

**QUEENSLAND FLOODS
COMMISSION OF INQUIRY**

STATEMENT OF PETER HUGH ALLEN

I, **PETER HUGH ALLEN**, of c/- 41, George Street, Brisbane in the State of Queensland, Project Director (Dam Safety), Office of the Water Supply Regulator, Department of Environment and Resource Management (DERM), state on oath:

Requirement from Queensland Floods Commission of Inquiry

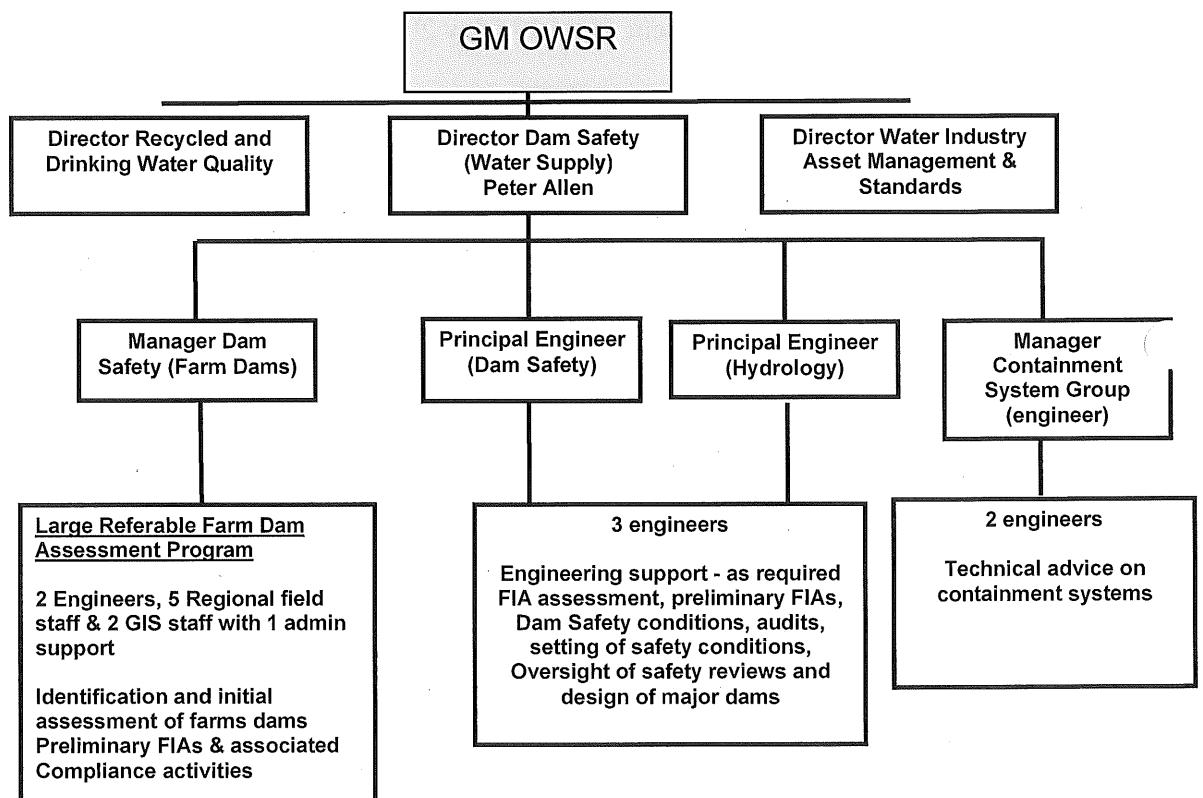
1. I have seen a copy of a letter dated 17 November 2011, which is attachment **PHA-35**, from the Commissioner, Queensland Floods Commission of Inquiry (the Commission) to me requiring a written statement under oath or affirmation, and which details the topics my statement should cover.
2. I have previously provided sworn statements to the Commission as follows:
 - a. statement dated 4 April 2011.
 - b. addendum dated 11 April 2011.
 - c. supplementary statement dated 13 May 2011.
 - d. statement dated 12 September 2011.
 - e. statement dated 16 September 2011.
3. In compiling this statement I have been assisted by the following members of the Dam Safety Work Unit:
 - a. Hari Khadka (Principal Engineer, Dam Safety).
 - b. Ron Guppy (Principal Engineer, Dam Safety).
 - c. John McKenna (A/Director Dam Safety (Water Supply)).

Role

4. My substantive position is the Director, Dam Safety work unit in the Office of the Water Supply Regulator branch, Environment and Natural Resource Regulation division, Operations and Environmental Regulator business group, DERM. For the duration of the Commission I have been moved to a temporary position titled "Project Director, Dam Safety". This was done as it was considered that I could not be expected to both perform the duties of the Director, Dam Safety as well as assist the Commission. [REDACTED] is currently the A/Director, Dam Safety until such time as I return to my substantive position. Mr [REDACTED] is not an engineer.

Structure of the DERM Dam Safety Work Unit

5. The structure of the dam safety group has varied significantly over the years both in terms of capacity and capability.
6. The DERM Dam Safety group basically is now organised into three groups. These groups are:
 - a. The major water dams group consisting of five engineers.
 - b. The Large Referable Farm Dams Assessment Group consisting of the manager, two engineers, five regional field officers, two GIS officers and one admin support officer.
 - c. The Containment Systems group containing three engineers experienced in tailings dams and other hazardous waste containment systems. This group joined the Dam Safety group in October 2010. While they provide technical advice to DERM staff across Queensland, they have no delegations to make decisions on such systems.
7. The overall structure of the Dam Safety group (within OWSR) is illustrated in the following diagram.



