estimated the PMF inflow to be 39,880 m^3/s, which is lower than the 1983 estimate but still substantially higher than the 1977 estimate. The lower PMF estimate were mainly attributed (again) to changes in the PMP, which was revised down to 870 mm for the 48-hour duration storm. The development and calibration of the rainfall runoff routing model was also much more comprehensive than previous studies. Flood operating procedures were also incorporated into the models to estimate design outflows.

A detailed review of the previous studies is provided in Report No. 8a of the DNR flood study reports (1994).

The BOM updated the PMP estimates in 2002/2003 for the Wivenhoe catchment using the revised Generalised Tropical Storm Method (BOM, 2003). This report also provides the latest information on temporal patterns and spatial rainfall weightings to be used with the new PMP data. The 2003 PMP estimates are some 20% higher than PMP estimates used by DNR in the 1994 study. As a result, the new PMF estimate for the catchment using this data is significantly higher than the 1994 estimate. The new estimate was used for the upgrade of the dam in 2004/2005 by the Wivenhoe Alliance. The DNR models (1994) were used to estimate design flows for Wivenhoe Alliance.

For the purposes of this study design hydrographs from the Wivenhoe Alliance have been used along with recorded data from three historic flood events.

4.2 Flood Mitigation

The Design Report for Wivenhoe Dam (DPI 1994) provides a summary on the design of the flood mitigation component of the dam. The report indicates that *the estimated PMF was used to assess the safety of the dam against overtopping. In additon, inflow hydrographs from various historical floods (eg the 1893 and the 1974 floods) and for floods synthesised from storm frequency data were developed in order to provide data for the benefit – cost analysis for the flood mitigation component of the dam.*

For the flood mitigation benfit – costs studies, the historic and synthesised floods were routed through the dam and the ouflow routed down the Brisbane River. The objectives were to limit outflow below a damaging level for Brisbane with the available storage and to empty the dam within a reasonable time, say 5 or 6 days, after the reservoir had reached the maximum level.

The results of the flood rouitng for the economic studies are summarised in a report by Grigg. The 1974 flood, which reached 5.45meteres on the Brisbane City Gauge, would have been lowered by 2.6m if Wivenhoe Dam had then been in existence. The damage caused by the 1974 flood was estimated at $178M, and the savings produced by the lowering the flood level would have been $140M.

The flood mitigation studie indicated that all major historical floods could be controlled with outflows not exceeeding 3,200m3/s. If no other inflows occur below the dam, prolonged outflow of this magnitude would cause little or no damage to Brisbane. The dam would then be able to be emptied in a reasonable time frame after a major flood such as the 1893 flood.

An extract of the design report detailing the design of the spillway is presented as Attachment 2.

5 Assessment of the Impact of Lowering the Full Supply Level

Lowering the full supply level was assessed to determine the impact on the peak flood levels and discharges.

5.1 Analysis Methodology

The analysis was undertaken using a spreadsheet developed to model the gate opening sequence as provided in the Flood Manual during a loss of communications situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be stressed that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

A history of floods in the Brisbane River is presented in Table 1.

Table 1 – Summary of Significant Flood Events in the Brisbane River

Event	Somerset Dam			Wivenhoe Dam		
	Peak Elevation	Inflow	Outflow	Peak Elevation	Total Inflow Flood Volume	Outflow Flood Volume
	m AHD	ML	ML	m AHD	ML	ML
Jan 1974#	106.57	620,000	450,000	73.31	1,410,000	1,410,000
Jun 1983	101.58	260,000	280,000	69.49	1,080,000	470,000
Mar 1989	102.59	370,000	380,000	69.78	690,000	660,000
Apr 1989	102.69	340,000	350,000	71.45	870,000	820,000
Feb 1999	102.96	450,000	280,000	70.45	1,220,000	900,000
May 2009	99.62	110,000	110,000	62.19	235,000	0
Mar 2010	99.41	210,000	200,000	66.43	390,000	0
Oct 2010	101.37	250,000	270,000	69.61	630,000	630,000
Mid Dec 2010	100.42	150,000	140,000	67.50	360,000	330,000
Late Dec 2010	99.98	120,000	130,000	69.35	500,000	460,000
Jan 2011	105.11	825,000	820,000	74.97	2,650,000	2,650,000

Presence of Wivenhoe Dam simulated

The assessment has investigated the impacts of the lowered storage level on the three largest events – the 1974 flood, the 1999 flood and the 2011 flood.

Plots of the inflow and estimated outflow for these events are presented in Figure 1.

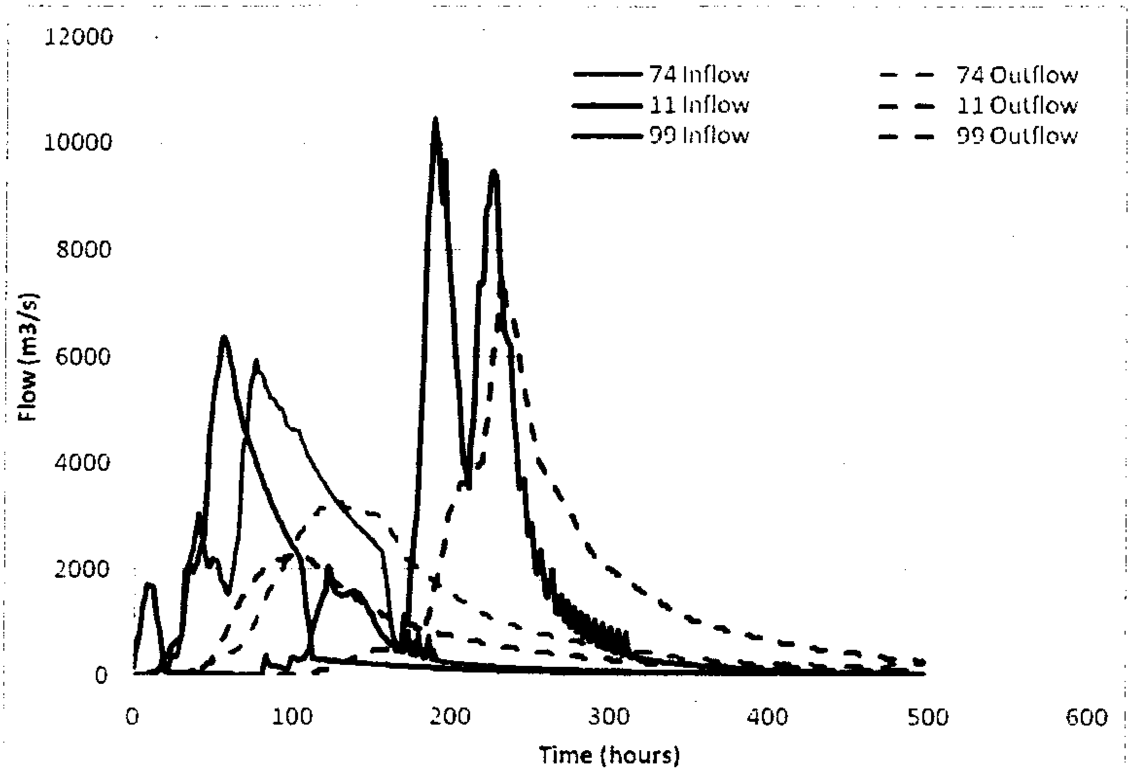

Figure 1 - Plots of Historic Events with Simulated Outflows

5.2 Analysis Results

A summary of the results of the modelling is presented in Table 2.

Table 2 – Reduction in flood peak due to adoption of different initial storage levels

		Wivenhoe Dam		Somerset Dam		Lockyer Creek	Lowood	Bremer River	Moggill	Reduction at Moggill
Storage Level at Start	% of Full Supply Volume	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Peak Flow (m^3/s)	Peak Flow (m^3/s)	Peak Flow (m^3/s)	Peak Flow[1] (m^3/s)	%
1974 Flood										
67.0	100	5,953	3,275	5,019	3,548	3,260	5,110	4,241	7,948	
66.5	95	5,953	3,153	5,019	3,480	3,260	4,799	4,241	7,910	0.5%
65.8	90	5,953	2,974	5,019	3,419	3,260	4,524	4,241	7,897	0.6%
64.0	75	5,953	2,618	5,019	3,302	3,260	4,117	4,241	7,683	3.3%
60.0	50	5,953	2,067	5,019	3,040	3,260	3,342	4,241	7,423	6.6%
1999 Flood										
67.0	100	6,358	2,312	7,540	3,837	663	2,556	308	2,593	
66.5	95	6,358	2,132	7,540	3,662	663	2,434	308	2,479	4.4%
65.8	90	6,358	2,003	7,540	3,470	663	2,284	308	2,319	10.6%

[1] Note the flows quoted for Moggill are based on the addition of outflows from the dam and the measured flows at Lockyer Creek and the Bremer River. They do not have any allowance for routing of the flows through the river system and the subsequent reduction in flows that were observed during the actual flood events.

64.0	75	6,358	1,687	7,540	3,214	663	1,906	308	1,936	25.3%
60.0	50	6,358	1,007	7,540	2,798	663	1,186	308	1,214	53.2%
2011 Flood										
67.0	100	10,470	7,528	3,824	2,814	3,040	10,495	2,793	13,104	
66.5	95	10,470	7,453	3,824	2,798	3,040	10,445	2,793	13,004	0.8%
65.8	90	10,470	6,756	3,824	2,815	3,040	9,791	2,793	12,302	6.1%
64.0	75	10,470	5,748	3,824	2,680	3,040	8,788	2,793	11,110	15.2%
60.0	50	10,470	4,209	3,824	1,595	3,040	7,249	2,793	9,582	26.9%

The preliminary work done by Seqwater before Christmas 2010 showed that for the October 2010 event, reducing the level of Wivenhoe by small amounts would have had minimal impact on the flood releases. From the Table 2 the following comments are applicable:

- Similarly to work completed previously, reducing levels by small amounts prior to the January 2011 Event (if it was feasible) would have had little impact on the peak level in Wivenhoe Dam as shown in the Table 2. The reason for this is that the total event inflow volume of 2,600,000 ML is well in excess of the useable flood storage combined with the available water supply storages shown in the table. Large reductions to the storage level of the dam (25 to 50%) would be required if significant impacts on flooding are to be achieved.
- For the 1999 flood, where most of the flooding occurred upstream of the Wivenhoe Dam, there is a dramatic reduction in the peak outflow if the storage is lowered. However, this is of little benefit as the flood would not have resulted in damaging flows downstream of the dam even if the storage was full.
- The 1974 flood simulation is based on the recorded flows being routed through the both Somerset and Wivenhoe. The presence of Wivenhoe would have reduced the flooding damage in Brisbane during the 1974 event, however there is very little change to the flood mitigation benefits by varying the storage level in Wivenhoe. As most of the flood flows in 1974 were downstream of the dam and the flood in the Brisbane River was relatively small compared to the downstream flooding the event is insensitive to the starting level in Wivenhoe.
- It should be noted that the increasing early releases from Wivenhoe was investigated during the Brisbane Valley Flood Damages Study as part of a review of the operation of the dam. Releasing more water earlier on from Wivenhoe dam was shown to lessen the flood mitigation benefits compared with the existing flood manual release strategies.

The key point being that each flood event is unique and presents varying opportunities to mitigate flows through Brisbane.

5.3 Downstream Water Level Changes

To evaluate the specific impact on the Lower Brisbane River of these reduced dam outflows from lowering the storage requires the use of a complex hydraulic model. The results of this modelling would still contain a degree of uncertainty as illustrated by the difficulties in estimating the final flood peak in Brisbane during the event. The uncertainty was partly due to the rapid closure of the Wivenhoe gates after the peak inflow of the flood and the attenuation achieved in the downstream river system. It is extremely difficult to model accurately.

Given the timeframe of this report it is not possible to generate any reliable estimate of the changes to the water level at the Port Office Gauge due to tidal influences, the need to interpolate between previously modelled results that vary markedly between differing events, the availability of verified data, and the uncertainty surrounding the timing of peak flows for the differing scenarios.

Table 3 shows a comparison of the peak water level for each of the various starting levels for the 2011 Flood Event. It should be noted that each scenario results in the storage level exceeding EL74 requiring the gates to be opened until the storage rise is stopped. These estimates of flood levels at the Port Office are based on the interpolation and scaling of previously modelled results – these estimates should thus be regarded as indicative only.

Table 3 - Preliminary Estimate of Brisbane Levels Changes due to Lowering Wivenhoe for the 2011 flood

Wivenhoe Dam				Approximate reduction in level
Starting Level		Peak Height	Capacity at Peak Height	Brisbane Port Gauge
%	m AHD	m AHD	%	m
100	67.0	74.98	191.1	0
95	66.5	74.93	190.6	0 to 0.1
90	65.8	74.88	189.9	0.1 to 0.3
75	64.0	74.63	186.5	0.2 to 0.6
50	60.0	74.11	179.6	0.4 to 0.9

It is seen that appreciable reductions could only have been achieved when the storage is drawn down towards the lowest levels considered.

It should also be noted that to accurately calculate the impacts of reducing the storage levels of Wivenhoe Dam at the start of a major flood event requires considerable study as rainfall events of different intensity, duration, peak, location and spread will give very different outcomes. In addition, there is the need to do detailed hydraulic analysis of the river system for each scenario to more accurately determine impacts.

5.4 Summary

Due to the large volumes of water associated with major flood events in the Brisbane River (that is with events with annual exceedance probabilities rarer than 1 in 100), to effectively reduce flood peak discharges significantly would require the storage level of Wivenhoe Dam to be lowered by at least 25 to 50%.

6 Contingency Options

There is the possibility of further flood events in the South East Queensland during the 2010/2011 wet season. To reduce the risk of flooding in Brisbane should a major rainfall event be predicted it has been requested that lowering of the storage level of Wivenhoe Dam be investigated to determine if this is a feasible option to further mitigate flood flows.

The assessment carried out by Seqwater has indicated that to have any significant impact on releases downstream of Wivenhoe Dam during a major flood event it would be necessary to lower the storage level by 25 to 50%.

There are five options considered going forward:

- "Option 0" - Continue with the current approved flood manual strategies
- "Option 1" - Commence drawing down the storage at a safe rate to bring it down to say 75%.
- "Option 2" - Pre-release water from the dam following the prediction of a major rainfall event
- "Option 3" - Change the flood manual strategies to ignore the early strategies designed to minimise disruption to the rural communities.
- "Option 4" - Temporarily reduce the full supply of Wivenhoe Dam and amend the flood releases to commence flood operations from the lowered full supply level.

6.1 Do Nothing Option – Continue with the Current Flood Manual

This option maintains the status quo and continues to utilise the dam as originally designed. This option has the least risks associated with it as the Strategies have been implemented and refined over several flood events and the manual was developed by a comprehensive study. The strategies in the flood manual have proved adequate for more frequent flood events.

6.2 Option 1 – Vary the early strategies for the Flood Manual

It has been proposed that increasing the releases from the dam up to 1,600 m^3/s as soon as practicable after gate operations commence may deliver reduced peak flood levels. This has been investigated to assess the impact of attempting to release more water at the very start of an event.

This option has been assessed using a range of design events from the Wivenhoe Alliance Design hydrology. To model the impacts of increasing releases up to 1,600 m^3/s as soon as practicable a range of design flood events from the Wivenhoe Alliance were compared using the program FLROUTE. . It was assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.

The results for the model runs are presented in Table 4.

Table 4 - Comparison of Release Strategies

Flood Event			Existing Rules		Amended Rules		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6.4%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4.1%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3.2%
48 hours 1 in 5000	14,278	2,562,553	9,083	74.71	8,994	74.66	1.0%

design							
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.10	1.3%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	1.6%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	3.8%
January 2011 historic							
1974 historic							
1999 historic							

It should be noted that predicted flood levels greater than EL 74 require the gates to be opened until the water level stabilises. This is fundamental to the dam's safety. In addition, any reduction in starting level, which does not achieve a peak lower than EL 74, is unlikely to have any impact upon peak release rate.

It can be clearly seen from Table 4 that changes to the early releases adopted for the flood manual strategies have minimal impact on the maximum outflow for the dam. The influence of reduced initial starting level decreases with increasing flood magnitude. For the major flood events investigated the reduction in peak outflow for the dam is negligible. Note that this analysis does not consider the downstream flooding in the Lockyer and Bremer Rivers.

However, it should be noted that there is the real risk that the release of additional water from the dam early in the flood event may make local flooding impacts in Brisbane worse. Due to the travel time of releases, uncertainty in forecast rainfall, and the low lying local catchment areas between Wivenhoe Dam and the urban areas of Brisbane, it is likely that for some events the increased early releases will exacerbate local flooding in Brisbane. This is potentially a significant risk as this flooding is directly attributable to the dam releases and could be avoided if the dam was operated according to the current strategy.

The flood strategies for Wivenhoe and Somerset are based on holding back flood waters until the rain has occurred and downstream flooding has peaked. Releasing early in an event compromises some of the flood mitigation capacity for the intermediate flood events.

6.3 Option 2 - Pre-release water when a major event is forecast

This option involves implementing a significant release of water once the notification of a major rainfall event has been received. This option is reliant on the accuracy of forecasts and having predefined approval processes in place.

The Bureau of Meteorology was approached by the SEQWater Corporation in 2006 to discuss the ability of the provision of short term forecasts of large rainfall events. Their response is included in Attachment A. The summary of their advice from the meeting was:

"In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is

limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist."

There are also physical constraints on the amount of water that can be released. To reduce Wivenhoe to 75% in 48 hours requires water to be released at a rate that would close all of the road crossings over the Brisbane River between the dam and the Jindalee Bridge (peak flow of over 1,900 m^3/s) and result in a final volume in Wivenhoe of around 66.8% during the third day if the gates were closed down using the established closure sequence after the 48 hours. If the high rainfall did occur, then the gates would no doubt remain open.

It is not possible to lower Wivenhoe to 50% within 3 days due to the incremental opening of the gates required for safety, the reduction in discharge through the gates with the dropping dam level, and the need to limit discharges below damaging flows through Brisbane.

In light of the above comment, pre-releases (i.e. releasing water prior to an event based on predicted rainfall) has significant risks associated with the strategy in terms of:

- The difficulty in actually releasing significant volumes of water,
- The potential impacts downstream if rainfall doesn't eventuate (disrupting the downstream community, causing minor damage to low lying areas, creating a "sunny day" flood event totally attributable to the dam, someone could be injured or washed away in such a release).
- The risk of exacerbating flooding by making releases that then add to flood levels downstream occurring after the pre-release. (i.e. the predicted rainfall occurs downstream of the dam while the river level is elevated due to the pre-release's from the dam combining to create a damaging flood).
- Predicting rainfall 2 days before an event is highly variable even according to the Bureau of Meteorology and 3 days is problematic.

6.4 Option 3 - Lower the Storage Level by Sunny Day Releases to 75% and operate under the current flood manual

This option involves effectively lowering the Full Supply Level of Wivenhoe Dam to increase the flood mitigation storage at the commencement of a flood event. As discussed previously, the storage would need to be lowered by 25 to 50% to provide a significant reduction in peak flows for a major flood event. Once the storage level reached EL67 gate operations would commence as per the current flood manual.

To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater.

In the 25 days leading up to the January 2011 Flood event, three flood events impacting on Wivenhoe Dam were experienced, with gate releases being made on all but five of those days. The total outflow from these events was around 790,000ML.

During these events, multiple requests were received from Councils and residents impacted by bridge closures downstream of the dam to curtail releases as soon and as quickly as possible.

Additionally, the 2 January end date of the flood event prior to the January 2011 Flood event meant that significant draw down of the dam prior to the onset of the January 2011 Flood event that commenced on 6 January 2011, was not possible without major bridge inundation downstream of the dam and without exceeding minor flood levels in the lower Brisbane River.

Additionally, a flood event was also experienced in October 2010 that resulted in a release of 640,000ML from the dam. Accordingly, to draw down the dam below full supply level prior to the start of the first December event would not have been possible without significant bridge inundation and without exceeding minor flood levels (as defined by BOM and BCC) in the lower Brisbane River.

In other words, preceding rainfall events to the January 2011 Major Flood event had created flooding that would have maintained the storage at the current FSL and prevent drawdown of the storage if such a strategy was proposed.

Risks to this strategy are:

- Compromising water security for South East Queensland by lowering the storage at the end of the each event. The impact on yield needs to be quantified.
- Having preceding rainfall events fill up the dam and prevent it from being lowered before a major flood event. Effectively compromising any effectiveness associated with this strategy.
- The limited discharges that can be utilised during sunny day flows in the river system. To reduce levels prior to summer would take some time without inundating any bridges and without any further inflows. To reduce from 100% to 50% and only impact on Twin Bridges and Savages Crossings and keep Colleges Crossing open could take some 5 to 6 weeks. Even if levels are reduced in Wivenhoe prior to summer, as occurred this summer, multiple rain events can fill the dam and would require significant releases to keep the storage level down.

6.5 Option 4 - Temporarily Lower the Full Supply Level to 85% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 85% of the current storage capacity (for this option make EL65.25 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL65.5. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

This amended change would result in flow reductions similar to that obtained from Option 3.

Table 5 - Impact of temporarily Lowering FSL to 85%

Flood Event			Existing Rules		Temporarily Reducing FSL.		
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Maximum Lake Level	Flow Reduction

	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	(m AHD)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.4	2,639	70.66	32%
36 hours 1 in 500 design	10,455	1,624,119	5,983	72.2	4,028	71.53	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,010	72.78	5,031	72.16	16%
48 hours 1 in 5000 design	14,278	2,562,553	9,066	74.7	8,535	74.37	6%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.15	7,821	73.92	5%
96 hours 1 in 5000 design	11,870	2,948,032	7,534	73.74	7,135	73.49	5%
120 hours 1 in 5000 design	12,727	3,005,136	7,227	73.55	6,751	73.25	7%
January 2011 historic	10,470	2,650,000	7,528	74.98	5,746	74.62	24%
1974 historic	5,953	1,410,000	3,275	73.305	2,737	72.91	16%
1999 historic	6,358	1,220,000	2,312	72.23	1,814	71.89	22%

* Design event characteristics obtained from WA (2005)

6.6 Option 5 - Temporarily Lower the Full Supply Level to 75% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 75% of the current storage capacity (for this option make EL64 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL64. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

As can be seen in Table 6 lowering the FSL to EL64 (75% of the current FSL) and commencing flood operations at this level has a profound impact on the discharges for the shorter duration flood events with smaller flood volumes. However, once the flood volume exceeds the 2,000,000ML mark the effectiveness of this change in the operating level is diminished resulting in only a 10% reduction in the peak outflows for the dam.

Given the January 2011 Event had a volume of over 2,500,000Ml the benefits from lowering the storage level would not have resulted in any major change to the extent of flood inundation. It would however have reduced the depth of inundation with a corresponding reduction in the number of house and commercial properties flooded.

Table 6 - Impact of temporarily Lowering FSL to 75%

Flood Event				**Existing Rules**		**Temporarily Reducing FSL.**	
Event description	**Maximum Inflow (m^3/s)**	**Flood Volume (ML)**	**Maximum Outflow (m^3/s)**	**Maximum Lake Level (m AHD)**	**Maximum Outflow (m^3/s)**	**Maximum Lake Level (m AHD)**	**Flow Reduction %**
36 hour 1 in 200 design*	8,214	1,544,119	38141	71.4	1,971	70.24	94%
36 hours 1 in 500 design	10,455	1,624,119	5983	72.2	3,446	71.17	42%
36 hours 1 in 1000 design	12,031	1,772,752	6010	72.78	4,504	71.83	25%

48 hours 1 in 5000 design	14,278	2,562,553	9066	74.7	8,217	74.17	9%
72 hours 1 in 5000 design	13,181	2,880,602	8190	74.15	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7534	73.74	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7227	73.55	6,635	73.17	8%
January 2011 historic	10,470	2,650,000	7,528	74.98	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.305	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	1,561	71.48	33%

* Design event characteristics obtained from WA (2005)

It can be seen from the comparison of Table 5 and Table 6 that the reduction of the storage level to 75% can provide a significant reduction on the outflows from the dam when combined with an amended release strategy, but again this impact reduces as the magnitude of the event increases. This is consistent with the previous observations that reductions of at least 25% of the storage volume are required to significantly alter the outflows from the dam.

It is also important to note that even with the reduction of the storage level to 75% and the amended flood operation rules, the storage level still exceeds EL74 for the January 2011 Flood Event. The changes would result in reduced flood levels downstream but would not prevent damaging flows through Brisbane.

7 References

DPI (1995) Department of Primary Industries Qld, Water Commercial, "Wivenhoe Dam Design Report – Volume 1 – Text", WS094, September 1995

WA (2005) Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

WRM (2006) WRM Water and Environment, "Brisbane Valley Flood Damage Minimisation Study – Brisbane City Flood Damage Assessment, Brisbane City Council City Design, October 2006

8 Attachment A

Rainfall Forecasting for the Wivenhoe Dam Catchment

Background

1. On 6 July, Chris Russell, of Connell Wagner, met with Mike Bergin and Peter Baddiley seeking advice regarding the predictability of significant rain events over the Wivenhoe Dam catchment. Connell Wagner has been engaged by SEQWCo to provide advice on the feasibility of maintaining the water level in the Wivenhoe storage at one metre above Full Supply Level. As a part of the dam operations under that scenario, it would be required that the additional storage above FSL be released ahead of a major inflow into Wivenhoe Dam. This would require some 24 to 48 hour advance prediction of catchment average rainfalls in the order of 300mm in 24 hours; 375mm in 36 hours and/or 430mm in 48 hours.

2. Wivenhoe Dam catchment is located to the north-west of Brisbane and has an area of about 7,000 square kilometres. For meteorological forecasting, the catchment is broadly about 100 km in the north-south direction, and 70 kilometres wide (east-west); bounded in the west by the Dividing Range with its eastern boundary varying from about 40 to 80 kilometres inland from the coast. The distribution of rainfall over the catchment is significantly influenced by the topography in major events.

Discussion

3. As discussed at the meeting, the experience of Meteorologists and Hydrologists in the Brisbane office of the Bureau is that the short to medium term (0 to 48 hour) prediction of rainfall for the purpose of objective use in flood forecasting models is a difficult task. Quantitative Precipitation Forecasts (QPF) are available from the Australian and international Numerical Weather Prediction (NWP) models and have been used subjectively in the Brisbane office for many years. Whilst the NWP models have shown improvement in the accuracy of QPF over the past decade or so, there is still at times considerable error or uncertainty, in the prediction of the location, amount and timing of rainfall events at the catchment scale.

4. The improved skill of NWP models in recent years has particularly been in forecasting the development and movement of broad-scale synoptic features that would be likely to produce the threshold rainfall amounts in question. These large-scale features include decaying tropical cyclones, east coast low pressure systems and significant upper level troughs. However while these systems maybe well forecast on a time scale of 2 to 3 days the very heavy rainfall concentrations are dependent on finer scale (mesoscale) and convective features. Whilst there is often the ability to forecast the potential for a significant rain event to occur in the southeast Qld-northern NSW region, it is difficult (if not impossible) to predict the actual location of the heaviest rain, even with only a few hours notice.

5. Examples of high rainfall events that have occurred in the past 10 to 15 years in this region, some of which had little to no advance prediction of the "precise" location and/or magnitude of resulting rainfall, include Feb 1991, Dec 1991, Feb 1992, May 1996, Feb 1999, Mar 2001 and June 2005. Several of these events were not produced by large-scale features but by slow moving convergence zones which the current modelling capability cannot adequately predict. The two most recent events in 2001 and 2005 were relatively short-lived events and occurred at different times of the day – 2001 in the afternoon and 2005 overnight. While one could reasonably expect that most really significant rainfall events are most likely through the warmer months, winter extreme events are by no means rare.

6. Considerable effort is being applied to derive improved deterministic and probabilistic QPFs from NWP models. In the near future, the Bureau will be providing a publicly available rainfall forecasting service via a website. The rainfall predictions will be generated automatically by combining the outlooks from a suite of Australian and international. Forecast rainfall amounts for 24 hour periods will be given for 4 days ahead, together with the chance of exceeding various amounts from 1mm to 50mm. The latter is a "pseudo" measure of probability based on the consistency in the forecast rain amounts given by up to eight NWP models used in deriving the rainfall forecast. Whilst it is not considered that this will provide a sufficiently accurate method for objective decision making for pre-releases from Wivenhoe Dam, the probabilistic rain forecasts may provide a basis for a risk management approach. There may need to be further studies on risk quantification for prediction of high to extreme rainfall events to support this approach. Given that there are large levels of uncertainty in rainfall forecasts, the forecasting of hydrological response may require an ensemble of future rain scenarios to be considered for the Wivenhoe Dam application.

7. As for a potential service provided by the Bureau an alert type product would seem to be the best alternative where the potential for an extreme rainfall event in the following 2 to 3 days across southeast Queensland was given a rating on say a 3 level scale. If that rating was high then a second phase could be activated which could provide more detailed forecast of expected rainfall amounts and location. However I emphasise that this type of service can be expected to not provide the required 2 days advice of an event on some occasions and may fail to provide anything more than a few hours notice, such is the nature of the predictability of the mesoscale components of these events.

8. Currently the Bureau provides a QPF service for the dams in Southeast Queensland. This twice-daily service predicts the average rainfall across the catchments in the following 24-hour period. We have not undertaken any verification of the service. However it is likely that verification would show reasonable skill in identifying rainfall events but quite poor skill in predicting extreme events. This service is to be reviewed in the next few months and we may commence charging for the product as it is essentially not a basic service and should not be publicly funded. We have yet to commence discussions with the client so these comments should be kept confidential. This issue is raised because any future customized product provided in support of dam operations will certainly be on a fee for service basis. There is also the issue of whether the Bureau would have the capacity to provide such a service at all and that would have to be part of any future discussions.

Summary

9. In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist.

Mike Bergin
Manager Weather Services,
Bureau of Meteorology, Queensland.

Peter Baddiley
Supervising Engineer Hydrology
Bureau of Meteorology, Queensland

24 July 2006

9 Attachment 2 – Extracts from the Wivenhoe Design Report

"PB-21"

Telephone Discussion with John Bradley, Debbie Best, Greg Claydon, 8 February 2011 9.30pm

Seqwater attendees: Peter Borrows, Jim Pruss, Mike Foster, Fiona Murdoch

John Bradley requested that the meeting cover 3 items:

1. Status of Seqwater's modelling work
2. Contingency Protocol
3. Assessment and advice

PB agreed with the agenda.

1. Status of Seqwater's modelling work

JB enquired as to the status of the modelling.
PB advised that he had sent the modelling output across this morning in an email to JB, cc to DB, GC and PA at approximately 9.00am. PB advised that this document had been through the lawyers, the insurers and the Chairman.
JB enquired whether the document expressed a view on Seqwater's preferences or contained a recommendation or was simply data.
PB advised that it was the results of the modelling as was discussed at the meeting last Friday and did not make a recommendation.
PB highlighted that a key issue is what sort of event was trying to be improved and mitigated against, e.g. 1:100, 1:500, 1:5000 year event.
PB confirmed that JP would be the contact for any queries relating to the modelling content.

2. Contingency Protocol

JB asked whether Seqwater had considered GC's email of last night (7.11pm).

PB advised that he had had a preliminary consideration but had not had the opportunity to fully discuss with relevant staff. PB confirmed that he was wanting further details of the issues raised in GC's email.

JB referred to the letter provided by the Chairman of Seqwater to the Minister on 4 February. He stated that the letter had been written with repeated references to "Seqwater to assist DERM".

JB stated that collectively, including the Minister, they were surprised by the expression of the owner and operator of the dam Seqwater's response. JB stated that the Minister's earlier letter did not ask for Seqwater's assistance it asked for Seqwater to expedite its review under the Flood Operations Manual including a consideration of the FSL. JB stated that it was implicit in the interactions over the last week, they were asking for explicit advice from Seqwater on the FSL.

PB stated that this had already been discussed a number of times, including last Friday, and therefore consideration of FSL would not be part of Seqwater's regulatory report. PB advised that Seqwater was working to complete the regulatory report under the 6 week period but it would be very close to the due date.

JB stated that they had a different expectation of the view that Seqwater would bring to this matter and a different expectation of the advice from Seqwater under the manual.

PB stated that he did not see the review under the manual driving a change of FSL. PB stated that there was a fundamental difference between FSL from a water security point of view to the level for the flood mitigation manual. PB pointed to the standards for flood mitigation and said that was not a Seqwater decision.

JB stated that from DERM's point of view he could not comprehend how an owner and operator can't come to a corporate position on FSL as required by the statutory report under the manual. JB stated that the duty operators have significant discretion in how they operate under the manual and that there is flexibility throughout the manul.

PB stated whilst there was some flexibility it was in the context of very prescriptive parameters approved by the regulator and gazetted.

JB further stated that Seqwater appeared to be not taking control and that there was no ownership by Seqwater. JB stated that Seqwater was passing the issue back through government without analysis and advice.

JB asked if the manual was not the regulatory instrument to change or specify the FSL where has FSL been set in regulations? JB stated that even if DERM wanted to take it on DERM could not do that was there was no instrument to do so. JB said it appears that Seqwater is not capable of making that decision.

PB stated the question whether the manual is a taker of FSL or a decider of FSL? PB stated that Seqwater's view is that the manual is a taker of FSL.

JB stated that the manual was now the operating framework that specifies FSL and was therefore the regulatory instrument. JB stated that to therefore lower FSL in this current environment would require a tactical change only for this year.

PB replied that Seqwater considered that the SEQ Water Supply Strategy, ROP and the water planning process are the specifiers of the FSL.

JB stated that if there was to be a fundamental long term change to the FSL requiring a change of the yield he indicated that the strategy and ROP would be relevant instruments. JB however stated that this was a temporary change and therefore a variation to the manual was appropriate and could be done in that regulatory context. JB stated that Seqwater could use section 3 to say what FSL is for the next 12 months.

JB stated that if the manual was not the instrument to change FSL – what is the other regulatory instrument – it is not the ROP.

PB reiterated the water supply security position and that it takes FSL as part of it. PB further stated that it was a balance of water supply and flood mitigation under the water resource planning framework.

JB agreed to the fundamental premise however stated that we were in a situation that was beyond the normal bounds of gravity of decisions envisaged by the manual.

JB stated that it was the expectation of the Minister that Seqwater consider this and take into account the gravity of the situation. JB stated that the Minister expected the Board to provide corporate decisions on FSL.

PB stated that he heard his position but that there were too many variables given that different events produced significantly different outcomes. PB further highlighted the limited time to undertake appropriate analysis.

JB stated that Seqwater is the organisation that takes into account downstream impacts through the manual. JB further stated that it should be Seqwater's view in relation to pre-emptive releases or accelerated releases when needed.

JB stated to not come to a position on the benefits and desirability of changing FSL/releases is a fundamental vacation of the area that we should be expert in. JB stated that he could not understand how change gets done without using the manual.

JB offered to talk with the Chairman of Seqwater and also for the Minister to talk with the Chairman.

JB stated that it was a time critical decision. JB stated that they wanted a clear timeframe for how long to complete the review and the FSL advice.

JB stated that the issue at the moment was that we needed to work through this as we are at 100% and have a community on tenderhooks and that we need a plan.

JB stated the Minister and himself had a fundamental concern about the lack of progress. JB stated that we are in real time operational mode that Seqwater needs to be able to function in.

PB stated that we have heard all this and discussed this a number of times and as stated it is the Board's position taking advice from the lawyers and insurers.

JB stated that he was sure that there was nothing in Seqwater's insurance policy that would prevent Seqwater from fulfilling its regulatory obligation.

PB advised that he would have to talk with the Chairman and insurers based on this further discussion.

JB asked for a phonecall from PB later in the day advising on where Seqwater was at.

"PB-22"

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/502

9 February 2010

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Peter

Dear ~~Mr~~ Borrows

I refer to Seqwater's Chair's letter to Minister Robertson dated 4 February 2011, regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset dams. We acknowledge having recently received a copy of this letter from you.

I write regarding the water security impacts of lowering the FSL of Wivenhoe Dam, in light of the SEQ Water Grid Manager's obligation to manage water supplied from its water entitlements in accordance with Sections 6 and 7 (Desired Levels of Service Objectives and Risk Criteria) in the *South East Queensland System Operating Plan*. We understand that this is being considered as an interim measure for the current wet season.

I confirm previous verbal advice that, from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary draw down are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations.

If a permanent reduction of Wivenhoe Dam's FSL is later considered, this may have an impact on the *South East Queensland System Operating Plan's* desired levels of service objectives and we would suggest that you also engage with the Queensland Water Commission on this matter.

I trust that this advice is sufficient. If you have any questions, please do not hesitate to contact me by telephone on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

CC: Karen Waldman, Chief Executive Officer, Queensland Water Commission.

"PB-23"

10 February 2011

Mr John Bradley
Director-General
Department of Environment and Resource Management
Level 13, 400 George Street
BRISBANE QLD 4000

Dear John,

Further to our Chairman's letter to the Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, of 4 February 2011, I advise that the SEQ Water Grid Manager informed Seqwater by the attached letter, received yesterday, 9 February 2011, that it has no objection, from a water security perspective, to Wivenhoe Dam being drawn down to 75% of its Full Supply Level (***FSL***) and that such a draw down, if temporary, would be unlikely to impact its obligations.

You will recall that, pursuant to Minister Robertson's earlier request, Seqwater undertook modelling of various potential flood events (which included approximately 90 permutations in respect of 3 previous flood events and 6 design flood events) and confirmed to you that a reduction in Wivenhoe Dam's storage level to 75% of its FSL will provide appreciable flood mitigation benefits. Reducing storage to this level will effectively increase the capability of the dam to further mitigate flood events (depending on rainfall conditions downstream of the dam).

By way of example, the simulation modelling undertaken by Seqwater, which was peer reviewed by independent experts and submitted to you with Seqwater's letter dated 7 February 2011, demonstrated, subject to the qualifications referred to in that letter, that the reduction in storage level of the Wivenhoe Dam to 75% of its FSL achieved (approximately):

(a) a flow reduction from 3900 cumecs to 2400 cumecs (being a 39% reduction) in the case of a 36 hour 1 in 200 design flood event; and

(b) a flow reduction from 5100 cumecs to 3700 cumecs (being a 28% reduction) in the case of a 36 hour 1 in 500 design flood event.

Seqwater notes the extreme January 2011 flood event resulted in 2,650,000 ML of flood water passing through Somerset and Wivenhoe Dams, which was 1,240,000 ML more than the 1974 floods.

In light of the SEQ Water Grid Manager's abovementioned advice to Seqwater, the extreme nature of the January 2011 event and the abovementioned modelling results, Seqwater recommends that Wivenhoe Dam's storage level be temporarily reduced to 75% of its FSL in order to temporarily increase its flood mitigation capacity. Should the State agree with this recommendation, Seqwater will then confer with your Departmental officers to explore the various options by which this outcome can most promptly be achieved.

I look forward to receiving your response.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Attach.

"PB-24"

CTS /11

Queensland Government

Department of
Environment and Resource Management

11 FEB 2011

Mr Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority
PO Box 16146
CITY EAST QLD 4002

Dear ~~Mr Borrows~~ Peter

Thank you for your letter of 10 February 2011, in which you provided further advice regarding Seqwater's consideration of potential reductions in the Full Supply Level of Wivenhoe Dam.

Since receiving this correspondence on Thursday evening, we have held a number of discussions directly and with our officers to facilitate the early implementation of Seqwater's recommendation to reduce the storage level of Wivenhoe Dam to 75% of its Full Supply Level in order to temporarily increase its flood mitigation capacity.

It was also useful to receive the briefing yesterday afternoon on the outlook for the current wet season, with particular reference to South East Queensland, by the Queensland Regional Director of the Bureau of Meteorology, Mr Jim Davidson. We have discussed the immediate and 3 month weather outlook further today.

In our discussions today, you have indicated that the earliest timeframe by which Seqwater would seek to implement the reduction in the storage level of the dam would be late in the coming week, recognising the need to consider rainfall conditions and notification timeframes before such a release. You have indicated Seqwater remains confident in its ability to operationally respond to rainfall in the Bureau's current 8-day forecast within the provisions of the current Flood Mitigation Manual.

We have agreed to implement the recommendations of Seqwater in the following manner –

- I intend to propose an amendment to the Moreton Resource Operating Plan (ROP) for the consideration of Governor in Council. I am currently investigating the earliest possible date for such consideration but anticipate it will be no later than Thursday 17 February 2011.

- This ROP amendment would permit the subsequent submission by Seqwater to me of an Interim Program, for operations consistent with the recommendations of your letter of 10 February 2011. This Interim Program should be received immediately after the formal amendment of the ROP.

- I would then consider the interim program and respond directly.

- The State is currently considering the request for a Deed of Indemnity for the Corporation, its Board and officers, recognising that such releases below 100% Full Supply Level will occur outside the current provisions of the Flood Mitigation Manual and the ROP. If granted, such an indemnity would be expected to be required for a limited duration until Seqwater arranges appropriate insurance relevant to the proposed new operating mode.

- Seqwater would then commence its recommended releases in accordance with the approved Interim Program.

Should you have any enquiries concerning the information in this letter, please do not hesitate to contact me on [redacted]

Yours sincerely

[redacted]

John Bradley
Director General

"PB-25"

[235]

Queensland Government Gazette

EXTRAORDINARY

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Water Act 2000

APPROVAL OF AN AMENDMENT OF A RESOURCE OPERATIONS PLAN NOTICE (No 01) 2011

Short title

1. This notice may be cited as the *Approval of an amendment of a Resource Operations Plan Notice (No 01) 2011.*

Notice of document [s.106 of the Act]

2. Notice is given that the Governor in Council on 14 February 2011 approved an amendment to the Moreton Resource Operations Plan 2009.

The amended "Moreton Resource Operations Plan 2009" takes effect on the day the Governor in Council approved the amendment.

ENDNOTES

1. Made by the Governor in Council on 14 February 2011.
2. Published in the Gazette on 14 February 2011.
3. Not required to be laid before the Legislative Assembly.
4. The administering agency is the Department of Environment and Resource Management.

BRISBANE
Printed by Government Printer, Vulture Street, Woolloongabba
14 February 2011

"PB-26"

Seqwater Interim Program – Moreton Resource Operations Plan
(Revised 17 February 2011)

The Moreton Resource Operations Plan (the ROP) commenced on 7 December 2009. The Queensland Bulk Water Supply Authority (trading as Seqwater) is the Resource Operations Licence Holder under the ROP for the following Water Supply Schemes:

- Central Brisbane River Water Supply Scheme;
- Pine Valleys Water Supply Scheme; and
- Stanley River Water Supply Scheme.

Where Seqwater, as the ROL holder, is unable to meet requirements of the ROP on its commencement, a structured process is available whereby a statement of programs currently in existence can be prepared and submitted to the Department of Environment and Resource Management (DERM), to be followed by an Interim Program. The box below sets out the relevant provisions under the ROP.

Relevant ROP Requirement

Interim Program

s13(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.
s13(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.
s13(3) The resource oeperations licence holder must –
(a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and
(b) **within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.**
s13(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, **including timetable and interim methods to be used.**
s13(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.
s13(6) The chief executive, in considering any submitted program, may request additional information.
s13(6A) Despite anything in subsections 2, 3 or 4, a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection 7.
s13(7) The chief executive, in considering any submitted program, may either–
(a) approve the program with or without conditions;
(b) amend and approved the amended program; or
(c) require the resource operations licence holder to submit a revised program.
s13(8) Within 10 business days of making a decision on a program submitted under this section the chief executive must notify the resource operations licence holder of the decision.
s13(9) Following approval of the program by the chief executive, the resource operations licence holder must–
(a) implement and operate in accordance with the approved program; and
(b) make public details of the approved program on their internet site.
s13(10) Where there is conflict between the provisions of this plan and the provisions of an approved program, the approved program prevails for the time that the approved program is in place.
S13(11) Where this section applies, the resource operations licence holder may continue to operate under the existing program until the program submitted under this section is approved.

Seqwater submitted a Statement of Current Programs to DERM on 5 February 2010, in accordance with Section 13 of the ROP.

Seqwater submitted an Interim Program for the Moreton ROP to DERM in May 2010, as required under s13 of the ROP. After consultation with and at the request of DERM, an amended Interim Program was submitted to DERM on 27 August 2010. A delegate of the Chief Executive approved Seqwater's 27 August 2010 Interim Program on 3 December 2010.

On 14 February 2011, the ROP was amended to permit a Resource Operations Licence Holder to submit a revised program.

Under Section 6A of the ROP, this Revised Interim Program is now submitted to DERM for approval to facilitate the temporary reduction of the water storage level at Wivenhoe Dam to temporarily increase the flood mitigation capacity of the dam.

Seqwater Interim Program – Moreton Resource Operations Plan

Current as at 17 February 2011

Relevant ROP Requirement	Programs Currently In Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
Departmental water monitoring data collection standards 11(1) Where this plan required monitoring by a resource operations licence holder, including measurement, collection, analysis and storage of data, the resource operations licence holder must ensure the monitoring is consistent with the Water Monitoring Data Collection Standards.	Refer ss151-160.	There is currently limited monitoring of listed infrastructure under the ROP, however, a review will be undertaken (due for a staged completion, with final stage completed by 1 March 2012) to ensure monitoring is consistent with the Queensland Government Water Monitoring Data Collection Standards. The following sets out the timeline for the review: North Pine Dam: Review 1 July 2010; Implementation 1 September 2010 Sideling Creek Dam: Review 1 July 2010; Implementation 1 September 2010 Wivenhoe Dam: Review 1 October 2010; Implementation 1 January 2011 Somerset Dam: Review 1 October 2010; Implementation 1 January 2011 Enoggera Dam: Review 1 October 2011; Implementation 1 January 2012 Gold Creek Dam: Review 1 October 2011; Implementation 1 January 2012 Caboolture River: Review 1 January 2012; Implementation 1 March 2012	1 September 2010 - 1 March 2012.
Departmental water monitoring data reporting standards 12(1) Where this plan requires transfer of data or reporting by a resource operations licence holder the resource operational licence holder must ensure the transfer or reporting is consistent with the Water Monitoring Data Collection Standards.	Refer ss161-167.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures.	Refer ss161-167.
Central Brisbane River and Stanley River Water Supply Schemes – Operating levels for infrastructure 72(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to— (a) meet minimum flow rates in section 75; or (b) supply downstream demand.	Not compliant with ROP (releases made for operational purposes and water quality and ecosystem health including fish management)	A. Seqwater will continue to make releases from infrastructure – 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam; 3. for operational maintenance of dam infrastructure; 4. where B does not apply, to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery. B. Seqwater will, between 20 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure – (a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and (b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level. The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable. If, after releases specified in (a) or (b) have commenced, a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) will be recommenced. For the purpose of the above, "Interim Supply Security Level" means 64.0 m AHD.	Part A: Ongoing Part B: 20 February 2011 – 31 March 2011
Central Brisbane River and Stanley River Water Supply Schemes – Streamflow Requirement 75 When critical water sharing arrangements are not in force, the resource operations licence holder must release a minimum flow of 8.64ML/day from Mount Crosby Weir.	No operational outlet works at Mt Crosby Weir, therefore no managed releases made.	As there are no operable outlet works at Mt Crosby Weir (and cannot be implemented without significant investment, including possible reconstruction of the weir), overflows are dependent upon releases from Wivenhoe and projected water supply demands and local inflows, the latter two components being outside Seqwater control. As a result, Seqwater has very limited control over releases from Mt Crosby Weir on a daily basis. As such, it is proposed that this requirement be deemed as satisfied if a minimum average flow of 8.64ML/day (for any given month) flows over Mt Crosby Weir, rather than a minimum flow of 8.64ML/day (for any given day).	Seqwater would be compliant with a requirement for a minimum average flow of 8.64ML/day for any given month from 1 July 2010. Compliance is not able to be achieved for a minimum flow of 8.64Ml/day for any given day.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations 76 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for medium priority water allocations increase by 10 or more percentage points; (B) for high priority water allocations increase by 5 or more percentage points; or (C) increase to 100 per cent. (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d)— (i) publish details of the announced allocation; and (ii) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point (h) not set an announced allocation that is greater than 100 per cent.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations for Medium Priority Water Allocations 77(1) The announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme is the announced allocation percentage stated in Attachment 5, Table 5, column 2 corresponding to the combined percentage of useable volume in storage of Wivenhoe and Somerset dams stated in Attachment 5, Table 5, column 1. 77(2) the combined percentage of useable volume in storage of Wivenhoe and Somerset dams must be calculated using the following formula— SPUVS = ((UVWivenhoe+UVSomerset)/CUFSV)*100 77(3) The parameters used in the formula for combined percentage of volume in storage are defined in Attachment 5, Table 6.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal) Please note: the volume stored in Split Yard Creek Dam may influence the Announced Allocation.	New Medium Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocation for 'High Priority A' Water Allocations 78 (1) The announced allocation for 'High Priority A' water allocations within the Central Brisbane River Water Supply Scheme must be as follows— (a) 100 per cent when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is greater than or equal to 25 per cent or (b) when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is less than 25 per cent, the announced allocation percentage for 'High Priority A' water allocations must be calculated using the following formula— AAHPA=((UV-(AAMP*MPA)+DIVHPA+DIVMP)/HPAA)*100 78(2) The parameters used in the formula for announced allocation are defined in Attachment 5, Table 4. 78(3) For subsection 1 the combined percentage of useable volume in storage	Not compliant with ROP (no programs currently in existence)	New High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
of Wivenhoe and Somerset dams must be calculated using the formula in section 77(2) of this plan.			
Central Brisbane River and Stanley River Water Supply Schemes – Critical Water Sharing Arrangements 80(1) Critical water sharing arrangements are in force when the combined percentage of the volume of water in storage in Wivenhoe and Somerset Dams is less than 15 percent. 80(2) During times when critical water sharing arrangements are in force the resource operations licence holder must— (a) cease making releases from Mount Crosby Weir under section 75 of this plan; (b) when at the start of the water year the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is less than 15 per cent, set the announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme to zero per cent; and 80(3) For subsection 1 the combined percentage of volume of water in storage for Wivenhoe and Somerset Dams must be calculated using the formula in section 77(2) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New Medium Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Seasonal water assignment rules 88(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 5, Table 9 for each zone. 88(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence, customers unmetered)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012). Advice will be provided to customers that where two parties wish to enter into a seasonal assignment transaction, that both parties will require a water meter, unless the selling party can demonstrate that they have no active water extraction or usage.	Metering program to be undertaken in close consultation with Mid-Brisbane Irrigators (likely to take until December 2012).
Pine Valleys Water Supply Schemes – Operating Levels for Infrastructure 97(1) The operating levels for the infrastructure in the Pine Valleys Water Supply Scheme are specified in Attachment 6, Table 1. 97(2) The resource operations licence holder must not release or supply water from any infrastructure when the water level in that infrastructure is at or below its minimum operating level. 97(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to supply downstream demand and is made in accordance with this plan.	Not compliant with ROP (releases made for operational purposes and for water quality and ecosystem health including fish management)	s97(1): Attachment 6, Table 1 incorrectly specifies the Minimum Operating Level for North Pine Dam as EL 14.2m AHD and Minimum Operating Volume as 2100ML. The correct Minimum Operating Level is EL 12.8m AHD and the correct Minimum Operating Volume is 1310ML. s97(2): Seqwater will continue to release or supply water from North Pine Dam in accordance with the correct Minimum Operating Level of EL 12.8m AHD rather than the incorrect Minimum Operating Level of EL 14.2m AHD as specified in Attachment 6, Table 1. Seqwater requests DERM correct this error in the ROP. s97(3): Seqwater will continue to make releases from infrastructure- 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam; 3. for operational maintenance of dam infrastructure; 4. to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery.	Ongoing.
Pine Valleys Water Supply Schemes – Announced Allocations 100 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for high priority water allocations increase by 5 or more percentage points; or	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
(B) increase to 100 per cent (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site for the Pine Valleys Water Supply Scheme; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point; and (h) not set an announced allocation that is greater than 100 per cent. 101(1) The announced allocation for 'High Priority A' water allocations in the Pine Valleys Water Supply Scheme must be as follows— (a) 100 per cent when the level of water in storage in North Pine Dam is greater than E.L. 29.3m AHD; and (b) When the water level of water in storage in North Pine Dam is equal to or less than E.L. 29.3m AHD the announced allocation percentage for high priority water allocations must be calculated using the following formula— AAHPA=((UV+DIVHPA)/HPAA)*100 101(2) The parameters used in the formula for announced allocations are defined in Attachment 6, Table 2. 102 The total volume of water taken under a water allocation in a water year must not exceed the nominal volume of the water allocation multiplied by the announced allocation and divided by 100.			
Pine Valleys Water Supply Schemes – Critical Water Sharing Arrangements 103(1) Critical water sharing arrangements are in force when the water level in North Pine Dam is equal to or less than E.L. 29.3m AHD. 103(2) During times when critical water sharing arrangements are in force the resource operations licence holder must calculate the announced allocation for high priority water allocations in accordance with section 101(1)(b) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Pine Valleys Water Supply Schemes – Seasonal Water Assignment Rules 110(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 6, Table 3 for each zone. 110(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place by 1 July 2010.	1 July 2010.
Resource operations licence holder monitoring and reporting – Monitoring data must be made available 151 The resource operations licence holder must provide any monitoring data required under this chapter to the chief executive upon request and within the time requested.	Not compliant with ROP	Requests for data outside of ROP reporting requirements will be provided within required timeframes. Please note, however, that a standard waiting period of 7-14 days applies to all ad-hoc requests and a longer waiting period may apply depending on the detail of the request.	1 July 2010 (please note waiting periods).
Monitoring requirements – Streamflow and infrastructure water level 152(1) The resource operations licence holder must record water level and volume and stream flow data in accordance with Attachment 9, Table 1. 152(2) Infrastructure inflows may be determined based upon an infrastructure inflow derivation technique supplied by the resource operations licence holder and approved by the chief executive.	Not compliant with ROP (ALERT data available for Baxters Ck and Dayboro WWTP)	152(2) Consistent inflow derivation methodology will be developed by July 2011 for all storages. In the interim, existing methodology inherited from previous asset owners will be used where in existence. Please refer to Attachment 9, Table 1 at end of document.	1 July 2010 – July 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
Monitoring requirements – Releases from infrastructure 153(1) This section applies to the following infrastructure— (a) Cressbrook Dam; (b) Mount Crosby Weir; (c) North Pine Dam; (d) Perseverance Dam; (e) Somerset Dam; and (f) Wivenhoe Dam. 153(2) The resource operations licence holder must measure and record for each release of water from infrastructure listed in subsection 1— (a) the daily volume released; (b) the release rate and for each change in release rate— (i) the date and time of the change; and (ii) the new release rate; (c) the reason for each release; and (d) the device used for each release. 153(3) The resource operations licence holder for infrastructure mentioned in subsection 1(c) and 1(f) must record— (a) the inlet level used for each release of water; and (b) the reason for taking water via a particular inlet level.	153(1)(b) No measured releases made 153(1)(c) Operational Log ex SunWater system 153(1)(e) Operational Log ex SunWater system 153(1)(f) Operational Log ex SunWater system 153(2) Data is recorded in Operational Log 153(3) Data is recorded in Operational Log	153(1)(b): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made.	1 July 2010 (note: overflows and not releases will be reported for Mt Crosby Weir).
Monitoring requirements – Announced allocations 154 The resource operations licence holder must record details of announced allocation determinations including— (a) the announced allocations for medium and high priority water allocations; (b) the date announced allocations are determined; and (c) the value of each parameter applied for calculating the announced allocation.	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water taken by water users 155 The resource operations licence holder must record the total volume of water taken, by each water user for each zone as follows— (a) the total volume of water taken in each quarter; (b) the total volume of water entitled to be taken at any time; and (c) the basis for determining the total volume of water entitlement to be taken at any time.	Only HP water take measured – no meters for measuring MP water take	Full compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program which will need to be implemented in close consultation with the Mid-Brisbane irrigators, and will likely take until December 2012). All other schemes will be compliant from 1 July 2010. In the interim water estimations will consist of a quarterly mailout of recording sheets, specifying the requirement for recording volumes of water taken, plus supporting information, with submission of the recording sheets on a quarterly basis. The quarterly mailout will be a prompt for customers to submit their records. Advice will also be given of the Seqwater position that where records are not received that it will be assumed that 25% of the customer's water entitlement has been used for that quarter, and that this will be recorded as such.	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012, with log sheets to be distributed in the first quarter after approval of the interim program).
Monitoring requirements – Seasonal water assignment of water allocations 156 The resource operations licence holder that approves a seasonal water assignment must record details of seasonal water assignment arrangements including— (a) the name of the assignee, volume and location of water that has been seasonally assigned by an assignor; (b) the name of the assignor, volume and location of the water that has been seasonally assigned to an assignee; and (c) the effective date of seasonal water assignments.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail).	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012).
Monitoring requirements – Critical water sharing arrangements 157 The resource operations licence holder must record details of critical water sharing arrangements including the following— (a) the commencement date(s) and effective period of critical water sharing arrangements; and (b) the effectiveness of the critical water sharing arrangements.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water Quality 158 the resource operations licence holder must monitor and record water	Somerset Dam Inflow:	Seqwater is currently compliant with the monitoring requirements for Wivenhoe Dam and Mt Crosby Weir (with the exception of tailwater monitoring since the downstream area is estuarine) and will be reported from 1 July	1 January 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
quality data in relation to relevant infrastructure listed in Attachments 5, 6 and 7.	None. Quality monitoring and recording is event-related only. Water quality meters are DERM infrastructure. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Chl, BGA, DO; Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO; Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. <u>Wivenhoe Dam</u> Inflow – (Caboonbah): Fortnightly – Total Cyanobacteria, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Monthly (SB) – Total Cyanobacteria, EC, TC, Chl a, Fe, Mn, true colour, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. <u>North Pine Dam</u> Inflow: None. Quality monitoring and recording is event-related only. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO	2010. North Pine Dam requires some parameter additions to the inflow site on the North Pine River and the addition of a tailwater site to be compliant with the ROP requirements. Seqwater is currently reviewing the North Pine Monitoring Program which will include the requirements under the ROP (scheduled for completion by 1 July 2010) and will be implemented by 1 September 2010 (including training, reporting and scheduling). In the interim, additional parameters will be added to the existing gauging and water quality site on the North Pine River to be sampled on a monthly basis as follows: • Inflow: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients • Tailwater: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients, total sulphides Somerset Dam requires the addition of an inflow site on the Stanley River. The Somerset Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011. Mt Crosby Weir requires the addition of an tailwater site on the Brisbane River. The Wivenhoe Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011.	

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
	Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None. Mt Crosby Weir (also TS sampling) Inflow: Kholo: Fortnightly – total phytoplankton, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Headwater: Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Cyano, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None, estuarine		
Monitoring requirements – Bank condition 159(1) The resource operations licence holder must inspect banks for evidence of collapse or erosion within the ponded areas and downstream of the relevant infrastructure listed in Attachments 5, 6 and 7 following instances of— (a) rapid water level changes; (b) large flows through infrastructure; or (c) other occasions when collapse or erosion of banks may be likely. 159(2) For subsection 1, downstream of the relevant infrastructure means the distance of influence of infrastructure operations.	Not compliant with ROP (inspections undertaken for ponded areas but not stream bank or downstream) No reporting or monitoring currently undertaken for ROP purposes however Dam Safety monitor dam wall and embankments directly surrounding dam storage.	Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011).	1 July 2010 – December 2011.
Reporting requirements 161 The resource operations licence holder must provide— (a) quarterly reports; (b) annual reports for the previous water year; (c) operational reports; and (d) emergency reports.	Not compliant with ROP. No reporting.	Refer ss162-167	Refer ss162-167.
Reporting requirements – Quarterly Report 162(1) The resource operations licence holder must submit a quarterly report to the chief executive after the end of each quarter, of every water year. 162(2) The report must contain the following data— (a) stream flow and infrastructure water levels—all records referred to in section 152 of this plan; (b) the total volume of water for each quarter— (i) taken for each zone; (ii) entitled to be taken from each zone; (c) water quality—all records referred to in section 158 of this plan; (d) a summary of bank condition monitoring and incidences of slumping, undertaken in accordance with section 159 of this plan; and (e) the details and status of any programs implemented under section 13 of this plan.	Not compliant with ROP. No reporting.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures. Commencing 1 July 2010 the following will be implemented: • ROP datasets will be supplied quarterly, as required under the ROP. • ROP Compliance Report will be submitted with the quarterly reporting process, including exceptions to ROP requirements and an update on the Interim Program, as required under the ROP. Results of weekly bank condition monitoring will be collated quarterly and reported, with progressive implementation commencing 1 July 2010 and fully implemented by December 2011. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss152, 158 and 159 for further details.	1 July 2010 – December 2011.
Reporting requirements – Annual Report 163(1) The resource operations licence holder must submit an annual report to the chief executive after the end of the water year. 163(2) The annual report must include—	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to s164 for further details.	1 July 2010 – December 2012

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
(a) water quantity monitoring results required under section 164 of this plan; (b) details of the impact of infrastructure operation on water quality as required under section 164 of this plan; (c) a discussion about any issues that arose as a result of the implementation and application of the rules and requirements of this plan.			
Reporting requirements – Water quantity monitoring – Annual Report 164 The resource operations licence holder must include in the annual report under section 163— (a) A summary of announced allocation determinations, including— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the date and value for the initial announced allocation and for each change made to an announced allocation; (b) instances where critical water sharing arrangements have been implemented— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the commencement date(s) and effective period(s) for each stage of the arrangements and outcomes; (c) records from infrastructure—records referred to in section 153; (d) the total annual volume of water taken by each water user, specified by zone, namely— (i) the total annual volume of supplemented water taken; (ii) the total annual volume of supplemented water entitled to be taken; and (iii) the basis for determining the volume entitled to be taken; (e) details of seasonal water assignments, namely— (i) the total number of seasonal water assignments arrangements; and (ii) the total volume of water seasonally assigned; (f) all details of changes to infrastructure or the operation of the infrastructure that may impact on compliance with rules in this plan; and (g) details of any new monitoring devices used such as equipment to measure stream flow.	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss76, 77, 78, 80, 88, 100, 101, 103, 110, 153, 155, 156 and 157 for further detail. s164(a): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(b): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(c): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made. Please refer to s153 for further details. ss164(d-e): Compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program and will need to be implemented in close consultation with the Mid-Brisbane Irrigators, timeframe likely to take until December 2012). All other schemes will be compliant from 1 July 2010. ss164(f-g): Seqwater will be compliant with these requirements from 1 July 2010.	ss164(a-b, f-g): 1 July 2010. s164(c): 1 July 2010 (note: overflows rather than releases will be reported for Mt Crosby Weir). Please refer to s153 for further details. s164(d-e): 1 July 2010 – December 2012. Please refer to ss88, 155 and 156 for further details.
Reporting requirements – Impact of infrastructure operation on natural ecosystems – Annual report 165 The resource operations licence holder must include in the annual report under section 163— (a) a summary of environmental considerations made by the resource operations licence holder in making operational and release decisions; (b) a summary of the environmental outcomes of the decision including any adverse environmental impacts; (c) a summary of bank condition and fish stranding monitoring and assessment, including— (i) results of investigations of bank slumping or erosion identified in ponded areas or downstream of infrastructure; (ii) results of investigations of fish stranding downstream of infrastructure; and (iii) changes to to the operation of infrastructure to reduce instances of bank slumping, erosion or fish stranding; (d) a discussion and assessment of the following water quality issues— (i) thermal and chemical stratification in each water storage associated with infrastructure; (ii) contribution of the water storage and its management to	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss 158 and 159 for further details.	1 July 2010 – December 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
the quality of water released; (iii) cumulative effect of successive water storages associated with infrastructure on water quality; (iv) cyanobacteria population changes in response to stratification in each water storage; and (v) any changes to the monitoring program as a result of evaluation of the data.			
Reporting requirements – Operational Report 166 The resource operations licence holder must— (a) notify the chief executive within one business day of becoming aware of any of the following operational incidents— (i) a non-compliance by the resource operations holder with the rules in this plan; and (ii) instances of fish stranding or bank slumping within the impounded areas or downstream of infrastructure listed in Attachment 9, Table 1 or watercourses associated with the operation of the Central Brisbane River, Cressbrook Creek, Pine Valleys and Stanley River water supply schemes; (b) provide to the chief executive a report which includes details of— (i) the incident; (ii) conditions under which the incident occurred; and (iii) any response or activities carried out as a result of the incident; (c) notify the chief executive upon commencement and cessation of critical water sharing arrangements; and (d) notify the chief executive on approval of any seasonal water assignment, including— (i) the name and location of the assignees and assignors; and (ii) the zone or zones where water is being seasonally assigned to and from; (e) notify the chief executive upon making a decision relating to an initial announced allocation and/or its recalculation; (f) transfer to the chief executive— (i) details of any arrangements of addressing circumstances where the resource operations licence holder is unable to supply water allocations under subsection (e); and (ii) relevant supporting information used in making a decision under subsection (e).	Not compliant with ROP. No reporting.	ss166(a)(i), (b): Seqwater will submit operational reports as required, commencing for the 2010/2011 water year. s166(a)(ii): Process for reporting instances of fish standing and bank slumping will be progressively implemented beginning 1 July 2010 with finalisation by December 2011. Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow to the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011). s166(c): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s166(d): Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail). s166(e-f): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010 – December 2011.
Reporting requirements – Emergency report 167 In an emergency where the resource operations licence holder cannot comply with a rule in this plan as a result of an emergency, the resource operations licence holder must— (a) notify the chief executive upon discovery of the emergency; and (b) provide to the chief executive a report that includes— (i) details of the emergency; (ii) conditions under which the emergency occurred; (iii) any responses or activities carried out as a result of the emergency; and (iv) any rules specified in this plan that the resource operations licence holder is either permanently or temporarily unable to comply with due to the emergency.	Not compliant with ROP. No reporting.	Seqwater will submit emergency reports as required, commencing for the 2010/2011 water year.	1 July 2010.