8. It is important to note that the group has gathered together most of the dam engineering expertise remaining within DERM after the separation of SunWater

from the Department in 2000 and the retirement of most of the remainder with the aging workforce.

9. It is also important to note that no referable dam has ever failed in Queensland.

Item 1: Gordonbrook Dam

A February 2008 Worley Parsons report identified that Gordonbrook Dam did not have an Emergency Action Plan ('EAP') and made the recommendation that one be prepared for the Dam. On the basis of current information held by the Commission, it appears that no action was taken to follow up this recommendation on the part of DERM or the Dam Safety Regulator, until the letters sent out by DERM in November 2010 to gain assurances from referable dam owners that the EAP for their respective dam was current.

- a) **Was any action taken by DERM between February 2008 and November 2010, in response to the recommendation made by Worley Parsons in its February 2008 report (or for any other reason), to ensure that an EAP was prepared for Gordonbrook Dam? If so, what actions were taken and by whom and when? If not, why not?**
10. Gordonbrook Dam is on the Stuart River near Kingaroy. It is a 19 metre high zoned earth and rockfill dam with a right abutment ogee crested spillway. The dam is owned by the South Burnett Regional Council (SBRC) (formerly Kingaroy Shire Council) and has an incremental Population At Risk (PAR) of about 10.
11. The spillway adequacy assessment report "Gordonbrook Dam Contract No. 558 Spillway Adequacy Assessment", prepared by Worley Parsons, dated 14 October 2008, reviewed and accepted the incremental PAR of less than 10 for the extreme flooding failure of the dam. The assessment which included dam break modelling indicated the dam was able to pass about 62% of the Acceptable Flood Capacity.
12. Interaction with the dam owner during the period February 2008 to early 2010 primarily related to the Acceptable Flood Capacity assessment.
13. In order to specify the requirement for the spillway upgrade, revisions to the original safety conditions in January 2008 were required. It was recognised at the time that the dam owner had made limited progress in satisfying the existing safety conditions. It was decided to 'reset' the general dam safety management requirements as part of the re-setting of safety conditions.
14. New conditions were drafted incorporating revised timings for the submission of various safety documentation and these were discussed with Steve Carroll of SBRC prior to their formal issue on 5 October 2010. The revised conditions specified a new date of 1 January 2010 for submission of the EAP (this date was obviously an error that was not picked up at the time).

15. During these discussions SBRC had indicated to K [REDACTED] (of DERM Dam Safety) there was a component relating to Gordonbrook Dam in the old Kingaroy Shire Council Disaster Management Plan. Unfortunately K [REDACTED] has now left DERM and is not available to provide further detail. However, an email sent by K [REDACTED] on 27 September 2010 to S [REDACTED] indicates that S [REDACTED] had advised that the Council had some form of EAP included in the regional flood emergency evacuation plan.
16. An email was sent by K [REDACTED] on 28 September 2010 to S [REDACTED] in response to S [REDACTED] request regarding compliance of DS 13 which is regarding the EAP submission by March 2011. K [REDACTED] discussed this request with me and the reply requested SBRC to submit an acceptable EAP before November/December 2010. SBRC was also requested to submit an extract of EAP from the Council's Regional Emergency Flood Response Action Plan. K [REDACTED] email also indicated that if this extract from the Regional Plan was found to be workable for Gordonbrook Dam then the Council's request for extension of time to March 2011 to comply with Dam Safety Condition DS13 would be accepted.
17. DERM Dam Safety engineers [REDACTED] and K [REDACTED] visited SBRC on 28 October 2010 to elaborate on the safety condition requirements, in particular the EAP. During this visit they held a meeting with S [REDACTED] and they discussed the details of the dam safety conditions and the compliance dates. The urgency to have EAP was discussed and S [REDACTED] assured [REDACTED] and K [REDACTED] that SBRC had given priority to preparing an EAP.
18. An email was sent by K [REDACTED] on 26 November 2010 to S [REDACTED] acknowledging the appointment of a consultant to prepare the EAP. K [REDACTED] had also stressed to S [REDACTED] that SBRC should prepare the first version of the EAP as a matter of urgency.
19. Copies of the reports and correspondence referred to above are available on request.
20. DERM received a Draft EAP from SBRC on 22 December 2010 (Attachment PHA-36).

Item 2: Has the final form of the EAP and SOP and OMM for Gordonbrook Dam been provided to DERM? If not, will it be completed in time for the 2011/2012 wet season?

21. A subsequent EAP titled "interim EAP" (Attachment PHA-37) was received by DERM from SBRC on 15 September 2011. This EAP has incorporated DERM's comments and also includes the Queensland Floods Commission of Inquiry Interim Report recommendations on general discharge and flood warning.
22. A draft Operation and Maintenance Manual (OMM) (Attachment PHA-38) was received by DERM from SBRC for comment on 31 August 2011. It should be noted that the Dam Safety Conditions do not require the OMM to be submitted to

DERM. SBRC advised DERM on 21 November 2011 that the OMM has now been finalised.