Attachment 8, Table 1 – Water Allocation Schedule

Relevant ROP Requirement	Programs Currently in Existence	Interim Program, Including Methodology	Timetable
Water Allocation Number 137: Brisbane Zone, Any Purpose, 25ML,	The map in Attachment 2(b) of the ROP does not include Somerset		

High Class A Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	The zone where this entitlement has been issued does not include Somerset Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	
Water Allocation Number 139: Mid-Brisbane Zone, Any Purpose, 150ML, Medium Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	In accordance with current take of water from the Mid-Brisbane zone.		

Attachment 9 – Resource operations licence holder monitoring: Locations where continuous time series height and flow data and storage water level data are required:

Location	Continuous time series storage water level data	Continuous time series flow data	Programs Currently in Existence	Interim Program, Including Methodology	Timetable
Mount Crosby Weir inflow		Y	Not continuous	A daily inflow derivation model is being developed which will incorporate outflow from Wivenhoe Dam, flow from Lockyer Creek and local area, change in Mt Crosby water levels and local irrigation and water supply demands.	1 July 2010.
Mount Crosby Weir headwater level	Y		Continuous	Water level is monitored via ALERT to a 20mm resolution.	1 July 2010.
Mount Crosby Weir tailwater		Y	Not continuous	Downstream of Mt Crosby Weir is tidal and, as such, a downstream gauging station will not provide estimates of river flow. Releases are not made from Mt Crosby Weir and any flow through the fish way and over the weir crest will provide an estimate of the flow from the weir.	Estimate of flow from the weir in place by 30 December 2010.
North Pine Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
North Pine Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
North Pine Dam tailwater		Y	Not continuous	Water level is monitored continuously at the Dayboro Rd WPS Weir about 1km downstream of North Pine Dam. At present, this is only available via SCADA and is not rated. Until the rating is developed and equipment installed at the site to enable remote monitoring, flow downstream of North Pine Dam can be estimated from the gate and valve openings at the Dam (anticipated for July 2011). A rating can be developed for the Dayboro Rd Weir based on recorded flows and heights.	July 2011.
Somerset Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be in place by 1 July 2010.	1 July 2010.
Somerset Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Somerset Dam tailwater		Y	Not continuous	Somerset Dam tailwater is affected by levels in Wivenhoe Dam. When full, the water in Wivenhoe back up to the toe of Somerset Dam. As such, a tailwater gauge is considered inappropriate. Outflows from Somerset can be estimated from the recorded openings of the gates, sluices and valves at the dam.	Nil
Wivenhoe Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
Wivenhoe Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Wivenhoe Dam tailwater		Y	Not continuous	Please note: Water level is continuously monitored and recorded via ALERT and on-site logger with a resolution of 20mm which is owned by DERM not Seqwater (143035A). The site is rated but can be affected by backwater from Lockyer Creek. Discharge from the dam can also be estimated via the rated gates and valves. Since the gauge is owned by DERM, Seqwater will not undertake monitoring for tailwater at this site.	Seqwater will not undertake monitoring for tailwater at this site since the gauge is owned by DERM (143035A).

"PB-27"

Department of Environment
and Resource Management

DEED OF INDEMNITY

(insurance equivalent)

between

the **State of Queensland**
as represented by the **Department of Environment and Resource Management**

and

Queensland Bulk Water Supply Authority trading as **Seqwater**

Legal Services
Department of Environment and Resource Management
GPO Box 2454
Brisbane Qld 4001
Australia

Agreement Version Number: Non-Standard
Document Reference: KEEPER 924823 v3

Queensland Government

THIS DEED is made:

BETWEEN: **State of Queensland** as represented by the Department of Environment and Resource Management ("the State")

AND: **Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater")**

BACKGROUND

A. Seqwater is the operator of Wivenhoe Dam and Somerset Dam ("Dams"). Seqwater operates the Dams in accordance with the Interim Program under the Moreton Resource Operations Plan 2009.

B. On 10 February 2011 Seqwater wrote to the Director-General of the Department of Environment and Resource Management advising that Seqwater recommended that the Wivenhoe Dam's storage level be temporarily reduced to 75% of Full Supply Level in order to temporarily increase its flood mitigation capacity. Seqwater premised this recommendation on the following factors:
(a) Advice from SEQ Water Grid Manager ("Grid Manager") to Seqwater that the Grid Manager had no objection from a water security perspective to Wivenhoe Dam being drawn down to 75% of Full Supply Level and that such a draw down, if temporary, would be unlikely to impact the Grid Manager's obligations;
(b) Modelling by Seqwater of various potential flood events which confirmed that a reduction in Wivenhoe Dam's storage level to 75% of Full Supply Level would provide appreciable flood mitigation measures; and
(c) The extreme nature of the January 2011 event.

C. The circumstances outlined in recital B above have resulted in Seqwater submitting a Revised Interim Program for the operation of Wivenhoe Dam.

D. Consequent on the above exceptional circumstances, Seqwater has requested and the State has agreed to grant, an indemnity in the terms of this Deed.

E. The State is granting an indemnity to Seqwater in relation to potential liability arising from proposed changes to existing operations under the regulatory requirements applicable to Seqwater in its operation of the Dams. The proposed operations will be authorised under a Revised Interim Program which is attached as Annexure 2 to this Deed (including the Relevant Part of the Revised Interim Program which forms Annexure 1 to this Deed) approved by the Chief Executive of the Department of the Environment and Resource Management pursuant to section 13 of the Moreton Resource Operations Plan 2009 (as amended).

F. The Relevant Part of the Revised Interim Program includes the following:
"Seqwater will, between 20 February and 31 March 2011 ("**2011 Summer Season**") and subject to the operational constraints specified below, make the following releases from infrastructure –
(a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and
(b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

If, after releases specified in (a) or (b) have commenced, a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) will be recommenced.

For the purpose of the above, "**Interim Supply Security Level**" means 64.0 m AHD."

G. The proposed operations in accordance with the Relevant Part of the Revised Interim Program will involve Seqwater releasing waters from Wivenhoe Dam (additional to usual requirements for downstream demand or minimum flows) on a temporary basis (from the period commencing 20 February 2011 until 31 March 2011) to achieve a storage level of 75% of the Full Supply Level.

Furthermore, as necessary during the term of the Relevant Part of the Revised Interim Program, when a storage level of 75% of the Full Supply Level is achieved and there are any subsequent in-flows into the storages of the Dams which then increase the storage level above 75% of the Full Supply Level Seqwater will recommence the release of waters to regain a storage level of 75% of Full Supply Level and to maintain that storage level of 75% of the Full Supply Level until the end of the Relevant Part of the Revised Interim Program. If there is a Flood Event Seqwater will follow procedures in the Flood Mitigation Manual.

H. Seqwater holds insurance pursuant to its Insurance Policies. Seqwater's insurers have advised that in their view the proposed operations under the Relevant Part of the Revised Interim Program are not covered by Seqwater's Insurance Policies. Seqwater has been unable to obtain Commercial Insurance Cover as at the Commencement Date. The indemnity is not intended to affect, nor will affect, the Insurance Policies in relation to events occurring before the Commencement Date

I. The State has agreed to provide an indemnity for Seqwater's operations under the Relevant Part of the Revised Interim Program to the same cover limit and on the same terms and conditions as the cover limit and terms and conditions that Seqwater has under its Insurance Policies in accordance with the terms of this Deed but subject to the circumstances in which the indemnity will expire or be suspended under this Deed.

J. The State is granting an indemnity which addresses the following:

- Seqwater, Seqwater's officers, and Seqwater's employees and agents ("the Indemnified") be indemnified fully and effectively as if the insurance cover under the Insurance Policies covered the risks arising from, or connected with, or related to, operations in accordance with the Relevant Part of the Revised Interim Program (directly or indirectly);
- the granting of this indemnity must not compromise any claims made by Seqwater under the Insurance Policies for events occurring prior to the Commencement Date;
- liabilities covered are intended to reflect the liabilities covered under the Insurance Policies, including civil claims, statutory liability and costs on a solicitor/own client basis;
- an Indemnified will not lose the benefit of the indemnity merely due to negligence, inadvertence, or error of judgment, provided that the Indemnified has not acted in bad faith, or engaged in wilful disregard or misconduct. For clarity, avoidance of the indemnity due to this range of matters will be available only in respect of the relevant Indemnified, but will affect no other Indemnified;
- Cessation of holding office or employment will not affect the continuing operation of the indemnity for acts or omissions which occurred prior to the cessation;
- the indemnity will be irrevocable though subject to expiry or suspension; and
- If there is a Flood Event, the procedures in the Flood Mitigation Manual will apply and the indemnity will be suspended until the end of the Flood Event (because Seqwater would expect to be able to access its Insurance Policies in respect of operations under the Flood Mitigation Manual).

IT IS AGREED

1. INTERPRETATION

1.1 In this Deed, where commencing with a capital letter and unless the context otherwise requires:

(a) **2011 Summer Season** means 20 February 2011 to 31 March 2011.

(b) **Business Day** means between 9:00am and 5:00pm on a weekday other than a Saturday, Sunday or public holiday in Brisbane, Queensland.

(c) **Commencement Date** means either:

(i) the date specified in 1 of the Schedule; or

(ii) if no date is specified in 1 of the Schedule, the date on which this Deed is executed by the Parties (and if not executed by the Parties on the same day, the date on which the last Party executes this Deed).

(d) **Commercial Insurance Cover** means insurance cover similar to the Insurance Polices which will cover the proposed operations under the Relevant Part of the Revised Interim Program.

(e) **Dams** means Wivenhoe Dam and Somerset Dam.

(f) **Deed** means this document and any schedules and annexures attached to it.

(g) **Flood Event** means a declared flood event pursuant to the Flood Mitigation Manual.

(h) **Flood Mitigation Manual** means the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 November 2009 (as amended).

(i) **Full Supply Level** means 67m AHD (Australian Height Datum).
(j) **Insurance Policies** means the commercial insurance policies currently held by Seqwater, summaries of the insurance coverage of which are contained in Annexure 3 to this Deed.
(k) **Interim Supply Security Level** means 64m AHD.
(l) **Parties** means the State and Seqwater, and **Party** means either of the Parties as the context requires.
(m) **Relevant Part of the Revised Interim Program** means the operational procedures set out in Annexure 1 to this Deed
(n) **Revised Interim Program** means the document attached as Annexure 2 to this Deed.
(o) **Schedule** means the schedule attached to this Deed.

1.2 In this Deed, unless a contrary intention appears:
(a) words importing a gender include any other gender;
(b) words in the singular include the plural and vice versa;
(c) all dollar amounts refer to Australian currency;
(d) a reference to any legislation includes any subordinate legislation made under it and any legislation amending, consolidating or replacing it;
(e) a reference to an entity or person includes an individual, corporation, partnership or other legal entity;
(f) a Party includes its executors, administrators, liquidators, successors and permitted assigns;
(g) a reference to a clause, schedule, attachment or annexure is a reference to a clause, schedule, attachment or annexure of this Deed;
(h) clause headings in this Deed are for convenience of reference only and are not intended to affect the meaning or interpretation of this Deed;
(i) if an expression is defined, other grammatical forms of that expression will have corresponding meanings;
(j) if an entity ceases to exist, is replaced, reconstituted or renamed, or its powers or functions are transferred to another entity, the reference is to the other entity; and
(k) if the day on or by which any act is to be done is a Saturday, Sunday or public holiday in Queensland, the act may be done on the next Business Day.

1.3 If a Party to this Deed consists of more than one person, those persons are jointly and severally bound under this Deed.

2. INDEMNITY

2.1 In this clause 2:
(a) **Seqwater** includes Seqwater and its directors, officers, employees and agents (the **Indemnified**). Cessation of holding office or employment will not affect the continuing operation of the indemnity for acts or omissions which occurred prior to the cessation; and
(b) **Claim** includes any action, claim, suit, proceeding, demand, liability and obligation (including a claim for negligence) including civil claims and proceedings for non-indictable statutory offences and penalties, for any damage, liability, loss, injury, death, and economic loss (and legal costs or expenses arising on a solicitor/own client basis).

2.2 Subject to clause 2.3 of this Deed, the State indemnifies the Indemnified fully and effectively to the same cover limits and on the same terms as if the insurance cover under the Insurance Policies covered any Claims arising from, or connected with, or related to, operations in accordance with the Relevant Part of the Revised Interim Program (directly or indirectly).

2.3 The indemnity provided in clause 2.2 of this Deed:
(a) is irrevocable;
(b) will not apply to events occurring before the Commencement Date;
(c) will not apply to events occurring after the expiry of this Deed;
(d) is limited to the terms and limits of cover in the Insurance Polices as if they applied to the Relevant Part of the Revised Interim Program;
(e) only applies to operations in actual or purported compliance with the Relevant Part of the Revised Interim Program;
(f) is not related to and does not apply to participation in the Queensland Floods Commission of Inquiry established by the *Commissions of Inquiry Order (No. 1) 2011* on 17 January 2011;

(g) will not be denied to an Indemnified merely due to negligence, inadvertence, or error of judgment, provided that the Indemnified has not acted in bad faith, or engaged in wilful disregard or misconduct. Loss of the benefit of the indemnity due to bad faith, wilful disregard or misconduct will apply only in respect of the relevant Indemnified, but will affect no other Indemnified;

3. TERM

3.1 This Deed commences on the Commencement Date and expires on the earlier of the following two dates:

(a) when Seqwater obtains Commercial Insurance Cover

(b) 31 March 2011.

For the avoidance of doubt, after 31 March 2011 or when Seqwater obtains Commercial Insurance Cover the indemnity in clause 2.2 of this Deed still applies to events that occurred in the time period between the Commencement Date and the expiry date of this Deed.

3.2 If there is a Flood Event, the procedures in the Flood Mitigation Manual will apply and the operation of this Deed and the indemnity provided in clause 2.2 of this Deed will be suspended from the commencement of the Flood Event until the end of the Flood Event.

4. WARRANTIES, OBLIGATIONS TO SEEK COVER AND TO NOTIFY

4.1 Seqwater warrants that:

(a) it has been unable to obtain Commercial Insurance Cover from its current insurers on reasonable terms as at the Commencement Date;

(b) the indemnity is not intended to affect, nor will affect, the Insurance Policies in relation to events occurring before the Commencement Date;

(c) the Insurers who provide the Insurance Policies have confirmed their view that the proposed operations under the Relevant Part of the Revised Interim Program are not covered under the Insurance Policies; and

(d) the summaries of the Insurance Policies which are contained in Annexure 3 to this Deed are true and correct.

4.2 Seqwater agrees that, in the event of a claim pursuant to the indemnity in clause 2.2 of this Deed, it will within 2 days of written request by the State give true and correct copies of the relevant Insurance Policies to the State and if it is not possible to provide copies (for example because the insurer has refused consent) to supply sufficient details of the terms and conditions of the polices to claim under the indemnity (for example by providing a copy of the policy with the insurer's name redacted). The State agrees to treat any documents provided as being subject to an obligation of confidentiality.

4.3 Seqwater agrees that it will use its best endeavours to obtain Commercial Insurance Cover, including from the global insurance market, on reasonable terms as soon as possible.

4.4 Seqwater must immediately give notice to the State:

(a) if it has obtained Commercial Insurance Cover; or

(b) if it reasonably forms the view that Commercial Insurance Cover cannot be obtained on reasonable terms or at all.

4.5 If Seqwater gives notice to the State that it has reasonably formed the view that Commercial Insurance Cover cannot be obtained on reasonable terms or at all and the State is able to obtain the Commercial Insurance Cover for Seqwater on reasonable terms then Seqwater must take that Commercial Insurance Cover.

4.6 If Commercial Insurance Cover is obtained then the indemnity provided in clause 2.2 will apply for the period from the Commencement Date up to the date that the Commercial Insurance Cover commences including any consequences of actual or purported compliance with the Relevant Part of the Revised Interim Program.

5. GENERAL

5.1 **Waiver** - No provision of this Deed will be deemed waived unless that waiver is in writing signed by the waiving Party. A waiver by a Party of a breach of any provision of this Deed will not operate as

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a waiver of any subsequent breach of this Deed. Any failure by a Party at any time to enforce a clause of this Deed, or any forbearance, delay or indulgence granted by a Party to the other Party will not constitute a waiver of that Party's rights.

5.2 **Governing law** - This Deed is governed by the laws of Queensland and the Parties submit to the jurisdiction of the courts of Queensland.

5.3 **Variation** - No agreement or understanding that varies or amends this Deed binds either Party unless it is in writing and signed by both Parties.

5.4 **Severability** - Any provision in this Deed, which is invalid or unenforceable, is to be read down if possible, so as to be valid and enforceable, and if that is not possible the provision must, to the extent that it is capable, be severed to the extent of the invalidity or unenforceability, without affecting the remaining provisions.

5.5 **Further assistance** – Each Party must do all things reasonably required by the other Party to give effect to this Deed.

5.6 **No adverse inference** – No adverse inference may be drawn in the interpretation of this Deed against the Party who was responsible for its preparation.

5.7 **Costs** - Each Party will bear their own legal costs in relation to the preparation and execution of this Deed. Seqwater must pay any stamp duty payable on this Deed.

5.8 **Notices** – Notices under this Deed must be delivered in accordance with the terms of the Deed. Notices under this Deed must be in writing and may be delivered by prepaid postage or certified mail, by hand, by electronic mail ("email") or by facsimile transmission to the Parties at the address specified in Item 2 of the Schedule or other address subsequently notified by a Party to the other. Notices will be deemed to be given –

(a) two (2) days after deposit in the mail with postage prepaid; or
(b) immediately upon delivery by hand; or
(c) if sent by facsimile transmission, upon completion of transmission evidenced by a transmission record.
(d) if sent by email, upon completion of transmission evidenced by an electronic delivery receipt.

The Parties agree that where notice by hand, by email or by facsimile transmission is not given during a Business Day, it will be deemed to be given on the next Business Day.
The Parties agree that where notice is given by email or by facsimile the sender must use its best endeavours to ensure that the original document is sent by post on the same day as the email or facsimile transmission is sent.

5.9 **Counterparts** – this Deed may be signed by the Parties in counterpart and will become operational upon the exchange of signed counterparts. Each counterpart forms part of the original Deed.

5.10 **Electronic exchange** – the Parties may exchange signed counterparts by email or facsimile and agree that this is valid for the purposes of the *Electronic Transactions Act 1999* (Cth).

5.11 **Parties** – it is not intended that any Indemnified other than Seqwater execute this Deed, despite the Parties' intention that they receive the benefit of it. An Indemnified who is not party to this Deed may enforce the indemnities contained in this Deed as if they were party to it.

5.12 **Entire Agreement** - This terms and conditions in this Deed and the terms and conditions of the Insurance Policies together contain the entire agreement between the Parties and supersede all written or oral communications, negotiations, arrangements and agreements between the Parties about the subject matter of this Deed.

SCHEDULE 1

Item 1 : **Commencement Date**	17 February 2011
Item 2 : **Address for Notices**	**State** Department of Environment and Resource Management GPO Box 2454 BRISBANE QLD 4000 Facsimile: [redacted] Attention: Director, Legal Services Email: [redacted] **Seqwater** Allens Arthur Robinson PO Box 7082 Riverside Centre Brisbane Qld 4001 Facsimile: [redacted] Attention: Jamie Wells, Partner Email: [redacted]

ANNEXURE 1 - Relevant Part of Revised Interim Program

Seqwater will, between 20 February and 31 March 2011 ("**2011 Summer Season**") and subject to the operational constraints specified below, make the following releases from infrastructure –

(a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and

(b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

If, after releases specified in (a) or (b) have commenced, a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) will be recommenced.

For the purpose of the above, "**Interim Supply Security Level**" means 64.0 m AHD.

ANNEXURE 2 – Revised Interim Program

Seqwater Interim Program – Moreton Resource Operations Plan
(Revised 17 February 2011)

The Moreton Resource Operations Plan (the ROP) commenced on 7 December 2009. The Queensland Bulk Water Supply Authority (trading as Seqwater) is the Resource Operations Licence Holder under the ROP for the following Water Supply Schemes:

- Central Brisbane River Water Supply Scheme;
- Pine Valleys Water Supply Scheme; and
- Stanley River Water Supply Scheme.

Where Seqwater, as the ROL holder, is unable to meet requirements of the ROP on its commencement, a structured process is available whereby a statement of programs currently in existence can be prepared and submitted to the Department of Environment and Resource Management (DERM), to be followed by an Interim Program. The box below sets out the relevant provisions under the ROP.

Relevant ROP Requirement

Interim Program

s13(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.
s13(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.
s13(3) The resource operations licence holder must –
- (a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and
- (b) within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

s13(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including timetable and interim methods to be used.
s13(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.
s13(6) The chief executive, in considering any submitted program, may request additional information.
s13(6A) Despite anything in subsections 2, 3 or 4, a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection 7.
s13(7) The chief executive, in considering any submitted program, may either–
- (a) approve the program with or without conditions;
- (b) amend and approved the amended program; or
- (c) require the resource operations licence holder to submit a revised program.

s13(8) Within 10 business days of making a decision on a program submitted under this section the chief executive must notify the resource operations licence holder of the decision.
s13(9) Following approval of the program by the chief executive, the resource operations licence holder must–
- (a) implement and operate in accordance with the approved program; and
- (b) make public details of the approved program on their internet site.

s13(10) Where there is conflict between the provisions of this plan and the provisions of an approved program, the approved program prevails for the time that the approved program is in place.
S13(11) Where this section applies, the resource operations licence holder may continue to operate under the existing program until the program submitted under this section is approved.

Seqwater submitted a Statement of Current Programs to DERM on 5 February 2010, in accordance with Section 13 of the ROP.

Seqwater submitted an Interim Program for the Moreton ROP to DERM in May 2010, as required under s13 of the ROP. After consultation with and at the request of DERM, an amended Interim Program was submitted to DERM on 27 August 2010. A delegate of the Chief Executive approved Seqwater's 27 August 2010 Interim Program on 3 December 2010.

On 14 February 2011, the ROP was amended to permit a Resource Operations Licence Holder to submit a revised program.

Under Section 6A of the ROP, this Revised Interim Program is now submitted to DERM for approval to facilitate the temporary reduction of the water storage level at Wivenhoe Dam to temporarily increase the flood mitigation capacity of the dam.

Seqwater Interim Program – Moreton Resource Operations Plan

Current as at 17 February 2011

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Departmental water monitoring data collection standards 11(1) Where this plan required monitoring by a resource operations licence holder, including measurement, collection, analysis and storage of data, the resource operations licence holder must ensure the monitoring is consistent with the Water Monitoring Data Collection Standards.	Refer ss151-160.	There is currently limited monitoring of listed infrastructure under the ROP, however, a review will be undertaken (due for a staged completion, with final stage completed by 1 March 2012) to ensure monitoring is consistent with the Queensland Government Water Monitoring Data Collection Standards. The following sets out the timeline for the review: North Pine Dam: Review 1 July 2010; Implementation 1 September 2010 Sideling Creek Dam: Review 1 July 2010; Implementation 1 September 2010 Wivenhoe Dam: Review 1 October 2010; Implementation 1 January 2011 Somerset Dam: Review 1 October 2010; Implementation 1 January 2011 Enoggera Dam: Review 1 October 2011; Implementation 1 January 2012 Gold Creek Dam: Review 1 October 2011; Implementation 1 January 2012 Caboolture River: Review 1 January 2012; Implementation 1 March 2012	1 September 2010 - 1 March 2012.
Departmental water monitoring data reporting standards 12(1) Where this plan requires transfer of data or reporting by a resource operations licence holder the resource operational licence holder must ensure the transfer or reporting is consistent with the Water Monitoring Data Collection Standards.	Refer ss161-167.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures.	Refer ss161-167.
Central Brisbane River and Stanley River Water Supply Schemes – Operating levels for infrastructure 72(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to— (a) meet minimum flow rates in section 75; or (b) supply downstream demand.	Not compliant with ROP (releases made for operational purposes and water quality and ecosystem health including fish management)	A. Seqwater will continue to make releases from infrastructure – 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam; 3. for operational maintenance of dam infrastructure; 4. where B does not apply, to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery. B. Seqwater will, between 20 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure – (a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and (b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level. The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable. If, after releases specified in (a) or (b) have commenced, a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) will be recommenced. For the purpose of the above, "Interim Supply Security Level" means 64.0 m AHD.	Part A: Ongoing Part B: 20 February 2011 – 31 March 2011
Central Brisbane River and Stanley River Water Supply Schemes – Streamflow Requirement 75 When critical water sharing arrangements are not in force, the resource operations licence holder must release a minimum flow of 8.64ML/day from Mount Crosby Weir.	No operational outlet works at Mt Crosby Weir, therefore no managed releases made.	As there are no operable outlet works at Mt Crosby Weir (and cannot be implemented without significant investment, including possible reconstruction of the weir), overflows are dependent upon releases from Wivenhoe and projected water supply demands and local inflows, the latter two components being outside Seqwater control. As a result, Seqwater has very limited control over releases from Mt Crosby Weir on a daily basis. As such, it is proposed that this requirement be deemed as satisfied if a minimum average flow of 8.64ML/day (for any given month) flows over Mt Crosby Weir, rather than a minimum flow of 8.64ML/day (for any given day).	Seqwater would be compliant with a requirement for a minimum average flow of 8.64ML/day for any given month from 1 July 2010. Compliance is not able to be achieved for a minimum flow of 8.64ML/day for any given day.

Relevant ROP Requirement	Programs Currently In Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations 76 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for medium priority water allocations increase by 10 or more percentage points; (B) for high priority water allocations increase by 5 or more percentage points; or (C) increase to 100 per cent. (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d)— (i) publish details of the announced allocation; and (ii) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point (h) not set an announced allocation that is greater than 100 per cent.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal)	New Medium Priority and High Priority Announced Allocation processes and procedures [cut off at edge] commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations for Medium Priority Water Allocations 77(1) The announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme is the announced allocation percentage stated in Attachment 5, Table 5, column 2 corresponding to the combined percentage of useable volume in storage of Wivenhoe and Somerset dams stated in Attachment 5, Table 5, column 1. 77(2) the combined percentage of useable volume in storage of Wivenhoe and Somerset dams must be calculated using the following formula— SPUVS = ((UVWivenhoe+UVSomerset)/CUFSV)*100 77(3) The parameters used in the formula for combined percentage of volume in storage are defined in Attachment 5, Table 6.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal) Please note: the volume stored in Split Yard Creek Dam may influence the Announced Allocation.	New Medium Priority Announced Allocation processes and procedures will be in place b[cut off at edge] the 2010/2011 Water Year (i.e. from 1 July 2010).
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocation for 'High Priority A' Water Allocations 78 (1) The announced allocation for 'High Priority A' water allocations within the Central Brisbane River Water Supply Scheme must be as follows— (a) 100 per cent when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is greater than or equal to 25 per cent or (b) when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is less than 25 per cent, the announced allocation percentage for 'High Priority A' water allocations must be calculated using the following formula— AAHPA=((UV-(AAMP*MPA)+DIVHPA+DIVMP)/HPAA)*100 78(2) The parameters used in the formula for announced allocation are defined in Attachment 5, Table 4. 78(3) For subsection 1 the combined percentage of useable volume in storage	Not compliant with ROP (no programs currently in existence)	New High Priority Announced Allocation processes and procedures will be in place by the [cut off at edge] 2010/2011 Water Year (i.e. from 1 July 2010).

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
of Wivenhoe and Somerset dams must be calculated using the formula in section 77(2) of this plan.			
Central Brisbane River and Stanley River Water Supply Schemes – Critical Water Sharing Arrangements 80(1) Critical water sharing arrangements are in force when the combined percentage of the volume of water in storage in Wivenhoe and Somerset Dams is less than 15 percent. 80(2) During times when critical water sharing arrangements are in force the resource operations licence holder must— (a) cease making releases from Mount Crosby Weir under section 75 of this plan; (b) when at the start of the water year the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is less than 15 per cent, set the announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme to zero per cent; and 80(3) For subsection 1 the combined percentage of volume of water in storage for Wivenhoe and Somerset Dams must be calculated using the formula in section 77(2) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New Medium Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Seasonal water assignment rules 88(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 5, Table 9 for each zone. 88(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence, customers unmetered)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012). Advice will be provided to customers that where two parties wish to enter into a seasonal assignment transaction, that both parties will require a water meter, unless the selling party can demonstrate that they have no active water extraction or usage.	Metering program to be undertaken in close consultation with Mid-Brisbane Irrigators (likely to take until December 2012).
Pine Valleys Water Supply Schemes – Operating Levels for Infrastructure 97(1) The operating levels for the infrastructure in the Pine Valleys Water Supply Scheme are specified in Attachment 6, Table 1. 97(2) The resource operations licence holder must not release or supply water from any infrastructure when the water level in that infrastructure is at or below its minimum operating level. 97(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to supply downstream demand and is made in accordance with this plan.	Not compliant with ROP (releases made for operational purposes and for water quality and ecosystem health including fish management)	s97(1): Attachment 6, Table 1 incorrectly specifies the Minimum Operating Level for North Pine Dam as EL 14.2m AHD and Minimum Operating Volume as 2100ML. The correct Minimum Operating Level is EL 12.8m AHD and the correct Minimum Operating Volume is 1310ML. s97(2): Seqwater will continue to release or supply water from North Pine Dam in accordance with the correct Minimum Operating Level of EL 12.8m AHD rather than the incorrect Minimum Operating Level of EL 14.2m AHD as specified in Attachment 6, Table 1. Seqwater requests DERM correct this error in the ROP. s97(3): Seqwater will continue to make releases from infrastructure- 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam; 3. for operational maintenance of dam infrastructure; 4. to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery.	Ongoing.
Pine Valleys Water Supply Schemes – Announced Allocations 100 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for high priority water allocations increase by 5 or more percentage points; or	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
(B) increase to 100 per cent (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site for the Pine Valleys Water Supply Scheme; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point; and (h) not set an announced allocation that is greater than 100 per cent. 101(1) The announced allocation for 'High Priority A' water allocations in the Pine Valleys Water Supply Scheme must be as follows— (a) 100 per cent when the level of water in storage in North Pine Dam is greater than E.L. 29.3m AHD; and (b) When the water level of water in storage in North Pine Dam is equal to or less than E.L. 29.3m AHD the announced allocation percentage for high priority water allocations must be calculated using the following formula— AAHPA=((UV+DIVHPA)/HPAA)*100 101(2) The parameters used in the formula for announced allocations are defined in Attachment 6, Table 2. 102 The total volume of water taken under a water allocation in a water year must not exceed the nominal volume of the water allocation multiplied by the announced allocation and divided by 100.			
Pine Valleys Water Supply Schemes – Critical Water Sharing Arrangements 103(1) Critical water sharing arrangements are in force when the water level in North Pine Dam is equal to or less than E.L. 29.3m AHD. 103(2) During times when critical water sharing arrangements are in force the resource operations licence holder must calculate the announced allocation for high priority water allocations in accordance with section 101(1)(b) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Pine Valleys Water Supply Schemes – Seasonal Water Assignment Rules 110(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 6, Table 3 for each zone. 110(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place by 1 July 2010.	1 July 2010.
Resource operations licence holder monitoring and reporting – Monitoring data must be made available 151 The resource operations licence holder must provide any monitoring data required under this chapter to the chief executive upon request and within the time requested.	Not compliant with ROP	Requests for data outside of ROP reporting requirements will be provided within required timeframes. Please note, however, that a standard waiting period of 7-14 days applies to all ad-hoc requests and a longer waiting period may apply depending on the detail of the request.	1 July 2010 (please note waiting periods).
Monitoring requirements – Streamflow and Infrastructure water level 152(1) The resource operations licence holder must record water level and volume and stream flow data in accordance with Attachment 9, Table 1. 152(2) Infrastructure inflows may be determined based upon an infrastructure inflow derivation technique supplied by the resource operations licence holder and approved by the chief executive.	Not compliant with ROP (ALERT data available for Baxters Ck and Dayboro WWTP)	152(2) Consistent inflow derivation methodology will be developed by July 2011 for all storages. In the interim, existing methodology inherited from previous asset owners will be used where in existence. Please refer to Attachment 9, Table 1 at end of document.	1 July 2010 – July 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Monitoring requirements – Releases from infrastructure 153(1) This section applies to the following infrastructure— (a) Cressbrook Dam; (b) Mount Crosby Weir; (c) North Pine Dam; (d) Perseverance Dam; (e) Somerset Dam; and (f) Wivenhoe Dam. 153(2) The resource operations licence holder must measure and record for each release of water from infrastructure listed in subsection 1— (a) the daily volume released; (b) the release rate and for each change in release rate— (i) the data and time of the change; and (ii) the new release rate; (c) the reason for each release; and (d) the device used for each release. 153(3) The resource operations licence holder for infrastructure mentioned in subsection 1(c) and 1(f) must record— (a) the inlet level used for each release of water; and (b) the reason for taking water via a particular inlet level.	153(1)(b) No measured releases made 153(1)(c) Operational Log ex SunWater system 153(1)(e) Operational Log ex SunWater system 153(1)(f) Operational Log ex SunWater system 153(2) Data is recorded in Operational Log 153(3) Data is recorded in Operational Log	153(1)(b): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made.	1 July 2010 (note: overflows and not releases will be reported for Mt Crosby Weir).
Monitoring requirements – Announced allocations 154 The resource operations licence holder must record details of announced allocation determinations including— (a) the announced allocations for medium and high priority water allocations; (b) the date announced allocations are determined; and (c) the value of each parameter applied for calculating the announced allocation.	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water taken by water users 155 The resource operations licence holder must record the total volume of water taken, by each water user for each zone as follows— (a) the total volume of water taken in each quarter; (b) the total volume of water entitled to be taken at any time; and (c) the basis for determining the total volume of water entitlement to be taken at any time.	Only HP water take measured – *no meters for measuring MP water take*	Full compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program which will need to be implemented in close consultation with the Mid-Brisbane Irrigators, and will likely take until December 2012). All other schemes will be compliant from 1 July 2010. In the interim water estimations will consist of a quarterly mailout of recording sheets, specifying the requirement for recording volumes of water taken, plus supporting information, with submission of the recording sheets on a quarterly basis. The quarterly mailout will be a prompt for customers to submit their records. Advice will also be given of the Seqwater position that where records are not received that it will be assumed that 25% of the customer's water entitlement has been used for that quarter, and that this will be recorded as such.	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012, with log sheets to be distributed in the first quarter after approval of the interim program).
Monitoring requirements – Seasonal water assignment of water allocations 156 The resource operations licence holder that approves a seasonal water assignment must record details of seasonal water assignment arrangements including— (a) the name of the assignee, volume and location of water that has been seasonally assigned by an assignor; (b) the name of the assignor, volume and location of the water that has been seasonally assigned to an assignee; and (c) the effective date of seasonal water assignments.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail).	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012).
Monitoring requirements – Critical water sharing arrangements 157 The resource operations licence holder must record details of critical water sharing arrangements including the following— (a) the commencement date(s) and effective period of critical water sharing arrangements; and (b) the effectiveness of the critical water sharing arrangements.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water Quality 158 the resource operations licence holder must monitor and record water	<u>Somerset Dam</u> Inflow:	Seqwater is currently compliant with the monitoring requirements for Wivenhoe Dam and Mt Crosby Weir (with the exception of tailwater monitoring since the downstream area is estuarine) and will be reported from 1 July	1 January 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
quality data in relation to relevant infrastructure listed in Attachments 5, 6 and 7.	None. Quality monitoring and recording is event-related only. Water quality meters are DERM infrastructure. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Chl, BGA, DO; Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO; Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Wivenhoe Dam** **Inflow – (Caboonbah):** Fortnightly – Total Cyanobacteria, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Monthly (SB) – Total Cyanobacteria, EC, TC, Chl a, Fe, Mn, true colour, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **North Pine Dam** **Inflow:** None. Quality monitoring and recording is event-related only. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO	2010. North Pine Dam requires some parameter additions to the inflow site on the North Pine River and the addition of a tailwater site to be compliant with the ROP requirements. Seqwater is currently reviewing the North Pine Monitoring Program which will include the requirements under the ROP (scheduled for completion by 1 July 2010) and will be implemented by 1 September 2010 (including training, reporting and scheduling). In the interim, additional parameters will be added to the existing gauging and water quality site on the North Pine River to be sampled on a monthly basis as follows: • Inflow: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients • Tailwater: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients, total sulphides Somerset Dam requires the addition of an inflow site on the Stanley River. The Somerset Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011. Mt Crosby Weir requires the addition of an tailwater site on the Brisbane River. The Wivenhoe Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011.	

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
	Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None. Mt Crosby Weir (also TS sampling) Inflow: Kholo: Fortnightly – total phytoplankton, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Headwater: Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Cyano, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None, estuarine		
Monitoring requirements – Bank condition 159(1) The resource operations licence holder must inspect banks for evidence of collapse or erosion within the ponded areas and downstream of the relevant infrastructure listed in Attachments 5, 6 and 7 following instances of— (a) rapid water level changes; (b) large flows through infrastructure; or (c) other occasions when collapse or erosion of banks may be likely. 159(2) For subsection 1, downstream of the relevant infrastructure means the distance of influence of infrastructure operations.	Not compliant with ROP (inspections undertaken for ponded areas but not stream bank or downstream) No reporting or monitoring currently undertaken for ROP purposes however Dam Safety monitor dam wall and embankments directly surrounding dam storage.	Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011).	1 July 2010 – December 2011.
Reporting requirements 161 The resource operations licence holder must provide— (a) quarterly reports; (b) annual reports for the previous water year; (c) operational reports; and (d) emergency reports.	Not compliant with ROP. No reporting.	Refer ss162-167	Refer ss162-167.
Reporting requirements – Quarterly Report 162(1) The resource operations licence holder must submit a quarterly report to the chief executive after the end of each quarter, of every water year. 162(2) The report must contain the following data— (a) stream flow and infrastructure water levels—all records referred to in section 152 of this plan; (b) the total volume of water for each quarter— (i) taken for each zone; (ii) entitled to be taken from each zone; (c) water quality—all records referred to in section 158 of this plan; (d) a summary of bank condition monitoring and incidences of slumping, undertaken in accordance with section 159 of this plan; and (e) the details and status of any programs implemented under section 13 of this plan.	Not compliant with ROP. No reporting.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures. Commencing 1 July 2010 the following will be implemented: • ROP datasets will be supplied quarterly, as required under the ROP. • ROP Compliance Report will be submitted with the quarterly reporting process, including exceptions to ROP requirements and an update on the Interim Program, as required under the ROP. Results of weekly bank condition monitoring will be collated quarterly and reported, with progressive implementation commencing 1 July 2010 and fully implemented by December 2011. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss152, 158 and 159 for further details.	1 July 2010 – December 2011.
Reporting requirements – Annual Report 163(1) The resource operations licence holder must submit an annual report to the chief executive after the end of the water year. 163(2) The annual report must include—	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to s164 for further details.	1 July 2010 – December 2012

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
(a) water quantity monitoring results required under section 164 of this plan; (b) details of the impact of infrastructure operation on water quality as required under section 164 of this plan; (c) a discussion about any issues that arose as a result of the implementation and application of the rules and requirements of this plan.			
Reporting requirements – Water quantity monitoring – Annual Report 164 The resource operations licence holder must include in the annual report under section 163— (a) A summary of announced allocation determinations, including— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the date and value for the initial announced allocation and for each change made to an announced allocation; (b) Instances where critical water sharing arrangements have been implemented— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the commencement date(s) and effective period(s) for each stage of the arrangements and outcomes; (c) records from infrastructure—records referred to in section 153; (d) the total annual volume of water taken by each water user, specified by zone, namely— (i) the total annual volume of supplemented water taken; (ii) the total annual volume of supplemented water entitled to be taken; and (iii) the basis for determining the volume entitled to be taken; (e) details of seasonal water assignments, namely— (i) the total number of seasonal water assignments arrangements; and (ii) the total volume of water seasonally assigned; (f) all details of changes to infrastructure or the operation of the infrastructure that may impact on compliance with rules in this plan; and (g) details of any new monitoring devices used such as equipment to measure stream flow.	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss76, 77, 78, 80, 88, 100, 101, 103, 110, 153, 155, 156 and 157 for further detail. s164(a): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(b): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(c): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made. Please refer to s153 for further details. ss164(d-e): Compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program and will need to be implemented in close consultation with the Mid-Brisbane Irrigators, timeframe likely to take until December 2012). All other schemes will be compliant from 1 July 2010. ss164(f-g): Seqwater will be compliant with these requirements from 1 July 2010.	ss164(a-b, f-g): 1 July 2010. s164(c): 1 July 2010 (note: overflows rather than releases will be reported for Mt Crosby Weir). Please refer to s153 for further details. s164(d-e): 1 July 2010 – December 2012. Please refer to ss88, 155 and 156 for further details.
Reporting requirements – Impact of infrastructure operation on natural ecosystems – Annual report 165 The resource operations licence holder must include in the annual report under section 163— (a) a summary of environmental considerations made by the resource operations licence holder in making operational and release decisions; (b) a summary of the environmental outcomes of the decision including any adverse environmental impacts; (c) a summary of bank condition and fish stranding monitoring and assessment, including— (i) results of investigations of bank slumping or erosion identified in ponded areas or downstream of infrastructure; (ii) results of investigations of fish stranding downstream of infrastructure; and (iii) changes to to the operation of infrastructure to reduce instances of bank slumping, erosion or fish stranding; (d) a discussion and assessment of the following water quality issues— (i) thermal and chemical stratification in each water storage associated with infrastructure; (ii) contribution of the water storage and its management to	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss 158 and 159 for further details.	1 July 2010 – December 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
the quality of water released; (iii) cumulative effect of successive water storages associated with infrastructure on water quality; (iv) cyanobacteria population changes in response to stratification in each water storage; and (v) any changes to the monitoring program as a result of evaluation of the data.			
Reporting requirements – Operational Report 166 The resource operations licence holder must— (a) notify the chief executive within one business day of becoming aware of any of the following operational incidents— (i) a non-compliance by the resource operations holder with the rules in this plan; and (ii) instances of fish stranding or bank slumping within the impounded areas or downstream of infrastructure listed in Attachment 9, Table 1 or watercourses associated with the operation of the Central Brisbane River, Cressbrook Creek, Pine Valleys and Stanley River water supply schemes; (b) provide to the chief executive a report which includes details of— (i) the incident; (ii) conditions under which the incident occurred; and (iii) any response or activities carried out as a result of the incident; (c) notify the chief executive upon commencement and cessation of critical water sharing arrangements; and (d) notify the chief executive on approval of any seasonal water assignment, including— (i) the name and location of the assignees and assignors; and (ii) the zone or zones where water is being seasonally assigned to and from; (e) notify the chief executive upon making a decision relating to an initial announced allocation and/or its recalculation; (f) transfer to the chief executive— (i) details of any arrangements of addressing circumstances where the resource operations licence holder is unable to supply water allocations under subsection (e); and (ii) relevant supporting information used in making a decision under subsection (e).	Not compliant with ROP. No reporting.	ss166(a)(i), (b): Seqwater will submit operational reports as required, commencing for the 2010/2011 water year. s166(a)(ii): Process for reporting instances of fish standing and bank slumping will be progressively implemented beginning 1 July 2010 with finalisation by December 2011. Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow to the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011). s166(c): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s166(d): Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail). s166(e-f): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010 – December 2011.
Reporting requirements – Emergency report 167 In an emergency where the resource operations licence holder cannot comply with a rule in this plan as a result of an emergency, the resource operations licence holder must— (a) notify the chief executive upon discovery of the emergency; and (b) provide to the chief executive a report that includes— (i) details of the emergency; (ii) conditions under which the emergency occurred; (iii) any responses or activities carried out as a result of the emergency; and (iv) any rules specified in this plan that the resource operations licence holder is either permanently or temporarily unable to comply with due to the emergency.	Not compliant with ROP. No reporting.	Seqwater will submit emergency reports as required, commencing for the 2010/2011 water year.	1 July 2010.

Attachment 8, Table 1 – Water Allocation Schedule

Relevant ROP Requirement	Programs Currently in Existence	Interim Program, Including Methodology	Timetable
Water Allocation Number 137: Brisbane Zone, Any Purpose, 25ML,	The map in Attachment 2(b) of the ROP does not include Somerset		

High Class A Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	The zone where this entitlement has been issued does not include Somerset Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	
Water Allocation Number 139: Mid-Brisbane Zone, Any Purpose, 150ML, Medium Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	In accordance with current take of water from the Mid-Brisbane zone.		

Attachment 9 – Resource operations licence holder monitoring: Locations where continuous time series height and flow data and storage water level data are required.

Location	Continuous time series storage water level data	Continuous time series flow data	Programs Currently in Existence	Interim Program, Including Methodology	Timetable
Mount Crosby Weir inflow		Y	Not continuous	A daily inflow derivation model is being developed which will incorporate outflow from Wivenhoe Dam, flow from Lockyer Creek and local area, change in Mt Crosby water levels and local irrigation and water supply demands.	1 July 2010.
Mount Crosby Weir headwater level	Y		Continuous	Water level is monitored via ALERT to a 20mm resolution.	1 July 2010.
Mount Crosby Weir tailwater		Y	Not continuous	Downstream of Mt Crosby Weir is tidal and, as such, a downstream gauging station will not provide estimates of river flow. Releases are not made from Mt Crosby Weir and any flow through the fish way and over the weir crest will provide an estimate of the flow from the weir.	Estimate of flow from the weir in place by 30 December 2010.
North Pine Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
North Pine Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
North Pine Dam tailwater		Y	Not continuous	Water level is monitored continuously at the Dayboro Rd WPS Weir about 1km downstream of North Pine Dam. At present, this is only available via SCADA and is not rated. Until the rating is developed and equipment installed at the site to enable remote monitoring, flow downstream of North Pine Dam can be estimated from the gate and valve openings at the Dam (anticipated for July 2011). A rating can be developed for the Dayboro Rd Weir based on recorded flows and heights.	July 2011.
Somerset Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be in place by 1 July 2010.	1 July 2010.
Somerset Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Somerset Dam tailwater		Y	Not continuous	Somerset Dam tailwater is affected by levels in Wivenhoe Dam. When full, the water in Wivenhoe back up to the toe of Somerset Dam. As such, a tailwater gauge is considered inappropriate. Outflows from Somerset can be estimated from the recorded openings of the gates, sluices and valves at the dam.	Nil
Wivenhoe Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
Wivenhoe Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Wivenhoe Dam tailwater		Y	Not continuous	Please note: Water level is continuously monitored and recorded via ALERT and on-site logger with a resolution of 20mm which is owned by DERM not Seqwater (143035A). The site is rated but can be affected by backwater from Lockyer Creek. Discharge from the dam can also be estimated via the rated gates and valves. Since the gauge is owned by DERM, Seqwater will not undertake monitoring for tailwater at this site.	Seqwater will not undertake monitoring for tailwater at this site since the gauge is owned by DERM (143035A).

ANNEXURE 3 – Summary of Insurance Policies

	Insurance Type	Policy ID	Cover Limit
1	Industrial Special Risks	1840003609IAR	$675,000 single loss, combined limit of $900,000
2	Industrial Special Risks	134891	$675,000 single loss, combined limit of $900,000
3	Industrial Special Risks	04FX007499	$675,000 single loss, combined limit of $900,000
4	Industrial Special Risks	01R 2688403	$675,000 single loss, combined limit of $900,000
5	Public Liability / Products Liability / Professional Indemnity	509DR455210	$50,000,000 per occurrence (6 layers, limited to $300,000,000 in total)
6	Directors and Officers Liability	42 2977449 GNX	$30,000,000 per claim
7	Supplementary Legal Expenses Policy	0040212 SLE	$1,000,000 per claim
8	Statutory Liability Policy	0040213 SLI	$1,000,000 per claim

EXECUTED AS A DEED

STATE

SIGNED SEALED & DELIVERED for and on behalf of the **STATE OF QUEENSLAND** as represented by the **Department of Environment and Resource Management**

this 17th day of February 2011

by John Neville Bradley, Director-General

who is a duly authorised officer

in the presence of:

[redacted]

[redacted] ...... (signature)

.... (full name of witness)

.... (signature of witness)

SEQWATER

SIGNED SEALED & DELIVERED for and on behalf of **Queensland Bulk Water Supply Authority trading as Seqwater**

this 17th day of February 2011

by Peter Clark Borrows, Chief Executive Officer

who is a duly authorised officer

in the presence of:

.... (signature)

by .... (full name of witness)

.... (signature of witness)

"PB-28"

seqwater
WATER FOR LIFE

17 February 2011

Lyall Hinrichsen
Acting General Manager
Water Allocation and Planning
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Dear Mr Hinrichsen,

Revised Interim Program – Moreton Resource Operations Plan

Seqwater notes that the Minister for Natural Resources, Mines and Energy and Minister for Trade announced on 13 February 2011 that, in order to temporarily increase the flood mitigation capacity of Wivenhoe Dam, the water storage level in the dam was to be reduced to and held at 75% of its Full Supply Level (FSL) until the end of the wet season on 31 March 2011.

The announcement followed advice from the SEQ Water Grid Manager on 9 February 2011 that the Grid Manager had no objection to Wivenhoe Dam being drawn down to 75% of its FSL from a water security perspective, and that the temporary draw down is unlikely to impact the Grid Manager's ability to comply with its obligations under the *South East Queensland System Operating Plan* or Grid Contracts.

In light of the Grid Manager's advice, the extreme nature of the January 2011 flood event and Seqwater's modelling, Seqwater recommended to DERM that Wivenhoe Dam's storage level be temporarily reduced to 75% of its FSL to temporarily increase its flood mitigation capacity.

We note the Director-General of DERM agreed to implement the above reduction in the water storage level, in the manner stated in his letter dated 11 February 2011.

On 14 February 2011, the Moreton Resource Operations Plan was amended as contemplated in the Director-General's letter of 11 February 2011, to include a new Section 13(6A) permitting a Resource Operations Licence holder with an approved interim program to submit a revised program to the chief executive for approval.

Seqwater is a Resource Operations Licence holder under the Moreton Resource Operations Plan with an approved interim program, and hereby submits a Revised Interim Program for the approval of the chief executive under Section 13(7) of the Moreton Resource Operations Plan.

The Revised Interim Program, if approved, would authorise releases:

- to effect the initial reduction in the water storage level of Wivenhoe Dam to an 'Interim Security Supply Level' being 75% of its FSL, from 20 February 2011; and
- thereafter, until 31 March 2011, to bring Wivenhoe Dam back to the Interim Security Supply Level where inflows occur after the initial reduction.

In connection with the above releases:

- a duty engineer will be monitoring rainfall as currently occurs in respect of operational releases; and
- Seqwater will provide information regarding release volume and timing to:
  - Somerset Regional Council, Ipswich City Council and Brisbane City Council; and
  - the mid-Brisbane River irrigator community.
- The same information will also be provided to the communication managers of Somerset Regional Council, Ipswich City Council and Brisbane City Council via the Water Grid and will be included on the Water Grid manager and Seqwater websites. Additionally, the

Water Grid Manager will include release information as part of its daily communication updates and such information will be included in the Water Grid 1800 updates.

Should chief executive approval be given in respect of the Revised Interim Program, Seqwater's releases pursuant to that approved program would not commence until after Seqwater had provided notifications to third parties (including Councils) and the finalization of the other actions referred to in the letter from your Director-General to Seqwater, dated 11 February 2011.

Yours sincerely,

Peter Borrows
Chief Executive Officer

enc

Received 17 Feb 2011

"PB-29"

[redacted]

Queensland Government

Ref CTS 02576/11

Department of
Environment and Resource
Management

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
CITY EAST QLD 4002

Dear ~~Mr Borrows~~ Peter

Thank you for submitting a revised interim program under section 13(6A) of the Moreton Resource Operations Plan (the ROP) outlining a proposal to make releases from Wivenhoe Dam (the dam) to maintain a 75% full supply level for the remainder of the 2011 summer season (between 20 February 2011 and 31 March 2011).

I advise that I have approved the submitted program under Section 13 (7) (a) of the ROP. I acknowledge that Seqwater will put suitable communications arrangements in place prior to and during the period when releases are being made under the interim program. I also note that the releases will be monitored and managed by Seqwater through suitably qualified personnel.

I also remind you that releases made under the interim program must be in accordance with other provisions of the Moreton ROP, including section 74, which states that the rate of release of water from the dam must occur to minimise the occurrence of adverse environmental impacts, such as bank slumping.

Should you have any further enquiries, please do not hesitate to contact me on telephone 3330 6306.

Yours sincerely

[redacted]

John Bradley
Director-General

[illegible]
[illegible]
[illegible]
[illegible]
Telephone [illegible]
Facsimile [illegible]
Website www.derm.qld.gov[illegible]
[illegible]

Seqwater Interim Program – Moreton Resource Operations Plan
(Revised 17 February 2011)

The Moreton Resource Operations Plan (the ROP) commenced on 7 December 2009. The Queensland Bulk Water Supply Authority (trading as Seqwater) is the Resource Operations Licence Holder under the ROP for the following Water Supply Schemes:

- Central Brisbane River Water Supply Scheme;
- Pine Valleys Water Supply Scheme; and
- Stanley River Water Supply Scheme.

Where Seqwater, as the ROL holder, is unable to meet requirements of the ROP on its commencement, a structured process is available whereby a statement of programs currently in existence can be prepared and submitted to the Department of Environment and Resource Management (DERM), to be followed by an Interim Program. The box below sets out the relevant provisions under the ROP.

Relevant ROP Requirement

Interim Program

s13(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.
s13(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.
s13(3) The resource operations licence holder must –
(a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and
(b) within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.
s13(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including timetable and interim methods to be used.
s13(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.
s13(6) The chief executive, in considering any submitted program, may request additional information.
s13(6A) Despite anything in subsections 2, 3 or 4, a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection 7.
s13(7) The chief executive, in considering any submitted program, may either–
(a) approve the program with or without conditions;
(b) amend and approved the amended program; or
(c) require the resource operations licence holder to submit a revised program.
s13(8) Within 10 business days of making a decision on a program submitted under this section the chief executive must notify the resource operations licence holder of the decision.
s13(9) Following approval of the program by the chief executive, the resource operations licence holder must–
(a) implement and operate in accordance with the approved program; and
(b) make public details of the approved program on their internet site.
s13(10) Where there is conflict between the provisions of this plan and the provisions of an approved program, the approved program prevails for the time that the approved program is in place.
S13(11) Where this section applies, the resource operations licence holder may continue to operate under the existing program until the program submitted under this section is approved.

Seqwater submitted a Statement of Current Programs to DERM on 5 February 2010, in accordance with Section 13 of the ROP.

Queensland Government

Ref CTS 02576/11

Department of
Environment and Resource
Management

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
CITY EAST QLD 4002

Dear ~~Mr Borrows~~ Peter

Thank you for submitting a revised interim program under section 13(6A) of the Moreton Resource Operations Plan (the ROP) outlining a proposal to make releases from Wivenhoe Dam (the dam) to maintain a 75% full supply level for the remainder of the 2011 summer season (between 20 February 2011 and 31 March 2011).

I advise that I have approved the submitted program under Section 13 (7) (a) of the ROP. I acknowledge that Seqwater will put suitable communications arrangements in place prior to and during the period when releases are being made under the interim program. I also note that the releases will be monitored and managed by Seqwater through suitably qualified personnel.

I also remind you that releases made under the interim program must be in accordance with other provisions of the Moreton ROP, including section 74, which states that the rate of release of water from the dam must occur to minimise the occurrence of adverse environmental impacts, such as bank slumping.

Should you have any further enquiries, please do not hesitate to contact me on telephone [redacted]

Yours sincerely

[redacted]

John Bradley
Director-General

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400 George Street Brisbane Qld 4000
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Queensland 4001 Australia
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ABN 46 640 294 485

Seqwater submitted an Interim Program for the Moreton ROP to DERM in May 2010, as required under s13 of the ROP. After consultation with and at the request of DERM, an amended Interim Program was submitted to DERM on 27 August 2010. A delegate of the Chief Executive approved Seqwater's 27 August 2010 Interim Program on 3 December 2010.

On 14 February 2011, the ROP was amended to permit a Resource Operations Licence Holder to submit a revised program.

Under Section 6A of the ROP, this Revised Interim Program is now submitted to DERM for approval to facilitate the temporary reduction of the water storage level at Wivenhoe Dam to temporarily increase the flood mitigation capacity of the dam.

Seqwater Interim Program – Moreton Resource Operations Plan

Current as at 17 February 2011

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Departmental water monitoring data collection standards 11(1) Where this plan required monitoring by a resource operations licence holder, including measurement, collection, analysis and storage of data, the resource operations licence holder must ensure the monitoring is consistent with the Water Monitoring Data Collection Standards.	Refer ss151-160.	There is currently limited monitoring of listed infrastructure under the ROP, however, a review will be undertaken (due for a staged completion, with final stage completed by 1 March 2012) to ensure monitoring is consistent with the Queensland Government Water Monitoring Data Collection Standards. The following sets out the timeline for the review: North Pine Dam: Review 1 July 2010; Implementation 1 September 2010 Sideling Creek Dam: Review 1 July 2010; Implementation 1 September 2010 Wivenhoe Dam: Review 1 October 2010; Implementation 1 January 2011 Somerset Dam: Review 1 October 2010; Implementation 1 January 2011 Enoggera Dam: Review 1 October 2011; Implementation 1 January 2012 Gold Creek Dam: Review 1 October 2011; Implementation 1 January 2012 Caboolture River: Review 1 January 2012; Implementation 1 March 2012	1 September 2010 - 1 March 2012.
Departmental water monitoring data reporting standards 12(1) Where this plan requires transfer of data or reporting by a resource operations licence holder the resource operational licence holder must ensure the transfer or reporting is consistent with the Water Monitoring Data Collection Standards.	Refer ss161-167.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures.	Refer ss161-167.
Central Brisbane River and Stanley River Water Supply Schemes – Operating levels for infrastructure 72(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to— (a) meet minimum flow rates in section 75; or (b) supply downstream demand.	Not compliant with ROP (releases made for operational purposes and water quality and ecosystem health including fish management)	A. Seqwater will continue to make releases from infrastructure – 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam; 3. for operational maintenance of dam infrastructure; 4. where B does not apply, to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery. B. Seqwater will, between 20 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure – (a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and (b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level. The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable. If, after releases specified in (a) or (b) have commenced, a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) will be recommenced. For the purpose of the above, "Interim Supply Security Level" means 64.0 m AHD.	Part A: Ongoing Part B: 20 February 2011 – 31 March 2011
Central Brisbane River and Stanley River Water Supply Schemes – Streamflow Requirement 75 When critical water sharing arrangements are not in force, the resource operations licence holder must release a minimum flow of 8.64ML/day from Mount Crosby Weir.	No operational outlet works at Mt Crosby Weir, therefore no managed releases made.	As there are no operable outlet works at Mt Crosby Weir (and cannot be implemented without significant investment, including possible reconstruction of the weir), overflows are dependent upon releases from Wivenhoe and projected water supply demands and local inflows, the latter two components being outside Seqwater control. As a result, Seqwater has very limited control over releases from Mt Crosby Weir on a daily basis. As such, it is proposed that this requirement be deemed as satisfied if a minimum average flow of 8.64ML/day (for any given month) flows over Mt Crosby Weir, rather than a minimum flow of 8.64ML/day (for any given day).	Seqwater would be compliant with a requirement for a minimum average flow of 8.64ML/day for any given month from 1 July 2010. Compliance is not able to be achieved for a minimum flow of 8.64ML/day for any given day.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations 76 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for medium priority water allocations increase by 10 or more percentage points; (B) for high priority water allocations increase by 5 or more percentage points; or (C) increase to 100 per cent. (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d)— (i) publish details of the announced allocation; and (ii) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point (h) not set an announced allocation that is greater than 100 per cent.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations for Medium Priority Water Allocations 77(1) The announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme is the announced allocation percentage stated in Attachment 5, Table 5, column 2 corresponding to the combined percentage of useable volume in storage of Wivenhoe and Somerset dams stated in Attachment 5, Table 5, column 1. 77(2) the combined percentage of useable volume in storage of Wivenhoe and Somerset dams must be calculated using the following formula— SPUVS = ((UVWivenhoe+UVSomerset)/CUFSV)*100 77(3) The parameters used in the formula for combined percentage of volume in storage are defined in Attachment 5, Table 6.	Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazettal) Please note: the volume stored in Split Yard Creek Dam may influence the Announced Allocation.	New Medium Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocation for 'High Priority A' Water Allocations 78 (1) The announced allocation for 'High Priority A' water allocations within the Central Brisbane River Water Supply Scheme must be as follows— (a) 100 per cent when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is greater than or equal to 25 per cent or (b) when the combined percentage of useable volume in storage of Wivenhoe and Somerset dams is less than 25 per cent, the announced allocation percentage for 'High Priority A' water allocations must be calculated using the following formula— AAHPA=((UV-(AAMP*MPA)+DIVHPA+DIVMP)/HPAA)*100 78(2) The parameters used in the formula for announced allocation are defined in Attachment 5, Table 4. 78(3) For subsection 1 the combined percentage of useable volume in storage	Not compliant with ROP (no programs currently in existence)	New High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
of Wivenhoe and Somerset dams must be calculated using the formula in section 77(2) of this plan.			
Central Brisbane River and Stanley River Water Supply Schemes – Critical Water Sharing Arrangements 80(1) Critical water sharing arrangements are in force when the combined percentage of the volume of water in storage in Wivenhoe and Somerset Dams is less than 15 percent. 80(2) During times when critical water sharing arrangements are in force the resource operations licence holder must— (a) cease making releases from Mount Crosby Weir under section 75 of this plan; (b) when at the start of the water year the combined percentage of usable volume in storage of Wivenhoe and Somerset dams is less than 15 per cent, set the announced allocation for medium priority water allocations in the Central Brisbane River Water Supply Scheme to zero per cent; and 80(3) For subsection 1 the combined percentage of volume of water in storage for Wivenhoe and Somerset Dams must be calculated using the formula in section 77(2) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New Medium Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Central Brisbane River and Stanley River Water Supply Schemes – Seasonal water assignment rules 88(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 5, Table 9 for each zone. 88(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence, customers unmetered)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012). Advice will be provided to customers that where two parties wish to enter into a seasonal assignment transaction, that both parties will require a water meter, unless the selling party can demonstrate that they have no active water extraction or usage.	Metering program to be undertaken in close consultation with Mid-Brisbane Irrigators (likely to take until December 2012).
Pine Valleys Water Supply Schemes – Operating Levels for Infrastructure 97(1) The operating levels for the infrastructure in the Pine Valleys Water Supply Scheme are specified in Attachment 6, Table 1. 97(2) The resource operations licence holder must not release or supply water from any infrastructure when the water level in that infrastructure is at or below its minimum operating level. 97(3) The resource operations licence holder must not release water from any infrastructure unless the release is necessary to supply downstream demand and is made in accordance with this plan.	Not compliant with ROP (releases made for operational purposes and for water quality and ecosystem health including fish management)	s97(1): Attachment 6, Table 1 incorrectly specifies the Minimum Operating Level for North Pine Dam as EL 14.2m AHD and Minimum Operating Volume as 2300ML. The correct Minimum Operating Level is EL 12.8m AHD and the correct Minimum Operating Volume is 1310ML. s97(2): Seqwater will continue to release or supply water from North Pine Dam in accordance with the correct Minimum Operating Level of EL 12.8m AHD rather than the incorrect Minimum Operating Level of EL 14.2m AHD as specified in Attachment 6, Table 1. Seqwater requests DERM correct this error in the ROP. s97(3): Seqwater will continue to make releases from infrastructure- 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam; 3. for operational maintenance of dam infrastructure; 4. to operationally maintain storage levels, in the absence of a flood event, at or close to FSL; and 5. for fish recovery.	Ongoing.
Pine Valleys Water Supply Schemes – Announced Allocations 100 The resource operations licence holder must— (a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water allocations in that priority group; (b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year; (c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year; (d) following the commencement of a water year— (i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month; (ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would— (A) for high priority water allocations increase by 5 or more percentage points; or	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
(B) Increase to 100 per cent (e) within 5 business days of setting an announced allocation under subsection 1(c) or the first calendar day of every month when resetting the announced allocation under subsection 1(d) make public details of the announced allocation, including parameters for determining the announced allocation, on the resource operations licence holder's internet site for the Pine Valleys Water Supply Scheme; (f) not reduce the announced allocation during a water year; (g) round the announced allocation to the nearest whole percentage point; and (h) not set an announced allocation that is greater than 100 per cent. 101(1) The announced allocation for 'High Priority A' water allocations in the Pine Valleys Water Supply Scheme must be as follows— (a) 100 per cent when the level of water in storage in North Pine Dam is greater than E.L. 29.3m AHD; and (b) When the water level of water in storage in North Pine Dam is equal to or less than E.L. 29.3m AHD the announced allocation percentage for high priority water allocations must be calculated using the following formula— AAHPA=((UV+DIV/HPA)/HPAA)*100 101(2) The parameters used in the formula for announced allocations are defined in Attachment 6, Table 2. 102 The total volume of water taken under a water allocation in a water year must not exceed the nominal volume of the water allocation multiplied by the announced allocation and divided by 100.			
Pine Valleys Water Supply Schemes – Critical Water Sharing Arrangements 103(1) Critical water sharing arrangements are in force when the water level in North Pine Dam is equal to or less than E.L. 29.3m AHD. 103(2) During times when critical water sharing arrangements are in force the resource operations licence holder must calculate the announced allocation for high priority water allocations in accordance with section 101(1)(b) of this plan.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). New High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Pine Valleys Water Supply Schemes – Seasonal Water Assignment Rules 110(1) The resource operations licence holder may approve a seasonal assignment of a volume of water provided that the total volume of water use in a water year for each zone will not exceed the maximum allowable water use volume in Attachment 6, Table 3 for each zone. 110(2) The resource operations licence holder is responsible for dealing with applications for seasonal water assignment where the resource operations licence holder distributes water to the assignee.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place by 1 July 2010.	1 July 2010.
Resource operations licence holder monitoring and reporting – Monitoring data must be made available 151 The resource operations licence holder must provide any monitoring data required under this chapter to the chief executive upon request and within the time requested.	Not compliant with ROP	Requests for data outside of ROP reporting requirements will be provided within required timeframes. Please note, however, that a standard waiting period of 7-14 days applies to all ad-hoc requests and a longer waiting period may apply depending on the detail of the request.	1 July 2010 (please note waiting periods).
Monitoring requirements – Streamflow and infrastructure water level 152(1) The resource operations licence holder must record water level and volume and stream flow data in accordance with Attachment 9, Table 1. 152(2) Infrastructure inflows may be determined based upon an infrastructure inflow derivation technique supplied by the resource operations licence holder and approved by the chief executive.	Not compliant with ROP (ALERT data available for Baxters Ck and Dayboro WWTP)	152(2) Consistent inflow derivation methodology will be developed by July 2011 for all storages. In the interim, existing methodology inherited from previous asset owners will be used where in existence. Please refer to Attachment 9, Table 1 at end of document.	1 July 2010 – July 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
Monitoring requirements – Releases from infrastructure 153(1) This section applies to the following infrastructure— (a) Cressbrook Dam; (b) Mount Crosby Weir; (c) North Pine Dam; (d) Perseverance Dam; (e) Somerset Dam; and (f) Wivenhoe Dam. 153(2) The resource operations licence holder must measure and record for each release of water from infrastructure listed in subsection 1— (a) the daily volume released; (b) the release rate and for each change in release rate— (i) the date and time of the change; and (ii) the new release rate; (c) the reason for each release; and (d) the device used for each release. 153(3) The resource operations licence holder for infrastructure mentioned in subsection 1(c) and 1(f) must record— (g) the inlet level used for each release of water; and (h) the reason for taking water via a particular inlet level.	153(1)(b) No measured releases made 153(1)(c) Operational Log ex SunWater system 153(1)(e) Operational Log ex SunWater system 153(1)(f) Operational Log ex SunWater system 153(2) Data is recorded in Operational Log 153(3) Data is recorded in Operational Log	153(1)(b): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made.	1 July 2010 (note: overflows and not releases will be reported for Mt Crosby Weir).
Monitoring requirements – Announced allocations 154 The resource operations licence holder must record details of announced allocation determinations including— (a) the announced allocations for medium and high priority water allocations; (b) the date announced allocations are determined; and (c) the value of each parameter applied for calculating the announced allocation.	Not compliant with ROP (no programs currently in existence)	New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water taken by water users 155 The resource operations licence holder must record the total volume of water taken, by each water user for each zone as follows— (a) the total volume of water taken in each quarter; (b) the total volume of water entitled to be taken at any time; and (c) the basis for determining the total volume of water entitlement to be taken at any time.	Only HP water take measured – no meters for measuring MP water take	Full compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program which will need to be implemented in close consultation with the Mid-Brisbane Irrigators, and will likely take until December 2012). All other schemes will be compliant from 1 July 2010. In the interim water estimations will consist of a quarterly mailout of recording sheets, specifying the requirement for recording volumes of water taken, plus supporting information, with submission of the recording sheets on a quarterly basis. The quarterly mailout will be a prompt for customers to submit their records. Advice will also be given of the Seqwater position that where records are not received that it will be assumed that 25% of the customer's water entitlement has been used for that quarter, and that this will be recorded as such.	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012, with log sheets to be distributed in the first quarter after approval of the interim program).
Monitoring requirements – Seasonal water assignment of water allocations 156 The resource operations licence holder that approves a seasonal water assignment must record details of seasonal water assignment arrangements including— (a) the name of the assignee, volume and location of water that has been seasonally assigned by an assignor; (b) the name of the assignor, volume and location of the water that has been seasonally assigned to an assignee; and (c) the effective date of seasonal water assignments.	Not compliant with ROP (no programs currently in existence)	Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail).	1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012).
Monitoring requirements – Critical water sharing arrangements 157 The resource operations licence holder must record details of critical water sharing arrangements including the following— (a) the commencement date(s) and effective period of critical water sharing arrangements; and (b) the effectiveness of the critical water sharing arrangements.	Not compliant with ROP (no programs currently in existence)	New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010.
Monitoring requirements – Water Quality 158 The resource operations licence holder must monitor and record water	<u>Somerset Dam</u> Inflow:	Seqwater is currently compliant with the monitoring requirements for Wivenhoe Dam and Mt Crosby Weir (with the exception of tailwater monitoring since the downstream area is estuarine) and will be reported from 1 July	1 January 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
quality data in relation to relevant infrastructure listed in Attachments 5, 6 and 7.	None. Quality monitoring and recording is event-related only. Water quality meters are DERM infrastructure. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Chl, BGA, DO; Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO; Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **<u>Wivenhoe Dam</u>** **Inflow – (Caboonbah):** Fortnightly – Total Cyanobacteria, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Monthly (SB) – Total Cyanobacteria, EC, TC, Chl a, Fe, Mn, true colour, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **Tailwater:** Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. **<u>North Pine Dam</u>** **Inflow:** None. Quality monitoring and recording is event-related only. **Headwater:** Real-time telemetered VPS pH, Cond., Turb., Temp., Chl, BGA, DO Fortnightly – Total Phyto, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO	2010. North Pine Dam requires some parameter additions to the inflow site on the North Pine River and the addition of a tailwater site to be compliant with the ROP requirements. Seqwater is currently reviewing the North Pine Monitoring Program which will include the requirements under the ROP (scheduled for completion by 1 July 2010) and will be implemented by 1 September 2010 (including training, reporting and scheduling). In the interim, additional parameters will be added to the existing gauging and water quality site on the North Pine River to be sampled on a monthly basis as follows: • Inflow: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients • Tailwater: electrical conductivity, temperature, dissolved oxygen, pH, turbidity, total nutrients, dissolved nutrients, total sulphides Somerset Dam requires the addition of an inflow site on the Stanley River. The Somerset Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011. Mt Crosby Weir requires the addition of an tailwater site on the Brisbane River. The Wivenhoe Dam Monitoring Program Review is scheduled for completion on 1 October 2010, with implementation (including training, reporting and scheduling) by 1 January 2011.	