23. DERM received a draft Standing Operating Procedures (SOPs) (Attachment PHA-39) on 31 August 2011 for comment. SBRC advised on 21 November 2011 that the SOPs have now been finalised and that SBRC will be submitting a copy to DERM.

Item 3: Is there a complete communications list contained in the EAP; in particular, are residents downstream of the dam identified in the communications list as parties to contact in the event of the dam overtopping?

24. A communication list is included in the EAP (Attachment PHA-37). This list contains contact details of 18 residents. The list also contains 10 additional residents whose telephone numbers are apparently being currently gathered.
25. I am not able to say whether the communications list is complete and whether all residents downstream of the dam are identified. It is not a function of DERM to assess EAPs for completeness of communication lists.

Item 4: No emergency event report was provided to the Commission in relation to the events at Gordonbrook Dam in the 2010/2011 wet season.

- a. Was any report provided to DERM by the dam operators?
- b. If not, what is the usual practice of DERM when no emergency event report is produced?

26. The Dam Safety condition requires an emergency event report to be produced by the dam owner (not operator) only if the EAP is activated.
27. The draft EAP that was in place during the January 2011 flood event (Attachment PHA-36) was only required to be activated when the safety of the dam was at significant risk i.e. within 5 metres of overtopping of the spillway. DERM Dam Safety were advised by SBRC that the EAP was not activated as the flood level over the spillway peaked at 2.35 metres and did not reach the trigger level to activate the EAP of the time.
28. The current interim EAP (Attachment PHA-37) has since reduced this trigger to 1.5 metres over the spillway.
29. Therefore no report was provided to DERM by the dam owner (not operator), as no report was required to be provided.
30. DERM is not generally in a position to assess whether an EAP has been triggered and that an emergency event report is due. This is the responsibility of the dam owner. If there is a major event and DERM discovers through other sources (e.g. the LDMG) that the EAP for a dam had been triggered but no emergency event

report has been produced DERM would follow up with the dam owner. Also if DERM is aware that extreme rainfalls occurred in the general areas of dams of interest during the wet season, the dam owners would be contacted to ascertain how the dam was performing.

Item 5: Flood preparedness - dam safety

Gordonbrook Dam has had a number of issues separately addressed, yet it is also one of the seven referable dams identified in Mr Allen's statement that had compliance action initiated against it due to the dam owner's failure to provide assurance of the currency of its EAP.

- a) **A Show Cause Notice was identified as a compliance action that was initiated. Was any other compliance action taken? If so, what action was taken?**
- b) **What was the process of deciding to issue a Show Cause Notice?**
- c) **What happened in response to the Show Cause Notice?**
- d) **What other compliance powers or actions are available to DERM or to Mr. Allen specifically to respond to this scenario, or similar breaches?**

Item 5 (a): A Show Cause Notice was identified as a compliance action that was initiated. Was any other compliance action taken? If so, what action was taken?

31. In relation to providing a response to this Item, I have assumed that the Commission requires a response for all seven dams identified in my earlier Statement. Compliance action in relation to Gordonbrook Dam is also detailed above.
32. My statement of 16 September 2011 at Paragraph 53 outlined compliance action taken by officers of DERM in relation to seven dams whose owners had failed to provide updates of EAPs for their dams as at 5 November 2010.
33. Under the provisions of the *Sustainable Planning Act 2009*, it is a requirement that a 'Show Cause Notice' is issued prior to taking compliance action in relation to non-compliance with dam safety conditions.
34. One of the seven referable dams was Gordonbrook Dam, which has already been dealt with in this statement. The following paragraphs summarise actions on the other six dams is outlined below. Copies of all correspondence and documents are available upon request. The actions are subsequent to those detailed in my previous statement of 16 September 2011. A Show Cause Notice was only issued in relation to Moody Creek Detention Dam.
35. Springfield Lakes – Upper Dam (#2016)
 - a. 6/05/11 – letter to dam owner providing comment regarding the Emergency Action Plan (EAP) and the Standing Operating Procedure (SOP) for the dam.

- b. 12/05/11 – letter from dam owner advising that EAP and SOP are to be revised and the documents re-issued.
- c. 18/05/11 – letter from dam owner advising that a consultant has been appointed to carry out the comprehensive inspection of the dam and review of all technical and operational documentation commencing June 2011.
- d. 23/08/11 – letter to dam owner advising of Queensland Floods Commission of Inquiry interim recommendations affecting referable dams that included issuing warnings about releases and outflows and developing a communication protocol.
- e. 26/09/11 – letter to dam owner concerning a new draft guideline on emergency action planning.
- f. 26/10/11 – email from dam owner advising that the Comprehensive Inspection of Springfield Lakes - Upper Dam and Lower Dam (Dam 2277) will be undertaken on 9/11/11.
- g. 13/11/11 – email from dam owner confirming inspection occurred on 9/11/11.
- h. 14/11/11 – email to dam owner acknowledging advice regarding the comprehensive inspection and seeking an update of the status of the SOP for the dam.