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, Including Methodology	Timetable
	Monthly (SB) – Total Phyto, EC, TC, Chl a, Fe, Mn, true colour, TSS, H2S, DOC, TOC, NH4, NOX, FRP, TN, TP, silica, Chl a, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None. Mt Crosby Weir (also TS sampling) Inflow: Khalo: Fortnightly – total phytoplankton, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Headwater: Fortnightly – Total Cyano, EC, TC, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO Monthly – Total Cyano, EC, TC, Chl a, Fe, Mn, true colour, TSS, DOC, TOC, NH4, NOX, FRP, TN, TP, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO. Tailwater: None, estuarine		
Monitoring requirements – Bank condition 159(1) The resource operations licence holder must inspect banks for evidence of collapse or erosion within the ponded areas and downstream of the relevant infrastructure listed in Attachments 5, 6 and 7 following instances of— (a) rapid water level changes; (b) large flows through infrastructure; or (c) other occasions when collapse or erosion of banks may be likely. 159(2) For subsection 1, downstream of the relevant infrastructure means the distance of influence of infrastructure operations.	Not compliant with ROP (inspections undertaken for ponded areas but not stream bank or downstream) No reporting or monitoring currently undertaken for ROP purposes however Dam Safety monitor dam wall and embankments directly surrounding dam storage.	Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011).	1 July 2010 – December 2011.
Reporting requirements 161 The resource operations licence holder must provide— (a) quarterly reports; (b) annual reports for the previous water year; (c) operational reports; and (d) emergency reports.	Not compliant with ROP. No reporting.	Refer ss162-167	Refer ss162-167.
Reporting requirements – Quarterly Report 162(1) The resource operations licence holder must submit a quarterly report to the chief executive after the end of each quarter, of every water year. 162(2) The report must contain the following data— (a) stream flow and infrastructure water levels—all records referred to in section 152 of this plan; (b) the total volume of water for each quarter— (i) taken for each zone; (ii) entitled to be taken from each zone; (c) water quality—all records referred to in section 158 of this plan; (d) a summary of bank condition monitoring and incidences of slumping, undertaken in accordance with section 159 of this plan; and (e) the details and status of any programs implemented under section 13 of this plan.	Not compliant with ROP. No reporting.	Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures. Commencing 1 July 2010 the following will be implemented: • ROP datasets will be supplied quarterly, as required under the ROP. • ROP Compliance Report will be submitted with the quarterly reporting process, including exceptions to ROP requirements and an update on the Interim Program, as required under the ROP. Results of weekly bank condition monitoring will be collated quarterly and reported, with progressive implementation commencing 1 July 2010 and fully implemented by December 2011. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss152, 158 and 159 for further details.	1 July 2010 – December 2011.
Reporting requirements – Annual Report 163(1) The resource operations licence holder must submit an annual report to the chief executive after the end of the water year. 163(2) The annual report must include—	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to s164 for further details.	1 July 2010 – December 2012

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
(a) water quantity monitoring results required under section 164 of this plan; (b) details of the impact of infrastructure operation on water quality as required under section 164 of this plan; (c) a discussion about any issues that arose as a result of the implementation and application of the rules and requirements of this plan.			
Reporting requirements – Water quantity monitoring – Annual Report 164 The resource operations licence holder must include in the annual report under section 163— (a) A summary of announced allocation determinations, including— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the date and value for the initial announced allocation and for each change made to an announced allocation; (b) instances where critical water sharing arrangements have been implemented— (i) an evaluation of the announced allocation procedures and outcomes; and (ii) the commencement date(s) and effective period(s) for each stage of the arrangements and outcomes; (c) records from infrastructure—records referred to in section 153; (d) the total annual volume of water taken by each water user, specified by zone, namely— (i) the total annual volume of supplemented water taken; (ii) the total annual volume of supplemented water entitled to be taken; and (iii) the basis for determining the volume entitled to be taken; (e) details of seasonal water assignments, namely— (i) the total number of seasonal water assignments arrangements; and (ii) the total volume of water seasonally assigned; (f) all details of changes to infrastructure or the operation of the infrastructure that may impact on compliance with rules in this plan; and (g) details of any new monitoring devices used such as equipment to measure stream flow.	Not compliant with ROP. No reporting.	Sequater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevent interim programs for various requirements as specified under the ROP. Refer to ss76, 77, 78, 80, 88, 100, 101, 103, 110, 153, 155, 156 and 157 for further detail. s164(a): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(b): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s164(c): No operable outlet works exist at Mount Crosby Weir and cannot be implemented without significant investment. Releases are not made – only overflows, which are monitored and recorded. As such, it is proposed Seqwater report the overflows in compliance with ss153(2) and 153(3) instead of releases since none are made. Please refer to s153 for further details. ss164(d-e): Compliance with these requirements for the Central Brisbane River Water Supply Scheme is dependent on the development and implementation of a metering program within the Scheme (anticipated to be an ongoing program and will need to be implemented in close consultation with the Mid-Brisbane irrigators, timeframe likely to take until December 2012). All other schemes will be compliant from 1 July 2010. ss164(f-g): Seqwater will be compliant with these requirements from 1 July 2010.	ss164(a-b, f-g): 1 July 2010. s164(c): 1 July 2010 (note: overflows rather than releases will be reported for Mt Crosby Weir). Please refer to s153 for further details. s164(d-e): 1 July 2010 – December 2012. Please refer to ss88, 155 and 156 for further details.
Reporting requirements – Impact of infrastructure operation on natural ecosystems – Annual report 165 The resource operations licence holder must include in the annual report under section 163— (a) a summary of environmental considerations made by the resource operations licence holder in making operational and release decisions; (b) a summary of the environmental outcomes of the decision including any adverse environmental impacts; (c) a summary of bank condition and fish stranding monitoring and assessment, including— (i) results of investigations of bank slumping or erosion identified in ponded areas or downstream of infrastructure; (ii) results of investigations of fish stranding downstream of infrastructure; and (iii) changes to to the operation of infrastructure to reduce instances of bank slumping, erosion or fish stranding; (d) a discussion and assessment of the following water quality issues— (i) thermal and chemical stratification in each water storage associated with infrastructure; (ii) contribution of the water storage and its management to	Not compliant with ROP. No reporting.	Seqwater will submit an annual report as required, commencing for the 2010/2011 water year. Collation of data for required reporting is dependent upon the implementation of relevant interim programs for various requirements as specified under the ROP. Refer to ss 158 and 159 for further details.	1 July 2010 – December 2011.

Relevant ROP Requirement	Programs Currently in Existence (as submitted to DERM in February 2010 and confirmed in 2010 Approved Interim Program)	Interim Program, including Methodology	Timetable
the quality of water released; (iii) cumulative effect of successive water storages associated with infrastructure on water quality; (iv) cyanobacteria population changes in response to stratification in each water storage; and (v) any changes to the monitoring program as a result of evaluation of the data.			
Reporting requirements – Operational Report 166 The resource operations licence holder must— (a) notify the chief executive within one business day of becoming aware of any of the following operational incidents— (i) a non-compliance by the resource operations holder with the rules in this plan; and (ii) instances of fish stranding or bank slumping within the impounded areas or downstream of infrastructure listed in Attachment 9, Table 1 or watercourses associated with the operation of the Central Brisbane River, Cressbrook Creek, Pine Valleys and Stanley River water supply schemes; (b) provide to the chief executive a report which includes details of— (i) the incident; (ii) conditions under which the incident occurred; and (iii) any response or activities carried out as a result of the incident; (c) notify the chief executive upon commencement and cessation of critical water sharing arrangements; and (d) notify the chief executive on approval of any seasonal water assignment, including— (i) the name and location of the assignees and assignors; and (ii) the zone or zones where water is being seasonally assigned to and from; (e) notify the chief executive upon making a decision relating to an initial announced allocation and/or its recalculation; (f) transfer to the chief executive— (i) details of any arrangements of addressing circumstances where the resource operations licence holder is unable to supply water allocations under subsection (e); and (ii) relevant supporting information used in making a decision under subsection (e).	Not compliant with ROP. No reporting.	ss166(a)(i), (b): Seqwater will submit operational reports as required, commencing for the 2010/2011 water year. s166(a)(ii): Process for reporting instances of fish standing and bank slumping will be progressively implemented beginning 1 July 2010 with finalisation by December 2011. Ponded area bank inspections for erosion are currently being undertaken on a weekly basis. Seqwater will add interim downstream visual bank inspections to weekly surveillance inspections with results collated quarterly and reported (commencing 1 July 2010 and implemented by September 2010). These interim downstream visual inspections will allow to the distance of influence of infrastructure for each storage to be determined and an appropriate monitoring and inspection program to be implemented (commencing December 2010 and fully implemented by December 2011). s166(c): New Critical Water Sharing Arrangements processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010). s166(d): Procedures for monitoring and approving Seasonal Water Assignments have been developed and will be in place for all schemes from 1 July 2010, however, it should be noted that Seasonal Water Assignments in the Central Brisbane River Water Supply Scheme are connected to implementation of a metering program (anticipated to take until December 2012 – please refer to ss88 and 164 for further detail). s166(e-f): New Medium Priority and High Priority Announced Allocation processes and procedures will be in place by the commencement of the 2010/2011 Water Year (i.e. from 1 July 2010).	1 July 2010 – December 2011.
Reporting requirements – Emergency report 167 In an emergency where the resource operations licence holder cannot comply with a rule in this plan as a result of an emergency, the resource operations licence holder must— (a) notify the chief executive upon discovery of the emergency; and (b) provide to the chief executive a report that includes— (i) details of the emergency; (ii) conditions under which the emergency occurred; (iii) any responses or activities carried out as a result of the emergency; and (iv) any rules specified in this plan that the resource operations licence holder is either permanently or temporarily unable to comply with due to the emergency.	Not compliant with ROP. No reporting.	Seqwater will submit emergency reports as required, commencing for the 2010/2011 water year.	1 July 2010.

Attachment 8, Table 1 – Water Allocation Schedule

Relevant ROP Requirement	Programs Currently in Existence	Interim Program, including Methodology	Timetable
Water Allocation Number 137: Brisbane Zone, Any Purpose, 25ML,	The map in Attachment 2(b) of the ROP does not include Somerset		

High Class A Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	The zone where this entitlement has been issued does not include Somerset Dam, where part of this water allocation has always been taken. Due to the boundaries of the Brisbane Zone, this allocation is currently being taken outside of the specified zone in the ROP.	
Water Allocation Number 139: Mid-Brisbane Zone, Any Purpose, 150ML, Medium Priority, "This authorisation was authorised to continue under section 360ZDP of the *Water Act 2000*.	In accordance with current take of water from the Mid-Brisbane zone.		

Attachment 9 – Resource operations licence holder monitoring: Locations where continuous time series height and flow data and storage water level data are required.

Location	Continuous time series storage water level data	Continuous time series flow data	Programs Currently in Existence	Interim Program, including Methodology	Timetable
Mount Crosby Weir inflow		Y	Not continuous	A daily inflow derivation model is being developed which will incorporate outflow from Wivenhoe Dam, flow from Lockyer Creek and local area, change in Mt Crosby water levels and local irrigation and water supply demands.	1 July 2010.
Mount Crosby Weir headwater level	Y		Continuous	Water level is monitored via ALERT to a 20mm resolution.	1 July 2010.
Mount Crosby Weir tailwater		Y	Not continuous	Downstream of Mt Crosby Weir is tidal and, as such, a downstream gauging station will not provide estimates of river flow. Releases are not made from Mt Crosby Weir and any flow through the fish way and over the weir crest will provide an estimate of the flow from the weir.	Estimate of flow from the weir in place by 30 December 2010,
North Pine Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
North Pine Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
North Pine Dam tailwater		Y	Not continuous	Water level is monitored continuously at the Dayboro Rd WPS Weir about 1km downstream of North Pine Dam. At present, this is only available via SCADA and is not rated. Until the rating is developed and equipment installed at the site to enable remote monitoring, flow downstream of North Pine Dam can be estimated from the gate and valve openings at the Dam (anticipated for July 2011). A rating can be developed for the Dayboro Rd Weir based on recorded flows and heights.	July 2011.
Somerset Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be in place by 1 July 2010.	1 July 2010.
Somerset Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Somerset Dam tailwater		Y	Not continuous	Somerset Dam tailwater is affected by levels in Wivenhoe Dam. When full, the water in Wivenhoe back up to the toe of Somerset Dam. As such, a tailwater gauge is considered inappropriate. Outflows from Somerset can be estimated from the recorded openings of the gates, sluices and valves at the dam.	Nil
Wivenhoe Dam inflow		Y	Not continuous	A new daily inflow model is being developed and will be available by 1 July 2010.	1 July 2010.
Wivenhoe Dam headwater level	Y		Continuous	Compliant.	1 July 2010.
Wivenhoe Dam tailwater		Y	Not continuous	Please note: Water level is continuously monitored and recorded via ALERT and on-site logger with a resolution of 20mm which is owned by DERM not Seqwater (143035A). The site is rated but can be affected by backwater from Lockyer Creek. Discharge from the dam can also be estimated via the rated gates and valves. Since the gauge is owned by DERM, Seqwater will not undertake monitoring for tailwater at this site.	Seqwater will not undertake monitoring for tailwater at this site since the gauge is owned by DERM (143035A).

"PB-30"

Queensland Government

Ministerial Media Statements

[redacted]

Search

Minister for Natural Resources, Mines and Energy and Minister for Trade
The Honourable Stephen Robertson

Sunday, February 13, 2011

Seqwater to undertake dam release

13 February 2011

Seqwater intends to reduce the Wivenhoe Dam level for the remainder of the wet season, given the extreme floods in January and the current water security of South East Queensland.

Seqwater has formally recommended Wivenhoe Dam's be temporarily reduced to 75 per cent of its current Full Supply Level and expects to implement the release strategy gradually during the next week.

The Minister for Natural Resources, Stephen Robertson, said the release was recommended by Seqwater after its recent hydrology analysis and was a precaution given the second strongest La Nina pattern in history continues to influence the current wet season.

"Seqwater made its recommendation recognising the extreme January 2011 event that left the catchments soaked and the water tables full," Mr Robertson said.

"While we can't be certain about what rain is yet to come in this wet season, this measure reflects an abundance of caution.

"Seqwater has advised that a reduction in Wivenhoe's Dam storage level to 75 per cent of its Full Supply Level provides appreciable flood mitigation benefits ahead of any major rain events in the remainder of the wet season."

SEQ Water Grid manager Chief Executive Officer Barry Dennien said he had advised Seqwater a reduction to 75 per cent would be manageable from a water security perspective.

Mr Dennien said the January floods also transformed our long-term water storage capacity with the recently completed Wyaralong Dam now full five years earlier than expected and now storing 103,000 megalitres which is able to be connected to the Water Grid when required.

"With Wyaralong full, other dams full around the region and the Grid in place, Wivenhoe Dam can be operated at a lower level for the rest of the wet season without impacting on water security," Mr Dennien said.

Seqwater Chief Executive Peter Borrows said Seqwater expected to implement the release later this week to reduce the drinking water storage capacity of Wivenhoe Dam from 1,165 million megalitres down to around 874 million megalitres.

"We are likely to begin the transition by next weekend, with a slow release rate over about nine days discharging around 30,000 megalitres each day," he said.

"We will adjust the release to take into account any rainfall and tides as usual and this slow release will ensure no significant downstream impacts."

Mr Borrows said that like other low volume releases in the past, there will be a limited number of bridges immediately downstream of Wivenhoe (Twin Bridges, Colleges Crossing and Savages Crossing) which will be closed during the period.

Mr Robertson said Seqwater's operational decision reflected current circumstances rather than issues which likely to be considered by the Commission of Inquiry into the recent floods.

"As per its terms of reference, the Commission of Inquiry will continue to assess dam operations during the January flood event and whether any changes to the long term framework are required," Mr Robertson said.

Mr Borrows said the dam would be maintained at 75 per cent of the current Full Supply Level until April, after the end of the wet season.

About Wivenhoe Dam

Wivenhoe Dam was built in 1985 to provide flood protection for South East Queensland after the devastation of the 1974 floods .

About 40 per cent of the dam's capacity is devoted to storing drinking water and the remaining 60 per cent is for flood mitigation. The dam is said to be at 100 per cent full supply level when the drinking water component is full.

The strategy and requirements for operating the dam, including flood mitigation and water releases, are outlined in the Dam Operations Manual. This Manual was developed in 1992. Since then it has been revised six times, most recently in January 2010.

The Manual is approved by the State's Dam Safety Regulator, in accordance with the Water

Supply Act 2008.

Media contact: 0417 154 660

seqwater
WATER FOR LIFE

Media Release

13 February 2011

Temporary reduction in Full Supply Level in Wivenhoe Dam

Statement by:
Peter Borrows – Chief Executive Officer, Seqwater

Seqwater has recommended to the Government that the water level in Wivenhoe Dam be temporarily reduced to 75% of full supply.

We have done this for three reasons:

1. We received information from that there was no objection from a drinking water security perspective to the temporary reduction.
2. The extreme nature of the January flood event.
3. Our modelling has demonstrated appreciable flood mitigation benefits with this reduction.

This recommendation has not been made lightly. It is a recommendation that balances drinking water security and flood mitigation.

The recent floods and other natural disasters across Queensland have changed the landscape for all of us. We now have new data which must be considered. Let me put that data into perspective.

The inflow into Wivenhoe Dam from this January flood event was almost double that of the 1974 flood. Water was flowing into the Dam 50% faster than it was flowing 1974.

So the January event clearly created another benchmark which must be acted on.

That data has now been considered in Seqwater's modelling. This modelling has been peer reviewed by external experts, and involved 90 permutations of nine different flood events.

Given that we are still in the middle of the wet season, and given, rightly so, the community has zero tolerance for another flood event like January, as well as for the reasons I outlined at the outset, it is prudent we recommended reducing levels at Wivenhoe Dam to 75% of full supply.

Let me tell you how we do that.

Media Release

There are a lot of considerations – these are around the timing of the releases, the current weather forecast, and the impacts downstream. We also need to advise local residents, industry, business, irrigators and Councils of the timing of releases.

With these considerations in mind, we intend to start releasing water later this week, at a steady, controlled rate.

There are seven bridges immediately below Wivenhoe. This release will affect only three – Twin Bridges, Savages Crossing and Colleges Crossing. These three bridges will be closed to traffic during the release period. There are alternative routes available in each of these communities.

These releases will not impact tides and therefore will not affect Brisbane city and suburbs. It is also important to remember this is an interim measure for the remainder of the summer. The longer term approach will be shaped by the Commission of Inquiry's outcomes.

There have been a lot of questions and speculation in recent weeks and rightly so. These are matters to be dealt with during the Inquiry, but I do want to make a couple of observations:

- I want to reiterate that the January floods changed the landscape and set another flood benchmark;
- It is our view that we acted appropriately and in accordance with the Manual. Rightly, this will be considered by the Commission of Inquiry.

I also want to stress the current operating Manual has served us well. Most of the community is unaware that in 1999 and 1983 there were two significant flood events upstream of Wivenhoe, that were almost as big as 1974. During both of these events Wivenhoe did its job, and the Manual provided the guidance and strategies necessary to manage these two events without any major community impact.

We are currently in the process of reviewing the January event, including the Manual. A report will be provided to the Dam Safety Regulator and the Commission.

Finally, I want to reiterate that Wivenhoe Dam only protects 50% of the catchment. The Dam cannot eliminate floods. It was designed to mitigate floods, and this is what it has done.

ENDS

Media Release

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"PB-31"

Queensland water Commission

Securing our water, together.

Our ref: ME/11/0017

14 February 2011

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

RECEIVED
17 FEB 2011

Dear ~~Mr Borrows~~ Peter

On 20 January 2011, the Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy and Minister for Trade, wrote to the Queensland Water Commission (Commission) requesting the Commission provide all necessary assistance to Seqwater to ensure the Minister's requests to Mr Phil Hennessy, Chair, Seqwater, as raised in his letter of 20 January 2011, are able to be responded to as a matter of priority and with urgency.

On 25 January 2011, the Commission advised the Minister that it was liaising with Seqwater and undertaking preliminary work to support the matters raised.

Since that time the Commission has progressed its work in order to be in a position to provide advice to Seqwater and/or the Minister as and when required.

On 4 February 2011, you provided us with a copy of a letter from Seqwater's Chair to Minister Robertson regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset Dams. This letter advised that "DERM may be satisfied, based on advice from QWC and the WGM from a water supply security perspective, that Wivenhoe Dam's FSL could be reduced in the short term to, say, 75% of its current FSL".

I note that the South East Queensland (SEQ) Water Grid Manager has provided you with a letter on 9 February 2011, confirming that "from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75% of its FSL".

As you are aware, the Commission has now finalised a draft report as input information material for Seqwater, as requested by the Minister (attached), titled *Impacts on SEQ Water Strategy of Various Operating Scenarios for Wivenhoe Dam, 14 February 2011, Version 6*. The purpose of this report is to provide information on the potential impact on the security of supply in SEQ if a significant volume of water is released from the water supply capacity of Wivenhoe Dam as a potential flood mitigation measure. The information in this report has been shared with Seqwater officers during the course of its preparation, and a full version provided to you on 12 February 2011.

In preparing this report, the Commission has based its assumptions on the SEQ Water Strategy of July 2010, including the addition of purified recycled water into Wivenhoe at the 40% trigger level. Demand forecasts have been updated to align with the recent bulk water price review in November 2010.

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The report has considered scenarios as temporary options for the 2011 wet season, and commenced consideration of scenarios contemplating any permanent reductions to FSL from a Level of Service (LOS) yield perspective.

In summary, the report concludes that:

- If releases were made as a temporary measure to reduce the water level in Wivenhoe Dam by 25% from its FSL (a release of about 291,250 ML), the Risk Criteria of the *South East Queensland System Operating Plan* would still be met.
- Despite the above being met, if inflows for the next six years were as low as the 2001-2006 drought, full desalination may be triggered, as Grid 12 storage levels could drop to 60% in this time.
- As the volume released increases, more factors become impacted such as the increased likelihood of triggering desalination and the use of purified recycled water and restrictions, and potentially increased operating costs of the grid.
- Permanent reduction of the FSL by 25% will lower the LOS yield by about 30,000 ML/annum. This reduction in LOS yield may require the construction of new infrastructure to be brought forward by about five years to 2021, based on current demand assumptions. Other options to mitigate the yield reduction such as demand management measures may also be possible.
- Given the current demand is less than that in the recent bulk water price review assumptions used in this assessment, there is more confidence in the margin of supply security available in the demand/supply balance.
- Any permanent reduction would have to be more critically investigated, with this report commencing the analysis for purposes of assisting to inform the annual update of the SEQ Water Strategy and investigations related to the Brisbane River system.

Given the announcement on 13 February 2011 to lower the FSL to 75% for the 2011 wet season, the Commission looks forward to working with you closely in relation to any consideration of a permanent reduction of Wivenhoe's FSL.

The Commission would appreciate your feedback on this draft report, prior to formally progressing it as a final report to Seqwater and the Minister. I will be in touch shortly in order to discuss timing for your feedback with the aim of finalising the report within the next week or so.

If you require any further information, please contact me on [redacted] or on email at [redacted]

Yours sincerely

[redacted]

Karen Waldman
Chief Executive Officer

Enc (1)

cc John Bradley, Director General, Department of Environment and Resource Management

Barry Dennien, Chief Executive Officer, SEQ Water Grid Manager

INFORMATION MATERIAL ONLY

Queensland water Commission

Draft

Impacts on SEQ Water Strategy of Various Operating Scenarios for Wivenhoe Dam

14 February 2011

Version 6

Document Control

Date	Author/Reviewer	Description	Version
3/2/2011	Wai-Tong Wong	Draft	1
3/2/2011	Julie Allan, Mark Askins Richard Scott, Wendy Auton Justin Claridge, Gayle Leaver	Reviewed Draft - with edits	1, 2, 2A
8/2/2011	Wai-Tong Wong Mark Askins Wendy Auton	Draft edited with additional sections on modelling review by DERM, demand reduction and Waspp simulations. Incorporated comments by Karen Waldman	3
9/2/2011	Wai-Tong Wong Julie Allan, Mark Askins Wendy Auton, Justin Claridge John Collins (John Collins Consultants Pty Ltd)	Executive Summary added and section 4.1 edited. Comments from John Collins incorporated.	4
10/2/2011	Wai-Tong Wong Mark Askins, Wendy Auton Justin Claridge, Richard Scott	Incorporated strategic comments from Project Team meeting (Karen Waldman and Tad Bagdon)	5
11/2/2011	Wai-Tong Wong Julie Allan Mark Askins Justin Claridge	Incorporated minor edits and improved formatting	6

Approval

Date	Name	Description	Version
3/2/2011	Tad Bagdon Gayle Leaver	Reviewed	2
3/2/2011	Tad Bagdon Karen Waldman	Reviewed	2A
11/2/2011	Tad Bagdon Gayle Leaver Karen Waldman	Reviewed	5
11/2/2011	Tad Bagdon Karen Waldman	Reviewed	6

Table of Contents

Executive Summary

The purpose of this report is to provide information on the potential impact on the security of supply in South East Queensland (SEQ) if a significant volume of water is released from the water supply capacity of Wivenhoe Dam as a potential flood mitigation measure.

In the main the scenarios considered would be potentially a temporary measure over the 2011 wet season, based on the impacts to the SEQ Water Grid as a whole. The underlying assumptions used include the demand and supply capacity contained in the SEQ Water Strategy, with demand forecasts updated to align with the recent bulk water price review in November 2010.

For completeness two scenarios involving permanent reduction in the full supply volume of Wivenhoe Dam have also been considered, but further investigation is required to understand the full impacts. This assessment is based on sensitivity analysis of the total grid capacity and no detailed assessment has been undertaken.

The following observations can be drawn from these assessments:

- If releases were made as a temporary measure to reduce the water level in Wivenhoe Dam by 25% of full supply capacity (a release of about 291,250 ML), the (five year) Risk Criteria of the SEQ System Operating Plan (SOP) would still be met.
- Despite the SOP Risk Criteria being met, if inflows for the next 6 years were as low as the 2001-2006 drought, full desalination production may be triggered, as Grid 12 storage levels could drop to 60% in this time.
- As the volume released increases other factors become impacted such as the increased likelihood of triggering desalination and the use of purified recycled water and restrictions and potentially increased operating costs of the grid.
- Permanent reduction in the full supply volume of 25% will lower the LOS yield by about 30,000 ML/annum. This reduction in LOS yield may require the construction of new infrastructure to be brought forward by about 5 years to 2021, based on current demand assumptions. Other options to mitigate the yield reduction such as demand management measures may also be possible.

These analyses are an exercise in assessing risk management rather than a forecast for the future. Therefore an understanding of the consequences involved for a particular risk profile is important.

This report does not recommend a particular scenario for adoption as other factors such as social, economic and environmental may also need to be considered. It provides some risk information on the security of supply based on the short term (SOP Risk Criteria) and the long term water demand/supply balance in the SEQ Water Strategy.

Operational and regulatory impacts such as increased pumping costs and the Water Resource Plan have not been assessed. Advice from the responsible agency or entity would need to also be considered.

1 Purpose

The purpose of this report is to outline the results of the assessment, from a water supply security perspective for South East Queensland (SEQ) over the short and long term, of possible scenarios for lowering of Wivenhoe Dam below the current deemed full operating supply level (i.e. 100 percent dam level for water supply purposes). The effects of temporarily lowering the full supply level of Baroon Pocket and Hinze Dams were also assessed.

For the purpose of this report, short term is defined as the period over the next 5 years (as per risk criteria of SEQ System Operating Plan) where the supply security in SEQ may be impacted by any proposed temporary lowering of the Wivenhoe Dam operating level over the 2011 wet season.

Long term is defined as a period of up to 50 years in relation to the demand and supply (LOS Yield) balance in the SEQ Water Strategy.

This assessment does not consider the environmental, social and economic impacts of the dam operating levels in relation to flood mitigation for downstream properties and infrastructure.

2 Background

Major flooding occurred in the Brisbane River catchment on 13 January 2011.

This resulted in the Brisbane River peaking at [illegible]m at the Port Office in Brisbane City and causing extensive damage to properties and businesses throughout the catchment. The 2011 flood was about 1m lower than the 1974 Flood event of 5.45m at the Port Office, Brisbane City. However, indications are that the social and economic impacts are much more significant given the building and business developments in the catchment over the last 37 years. Flood rebuilding is currently estimated to cost about $5B.

The Minister for Natural Resources, Mines and Energy and the Minister for Trade has written to the Commissioner on 20 January 2011, requesting the Queensland Water Commission provide all necessary assistance to Seqwater in their review of the operation of Wivenhoe and Somerset Dams.

3 Role of Queensland Water Commission

3.1 Background/Context

The Queensland Water Commission (the Commission) is responsible for providing advice to the Minister on matters relating to water supply and demand management for water for SEQ. A key function of the Commission is to provide advice on the desired Levels of Service (LOS) for water supplied in SEQ.

The SEQ Water Strategy defines the LOS objectives to include the expected frequency, duration and severity of restrictions during future droughts based on a total demand of 375 litres/person/day (including residential, non-residential and system losses) of which 230 litres/person/day is attributed to residential demand. The LOS objectives are provided in Appendix A.

The Commission also makes and administers the South East Queensland System Operating Plan (SOP) under the *Water Act 2000* which sets out the rules for operating the SEQ Water Grid to help achieve the LOS objectives.

While the LOS objectives specify the basis for operating the Grid over the long term, the risk criteria of the SOP provide the basis for balancing water security and operating costs over the short term (up to 5 years).

The SOP risk criteria are given below:

Volume of water stored by all key water grid storages	Probability of reaching 40% and 30% volume of water stored		
	Within 1 year	Within 3 years	Within 5 years
40%	Less than 0.2%	Not Specified	Less than 5%
30%	Not Specified	Less than 0.5%	Less than 1%

3.2 Report to Seqwater

To support Seqwater's review of the operations of Wivenhoe and Somerset Dams, the Commission has conducted a series of modelling exercises to determine the potential impacts of certain operating arrangements on the security of supply for the region.

Consideration has been given to the ability of the SEQ Water Grid to continue to achieve the desired Level of Service objectives in the short term (up to 5 years) for various scenarios of lowering the deemed full water supply level particularly at Wivenhoe Dam, and also for Hinze and Baroon Pocket Dams.

For completeness two scenarios involving permanent reduction in the full supply volume of Wivenhoe Dam have also been considered, but further investigation is required to understand the full impacts. This assessment is based on sensitivity analysis of the total grid capacity and no detailed assessment has been undertaken.

These analyses are an exercise in assessing water security risk rather than a forecast for the future. Therefore an understanding of the consequences involved for a particular risk profile is important.

Operational and regulatory impacts such as increased pumping costs and the Water Resource Plan have not been assessed. Advice from the responsible agency or entity would need to also be considered.

This report provides an input, amongst other considerations, for Seqwater or other agencies to assist in developing advice to Government on the operating level of Wivenhoe Dam over this 2011 forecast wet season.

4 Short Term Impacts

The potential short term impacts are assessed using hydrological modelling. These are described in sections 4.1 to 4.3.

4.1 Use the SEQ Regional Water Balance Model (Wathnet Model) to assess the SOP risk criteria

The modelling conducted for this report was carried out using the Wathnet Model[1] which assesses the likelihood of reaching particular water storage volumes. Under the current operating arrangements and policies, the volumes of interest are:

- 60% of the Grid 12 volume, when full desalination production is triggered; and
- 40% of the Grid 12 volume, when full production of purified recycled water from the Western Corridor Recycled Water Project is triggered, to augment water supplies in Wivenhoe Dam and medium level restrictions would be introduced.

The Grid 12 storages and their corresponding capacities are provided in Appendix B.

Table 1 presents the five scenarios modelled. Scenarios 1 to 4 involved a reduction in water level at Wivenhoe Dam to 87%, 75%, 70% and 50% supply capacity with all other storages set at 100% full supply initially. The fifth scenario also includes a reduction of 50% capacity at Hinze and Baroon Pocket Dams with all other storages set at 100% full supply initially. This allows an assessment of the sensitivity to the security of supply should there be a need to also reduce the full operating levels in the Sunshine Coast (Baroon Pocket Dam) and Gold Coast (Hinze Dam).

For example, a 25% reduction of volume of [illegible],250 megalitres (ML) from Wivenhoe Dam would correspond to about 3 m drawdown from the full supply level based on the storage capacity data provided in Appendix B.

The key assumptions adopted for these runs were:

- Simulations start at the end of January 2011 with initial dam level (inflows from February 2011)
- Northern Pipeline Interconnector Stage 2 excluded
- Demand forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 litres/person/day by 2018)
- Medium series population growth consistent with SEQ population forecasts
- No desalination above 60% Grid 12 Storages
- Full desalination below 60% Grid 12 Storages

The scenarios do not consider day-to-day operational matters.

[1] Wathnet Model refers to the Generalised Water Supply Headworks Simulation using Network Linear Programming Model.

Table 1: Modelled scenarios

[redacted]				
1	13*	none	150,000	7.2
2	25	none	291,250	14.0
3	30	none	349,500	16.9
4	50	none	582,500	28.1
5	50	50 (Baroon Pocket) 50 (Hinze Dam)	693,500	33.5

* Scenario 1 was selected as a starting point for the assessment of 150,000 ML (about 12.9%, but rounded up to 13% in the Table).

This is only the total volume and the strategy for release has not been considered. Operational constraints are also not considered for the purpose of this assessment.

The corresponding risk criteria results as compared to the SOP requirements are shown in Table 2.

Table 2: Results of risk criteria

[redacted]						
1 year	**<0.2%**	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
5 year	**<5%**	0.09%	0.15%	0.20%	0.31%	0.49%
[redacted]						
3 year	**<0.5%**	<0.01%	<0.01%	<0.01%	<0.01%	0.01%
5 year	**<1%**	<0.01%	<0.01%	<0.01%	<0.01%	0.03%

From the above analysis, all scenarios 1 to 5 in Table 2 pass the SOP risk criteria. While this means that the risk associated with the short term security of supply is acceptable, the consequences of each scenario with respect to other factors would need to be examined – see Section 6.

4.2 Forecast the probability of Grid 12 storage levels over the next 5 years

To forecast the probability of the Grid 12 storages reaching a certain level, the Wathnet Model was used, based on stochastic data generation for 117 years of historical information.

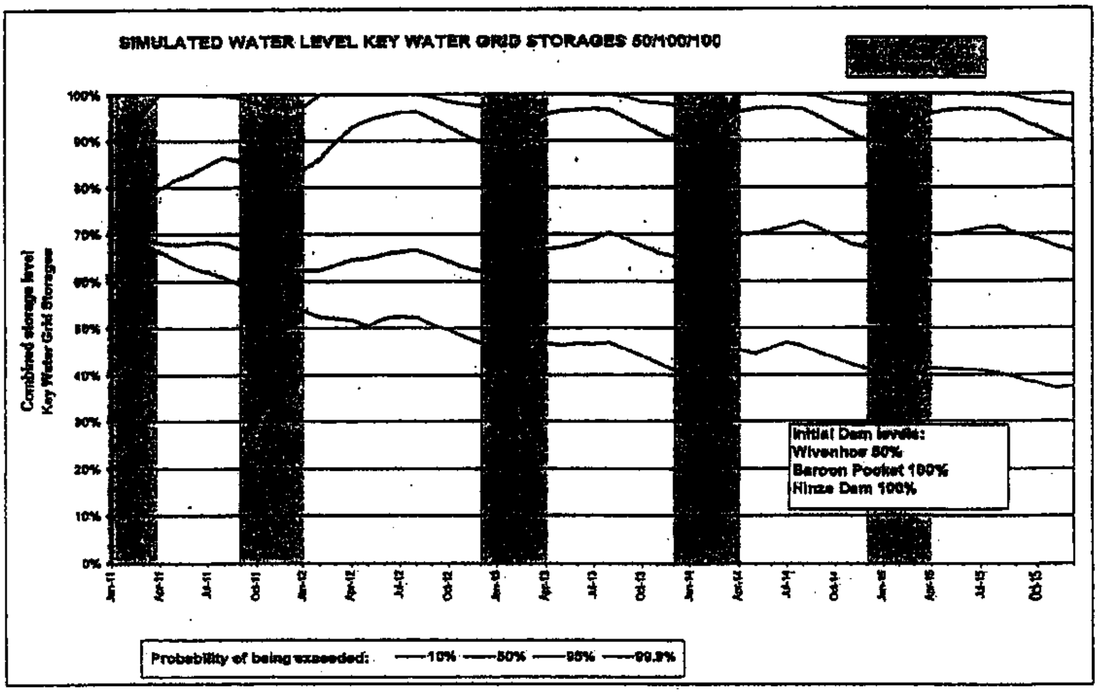
Stochastically generated data provides longer time sequences of hydrologic data that have similar statistical characteristics of that of the historical record. This data provides better information about climate variability and the potential for droughts worse than have occurred on record.

Figure 1 shows the forecast storage level for the Grid 12 storages for Scenario 4 (as described in Section 4.1) with Wivenhoe drawn down to 50% and the rest of the storages at 100% at the start of the simulation in end January 2011. (Note: The plots for Scenarios 1 – 3 would show higher storage levels than those shown in Figure 1).

In this scenario:

- there is a 95% probability that the combined Grid 12 storage level remain above 60% for the next 5 years;
- there is a 99.9% probability that the combined Grid 12 storage level remains above 40% for the next 4 years; and
- there is a 50% probability that the combined Grid 12 storage level will climb back to 90% and remain at this level for the remainder of the 5 year period.

Figure 1: Scenario 4 with Wivenhoe Dam drawn down to 50% - forecast combined Grid 12 storage level showing probabilities of exceedance

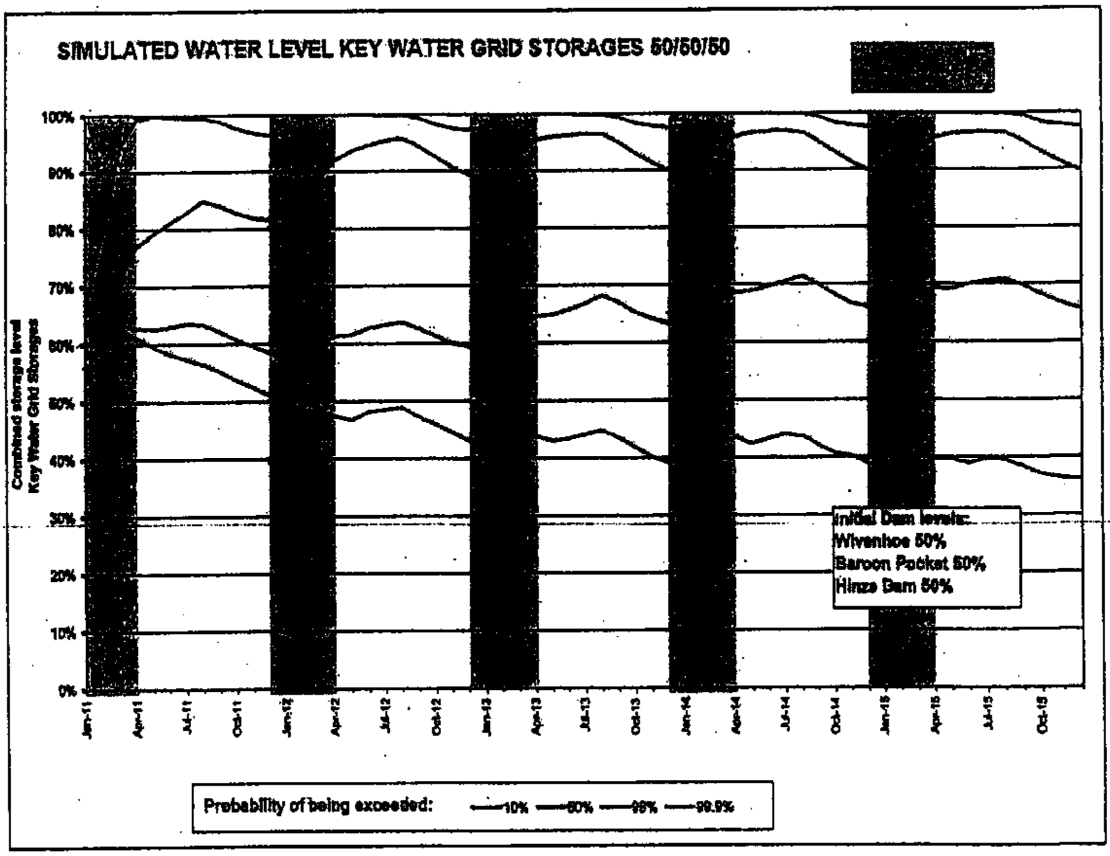


Scenario 5 (as described in Section 4.1) tests the sensitivity of the model findings by starting with Wivenhoe, Baroon Pocket and Hinze Dams all drawn down to 50% and the rest of the Grid 12 storages at 100% at the start of the simulation. This scenario represents the highest risk situation of all the modelled scenarios. The results are still within the bounds of the risk criteria set in the SOP.

In this scenario (Figure 2):

- There is almost a 95% probability that the combined Grid 12 storage level will stay above 60% for the next 5 years.
- There is at least a 95% probability (could be approaching 99.9%) that the combined Grid 12 storage level will stay above 40% for the next 5 years.
- There is a 50% probability that the combined Grid 12 storage level will climb back up to 90% and remain about this level for the next 5 years.

Figure 2: Scenario 5 with Wivenhoe, Baroon Pocket and Hinze Dams all drawn down to 50% - forecast combined Grid 12 storage level showing probabilities of exceedance



4.3 Simulated storage behaviour of Grid 12 storages over the next 6 years for three inflow scenarios (using Waspp Model)

The purpose of these simulations was to assess the potential behaviour of the Grid 12 storages over the next 6 years using three inflow scenarios based on probability of combined inflows into the storages.

For all inflow scenarios, Wivenhoe Dam was assumed to be initially at 75% capacity.

There are various methodologies that could be used for the selection of inflow sequences. For the purpose of this work, it is considered necessary to test scenarios covering a period of relative wet, of average inflow and of the driest years. The annual inflows for the Grid 12 storages from 1890 to 2007 were used in the analysis. Table 5 provides the scenarios corresponding to the 30% (wet), 50% (average) and 100% (dry) exceedance probabilities based on 6 years of cumulative inflow sequence.

The worst 6 years of inflows (100% exceedance probability) was found to correspond to the most recent drought on record from 2001 to 2006 as shown in Scenario 3 (Table 5).

Table 5: Inflow scenarios assessed

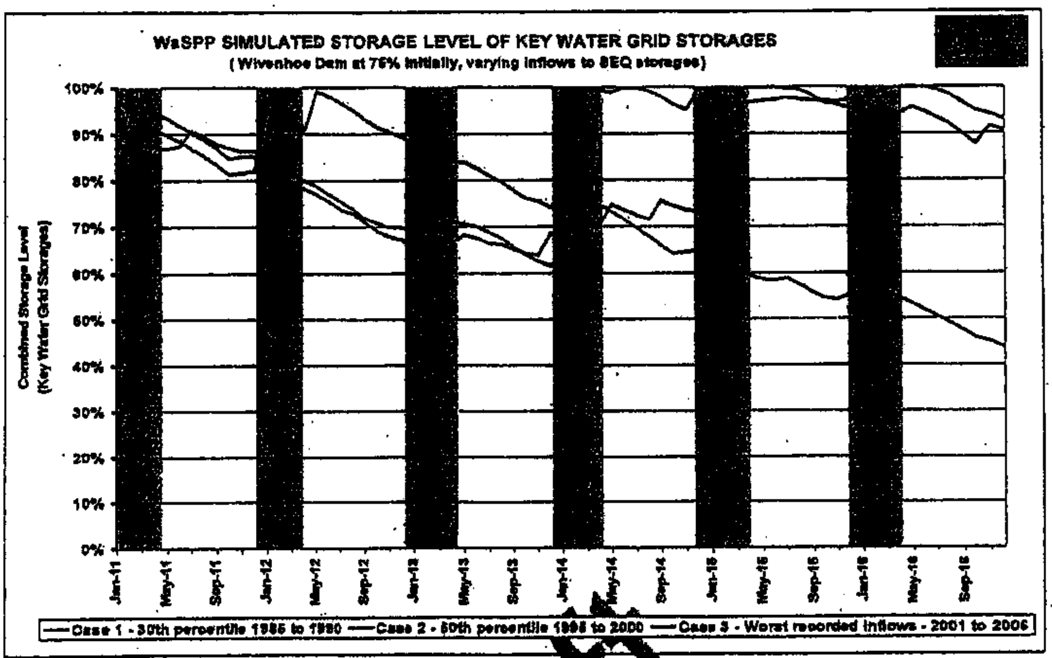
[illegible]	[illegible]	[illegible]	[illegible]
1	30%	[illegible]	10,193,300
2	[illegible]	J[illegible]995 – Dec 2000	7,243,300
• 3	• 100[illegible]	• Jan 2001 – Dec 2006	• 2,752,000

The assumptions adopted in the modelling were:

- 75% initial storage volume at Wivenhoe Dam (all other storages at 100% full) - or Grid 12 storages at 86% capacity
- Demands forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 litres/person/day by 2018)
- Full desalination production when Grid 12 storages drop below 60% capacity, and no desalination above 60%
- Northern Pipeline Interconnector Stage 2, Hinze Dam raising and Wyaralong Dam not included
- Purified Recycled Water introduced into Wivenhoe Dam when Grid 12 storages drop below 40% capacity.

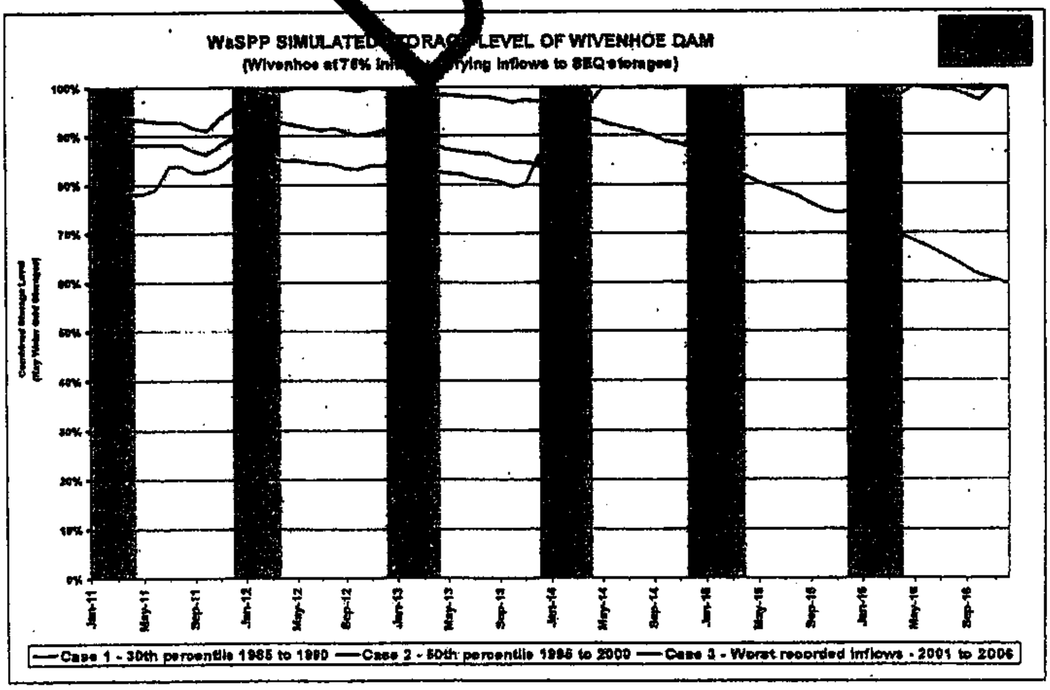
The results of the simulations for the 3 scenarios are shown in Figure 3. The worst case scenario from the historical records shows the lowest combined storage levels after June 2014, but staying above the 40% capacity to the end of 2016. Under this scenario of inflows, Purified Recycled Water is not expected to be introduced into Wivenhoe Dam within the next 5 years. For scenarios 1 and 2, the storage levels generally decreased for the first 3 years before increasing thereafter.

Figure 3: Simulated Grid 12 storage levels for 3 inflow scenarios



The simulated storage level behaviour of Wivenhoe Dam for the three inflow scenarios is indicated in Figure 4. As expected, the simulated level for Wivenhoe Dam reduces significantly due to the worst inflow sequence. With scenarios 1 and 2, Wivenhoe Dam recovers within about 3 years.

Figure 4: Simulated Wivenhoe Dam storage levels for 3 inflow scenarios



5 Long Term Impacts - assessment of the potential impact on the LOS Yield (using Wathnet Model)

To assess the long term impacts on the LOS yield if Wivenhoe Dam was permanently operated at a reduced water supply capacity, two scenarios involving a 10% and 25% reduction from full supply level were investigated.

This assessment is carried out for completeness only and does not suggest that the dams be operated permanently with a reduced full supply level. Further investigation is necessary to understand the full impacts.

The Regional Water Security Program for SEQ establishes the desired LOS objectives which form a basis for the SEQ Water Strategy and are implemented through the SOP. These objectives provide long term security of water supply and are defined as the:

- desirable maximum frequency, duration and severity of water restrictions, and
- the average amount of water per person that must be supplied in normal times.

These objectives are used to determine the Level of Service (LOS) Yield. The LOS Yield is used, along with the projected demands, to ensure that adequate initiatives are in place to meet demand in the future.

The LOS Yield for the 2010 Infrastructure (capacity to deliver) is assessed to be 485,000 ML/a. This assumes that the desalination plant is providing 125 ML/day and Purified Recycled Water (PRW) 142 ML/day.

To assess the impact on the long term LOS Yield, the Wathnet Model was used.

This assessment was based on the following assumptions:

- 2010 Infrastructure, prior to the full operation of Wyaralong Dam and Hinze Dam Stage 3
- PRW production at 52,000 ML/a (142 ML/day) and supplies 34,950 ML/a (96 ML/day) to industry
- Desalination production at 46,000 ML/a (125 ML/day)

5.1 Results – 10% reduction on Full Supply Volume for Wivenhoe Dam

The LOS Yield for the 2010 Infrastructure (capacity to deliver) is assessed to be 485,000 ML/a.

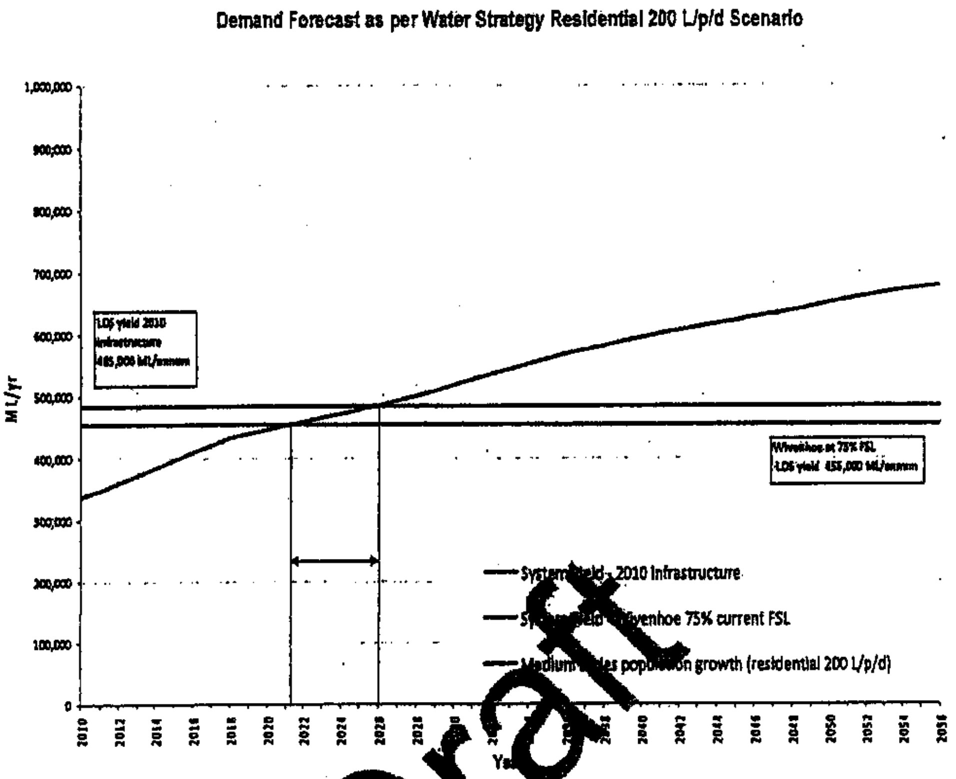
Preliminary modelling work suggests that the impact of a permanent 10% reduction in the full supply volume at Wivenhoe Dam is minimal on the LOS yield as this is within the tolerance of the model. This needs further investigation.

5.2 Results – 25% reduction on Full Supply Volume for Wivenhoe Dam

There is a significant reduction in the LOS yield of 30,000 ML/annum with a scenario where Wivenhoe Dam was permanently operated at 25% lower than the full supply level. The LOS yield has reduced from 485,000 ML/annum to 455,000 ML/annum.

Figure 5 shows that new infrastructure would need to be brought forward by about 5 years to about 2021 from 2026 under medium series population growth.

Figure 5: LOS Yield comparison



5.3 Potential for demand reduction

One of the input factors that impacts on the water supply balance is the level of extractions from the supply storages. The level of extraction depends on the level of demand in South East Queensland (SEQ).

The supply balance and risk assessment modelling conducted for this information paper includes the level of expected demand based on residential water consumption of 200 litres/person/day (l/p/d). This demand scenario is the same as the demand forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 l/p/d by 2018).

The 200 l/p/d demand scenario is the equivalent of total water demand of 870 ML per day for SEQ or 317,550 ML per annum.

The level of total water demand in SEQ for the last three months has been approximately 670 ML/d, which when annualised gives 244,550 ML per annum. On a per person basis this is the equivalent of 150 l/p/d. However, this level of consumption is unlikely to remain at this level.

The late 2010 demand scenario includes a residential demand at approximately 185 l/p/d for 2011, being the equivalent of 800 ML per day for SEQ or 292,000 ML per annum. If demand was to be maintained at this level, this represents a demand saving of 25,550 ML per annum.

A saving of 25,550 ML per annum (difference between 317,550 and 292,000 ML per annum) would significantly offset the LOS yield reduction of 30,000 ML/annum if Wivenhoe Dam was operated at 25% lower than Full Supply Level (FSL) over a long period (Refer to section 5.2).

6 Implications of each scenario

Table 3 provides a general framework for the assessment of the consequences of each scenario based on the following criteria for the short, intermediate and long term periods:

- Security of supply - involves examining the sufficiency, LOS Yield, desalination, and demand and supply balance
- Levers – these are some of the factors that could be reviewed to optimise the security of supply such as Levels of Service, policies and assumptions
- Inputs – these are some of the input factors which could be impacted e.g. allocation/yield, demand and supply
- Pricing – some of the scenarios may impact upon a future review of the Price Path such as through increases in operating costs.

The following observations are made and reflected in Table 3:

Short Term Reduction in Full Supply Capacity

- If releases were made as a temporary measure to reduce the water level in Wivenhoe Dam by 25% of full supply capacity (a release of about 291,250 ML), the Risk Criteria of the SEQ SOP (System Operating Plan) would still be met.
- As the volume released increases, more factors become impacted such as, the increased likelihood of triggering desalination, use of purified recycled water or introduction of restrictions and potentially increased operating costs of the grid.
- The SOP Risk Criteria are satisfied for scenarios with up to 50% of water released from Wivenhoe Dam. However other factors become impacted. This assessment deals only with the volume capacity and does not consider actual availability due to operational constraints.
- Operational costs may be impacted when the storage is drawn down to 50% as the grid operating costs will increase with the need for desalination being triggered more frequently.

Long Term (Permanent) Reduction in Full Supply Capacity at Wivenhoe Dam

- A reduction of 25% in the full supply level would have an impact on the security of supply.
- New infrastructure would need to be brought forward about 5 years to meet the LOS objectives for a 25% drawdown scenario.
- There could be an impact on the future bulk water through an increase in operational costs for a 25% drawdown scenario.

There could potentially be some optimal operating arrangement, indicated as Intermediate Option in Table 3. This could involve a review of the levers such as redefining the LOS objectives based on further investigations, to ensure that the short term operating options do not compromise the long term security of supply.

Table 3: Preliminary Framework for Consideration of Impacts on SEQ Water Strategy for Various Operating Levels of Wivenhoe Dam

Description	Base Case (status quo)	[redacted]
[redacted]		

Note: ✓ Minimal Impact × Impacted

[1] A permanent change in the full supply level of Wivenhoe Dam would require a review of available entitlements from Wivenhoe Dam under the Water Resource Plan.

[2] Needs further assessment.

7 Peer review of modelling by Department of Environment and Resource Management

The results of this modelling work were reviewed by the Queensland Hydrology Group of the Department of Environment and Resource Management.

The review of the input and results for the Wathnet Model was carried out by Dr John Vitkovsky, Senior Hydrologist, who stated that: "modifications were made to the WathNet SEQ Grid model for the purposes of a sensitivity analysis of the SEQ LOS statistics from lowering the full storage volume of key large storages. There (are) a number of changes to the model that can only be done by someone with intimate knowledge of the lower-level files in the model—and cannot be made using the spreadsheet. However, as long as it is only the SEQ volume LOS statistics that are being reported on and given the modifications made to the spreadsheet the results should be reasonable." Further:

- "The model setups for all runs seem correct
- The results seem entirely reasonable and satisfy the SOP Risk Criteria
- The output statistics for both the long-term and forecast model runs seem reasonable (without re-running those scenarios) and are compliant with the LOS and SOP criteria."

For the review of the Waspp Model, Mr Craig Johnston (Principal Hydrologist) has stated that "the results of the scenarios presented for review appeared logical and appropriate based on the rules of the SEQ Water Grid and the understanding (of) the model."

Appendix A – Level of Service Objectives (SEQ Water Strategy)

• During normal operating mode, sufficient water will be available from the SEQ Water Grid to meet an average regional urban demand of 375 litres per person per day (including residential, non-residential and system losses).

• Sufficient investment in the water supply system will occur so that:

-Medium Level Restrictions will not occur more than once every 25 years, on average

-Medium Level Restrictions will only reduce consumption by 15 per cent below the total consumption volume in normal operating mode

-drought response infrastructure will be not be required to be built more than once every 100 years, on average

-combined regional storage reserves do not decline to 10 per cent of capacity more than once every 1000 years, on average

-regional water storages do not reach 5 per cent of combined storage capacity

-Wivenhoe, Hinze and Baroon Pocket dams do not reach minimum operating levels.

• It is expected that Medium Level Restrictions will last longer than six months, no more than once every 50 years on average.