36. Springfield Lakes – Lower Dam (#2277)

- a. As for Springfield Lakes – Upper Dam (#2016)

37. Moody Creek Detention Dam (#1946)

- a. 6/07/11 – Information Notice accepting a further Failure Impact Assessment for Moody Creek Detention Dam as a Category 1 referable dam forwarded to Cairns Regional Council (CRC).
- b. 23/08/11 – letter to dam owner advising of Queensland Floods Commission of Inquiry interim recommendations affecting referable dams that included issuing warnings about releases and outflows and developing a communication protocol.
- c. 20/09/11 – email to [REDACTED], the consultant for CRC, providing comment/feedback on EAP for Moody Creek Detention Dam.
- d. 26/09/11 – letter to dam owner concerning a new draft guideline on emergency action planning.
- e. 21/10/11 – email to [REDACTED] the consultant for CRC, inquiring if the EAP for Moody Creek Detention Dam and McKinnon Creek Detention Dam (Dam Id 520) were activated during the flood rains in North Queensland in October 2011.

- f. 22/11/11 – telephone contact with [REDACTED] who advises EAPs for Moody Creek and McKinnon Creek detentions dams not activated as no significant runoff into the dams; the updated EAP for McKinnon Creek Detention Dam has now been completed and will be forwarded to DERM Dam Safety.

38. Lake Mitchell Dam (#521)

- a. 31/05/11 – Information Notice accepting a further Failure Impact Assessment for Lake Mitchell Dam as a category 1 referable dam forwarded to dam owner.
- b. 24/08/11 – letter to dam owner advising of Queensland Floods Commission of Inquiry interim recommendations affecting referable dams that included issuing warnings about releases and outflows and developing a communication protocol.
- c. 26/09/11 – letter to dam owner concerning a new draft guideline on emergency action planning.
- d. 30/09/11 – letter to dam owner requiring confirmation by 31 October 2011 that the EAP for the dam has been reviewed and updated, as necessary.
- e. 22/11/11 – telephone contact with [REDACTED] consultant for CRC, who advised that the EAP for the dam had been updated to reflect the recommendations of the Queensland Floods Commission of Inquiry. Copies yet to be provided to relevant stakeholders.

39. Forest Lake Dam (#651)

- a. 2/03/11 – email to Brisbane City Council (BCC) asking if Emergency Action Plan (EAP) for dam activated in 2010/2011 floods with response of same date advising that the EAP not activated as depth of water did not exceed 300mm above the fixed spillway.
- b. 23/05/11 – letter to BCC requiring response by 24 June 2011 to apparent non-compliance issues concerning Safety Conditions DS5, DS7, DS8, DS10, DS11 and DS13 of the EAP.
- c. 25/05/11 – email from BCC advising that a consultant had been engaged to undertake review of dam safety management documents referred to in DERM email of 23/05/11.
- d. 14/07/11 – DERM Dam Safety engineer accompanied BCC and consultant on Annual Inspection of Forest Lake Dam. Report received on 14/10 2011.
- e. 23/08/11 – letter to dam owner advising of Queensland Floods Commission of Inquiry interim recommendations affecting referable dams that included issuing warnings about releases and outflows and developing a communication protocol.

- f. 26/09/11 – letter to dam owner concerning a new draft guideline on emergency action planning.
- g. 3/10/11 – letter received from BCC advising of work being undertaken by the BCC in connection with Forest Lake Dam to deliver on the recommendations of the Queensland Floods Commission of Inquiry.
- h. 22/11/11 - an updated EAP yet to be received.

40. Environmental Dam (#222)

- a. 23/08/11 – letter to dam owner advising of Queensland Floods Commission of Inquiry interim recommendations affecting referable dams that included issuing warnings about releases and outflows and developing a communication protocol.
- b. 26/09/11 – letter to dam owner concerning a new draft guideline on emergency action planning.
- c. 1/11/11 – email to [REDACTED], DERM Senior Advisor, Regulatory Services, Water Management and Use (Rockhampton) seeking update of proposal to decommission dam, given that Safety Conditions had not been applied to the dam due to the fact that it is to be decommissioned.
- d. 1/11/11 – email from [REDACTED] advising that the timeframe for decommissioning is uncertain as it forms part of a larger change in mining operations that involves the re-diversion of two watercourses and mining of part of storage area of the dam. A copy of a letter to the mine owner dated 25 October 2011 was attached to this email.
- e. 7/11/11 – email to [REDACTED] of Rio Tinto seeking written undertakings from the dam owner concerning arrangements made with the downstream population at risk remote from the mine site (two houses), with the Local Disaster Management Group, and the Dam Safety Regulator, should an emergency event occur at the dam.
- f. 7/11/11- Darren Springer advised verbally that plan is to decommission the dam before the wet season but that timing is dependant on how soon Rio Tinto's consultant engineer can address questions raised by DERM's [REDACTED] hence can't be sure decommissioning will be completed by the wet season. Written confirmation in response to DERM's email of 7/11/11 is yet to be provided.

Item 5 (b): What was the process of deciding to issue a Show Cause Notice?

- 41. Section 588 of the *Sustainable Planning Act 2009* applies where the Dam Safety Regulator reasonably believes that a dam owner has committed or is committing a development offence, namely not complying with the requirements of a Dam Safety Condition applied to a referable dam.