Appendix B - Grid 12 Storages in South East Queensland

As at 27 October 2010

	FULL SUPPLY VOLUME (Megalitres)
Southern	
Little Nerang	6,705
Hinze	161,073
Total Southern	167,778
Central	
North Pine	214,302
Somerset	379,849
Wivenhoe	1,165,238
Lake Kurwongbah	14,370
Leslie Harrison	24,868
Total Central	7,798,627
Northern	
Baroon Pocket	61,000
Cooloolabin	13,800
Ewan Maddock	16,587
Lake MacDonald	8,018
Wappa	4,694
Total Northern	104,099
TOTAL SEQ	**2,070,504**

Appendix C – Wivenhoe Dam Storage Capacity Data

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	COMM
82.00	22181	3555000	
81.75	21916	3499906	
81.50	21688	3445429	
81.25	21416	3391580	
81.00	21165	3338351	
80.75	20918	3285752	
80.50	20677	3233774	
80.25	20434	3182382	
80.00	20182	3131819	
79.75	19962	3081433	
79.50	19736	3031815	
79.25	19508	2982750	
79.00	19285	2934279	
78.75	19061	2886368	
78.50	18831	2839008	
78.25	18613	2792206	
78.00	18390	2745957	
77.75	18173	2700255	
77.50	17956	2655099	
77.25	17740	2610476	
77.00	17525	2566379	
76.75	17322	2522810	
76.50	17118	2479767	
76.25	16920	2437229	
76.00	16724	2395172	
75.75	16531	2353607	
75.50	16337	2312526	
75.25	16147	2271926	
75.00	15964	2231791	
74.75	15783	2192113	
74.50	15612	2152874	
74.25	15443	2114058	
74.00	15269	2075679	
73.75	15108	2037713	
73.50	14943	2000156	
73.25	14782	1963000	
73.00	14620	1926202	
72.75	14454	1889842	
72.50	14286	1853902	
72.25	14121	1818486	
72.00	13960	1783386	
71.75	13800	1748600	
71.50	13642	1714209	
71.25	13484	1680155	
71.00	13323	1646563	
70.75	13167	1613071	
70.50	13008	1580156	
70.25	12851	1547833	
70.00	12695	1515906	
69.75	12529	1484379	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	COMM
69.50	12365	1454357	
69.25	12205	1423657	
69.00	12046	1393246	
68.75	11889	1363332	
68.50	11723	1333815	
68.25	11561	1304714	
68.00	11401	1276013	
67.75	11240	1247714	
67.50	11080	1219815	
67.25	10916	1192321	
67.00	10751	1165238	
66.75	10572	1138589	
66.50	10389	1112378	
66.25	10187	1086644	
66.00	9990	1061414	
65.75	9797	1036687	
65.50	9596	1012448	
65.25	9412	988681	
65.00	9234	965370	
64.75	9056	942515	
64.50	8884	920090	
64.25	8712	898096	
64.00	8541	876532	
63.75	8371	855391	
63.50	8194	834691	
63.25	8027	814418	
63.00	7854	794557	
62.75	7710	775097	
62.50	7558	756014	
62.25	7402	737320	
62.00	7247	719011	
61.75	7115	701062	
61.50	6987	683435	
61.25	6865	666123	
61.00	6745	649112	
60.75	6629	632398	
60.50	6510	615966	
60.25	6400	599809	
60.00	6289	583927	
59.75	6180	568311	
59.50	6085	552975	
59.25	5975	537896	
59.00	5876	523082	
58.75	5775	508519	
58.50	5674	494206	
58.25	5573	480151	
58.00	5467	466348	
57.75	5371	452812	
57.50	5273	439507	
57.25	5179	426447	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	COMM
57.00	5078	413632	
56.75	4988	401068	
56.50	4897	388706	
56.25	4810	376573	
56.00	4721	364660	
55.75	4627	352973	
55.50	4537	341518	
55.25	4446	330291	
55.00	4348	319302	
54.75	4236	308561	
54.50	4144	298084	
54.25	4042	287861	
54.00	3942	277871	
53.75	3837	268147	
53.50	3735	258683	
53.25	3633	249474	
53.00	3524	240520	
52.75	3425	231845	
52.50	3320	223403	
52.25	3218	215260	
52.00	3121	207334	
51.75	3028	199651	
51.50	2938	192203	
51.25	2837	184983	
51.00	2742	178010	
50.75	2664	171276	
50.50	2576	164730	
50.25	2501	158382	
50.00	2437	152231	
49.75	2360	146258	
49.50	2264	140494	
49.25	2179	134939	
49.00	2100	129594	
48.75	2039	124434	
48.50	1957	119482	
48.25	1886	114644	
48.00	1820	110006	
47.75	1754	105542	
47.50	1688	101235	
47.25	1630	97073	
47.00	1580	93058	
46.75	1542	89123	
46.50	1489	85365	
46.25	1444	81670	
46.00	1390	78116	
45.75	1365	74673	
45.50	1312	71340	
45.25	1255	68130	
45.00	1214	65053	
44.75	1174	62068	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	COMM
44.50	1134	59185	
44.25	1095	56393	
44.00	1046	53727	
43.75	1008	51167	
43.50	977	48686	
43.25	944	46285	
43.00	911	43966	
42.75	879	41726	
42.50	838	39583	
42.25	801	37557	
42.00	774	35588	
41.75	744	33692	
41.50	718	31868	
41.25	686	30115	
41.00	659	28435	
40.75	625	26829	
40.50	599	25299	
40.25	575	23834	
40.00	554	22424	
39.75	533	21066	
39.50	512	19761	
39.25	494	18504	
39.00	475	17292	
38.75	456	16128	
38.50	439	15014	
38.00	398	12937	
37.50	338	11096	
37.00	309	9480	
36.50	279	8006	
36.00	202	6725	
35.50	184	5765	
35.00	168	4886	
34.50	153	4083	
34.00	132	3379	
33.50	104	2807	
33.00	95	2311	
32.50	84	1864	
32.00	80	1507	
31.50	66	1220	
31.00	51	959	
30.50	44	718	
30.00	39	510	
29.50	34	327	
29.00	30	167	
28.50	19	47	
28.00	3	12	
27.50	2	1	
27.00	0	0	
26.50	0	0	
26.00	0	0	

Level Datum: AHD - PM 34781 EL 74.704 m
Computed using photogrammetric DTM produced in 1988 from 1971 photography
Survey records : 25727 FD
Full Supply Level: EL 67.000 m AHD [1,165,200 ML : 10,750 ha]
River Outlet : EL 33.200 m AHD [2,510 ML : 82 ha]
Catchment Area: 7020 sq km
Latitude: 27 23 38 Longitude: 152 36 08

DEPARTMENT OF PRIMARY INDUSTRIES

BRISBANE RIVER - BASIN 143
WIVENHOE DAM 150.2 km

STORAGE DATA

A3-110405

19/06/95

"PB-32"

seqwater
WATER FOR LIFE

22 March 2011

Ms Karen Waldman
Chief Executive Officer
Queensland Water Commission
PO Box 15087
CITY EAST QLD 4002

By Email

Dear Ms Waldman,

Draft *Impacts on SEQ Water Strategy Various Operating Scenarios for Wivenhoe Dam* report

I refer to your letter dated 14 February 2011 which enclosed a draft copy of the *Impacts on SEQ Water Strategy Various Operating Scenarios for Wivenhoe Dam* report (***Report***) (Version 6). Your letter sought Seqwater's feedback on the Report.

Seqwater is willing to provide the Commission with advice and assistance in respect of flood modelling and flood event data to the extent that an assessment of flood mitigation impacts bears upon:

- the finalisation of the draft Report;
- any consideration by the Commission for the State of a policy to permanently adjust the full supply level (***FSL***) of Wivenhoe Dam; and
- any review of the *SEQ Water Strategy 2010* and associated SEQ System Operating Plan.

Seqwater acknowledges that it has an advisory role in providing such flood mitigation advice concerning its assets as may be requested by the Commission or State.

As you may be aware, Seqwater has previously provided the Department of Environment and Resource Management (***DERM***) with simulation modelling in order to support it in its consideration of the appropriate FSL for Wivenhoe Dam. A copy of our correspondence to DERM dated 7 February 2011 is attached.

It is Seqwater's view, however, that it is beyond the scope of Seqwater's function to comment on the water supply security implications of the scenarios presented in the Report other than to provide comment and modelling on the respective flood mitigation impacts of those scenarios. Please contact Ms Alex Fisher directly on Tel. (07) 3035 5755 in order to progress this matter.

As the operator of the Wivenhoe Dam, Seqwater is subject to the operational rules and procedures specified in the Moreton Resource Operations Plan (***ROP***) and, during flood events, the flood mitigation manual for Wivenhoe and Somerset Dams (***Manual***).

The ROP, promulgated by the State, specifies the FSL for Wivenhoe Dam.

Both the ROP and the Manual, which is approved by the State, are predicated on a policy of restricting releases below Wivenhoe Dam's FSL.

Queensland Bulk Water Supply Authority (trading as Seqwater) | ABN 75 450 239 876 | Corporate Office: Level 3, 240 Margaret Street Brisbane, Queensland | Ph 07 3229 3399 | www.seqwater.com.au

All correspondence to PO Box 16146 City East Qld 4002

Any permanent change to the FSL of Wivenhoe Dam would require changes to the ROP and the Manual.

Extension of time for Interim Supply Security Level

As you are aware, the Minister announced on 13 February 2011 that the water storage level of Wivenhoe Dam was to be reduced to 75% of its FSL until the end of the current wet season. Following an amendment to the ROP, Seqwater sought and obtained approval from the Chief Executive of the DERM for an Interim Program to override the operational procedures contained in the ROP, in order that Seqwater be authorised to undertake releases, on specified terms:

- to reduce the water storage level in Wivenhoe Dam to an "Interim Security Supply Level" being 75% of its FSL from 20 February 2011; and
- to return the dam to the Interim Security Supply Level where inflows occur after the initial reduction, until 31 March 2011.

The relevant authorisation under the approved Interim Program is accordingly due to expire on 31 March 2011.

Seqwater is considering whether to commence discussions with the State regarding an extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level. The extension of time, if proposed, would be for the period **1 April 2011 to 30 June 2011**.

In view of the dual functionality of the Wivenhoe Dam storage, as both water supply storage and providing capacity for flood mitigation, Seqwater would only progress discussions with the State regarding a further extension of time to the current requirements under the Interim Program on receiving advice from the SEQ Water Grid Manager in relation to short term security, and the Commission in relation to long term security, that such an extension in time would not impact unfavourably on water supply security in SEQ.

Accordingly, Seqwater requests advice from the Commission whether it would object to an extension of time to the temporary draw down to 75% of FSL in Wivenhoe Dam until 30 June 2011. We request that your advice by provided by midday on Monday, 28 March 2011.

Seqwater has also sought similar advice from the SEQ Water Grid Manager.

Subject to receiving confirmation of supply security in this further advice, Seqwater would consult the Chief Executive of the Department of Environment and Resource Management to ascertain whether he would be likely to approve an extension to the present arrangements under the Interim Program for the Interim Security Supply Level at Wivenhoe Dam to be continued to 30 June 2011. Such an approach to DERM would only be made in circumstances where both the SEQ Water Grid Manager and the Commission have no objection to such a proposal from a water supply security perspective.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Attach.

"PB-33"

22 March 2011

Barry Dennien
Chief Executive Officer
South East Queensland Water Grid Manager
PO Box 16205
City East QLD 4002

By email

Dear Mr Dennien,

Request for water security advice - Proposed extension of Interim Program to maintain 75% full supply level at Wivenhoe Dam to 30 June 2011

I refer to your letter dated 9 February 2011 regarding the water security impacts of temporarily lowering the Full Supply Level (***FSL***) of Wivenhoe Dam.

I acknowledge your advice that "from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary drawdown are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations".

In light of the above advice, Seqwater sought and obtained approval from the Chief Executive of the Department of Environment and Resource Management for an Interim Program to override the operational procedures contained in the Moreton Resource Operations Plan, in order that Seqwater be authorised to undertake releases, on specified terms:

- to reduce the water storage level in Wivenhoe Dam to an "Interim Security Supply Level" being 75% of its FSL from 20 February 2011; and
- to return the dam to the Interim Security Supply Level where inflows occur after the initial reduction, until 31 March 2011.

The relevant authorisation under the approved Interim Program is accordingly due to expire on 31 March 2011.

Seqwater is considering whether to commence discussions with the State regarding an extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level. The extension of time, if proposed, would be for the period **1 April 2011 to 30 June 2011**.

In view of the dual functionality of the Wivenhoe Dam storage, as both water supply storage and providing capacity for flood mitigation, Seqwater would only progress discussions with the State regarding a further extension of time to the current requirements under the Interim Program on receiving advice from the SEQ Water Grid Manager in relation to short term security, and the Queensland Water Commission in relation to long term security, that such an extension in time would not impact unfavourably on water supply security in SEQ.

Accordingly, Seqwater requests advice from the SEQ Water Grid Manager whether it would object to an extension of time to the temporary draw down to 75% of FSL in Wivenhoe Dam until 30 June 2011. We request that your advice by provided by midday on Monday, 28 March 2011.

Queensland Bulk Water Supply Authority (trading as Seqwater) | ABN 75 450 239 876 | Corporate Office: Level 3, 240 Margaret Street Brisbane, Queensland | Ph 07 3229 3399 | www.seqwater.com.au

All correspondence to: PO Box 16146, City East QLD 4002

Subject to receiving confirmation of supply security in this further advice sought from the SEQ Water Grid Manager and similar advice to be sought from the Queensland Water Commission, Seqwater would consult the Chief Executive of the Department of Environment and Resource Management to ascertain whether he would be likely to approve an extension to the present arrangements under the Interim Program for the Interim Security Supply Level at Wivenhoe Dam to be continued to 30 June 2011. Such an approach to DERM would only be made in circumstances where both the SEQ Water Grid Manager and the Queensland Water Commission have no objection to such a proposal from a water supply security perspective.

Yours sincerely

Peter Borrows
Chief Executive Officer

"PB-34"

Queensland water Commission

Securing our water, together.

Our ref: ME/11/0179

25 MAR 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

By email to: [redacted]

Dear ~~Mr Borrows~~ Peter

Thank you for your letter of 22 March 2011 including your request for advice on a proposed extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level from 1 April 2011 to 30 June 2011.

The Queensland Water Commission has no objection to this proposal as a temporary measure. Our analysis of the total grid capacity shows that the impact on water security by the extension of time is compliant with the South East Queensland System Operating Plan Risk Criteria.

It should be noted that operational and regulatory impacts such as potential increased pumping costs have not been assessed. Advice from the responsible agency or entity would need to also be considered.

If you would like to further discuss these matters or require any information, please contact Mr Tad Bagdon, Acting General Manager, Regional Planning and Policy on [redacted]

Yours sincerely

[redacted]

Ms Karen Waldman
Chief Executive Officer

Queensland Water Commission
PO Box 15087 City East Qld 4002
Ph: +61 7 3227 8207 Fax: +61 7 3227 8227
ABN: 65 242 908 036 web: www.qwc.qld.gov.au

"PB-35"

SEQ Water Grid manager

Secure and efficient water
through partnership and innovation

TRIM ref: D/11/2127

25 March 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear ~~Mr Borrows~~ Peter

Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011

I refer to your letter dated 22 March 2011 regarding Seqwater's consideration of extending the period in which Wivenhoe Dam is maintained at 75%, from 31 March 2011 to 30 June 2011.

As requested in your letter, to assist Seqwater in deciding whether it makes a recommendation to the Chief Executive of the Department of Environment and Resource Management, we confirm that temporarily maintaining Wivenhoe Dam at 75% up to 30 June 2011, is unlikely to impact on our ability to manage the Water Grid to achieve the desired levels of service and the System Operating Plan's risk criteria. Please note that this is based on information currently available and may be subject to change.

If you have any questions, please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

PO Box 16205, City East QLD 4002 Tel: +61 7 3247 3012 Fax: +61 7 3405 0373 www.seqwgm.qld.gov.au
ABN 14 783 317 630

"PB-36"

seqwater
WATER FOR LIFE

30 March 2011

Mr John Bradley
Director-General
Department of Environment & Resource Management
Level 13
400 George Street
Brisbane QLD 4000

Dear John,

Wivenhoe Dam - Interim Supply Security Level

Seqwater's approved interim program under the Moreton Resource Operations Plan obliges Seqwater to maintain the water storage level in Wivenhoe Dam at the Interim Supply Security Level (which is 75% of Full Supply Level) until 31 March 2011.

In view of the impending expiry of this part of Seqwater's interim program, Seqwater has recently sought advice from the Queensland Water Commission and the Water Grid Manager as to whether either agency has any objection from a water supply security perspective to an extension of the above temporary arrangements to 30 June 2011.

The advice received from the Queensland Water Commission and the Water Grid Manager (copies attached) is qualified in this regard.

Accordingly, Seqwater does not propose to submit a revised interim program.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Attach.

Queensland Bulk Water Supply Authority (trading as Seqwater) | ABN 75 450 239 876 | Corporate Office: Level 3, 240 Margaret Street Brisbane, Queensland | Ph 07 3229 3399 | www.seqwater.com.au

All correspondence to: PO Box 16146, City East QLD 4002

Queensland water Commission

Securing our water, together.

Our ref: ME/11/0179

RECEIVED
29 MAR 2011

25 MAR 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

By email to: [redacted]

Dear ~~Mr Borrows~~ Peter

Thank you for your letter of 22 March 2011 including your request for advice on a proposed extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level from 1 April 2011 to 30 June 2011.

The Queensland Water Commission has no objection to this proposal as a temporary measure. Our analysis of the total grid capacity shows that the impact on water security by the extension of time is compliant with the South East Queensland System Operating Plan Risk Criteria.

It should be noted that operational and regulatory impacts such as potential increased pumping costs have not been assessed. Advice from the responsible agency or entity would need to also be considered.

If you would like to further discuss these matters or require any information, please contact Mr Tad Bagdon, Acting General Manager, Regional Planning and Policy on [redacted]

Yours sincerely

[redacted]

Ms Karen Waldman
Chief Executive Officer

Queensland Water Commission
PO Box 15087 City East Qld 4002
Ph: +61 7 3227 8207 Fax: +61 7 3227 8227
ABN: 65 242 908 036 web: www.qwc.qld.gov.au

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/2127

25 March 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr ~~Borrows~~ Peter

Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011

I refer to your letter dated 22 March 2011 regarding Seqwater's consideration of extending the period in which Wivenhoe Dam is maintained at 75%, from 31 March 2011 to 30 June 2011.

As requested in your letter, to assist Seqwater in deciding whether it makes a recommendation to the Chief Executive of the Department of Environment and Resource Management, we confirm that temporarily maintaining Wivenhoe Dam at 75% up to 30 June 2011, is unlikely to impact on our ability to manage the Water Grid to achieve the desired levels of service and the System Operating Plan's risk criteria. Please note that this is based on information currently available and may be subject to change.

If you have any questions, please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

PO Box 16205, City East QLD 4002 Tel: +61 7 3247 3012 Fax: +61 7 3405 0373 www.seqwgm.qld.gov.au
ABN: 14 783 317 630

"PB-37"

January
WEEK 1

				2010	
				22	29
				23	30
W	3	10	17	24	
T	4	11	18	25	
F	5	12	19	26	
S	6	13	20	27	
S	7	14	21	28	

December 2010					
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
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S	5	12	19	26	

January 2011					
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S	2	9	16	23	30

8 Saturday 008/357

8.00 am
· Phil Hemmins

8.30
[redacted]

9.00
· Rob D Lewt Wha

9.30
£740 @ 5.30 74.92.

10.00
6.30 – 74.~~66~~.96. →

10.30
· Jon P.
7.30 – 74.97.
9.30 – 74.97
8.00 74.97 →

11.00
· Calcraft

11.30
[redacted]
→

Noon
· Nolan D; →

11,000

12.30
· Robert. 74.97.

1.00
→ Baxter; → [redacted]

1.30
· Barry D [redacted]

2.00
· John

2.30

3.00

3.30

4.00

4.30

5.00

6.00 pm

February 2011					
M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
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April 2011					
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T		5	12	19	26
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T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

009/356 Sunday 9

8.00 am

9/1 → [illegible]

8.30

Steven → [illegible]

9.00

Assault

• Sh[illegible] Maxxin (My Car) →

9.30

⇒ [redacted]

[redacted] →

10.00

10.30

• [redacted]

(Fay Ship on Debbie) →

11.00

11.30

• Barry [illegible]

Noon

5PM round [illegible]

12.30

As discussed in 10 000.

1.00

1.30

• Stan Stevens ! ⇒ ELC

2.00

• Barry [illegible]

2.30

⇒ 4:30 [illegible]

3.00

• John Tubald

(6000 @ 4:30) ⇒ 180 140 100 →

3.30

74.81

[6700 Manual] ⇒ 74.80

4.00

4PM [illegible]

4.30

⇒ ~~9000~~ by 8AM ⇒ [50 - 100 [illegible]] →

5.00

3 [illegible]

6.00 pm

1,400000 [illegible] (1,800,000 2,500 000) →

January
WEEK 2

November 2010					
M	1	8	15	22	29
T	2	9	16	23	30
W	3	10	17	24	
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S	2	9	16	23	30

7.30

10 Monday *010/355*

Coming-of-Age Day (Japan)

8.00 am
- Armor in Bay .. new
- Barry flooding

8.30
+ 10.30 Martin Bruffy

9.00
- Phone hooks up
- 8.37

9.30

10.00
- 8.58 Debbie : →

10.30
- Sonny Stevens : [$400 / day] →
- [redacted]

11.00
-

11.30
- Terry Malone

Noon
→ 0419
→ 3 – 3.1 m AHD

12.30

1.00
74 was ≈ 5.5 AHD.

1.30
Sonny Stevens
- Sent details on the Mitsubishi →

2.00

2.30
- Damien details of offer / all done

3.00
Barry D [redacted]

3.30
- Sandra Hogarth → Mrs Mc.) →
54 918 711

4.00
→ Mrs Hogarth. (Janet)

4.30
→ Forrest Place) → Albany. 6, Esplanade
Ario EKP
Rogers The Gap.

5.00

6.00 pm [redacted]

296

February 2011					
M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
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F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

(John → 1300123123.

011/354 Tuesday 11

8.00 am Jean Stolun) 6.30 →. Cont 911
[redacted]

8.30

9.00 John Tkachev [redacted] →.

9.30 Terry Maloney

10.00 → John Tibaldi → →

10.30 → Terry Maloney →) →.

11.00 9000 (+6000)

11.30 x 7.5 m AHA →

Noon

12.30 1.17 – John Tibaldi

1.00 1.20 – Tom Bowman.) →.

1.30 1.24 – Rob Dunn. ✓ Next ad. on

2.00 1.40 Barry Dennis. [redacted]

2.30 [redacted]

(Motorbike Cam

3.00 Faifd Ship or Detotoi)(

3.30 – Peter Allen.

297

4.00 John Tibaldi (6000 this morn) → →
12000 / –
c 10000 release

4.30 → to get 24 hrs !!!

5.00 Jim / Peter Brockley → 10 000 BOM

6.00 pm (80 → 100 Now) 6500
(140 am) 5400 No → 74.71 / 75.6. → 6 tonight

8.00 am [redacted] Paul Boulan

>>>>

8.30 → Frank Greenhill

9.00 → Eastbourne Shalyn lum →

9.30 → boyfriend onto mer

10.00

10.30

11.00 Brett. Myatt.

11.30

Noon • Jetoline 43

12.30

1.00

1.30

2.00

2.30

3.00

3.30

4.00

4.30

5.00

6.00 pm

November 2010					
M	1	8	15	22	29
T	2	9	16	23	30
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T		4	11	18	
W		5	12	19	
T		6	13	20	
F		7	14	21	
S	1	8	15	22	
S	2	9	16	23	

14 Friday 014/351

8.00 am · Jim &
8.30 Barry
9.00 · Phil → update
9.30 · Stan Stern
- Mr Crosby
10.00 100 mil
· Barry Eastham update
10.30 · Phil [illegible] update
11.00 · Jeff Snyder
11.30 - update on [illegible]
Noon [illegible] (clips.
12.30 · Keith Duncan) →
⇒
1.00 ⇒ Craig) →
1.30 → [redacted]
2.00 CEO WaterStream.
2.30 ⇒ Dave Roberts) → Keith D.
→ [redacted] →
3.00
· Barry Devine
3.30 → Warden releases)
4.00 o - Rostro
- VP [illegible] Residential
4.30 730 [illegible]
Joe Mann
5.00
6.00 pm

	November 2010						December 2010						January 2011				
M	1	8	15	22	29	M		6	13	20	27	M	31	3	10	17	24
T	2	9	16	23	30	T		7	14	21	28	T		4	11	18	25
W	3	10	17	24		W	1	8	15	22	29	W		5	12	19	26
T	4	11	18	25		T	2	9	16	23	30	T		6	13	20	27
F	5	12	19	26		F	3	10	17	24	31	F		7	14	21	28
S	6	13	20	27		S	4	11	18	25		S	1	8	15	22	29
S	7	14	21	28		S	5	12	19	26		S	2	9	16	23	30

16 Sunday *016/349* 8.00 –

8.00 am
· Michael Lyons ⇒
8.30
⇒ Channel 7 ⇒⇒⇒⇒
10.30
⇒
9.00
⇒ Lowood ⇒ [redacted]
9.30
10.00
· 8.58 – Tom Fenwick
10.30
· Petros Pennell [redacted]
11.00
(· Mick Drews: ⇒) ⇒⇒⇒
⇒
11.30
Michael Lyon [redacted] ⇒⇒
Noon
⇒ Jim Kerr
9.07
12.30
Dan Spiller
1.00
Dan Spiller [redacted]
1.30
⇒ ret. call. (Ipswich
2.00
Tom Fenwick: ⇒
2.30
· 10.25. Mick Drews ⇒ ( ) ⇒⇒⇒
[redacted]
3.00
3.30
· Dan Spiller ⇒
4.00
· Joe Menn.
4.30
· Peter Allen – owners. [redacted] ⇒
· 10.25
5.00
· Barry Dunn } money
[redacted]
6.00 pm
Logan

	February 2011						March 2011						April 2011				
M		7	14	21	28	M		7	14	21	28	M		4	11	18	25
T	1	8	15	22		T	1	8	15	22	29	T		5	12	19	26
W	2	9	16	23		W	2	9	16	23	30	W		6	13	20	27
T	3	10	17	24		T	3	10	17	24	31	T		7	14	21	28
F	4	11	18	25		F	4	11	18	25		F	1	8	15	22	29
S	5	12	19	26		S	5	12	19	26		S	2	9	16	23	30
S	6	13	20	27		S	6	13	20	27		S	3	10	17	24	

January
WEEK 3

Anniv. Day (Southland-N.Z.)* *Martin Luther King's Birthday (U.S.A.)* 017/348 **Monday 17**

8.00 am · Noel Faulkner ⇒ Lawson
· Jim Primo ⇒⇒
8.30
· John Ruffini ⇒⇒
9.00
· 11.17 Jim Sooley ⇒ Healthy.
9.30
⇒ · 11.27 Faye Chowenter Case :⇒ }⇒. // Call
[redacted] 3.30 ⇒
10.00
10.30 · 11.40 Barry D
· 11.42 John R :⇒ }⇒. 7.57
11.00 ⇒ still a 7.43.
11.30
Noon · Tom – Phil's report.
Barry O ⇒
12.30
· Phil H.
1.00
· Barry D
1.30
1 Thought.
2.00
⇒ 2 Old report.
2.30
⇒ 3 Flood ...
3.00
· Bob R.
3.30
· Tom Fenwick. ⇒ }⇒ Colin Apelt ⇒.
4.00
· Jeff White ⇒ Rob Keyser ⇒
4.30
⇒ Seibert.
5.00

6.00 pm

January Rob Aus Flow
WEEK 3 [redacted]

November 2010					
M	1	8	15	22	29
T	2	9	16	23	30
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S	2	9	16	23	30

18 Tuesday 018/347

8.00 am Rm M
Bill (1) ECT (2) Merger.

Phil H.
— Wyaralong WTP
Zyrams

8.30

9.00 • Ursula.
— Nicole Sams

9.30

Dan Spelt
— 20
[redacted]

10.00 → • Bob Reilly OWSR

10.30 (1) • Flood operations staff.
— Sun Person OK
— [illegible]

11.00

11.30 (2) • Modification
— [illegible].
Noon — manual

(Accept policy settings)

12.30

1.00 (3) . • Report.

1.30

2.00 ⇒. • Phil Cummins (Dam)

2 pm
Thursday AM
(Thurs AM Fun)

2.30

3.00 — colin_apelt
@ [illegible].com.

3.30

4.00 — Alan Malthouse!
Mc Rural

4.30 • 9.39 Tom [illegible] ⇒ 10.20 • Shane [illegible] ⇒ Jamie [illegible]; →
• Phil H. ⇒ 7.50 ⇒.

5.00 • Bloomer WSM ⇒ [redacted]
• Ruth Dammy ⇒ ??. ⇒

6.00 pm • Bill — January, + Water Security

302

February 2011					
M		7	14	21	28
T	1	8	15	22	
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S	3	10	17	24	

019/346 Wednesday 19

8.00 am

8.30 John Tiratsoo
& Loren Value

9.00

9.30

10.00 Keith ⇒

10.30 (Phil ⇒ Strat Plan.

11.00

11.30 · Barry Dunn — Tech reports ⇒ no.
3xx

Noon · Bob Kelley - not today
· 1101

12.30 3.27 – Geoff Sheard. ⇒ Lauren ⇒

[redacted]

1.00

1.30 ↳ Geoff Sheard @ Muirfield, global game on

2.00 Policy to ⇒ Tim Watts ⇒

2.30 Jeff White / Leslie

3.00 · John Bradley ⇒ (Not available)

3.30 Tom Fenwick [redacted]

4.00

4.30

5.00

6.00 pm

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20 Thursday 020/345

8.00 am
- John Broadley
8.30
- Richard — Manual release ⇒
9.00

9.30
- Tom Harker
10.00

- John Broadley Debbie Best
10.30
- Greg Clayton.
11.00

- → Manual release.
11.30
- Operating manual
- ⇒ propensity [illegible] critical information
Noon
- Stephen → W4 ⇒
12.30

- What's available now ⇒ Publish available information
1.00

- Get it
1.30

- Shaped
2.00
- → Longbook (1) Manual + audit
- (3) rebuild / Review levels / Roll / Criteria
2.30
- (1) ⇒ Real time data
- drawn level
3.00
- Roll rates in lines
- Segmentation art.
3.30

- (2) → Real time data.
4.00

- → Inflow
4.30
- (2) Rate — not relevant
- (Ann Web) (3) Launch of release
5.00
- ⇒ Gradual Ann Operation ⇒ Wide release hatching / H00
- ⇒ test fire
6.00 pm

304

February 2011					
M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
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S	2	9	16	23	30
S	3	10	17	24	

021/344 Friday 21

8.00 am
=> Cont from 20/

8.30

9.00
* Campbell Wei [illegible] Appeals => OK =>
* Phil
9.30
– Colin Appeals OK in Bedson

10.00

10.30
Greg Clayden
=> [illegible]
11.00

11.30

Noon
Situation Report. BCC ICC SRC
Sunday
DEAM
12.30

1.00
Lots => Lund

1.30

2.00
John Bradley (with Debs for Greg
=> [illegible] W4 + also 52 = 53
2.30
(for 21 – see 22)

3.00

3.30

4.00

4.30

5.00

6.00 pm

November 2010					
M	1	8	15	22	29
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22 Saturday 022/343

8.00 am

Seg Tamb [illegible]

8.30 - engage Allen (in Class action cases)

9.00 Bob Reilly

9.30 Minister letter

10.00 (1) Protocol

10.30 Cooper report - adhered to protocols ✓

- Bob thinks protocols particularly ones on

11.00 → need to focus on Tech Situation Report

11.30 - frequency

- [illegible]

Noon - ? discuss with chair

(2) Q's → suggest shorter meeting goes to [illegible]

12.30 before we meet [illegible] later.

1.00

. Patrol 11 H

1.30 →

2.00 → Allen [illegible] Summ[illegible] [illegible] [illegible] →

2.30

3.00 - Barton. Hydrogen (Updates)

3.30

- Jim Prior

4.00 - Damian Gould →

. Ken Sedgwick → Pakistan (Seg.

4.30 . John [illegible] →

. Bob Reilly - meeting on [illegible]

5.00

(not) [illegible]

6.00 pm

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January
WEEK 3

-7.30

023/342 Sunday 23

8.00 am Meeting Helen Beauty Routine

8.30 Structure in here [illegible] Jim - role with this + [illegible] of [illegible]

9.00 Three roles

9.30 1 Strategy + Tech + Write about
- Expand [illegible] to Team

10.00

10.30 2 People to support - ext [illegible]/[illegible]
- cut
- 1 more person to participate in the fundraising dinner

11.00

11.30

Noon 3 Refund/[illegible] point for [illegible]
(- same person who is buying 1.