42. Under Safety Condition DS13 – ‘Emergency Action Plans and Event Reports’, the dam owner is required to inter alia:
- a. review the Emergency Action Plan (EAP) for the dam each calendar year by the nominated date in DS13; and
 - b. where amendments are made to the EAP, provide an updated copy of the EAP to the Dam Safety Regulator within one month of the nominated date; or
 - c. where no amendments are necessary, provide written notification to the Dam Safety Regulator within one month of the nominated date that the EAP has been reviewed.
43. The current version of DS13 is Attachment **PHA-40**. However, some referable dams have older versions of DS13 that do not necessarily place obligations on the dam owner to review EAPs annually, to provide a copy of an amended EAP to the Dam Safety Regulator, or to provide written notification to the Dam Safety Regulator where no amendment is necessary. Regardless of which version of DS13 has been applied, ongoing communication between the Dam Safety Regulator and owners of referable dams has resulted in all referable dams having EAPs, apart from those yet to have safety conditions applied or where the due date for the provision of the EAP has not been reached or where dams are in the process of being decommissioned or where the dam owner’s property contains the PAR.
44. The Dam Safety work unit does not have a written procedure relating to the issue of a Show Cause Notice however, the Water and Industry Asset Management and Standards (WIAMS) unit within OWSR does have such a procedure – IM 4.6 Issuing a Show Cause Notice (Attachment **PHA-41**).
45. The Dam Safety work unit has adopted a process for issuing a show cause notice that is consistent with WIAMS procedure IM 4.6 Issuing a Show Cause Notice (Attachment **PHA-41**). As part of a quality assurance process, drafts of all show cause notices are reviewed by a suitably senior officer within OWSR before being finalised and issued. All notices are sent as registered mail with acknowledgement.
46. In deciding to issue a Show Cause Notice to CRC for failing to provide a current EAP for Moody Creek Detention Dam (Dam Id 1946), the DERM officer who issued the notice undertook a review of past dealings with the CRC regarding non-compliance issues for this dam noting that no updated EAP had been provided to DERM since 2002. A copy of the Show Cause Notice is Attachment **PHA-43**.

Item 5 (c): What happened in response to the Show Cause Notice?

47. In response to the Show Cause Notice, the CRC advised on 9 May 2011 that its consultant was heavily involved in work for the Queensland Reconstruction

Authority in the Tully area since Cyclone Yasi and that an EAP for Moody Creek Detention Dam and McKinnon Creek Detention Dam (a referable dam also owned by CRC) would be submitted by the end of May 2011.

48. The EAP submitted by the CRC for Moody Creek Dam was received by DERM on 22 June 2011.
49. Only one other Show Cause Notice has been issued by the Dam Safety unit. The notice was issued on 4 November 2011 to Redland City Council (RCC) for failing to comply with a number of safety conditions relating to Crystal Waters Upper and Lower Dam (Dam Id 2002). A copy of the Show Cause Notice is Attachment **PHA-44**. The council has until 16 December 2011 to provide a written response to DERM.

Item 5 (d): What other compliance powers or actions are available to DERM or to Mr Allen specifically to respond to this scenario, or similar breaches?

50. After considering the written representations of a dam owner in response to a Show Cause Notice issued under section 588 of the *Sustainable Planning Act 2009* (SPA), the Dam Safety Regulator may:
 - a. accept that the dam owner is reasonably progressing towards submission of an EAP by a nominated date and therefore defer further compliance action until the EAP is received or the nominated date has passed and the dam owner remains non-compliant; or
 - b. decide to issue the dam owner with Enforcement Notice under section 590 of SPA requiring the dam owner to submit a copy of an updated EAP.
51. It should be noted that the OWSR, Dam Safety unit has never had to issue an Enforcement Notice under section 590 of SPA to a referable dam owner.
52. The chief executive of DERM has delegated powers to issue notices under section 588 and section 590 of SPA to certain positions within OWSR including the Director, Dam Safety. A copy of the relevant delegation *Sustainable Planning Act Delegation (No. 1) 2011* is Attachment **PHA-45**.
53. The chief executive of DERM has also delegated a range of powers in relation to the regulation of referable dams under SPA to a number of positions within OWSR including the Director, Dam Safety and the Project Director, Dam Safety. A copy of the relevant delegation *Sustainable Planning Act Delegation (No. 1) 2011* is Attachment **PHA-45**. These powers include compliance powers.
54. Since 2008, the Dam Safety work unit has had a major focus on ensuring that the owners of referable dams or potentially referable dams have a Failure Impact Assessment (FIA) for the dams performed by and independent Registered Professional Engineer of Queensland and the FIA submitted to DERM. A FIA is

the methodology used to establish the existence or otherwise of PAR. The FIA guidelines are attachment PHA-33 to my statement dated 16 September 2011.

55. This focus has resulted in the issue of some 152 compliance notices to the owners of 78 dams requiring them to be failure impact assessed. The DERM Dam Safety Unit has achieved a very high level of compliance with the notices, though not all FIAs have been submitted by the due date stated in the notice.
56. DERM Dam Safety is currently in the process of referring its first case of non-compliance involving a FIA of a dam that exceeds the size criteria stated in section 343 of SPA to DERM's Litigation Unit.
57. If the chief executive or his delegate is satisfied or reasonably believes that a referable dam is in danger of failure and immediate action is necessary to prevent or minimise the impact of the failure the chief executive can use the emergency powers set out in chapter 4, part 1, division 4 of the *Water Supply (Safety and Reliability) Act 2008* (WSA) (Emergency Powers). This is regardless of whether or not there is an EAP for the dam. DERM has never exercised the Emergency Powers.

Item 6: Are letters sent to referable dam owners annually ensuring that EAPs are current, or were the letters sent in November 2010 an action that occurred on one occasion?

58. The letters sent out to referable dam owners in November 2010 were the first time that letters had been sent out requesting details of the status of referable dam EAPs.
59. The primary reason for these letters was recognition that the 2010-2011 wet season had a higher probability of being severe.
60. I personally became aware of the potential for a severe wet season during a State Disaster Coordination Meeting which I attended and I passed this information on to the General Manager, OWSR, Mr Robert (Bob) Reilly. Aside from the general media reports, I understand that Mr Reilly also became aware through a meeting with the then Director-General DERM (Mr John Bradley – now Director-General of the Department of Premier and Cabinet) on Friday 15 October 2010 in relation to flood preparedness.
61. Given the very prolonged severe drought conditions that had prevailed across Queensland prior to last year's wetter than average forecast, it had not been considered necessary to send out letters to specifically remind dam owners of their EAP obligations prior to November 2010.

Item 7: Are there any other actions that the Dam Safety Regulator has undertaken in the lead up to previous wet seasons to ensure the emergency management procedures of referable dams are prepared and appropriate?

62. In the past, the Dam Safety work unit has typically relied on general compliance with Dam Safety Conditions to demonstrate readiness for upcoming wet seasons.
63. As part of this, Dam Safety Audits and comprehensive inspection reports have been used to assess dam owner compliance with Dam Safety Conditions.
64. The Dam Safety Audits are organised and paid for by DERM. One of the issues reviewed as part of the Dam Safety Audits was compliance with the requirement to have an up to date EAP.
65. Over the past few years, resourcing limitations have restricted the Dam Safety work unit to about 11 to 13 Dam Safety Audits per year (after an initial burst of 38 Dam Safety Audits in 2007-2008). Due to the pressure of other programs and the resources required to satisfy the requirements of the Queensland Floods Commission of Inquiry, the Dam Safety work unit has been unable to perform any Dam Safety Audits this calendar year.
66. DERM's Dam Safety Audits were initially targeted at the major dams owned by the major dam owners such as SunWater, Seqwater, DERM and the major Local Government Associations. This was largely because these dams presented the greatest hazard to downstream communities with the highest Population At Risk (PAR) if the dams were to fail. It was found that these dam owners generally had good compliance with the applied Dam Safety Conditions.
67. Subsequently Dam Safety Audits have been increasingly targeted at smaller dams. While these dams generally have lower PAR many are older and were often built to lower standards. The dam owners also tend to be less familiar with dam safety requirements.
68. If deficiencies are identified during a Dam Safety Audit, it is the responsibility of the dam owner to correct the deficiencies.
69. It is recognised that some external consulting engineers can adequately undertake the Dam Safety Audits. However, it has been clearly demonstrated that the Dam Safety work unit can undertake the Dam Safety Audits much more cost effectively than external consultants. There are also added benefits in terms of interaction with dam owners and the development and maintenance of the expertise of DERM's dam safety engineers.
70. The Dam Safety Audits program has meant that 85 of Queensland's current 106 referable dams have been the subject of an audit since 2007. My personal view is that it would be highly desirable if all referable dams were audited every three to five years with more frequent audits being undertaken for inexperienced or recalcitrant referable dam owners.
71. The Dam Safety work unit has been restricted in the number of Dam Safety Audits it can conduct each year from a budgetary perspective. In addition, the unit's resources have been severely stretched in the 2011 calendar year in responding to the requirements of the Queensland Floods Commission of Inquiry.

72. Under the Dam Safety Conditions applied to all referable dams, dam owners also have to arrange comprehensive inspections of their dams by a Registered Professional Engineer Queensland (RPEQ) every five years. Amongst other things, comprehensive inspections are required to report on the adequacy of the EAP.
73. Modifications to Dam Safety Conditions introduced in about 2009 also have requirements for dam owners to report to DERM of the status of their compliance with a number of Dam Safety Conditions such as updating EAP contact details on an annual basis and a five yearly overall review of EAPs. Recent Dam Safety Conditions have also required dam owners to regularly exercise their EAPs (typically on an annual basis) to ensure that those expected to be involved are acquainted with the EAP and potential deficiencies are identified. In some instances DERM has participated in these exercises.
74. Whenever older Dam Safety Conditions are updated, for whatever reason, these requirements are added to the updated Dam Safety Conditions.
75. Any additional attention given to particular dams prior to and during each wet season has been very dependent on whether the referable dam had identified deficiencies or not.
76. Where a dam had identified deficiencies, specific attention was given to the dam owners to ensure that personal contact was made with them and that the dams were at maximum readiness for the upcoming season. The emergency management groups would also be informed of the situation through either the police or the local authorities (generally through Emergency Management Queensland (EMQ)).
77. Examples of such dams include:
 - a. Middle Creek Dam at Sarina (from a spillway inadequacy perspective)
 - b. Ibis Dam at Irvinebank (from a dam stability perspective)
78. The Dam Safety work unit has also provided advice to local police and emergency services regarding non-referable dams whose failure might inundate bridge crossings downstream of the dams. This has occurred when the Dam Safety becomes aware of a dam with a potentially high risk of failure which would inundate such structures.
79. The Dam Safety unit has liaised with EMQ to ensure that EMQ has current copies of all referable dam EAPs.
80. If extreme rainfalls occurred in the general areas of these dams of interest during the wet season, the dam owners would be contacted to ascertain how the dam was performing.