12.30

1.00 → Neil Sudenswager → → Seats

1.30 → Meeting tomorrow →

2.00 Wendy Blue Car → [illegible]

2.30 - 11.24 Leanne Bond = [redacted]

3.00 - 11.04 Leanne NAB
Cross [illegible] [illegible]
132265. [illegible] ??

3.30 → [illegible].

4.00 · Leanne Bond [redacted] →

4.30 → Mick called Leanne.

307

5.00 John T → 30 few [illegible].
→ [illegible] [illegible] [illegible]

2.30

6.00 pm ③ John Jensen → [redacted]
[illegible]

November 2010

M	1	8	15	22	29
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S	6	13	20	27	
S	7	14	21	28	

December 2010

M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011

M	31	3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

8.15 -8.00.

24 Monday 024/341

Anniv. Day (Wellington-N.Z.)*

8.00 am
· Mike – Phetahu
8.30 · Phil – Sam
9.00
· Keith Jaques ⇒
9.30 ⇒ Phil Sutton ⇒
~~[illegible]~~ ⇒
10.00
10.30 [redacted]
11.00
· Caroline ⇒.
11.30
· 3.40 Karen W [redacted]
Noon Ave
12.30 · 12.10
1.00
· Sharon M.W [redacted] Travel notes.) Ret. call
1.30
· Caroline ⇒ update
2.00
· J T
2.30 · T M) ⇒
3.00 · Keith – today
⇒ Sharon Cox.
3.30
· Judi Moore ⇒ Ret. call.
4.00
4.30
5.00
6.00 pm

7:45 – 6:00

February 2011						March 2011						April 2011					
M		7	14	21	28	M		7	14	21	28	M		4	11	18	25
T	1	8	15	22		T	1	8	15	22	29	T		5	12	19	26
W	2	9	16	23		W	2	9	16	23	30	W		6	13	20	27
T	3	10	17	24		T	3	10	17	24	31	T		7	14	21	28
F	4	11	18	25		F	4	11	18	25		F	1	8	15	22	29
S	5	12	19	26		S	5	12	19	26		S	2	9	16	23	30
S	6	13	20	27		S	6	13	20	27		S	3	10	17	24	

Anniv. Day (Auckland & Northland-N.Z.)

031/334 **Monday 31**

8.00 am
- Peter M. – met
- Phil – update today

8.30
- John Bradley
  – Minister no longer doing 'door stop' on

9.00 Budget (Minister was @ the 8:30 meeting) + Minister discussed with Brownlee, & want

9.30
- Alex Fisher = 5755 : ⇒ Structure, R&D.

10.00

10.30
- Tom Fornwalt ⇒ Media today, briefing to Phil's call

11.00
- John O.
  – Signs off
  – Reports on

11.30
(as per EQY area, ⇒ ("dialogue" to Nicky Hunn.)

Noon
✓ Keith D. ⇒ left msg @1.55. (
① – Sign off

12.30
② – Staff after Bill's ⇒ soon to Saum on

1.00

1.30
- Keith ⇒ **Media** ⇒

2.00
- Phil ⇒ " – then money & media

2.30
- Ken Sedgwick ⇒ Press release: ⇒

3.00
- Leanne – Media ⇒ update.
- Fraser

3.30
- Phil H ① Minister visit
② David Gray – Meeting

4.00
- Ken S a Water Sign off
  ⇒ Ken will consider, as it has legislation implications as in

4.30

5.00
⇒ Sees Tourism abolished Govt authorities
- Mike – Media ⇒

6.00 pm

February
WEEK 5

December 2010					
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011					
M	31	3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

February 2011					
M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

1 Tuesday 032/333

8.00 am Mike [illegible] / [illegible]
• Karen [illegible]
8.30 – Direction Notice offer
→ (Time in resolution)
9.00
• Phil H → Minimum offer
9.30 –

10.00 • John Tibaldi →.
[illegible]
10.30
→ Summit → ~~500~~ 545 000 mts
11.00
• [illegible]
11.30 • Sharon McDowell } →
[redacted]
Noon
(Ret. call)
12.30

1.00 • Bill McCredie Allen
– left message
1.30 • Phil H – left message. } → Ret call

2.00 Allan Milhouse
→ Nothing today
2.30

3.00

3.30

4.00

4.30

5.00

6.00 pm

	March 2011						April 2011						May 2011					
M		7	14	21	28	M		4	11	18	25	M	30	2	9	16	23
T	1	8	15	22	29	T		5	12	19	26	T	31	3	10	17	24
W	2	9	16	23	30	W		6	13	20	27	W		4	11	18	25
T	3	10	17	24	31	T		7	14	21	28	T		5	12	19	26
F	4	11	18	25		F	1	8	15	22	29	F		6	13	20	27
S	5	12	19	26		S	2	9	16	23	30	S		7	14	21	28
S	6	13	20	27		S	3	10	17	24		S	1	8	15	22	29

- Jim ⇒ plan for legal letter etc for Fund

033/332 **Wednesday 2**

Lunar New Year Eve (China, Rep of Korea, Taiwan)

8.00 am
- Greg Claydon: - DERM: ⇒ ⇒⇒⇒.

8.30
- Up North: ⇒

9.00
⇒ If decision to made, ~~other~~ to release

9.30
⇒ Will send something through this afternoon or tomorrow.

10.00
- Jim Prun
  - column as above
  - Board pano
  - Program for the year.

10.30

11.00
- Graham Reegan re [illegible]
(Graham has letters of support from those he could up to. (Mary)

11.30

Noon
- Ken Stolzenheim [redacted]
  - update from yesterday
  ⇒ Tania ⇒ Holman.

12.30

1.00
- Pam M.
- Peter Allen [redacted] ⇒

1.30

2.00
- Phil
  ⇒ Legal ✓
  ⇒ Comm - Helen ✓
  ⇒ Tech ✓

③ Benefits of (cool) ⇒ Neighbour [illegible]

Existing

2.30

3.00
- Bob R [redacted]
  ① ⇒ Qualification on technical
  ② ⇒ how FSC came about
  [illegible] the [illegible], FSC came about
  eg SBB & WS, KOP
  (Follow into the [illegible] the retirement
  in long means ⇒ accepted
  [illegible] policy decision making +
  [illegible] in the market
  ③ Sort change FSC ⇒ [illegible]

Integrations

3.30

4.00

4.30

5.00

6.00 pm

⇒ BWC + Such [illegible]

February
WEEK 5

	December 2010					January 2011						February 2011				
M		6	13	20	27	M 31	3	10	17	24		M		7	14	21	28
T		7	14	21	28	T	4	11	18	25		T	1	8	15	22	
W	1	8	15	22	29	W	5	12	19	26		W	2	9	16	23	
T	2	9	16	23	30	T	6	13	20	27		T	3	10	17	24	
F	3	10	17	24	31	F	7	14	21	28		F	4	11	18	25	
S	4	11	18	25		S 1	8	15	22	29		S	5	12	19	26	
S	5	12	19	26		S 2	9	16	23	30		S	6	13	20	27	

3 Thursday 034/331

Lunar New Year (Rabbit) (China, H.K., Rep of Korea, Taiwan) Chinese New Year (Indonesia, M'sia, S'pore)

8.00 am • Jim Tom Miller
8.30 ① => Letter
② -> Meeting
9.00 ③ => Support - hold off
9.30 • Greg Claydon [redacted]
- legal advice on the RFD
10.00 [redacted]
=> in an hour or so
10.30 - suggested he forward the
legal advice so both
11.00 lawyers can discuss if any
differences of view.
11.30
. Rob Drury.
Noon 1st - EAP"
- Flood Centre Mgr role
12.30
2nd - Dam Safety Sum
1.00
• Helen Moore 5707
1.30 - Ipswich @ Muntend level) =>
- landmark letter
2.00
• Jeff White + Peter Boettcher (Sunwater)
2.30 - "legal" letter
- we are we are working
3.00 together on this flood issue;
not trying to move "blame"
3.30 => asked them to work with our
people (not lawyers)
4.00 => agreed we need protocols etc
- today to flood centre was early alarm
4.30 comm John T. => Tom let Bill McLean.
• Peter Mc => LGAQ =>=>=>
5.00
6.00 pm

March 2011					
M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

April 2011					
M		4	11	18	25
T		5	12	19	26
W		6	13	20	27
T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

May 2011					
M	30	2	9	16	23
T	31	3	10	17	24
W		4	11	18	25
T		5	12	19	26
F		6	13	20	27
S		7	14	21	28
S	1	8	15	22	29

Ambassador Hamad

Tamil Tiger

£30

79 → 80-1

2 day Auckland → When open

February

WEEK 5

Lunar New Year (China, H.K, Rep of Korea, Taiwan) *Chinese New Year (M'sia, S'pore)*

035/330 Friday 4

8.00 am • John Bradley → [redacted].

8.30 (1) Today → Admired of our letter – letter apparent content – no one → "our gearing" → harm them.

9.00

9.30 (2) • Jim (John – Terry) +

10.00 • Because ACPO → → how many games.) →.

10.30

11.00 • Jim [illegible] – (Peter Allen) – Alex Fisher →) →

11.30 • Guy Claydon.) →.

Noon [redacted]

12.30 → admired [illegible] of our letter content

1.00 → Point 1, different, [illegible] need to sit down & work through [illegible] [illegible]

1.30

2.00

2.30 • Phil (4:–) (1)

3.00 • Mike Foster → [Bob Bain → [illegible] restricted → communication.] → → [illegible] to get them [illegible].

3.30

4.00

4.30 • Bob Bain (1) – Safety of Dom (2) [illegible] → (3) [illegible]) → [illegible] [illegible] → (Letter [illegible] again)

5.00

6.00 pm Brett [redacted] • Mark Lewis → (Neil Fearing)

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March 2011

M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

April 2011

M		4	11	18	25
T		5	12	19	26
W		6	13	20	27
T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

May 2011

M	30		2	9	16	23
T	31		3	10	17	24
W			4	11	18	25
T			5	12	19	26
F			6	13	20	27
S			7	14	21	28
S		1	8	15	22	29

Waitangi Day (N.Z.)

037/328 **Sunday 6**

8.00 am Cont from 8/2.

8.30 John Beatty Meets Mueller

9.00 invite Abd (Loader)

Phil H 4.15 Mum

9.30

John Beatty confirms 4.15

10.00

Barry Rumm → he'll give us a letter (@25)

10.30

11.00

Benton St. 25% = 26% in whole only

11.30

Noon

12.30

1.00

1.30

2.00

2.30

3.00

3.30

4.00

4.30

5.00

6.00 pm

February
WEEK 6

	December 2010						January 2011						February 2011			
M		6	13	20	27	M	31	3	10	17	24	M		7	14	21	28
T		7	14	21	28	T		4	11	18	25	T	1	8	15	22
W	1	8	15	22	29	W		5	12	19	26	W	2	9	16	23
T	2	9	16	23	30	T		6	13	20	27	T	3	10	17	24
F	3	10	17	24	31	F		7	14	21	28	F	4	11	18	25
S	4	11	18	25		S	1	8	15	22	29	S	5	12	19	26
S	5	12	19	26		S	2	9	16	23	30	S	6	13	20	27

8.30 – 7.30

7 Monday 038/327

Barton – [illegible] on [illegible]
Jim [illegible]

8.00 am

Nick Preston
→ 9097 3116.

8.30

9.00 23/5/11.

9.30

10.00 Residual 18 364.

10.30 (Purchase: 36 728)

11.00 (Proto 25/7 →
Raw → 29/4 →

3584
650 – FBT (77,124.)

11.30

2904 = [illegible], Rego, [illegible], Fuel,
Tyres, Roadside, Insurance,
[illegible]

Noon

12.30

1.00 • Barton – [illegible] 1; [illegible] 85
0412 498 354

1.30

Fiona 5543
– [illegible]

2.00

2.30 • Barton [redacted].

3.00 • Fiona – to [illegible]
[illegible]

3.30 • Jim [illegible]

4.00 • [illegible] Rd) → [redacted].

4.30 ① Protocols → will [illegible] their [illegible] [illegible] / 100 [illegible] [illegible] / [illegible] [illegible]

5.00 ② Timing [illegible] details → [illegible] [illegible]
③ Col [illegible] / [illegible]. → Geoff Stears

6.00 pm [illegible] Geoff Stears [illegible] → Colin [illegible]

	March 2011					April 2011					May 2011				
M		7	14	21	28		4	11	18	25	30	2	9	16	23
T	1	8	15	22	29		5	12	19	26	31	3	10	17	24
W	2	9	16	23	30		6	13	20	27		4	11	18	25
T	3	10	17	24	31		7	14	21	28		5	12	19	26
F	4	11	18	25		1	8	15	22	29		6	13	20	27
S	5	12	19	26		2	9	16	23	30		7	14	21	28
S	6	13	20	27		3	10	17	24		1	8	15	22	29

7–45
≈ 50

February
WEEK 6

039/326 **Tuesday 8**

8.00 am → Phil → Update for the [illegible]
+ explanation of the [illegible].

8.30 ? Interim program under RoD.

9.00 Tania Roche.

9.30

10.00 → John Beddington → (Jim has detailed meeting notes).

10.30 Minister Robertson →→

11.00 1 Modeling ✓ →→→

11.30 2 Contingency protocol

Noon 3 Assessment

→→

12.30 4/2 → Phil to Minister
Assist DEMM.
→ supported by approach
1.00 FSC →

1.30 → Renee → Phil; →

2.00 →
· Jim Peres 5.30 ?? →→→→→→→→

2.30 · Bill McCaskie →→ ~~Allan Millhouse~~ →→
3.00 Allan Millhouse → Michael Ilhon.

3.30 · Neil G → Con to SciFleet:
· Peter A → [illegible] up.

Cont 6/2

4.00 → Sam → updates on [illegible]

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4.30 · John Beddington → left meeting (≈ 12.30).

· Jim P → Message re end March modeling
5.00 · John Beddington → 1.53 update
6.00 pm 200 → Advice of meeting tonight → happen to
→ the questions [illegible] on process → see how it was

February
WEEK 6

December 2010					
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
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F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011					
M	31	3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

February 2011					
M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

7.25 - 8.30

9 Wednesday 040/325

8.00 am · Phil [illegible]

7.45 — Insurer / Stud protection [illegible]

8.30 11.20 · — [illegible] adviser letter [illegible]

✓ [illegible]

9.00 — Barry's letter => [illegible]

25% "claim"

9.30 7.40 · Jim — Inquiry

— Meeting John B

10.00 8.00 10.06 10.36 · Bill Mc — Timing to meet John

— Insurer / Stud prot

10.30 => (use [illegible] funds [illegible]

7.52 · John Bradley => [illegible]

11.00 7.27 · Barry Dunne => re letter (25% claim)

— discussed [illegible]

11.30 "temp" release.

Noon · David Fullerton

[redacted] Ret. call 11.45

12.30 " 11.54

(left message).

1.00

· Hamish Waldron => Barry => =>

1.30

① => cancel [illegible]

2.00 ② Colin Appleton => [illegible]

[illegible]

2.30

· Shane McDonald

3.00 => £1400 => 1600 - 1800

[illegible] money

3.30

· Sam Romano => .

4.00 · Serg. Clayton => [redacted]

[illegible]

4.30 (Joss [illegible] [illegible]

[redacted]

5.00

6.00 pm

March 2011						**April 2011**						**May 2011**					
M		7	14	21	28	M		4	11	18	25	M	30	2	9	16	23
T	1	8	15	22	29	T		5	12	19	26	T	31	3	10	17	24
W	2	9	16	23	30	W		6	13	20	27	W		4	11	18	25
T	3	10	17	24	31	T		7	14	21	28	T		5	12	19	26
F	4	11	18	25		F	1	8	15	22	29	F		6	13	20	27
S	5	12	19	26		S	2	9	16	23	30	S		7	14	21	28
S	6	13	20	27		S	3	10	17	24		S	1	8	15	22	29

February
WEEK 6

8:30 - 6.30

041/324 Thursday 10

8.00 am – Jim – model
· ~~Alison~~ →
8.30 · Phil

9.00 – John Brierly
(1) Went through ln

9.30

10.00 · Phil
– Tom

10.30
⇒ Bill McCaslin

11.00
→ letter on modality.

11.30

Noon · Barry Dennis → comment on letter, on roles,
12.30 domain met

1.00 · John Brierley ⇒.
1.30 ⇒ letter OK.

2.00 · Barry Ramsay ⇒ spoke of
2.30 same reasons
3.00 ⇒ came back home
⇒ left message.

3.30

4.00 Barry D ⇒ follow up call
⇒ Mike will discuss with
4.30 his Michael Horan

5.00

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6.00 pm

February
WEEK 6

December 2010					
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011					
M	31	3	10	17	24
T		4	11	18	25
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T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

February 2011					
M		7	14	21	28
T	1	8	15	22	
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T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

8.30

11 Friday 042/323

National Foundation Day (Japan)

8.00 am • Mike =>
- meeting
8.30 - upcoming
• Bill A => - Mike + Bill Martin Stowe ✓
9.00 - Comm. hire desk
• Tehni - Sync[illegible]
- Advise company to Germany
9.30 • Jim Parr[illegible] - Confirm Cohen Staff — Bill 5 Jan
10.00 - Own letter → John B 10/2
10.30 - Submission to Minister => GOC (Decision Thu 17/2)
Suggest 14/2
11.00 - Advise to get [illegible] plan on 15/2
11.30
re Bill McCusker
Noon
Re Jim's note 7.16
12.30 (1) Jim will talk to
1.00 Santos about modelling
Flood - what makes
1.30 a difference
(2) I'll talk to Barry re
2.00 how low can it go
from a security point
2.30 of view
(3) Jim will discuss comms
3.00 around the releases with Mark
=> Kowalski
3.30
• Barry D
4.00 (1) → AP => look at flood security

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4.30 how low can he go
→ Barry will do this
5.00 (2) Hugh Dann → process => Mike
6.00 pm • Jim => advised of both [illegible] from Barry

March 2011					
M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

April 2011					
M		4	11	18	25
T		5	12	19	26
W		6	13	20	27
T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

May 2011					
M	30	2	9	16	23
T	31	3	10	17	24
W		4	11	18	25
T		5	12	19	26
F		6	13	20	27
S		7	14	21	28
S	1	8	15	22	29

February
WEEK 6

043/322 **Saturday 12**

(note from 11

8.00 am • 5712 = Jim Penn

8.30 • John Tibaldi
(Phil Rogers
– dam safety review on panel

9.00

9.30 => Brian Shannon. >=>
-> go ahead
=>

10.00

10.30 • Phil Hennessy [redacted]

11.00 ① Flood volume storage => Why not below FSL!

11.30 ② Panel foreign =>
③ ~~Munitions day~~.

Noon • ~~Ken Sexton~~
• Patrick Waddies => in review
=> Expt qtr report [redacted].

1.00 -> Tamar
① Rec on temp of SL => Accept ROD.
② Expt qtr report

1.30

2.00 • Jonathan 5668

2.30 • John Apelt =>
– update on the Longford question (for Aust).

3.00

3.30 • Mike Foster on Media

4.00 • Barton Maher
Simulation Report to SEQwater incl on pre-release strategy

4.30 • Sean Hutton

5.00 • Michael Ilott => OK [redacted] N/A
• Barry Dennien

6.00 pm • Alex Fisher 5755 Dan Spiller ! ->

February
WEEK 6

December 2010

M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
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F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011

M	31	3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

February 2011

M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

13 Sunday 044/321

8.00 am Text from 12/2

8.30 ⇒ Rayner Waldron
⇒ John Apsitt. } Complaint
9.00 of [illegible].

9.30 ⇒ Spokesman re
compliance with SOP
10.00 ⇒ Barry D.

10.30
• Tam Johnson
11.00 [redacted] | Keith McLean

11.30 • Terry Mahon

Noon • Phil H ⇒
Leith ⇒

12.30

1.00 ⇒ [redacted] Keith ⇒.

John T are assumptions ok.
1.30
Sat. • Peter Allen
2.00 – C/A past pass assumption OK.
8.00–6.45
2.30 John Bradley
– give call when you
3.00 have [illegible]

John B.
– Mon
– 11 [illegible]
Confirm

3.30 John – Branch [illegible]
? Promise to go [illegible]
4.00 ① Whether A/D Offer
② Sent contract
4.30 ③ Finance Bran

321

5.00 ⇒ release ⇒ Procedural release. John T
when
6.00 pm Allen on Friday. (Sunday to 12.30)

March 2011						April 2011						May 2011					
M		7	14	21	28	M		4	11	18	25	M	30	2	9	16	23
T	1	8	15	22	29	T		5	12	19	26	T	31	3	10	17	24
W	2	9	16	23	30	W		6	13	20	27	W		4	11	18	25
T	3	10	17	24	31	T		7	14	21	28	T		5	12	19	26
F	4	11	18	25		F	1	8	15	22	29	F		6	13	20	27
S	5	12	19	26		S	2	9	16	23	30	S		7	14	21	28
S	6	13	20	27		S	3	10	17	24		S	1	8	15	22	29

February
WEEK 7

730 - 615 045/320 **Monday 14**

Royal Hobart Regatta Day (Tas-Aust)*

8.00 am • Bob Reilly
- release strategy
① 430 right through from 75 vs flood [illegible] from 75.

8.30

9.00
② transition to flood release

9.30
- use cl, through f(flood)

10.00 • Phil H
- update on regulatory intent

10.30 - all letters → Tom until now

11.00 • Jim Ruin → follow up on Bob Reilly" on

11.30 • Peter/Max → update + coffee.

Noon • Jim Pruss
→ 130 m² → licence with Tom

12.30
① Submission to commission enquiry

1.00 → regard → submission.

1.30 • Rob - releases
- need to meet with Tom + Mike → determine action re the notification

2.00

2.30 - check re Tom levels

3.00 • Sharon Wilkinson [redacted]
① Schedule

3.30 ② Chance

4.00 Jim checking Barton "stats" ⇒ ⇒ On Sch

4.30 • Tom - Interim program ⇒ Draft on fact, ⇒
- [illegible] Jass ⇒

5.00 • (Ken Schrinke - [redacted] ⇒ not call
- In - planning

6.00 pm • Mike ⇒ channel 7 . 9 ⇒ aust PPC ⇒ Board.
• Bob Reilly / John Bradley [illegible]

February
WEEK 7

December 2010

M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	
S	5	12	19	26	

January 2011

M	31	3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	29
S	2	9	16	23	30

February 2011

M		7	14	21	28
T	1	8	15	22	
W	2	9	16	23	
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

~~8~~ 7.15 → Phil re 31/3

15 Tuesday 046/319

8.00 am · Phil - specify the date —
interim program ⇒ not us
8.30 · Tom [illegible] re date
· John [illegible] ⇒ will call back
9.00 · Steve Hubbard
· Bill [illegible] re interim date
9.30 · Jim [illegible] ⇒ re interim prog
· Mike Foster
10.00 - interim program
⇒ temporary period
10.30 - prior to interim report
within - all parties can consider
11.00 * make any decisions on
the interim report.
11.30
· John Grant ⇒ [redacted]
Noon 904: Dr [redacted]
12.30 ⇒ Magnus
regulatory law issues
1.00 · Sam [illegible]
· Helen - mail.
1.30 Tom - letter [illegible]
· Industry ⇒ confidential [illegible] [illegible] [illegible]
2.00 ⇒ [illegible] [illegible] [illegible] / [illegible] of [illegible]
⇒ [illegible] [illegible] [illegible]
2.30 · John [illegible]
① Industry ⇒ confidentiality
3.00 ② further [illegible] of
the [illegible] [illegible]
3.30 all parties
⇒ Phil H
4.00 David — [redacted] ⇒ ([illegible] ⇒)
· Bill McCusker [illegible] [illegible]
4.30 Sam [illegible] 502 [illegible]
· 1.17 Bill McCusker re [illegible]
5.00 · Phil H re 31/3.
· Patrick ⇒ [illegible] good ⇒ [illegible] [illegible]
6.00 pm Alice [illegible]
John [illegible] - [illegible] [illegible] [illegible]

323

...ch 2011						April 2011						May 2011					
7	14	21	28	M		4	11	18	25	M	30	2	9	16	23		
8	15	22	29	T		5	12	19	26	T	31	3	10	17	24		
9	16	23	30	W		6	13	20	27	W		4	11	18	25		
10	17	24	31	T		7	14	21	28	T		5	12	19	26		
11	18	25		F	1	8	15	22	29	F		6	13	20	27		
12	19	26		S	2	9	16	23	30	S		7	14	21	28		
13	20	27		S	3	10	17	24		S	1	8	15	22	29		

8.00 — 7.00

Prophet's Birthday (Indonesia) Birthday of Prophet Muhammad* (M'sia)

• Delphine Best
• John Ruffini
(• Simon Hamish
⇒⇒ Doctor today) →
→ Comm.

• John Bradley —
• Peter Barnes.
(Toni C).

(1) Updating on action program.)

• Report to regulator
— when relevant
⇒ Internal program

• ~~John~~
John T ret call. ⇒ John Ruffini
• Bruce Baker :→
→ Bar Emerg. / ⇒ .
→ Property / Centre ⇒
BT wrap → 44,000 ⇒ out of way.

• 8.30 David Ellis
Jim Prior — ret. call.
• Prado →
338 $022) → [227 KHW Prado 140K.) ⇒
7.15 → 23/2/2011 ⇒ 3PM ⇒]

• Phil ⇒ Brian Shannon? P.I. cover. ⇒⇒
→ Casual employee ⇒ → → → ⇒

→ Helen
John Bradley
(- David Stewart) Info on relations
(1) - Rob Ommy →) (2) Mogul firm
(2) Draft action program
(3) Legal
• ~~[illegible]~~ Robertson
• Bill Mor

								ry 2011				February 2011			
								3	10	17	24	M	7	14	21 28
								4	11	18	25	T 1	8	15	22
								5	12	19	26	W 2	9	16	23
T	2							6	13	20	27	T 3	10	17	24
F	3	10	17	24	31	F		7	14	21	28	F 4	11	18	25
S	4	11	18	25		S	1	8	15	22	29	S 5	12	19	26
S	5	12	19	26		S	2	9	16	23	30	S 6	13	20	27

17 Thursday 048/317

8.00 am
- Mike
  - Financial model
  - NPO
- Peter Mc – [illegible] re [illegible]

9.00
- Helen – AA
- John T
  - [illegible] for tech [illegible].

10.00
- Sue Claydon
  → [illegible] Program → →

10.30
(A) Manual

11.00
→ Jim [illegible] mtg
arrange a mtg

11.30
- Tom [illegible]

Noon
→ Moreton Bay

12.30
→ Rob O
→ Council Taxes mtg

1.00
→ 1/ Seqwater re NPO re [illegible]

1.30
→ 2/ Write to [illegible] flood engineering

2.00
(Steve Rossa)

2.30
- Message – Bill McCune

3.00
35/75 vs 100/75
– 123 – Glen Maxxon
– 208 – Phil

3.30
- Bill → ret call →

4.00
- Sue Claydon → update on [illegible]
- Phil H → Renew

4.30
- Phil → update on [illegible]
→ Phil will look at it [illegible]

5.00
- Also re Sharon → sort it
- John Tibaldi Colin Mallet →

6.00 pm

March 2011					
M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	
S	6	13	20	27	

April 2011					
M		4	11	18	25
T		5	12	19	26
W		6	13	20	27
T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30
S	3	10	17	24	

May 2011					
M	30	2	9	16	23
T	31	3	10	17	24
W		4	11	18	25
T		5	12	19	26
F		6	13	20	27
S		7	14	21	28
S	1	8	15	22	29

February
WEEK 8

7.30 - 5.30

- Mike Foster

053/312 **Tuesday 22**

8.00 am
- John Rautiex : 0419 704 571
  - process

8.30
  - Legislation - change ROP laws for
    - approval under ROP (DERM)

9.00
    - Our view + Qld/WGM view
      (water supply security)

9.30
=> Write to WGM + DERM as well

10.00
- We are making interim changes now in some
- To enable us to consider options ~~to change~~ to inform

10.30
① what level of flood immunity
is Council asking us to consider

11.00
② What are their [illegible]
standards now?

11.30
③ River modelling } For various
④ Inundation maps } flows.

Noon

12.30
- Claire - interim program } ✓ amendments
- Tom Lock - interim program } to ROP.

1.00
- Bill Ansdon - AMWU - (State Secretary)
  - Eastbrook

1.30

2.00

2.30

3.00

3.30

4.00

4.30

5.00

6.00 pm

Munster

Staff Strean.

700 Rochery
500 Bum
2700 W'lee

+ :4M out of titles

→ Release strategy : →

→ 2·30 to BOM

11 on Iparams + un
L early Taws

? circumstance.

likely to increase.

Taxes + wal

(53)

Ministers' staff

- BoM to model most cases

- Access to Disaster Relief money :→

12/1/2011.

- Louise Rudleigh → Q.U.V.) ⇒ Remain low for

- Cooking back on

→ 1 New - 1.03 Judi Minister.) ⇒
(→ ADF allowing
now

Admiral Barry Dunn

9.29 ⇒ for

- Judi Minister : 9.29 [redacted]) ⇒ Send Dunn's progress through

- State : ANZ constraints on people on claims. ← in before (11) ⇒

- Sat → → 19/1) → ≈ 10AM chronology

52

2.45 Wagner Coleman
- 4 Phillet. ⇒ Saturday ⇒

101 ⇒ 4.45.5

55

13/1

Barry: →

Phil - update.

630PM → Lawood - Hebdon and V_2 Gutter ent. →

827 Wayne Carbondin

cc [→ West.
→ Pensamiento Palms.] →

→ 4.30: Jesus concert (Pager).

Colin
3870 Qe 70

19/1/2011 Legal Allen / Alan McLaren / McCreaty

(38)

→ • Colin Appleb → legal prof. privacy (Tomi)

• Barber
→ data together

⇒ Star rebuttes
- manual reproduces
- regulated
) →

19/1/2011 DERM briefing.

• Gavt reviews
- Chris (ADA)

• LDMS process continues
• Alan Brown

* Keith Davis ⇒ PD's ⇒
Briefing on
PD's & how we got them.

5

Sing / Kumar Lt

=> [Ray Chamber]. + Kumar Hogan.

Paul Carson =>

YELLOW-TAB

DERM

Mary John B Phil H Sedan [illegible]
Karen Benny Doyle Peter B Brian
Bob Reilly
Peter A

BoM
- next 5 days => not much raising [illegible].
- no threat at present to Qld coast.

-> Seqwater -> flood [illegible]

-> scenarios

- long term

- Short term.

(Tuggun -> as well)

Mon/Tues -> Cont.

- Tues or Wed

-> Flood [illegible] change to 2000 [illegible]

Phil
When that 100's come from.

YELLOW TAB

(89) 1/2/2011.

John Bradley — Mary B — Phil A
Deb... — Kevin — Peter B
Ben — Jim
Peter A

R (variability)

→ Rainfall > 1 ⇒ needs to dam or release

⇒ Full modelling ...

4/2/11

=> Shredder) ?? (Peter Boelster / Renner Butterfield)

1/ Protocol => PB

2/ Report TL

3/ Statements.

60

YELLOW TAB

(22)

8/2

Mr Stephen R — Peter P
John Bucello — Phil
Michael Chia
Lauren

- Flood Manual

Cabinet → BoM → Oct 2010 [illegible]
→ letter to WSM (and SEQWater ??)

→ Response 21/12

→ Thinks unit will → through the event (Monitor)

- Recommendation given to us based on advice we have given.) → | WSM Qwc BCC BoM (3500)

- Change manual (5 [illegible]) ←

YELLOW TAB

63 11/2

· Jim Donaldson · Martin Lokantin
· Michael Chu
· Lower · Deborah Rum
· Jelin Bursch
· Geoff Stead. Peter B—.

=> MTO event
mech— & further north
=> Lower Neach
=> Glory aster ~~ ~~ remote
5 SEQ

=> Notes

=> Lead forecast matrix

Phil H: =>

[redacted]

TK

"Minister" office 1/3/2011

· SR John B Kate Jones. PB
· Lance Peter Allen. JP
· Geoff S. MF.

(- note Kate Jones attn. & comm).

· Whole report

(78) Phil 3 Mar 2011.

• Wivenhoe Flood Mitigation →

Drawing Boundaries 3/3. will have resolution by Monday.

(2) , Flood mitigation component (on agenda)

Sue Jim

→ Exec summary to Board?

"style" } Terry. ✓ Dan.

→ Legal/Ombc order

(included on Mon)

- Terry to confirm.

16 March 2011

(78)

· Alleurs
· Insurance
· Banking
· Supervision.

· Sequence
· BCC
· Sommet
· ICC
· BoM

⇒ · Insurance ?? (Separate stream)

licence to operate

[Prospective Developers –
– not given licence to operate]