Item 8: Is any action taken by the Dam Safety Regulator prior to a wet season to ensure that dams are safe and operable? For example, Lenthalls Dam operated by Wide Bay Water has five crest gates that have been relatively inoperable since their installation in 2008. What actions could the Dam Safety Regulator take to ensure that referable dams will be able to operate safely as intended throughout the wet season? Would these actions be effective?

81. Dam safety remains the responsibility of the dam owner.
82. It also needs to be recognised that under normal circumstances referable dams are designed to withstand 'extreme' flood events. While the flood events of the 2010-2011 wet season were 'significant', there were only a few referable dams (Ibis Dam, Middle Creek Dam and potentially (in hind sight) North Pine Dam) where the safety of the dam was considered to be potentially 'at significant risk'.
83. The primary action taken to ensure referable dams are ready for any particular wet season is the application of Dam Safety Conditions to the owners of the dams through the provisions of the *Water Supply (Safety and Reliability) Act 2008*. These Dam Safety Conditions effectively require the establishment of a dam safety management program for each referable dam.
84. As stated previously, the Dam Safety Conditions require (amongst other things) that the dam owner arrange:
 - a. Periodic inspections by a RPEQ of the dam to identify potential dam safety deficiencies and to monitor developing deficiencies.
 - b. Periodic dam safety reviews by a RPEQ of the dams to ensure that the dams comply with current standards or to identify dam safety deficiencies.
 - c. Specific review of spillway adequacy.
 - d. Development and maintenance of Standing Operating Procedures (SOPs) to ensure dam owners have specific responsibilities for dam safety assigned to particular personnel.
 - e. Development and maintenance of Emergency Action Plans (EAPs).
 - f. Development and maintenance of Operation and Maintenance Manuals (OMMs).
 - g. Documentation relating to dam safety is stored securely for future access.
85. Sometimes a dam owner will engage a separate dam operator to perform these functions. However, legislative responsibility still remains with the dam owner.
86. If a dam owner effectively implements a dam safety management program the preparations for each wet season would be expected to be considered as part of the dam owner's dam safety management program.

87. In addition to these activities, special attention is given to partially constructed dams to ensure that they have:
- a. adequate diversion arrangements in place during construction; and
 - b. an EAP in place for the partially constructed dam.
88. The Dam Safety work unit tries to take a proactive approach to particular dams or sets of dams when serious risks are identified. This is done by talking to the dam owners and their consultants to ensure the risks are minimised as much as possible.
89. The 2010-2011 wet-season was the first wet season where letters were forwarded to referable dam owners requesting them to advise the Dam Safety Regulator of the status of the EAPs for the dam/s.
90. Prior to this, the Dam Safety unit relied primarily on periodic audits of referable dams to determine compliance with Dam Safety Conditions (of which the preparation of an EAP was part). The Dam Safety Audits have been detailed above.
91. If deficiencies are identified, it becomes a case of when and how they can the deficiencies be safely remediated. Often remediation works need to be prioritised.
92. In terms of spillway inadequacies, these are generally identified as part of:
- a. Safety Reviews (which are typically required every 20 years or sooner, if little is known about the dam or major developments in dam technology occur); or
 - b. DERM's spillway upgrade program.
93. In Queensland there are a limited number of gated dams. These dams are mostly owned by Queensland Bulk Water Supply Authority trading as Seqwater (Seqwater) or SunWater. The exceptions are Ross River Dam (owned by Townsville Regional Council but operated by SunWater) and Lenthalls Dam (owned and operated by Wide Bay Water). All have SOPs in place which require regular exercising of gates to ensure their ongoing operability.
94. As far as I am aware, apart from Lenthalls Dam (where design issues are apparently affecting the proper operation of the gates) all planned gate movements were successfully completed during the 2010-2011 wet season. This was an admirable result and reflects the dam owners' operation and maintenance programs were effective and does not indicate a need for further requirements to be imposed at this time.
95. If the owner of a referable or a potentially referable dam refused to undertake remedial works to reduce the risk of dam failure or to reduce the consequences of dam failure then the emergency powers contained in sections 358 to 363 of the

Water Supply (Safety and Reliability) Act 2008 could be invoked. To date this has not been necessary.

96. Lenthalls Dam has been the result of significant on going problems. Discussion of these ongoing issues is provided separately below in this Statement.
97. In terms of the Dam Safety work unit's preparations for the 2011-2012 wet season, the following actions have been undertaken:
 - a. DERM has written to all referable dam owners advising them of the Queensland Floods Commission of Inquiry recommendations with regards to communicating to people downstream of the dam, and encouraging them to implement the findings for this wet season.
 - b. DERM has written to referable dam owners to request that they confirm the EAPs are current for their dams, and if they have updated the plans, they are requested to forward a copy to DERM.
 - c. The EAP guideline is being updated to reflect the Commission's recommendations and has been forwarded as a draft to all referable dam owners. State (i.e. DERM, SunWater, Seqwater, Local Government Associations) owned referable dams will be required to implement the new procedure this wet season and advise DERM by 1 February 2012 regarding progress with implementation.
 - d. The Flood Mitigation Manuals for Wivenhoe and Somerset Dams and for North Pine Dam have been reviewed as detailed below in this statement.
 - e. The annual flood preparedness reports for Wivenhoe, Somerset and North Pine dams were submitted to the department on 30 September 2011 and they have been reviewed by Dam Safety. Copies are available upon request.
 - f. In the event of a flood with potential to cause the failure of a dam, the Queensland Dam Safety Regulator, Office of the Water Supply Regulator (OWSR) and Emergency Management Queensland (EMQ) would be notified by the dam owner. DERM OWSR would inform the Director-General of DERM and through that person, the Minister for Natural Resources. EMQ and the LDMG would activate appropriate disaster management arrangements.
 - g. Procedures have been put in place to ensure that suitable personnel will be available over the Christmas/New Year period.

Item 9: It was mentioned in Mr Allen's statement that DERM do not approve or review the content of Emergency Action Plans. Emergency Action Plans are merely submitted to DERM to have on file. Is there any other State agency that assesses the content of referable dam EAPs either at the time they are written, or once they are finalised as part of an ongoing procedure of review?

98. If it was considered necessary for a "State agency" to approve or review the content of EAPs for referable dams then no doubt issues of exemption from legal liability would have to be considered along with resourcing and staffing skills and availability. Further issues of a head of power, enforcement powers, emergency powers and potential penalties might also arise.

99. It is my personal opinion that, should it be considered necessary for a "State agency" to approve or review the content of EAPs for referable dams then Emergency Management Queensland (EMQ) would be the most appropriate "State agency", perhaps working with the Local Disaster Management Groups (LDMGs). EMQ does not currently undertake this role.

100. As stated in my earlier statements, DERM does not approve or undertake any significant review of EAPs. Dam Safety staff officers are not members of the LDMGs and are not specifically trained in Disaster Management procedures/processes. Dam Safety staffs' participation in the emergency management system has generally been at a more strategic level although staff have, in the past, presented papers to Emergency Management Queensland (EMQ) conferences/workshops and visited some LDMGs to raise awareness of the potential impacts of dam failure. There is probably a need to do this again.

101. The only aspects of an EAP that Dam Safety staff review to any extent are:

- a. Which parties are included;
- b. The scope of the emergencies addressed; and
- c. The currency of the document.

102. Section 9 of the DERM Dam Safety Management Guidelines (Attachment PHA-46) requires dam owners to liaise with the Disaster District Coordinator in developing and reviewing the EAP for a referable dam.

103. In the draft updated version of Section 9, sent out to referable dam owners in September 2011, this requirement was updated and the liaison requirements strengthened. EMQ reviewed the updated version before it was sent out to referable dam owners and local authorities for comment.

104. The Local Disaster Management Group (LDMG) is the ideal group to ensure that the EAPs are appropriate and consistent with the local disaster management plans. The only risk is that the LDMG imposes an unbalanced set of responsibilities on the dam owner (with a corresponding reduction in their responsibilities). An issue such as this has already arisen in North Queensland where a local authority and a dam owner had such a disagreement. The only

current mechanism available to achieve an appropriate balance of responsibilities is perhaps EMQ acting as an arbitrator with dam safety advice provided by DERM when requested.

105. While it is a requirement of the dam safety conditions that the EAPs are forwarded to the local authorities downstream of the dams (who are the organisers of the Local Disaster Management Group), DERM does not have any control over LDMGs and while DERM can encourage dam owner membership of LDMGs, DERM cannot mandate membership. To this end, Recommendation 4.15 contained in the Queensland Floods Commission of Inquiry Interim Report has been extremely useful in making this happen.

Item 10: If DERM approved EAPs would this improve the process and outcome of the decision?

- a) **Is DERM the most appropriate agency to approve EAPs?**
- b) **If DERM is not the agency best able to approve or review the content of EAPs, who would be best placed to do this work?**

106. It is my personal opinion that DERM is not the most appropriate agency to approve EAPs. As stated above DERM Dam Safety staff are not members of the Local Disaster Management Groups (LDMGs) and are not trained in Disaster Management procedures/processes. As a result Dam Safety staff are not trained to assess whether a dam owner's proposed EAP is the best approach or not.

107. Different LDMGs have different compositions and arrangements which reflect their local community needs. As such, LDMGs are best placed to comment on the adequacy of a dam owner's EAP.

108. This is why Recommendation 4.15 of the Queensland Floods Commission of Inquiry's Interim Report was so important. The Dam Safety work unit has always encouraged dam owner involvement in Local Disaster Management Groups but this has met with mixed success.

109. As stated above, my personal opinion is that the LDMGs are in the best position to review the EAPs and EMQ is in the best position to approve the EAPs.

Item 11: Lenthalls Dam

How has DERM been involved in the issues with Lenthalls Dam and the inoperability of the gates since their installation on the spillway in 2008?

- a) **Has DERM initiated contact with Wide Bay Water to check up on the status of the gates in a general sense, or specifically before any wet season?**
- b) **Have the advantages and disadvantages in issuing a direction or initiating any kind of compliance action been considered by Mr Allen about this problem since 2008?**

- c) **Wide Bay Water has conducted a number of investigations into the problems with the gates on its own behalf. Has DERM given any thought to initiating or conducting an independent investigation to assess the options available in the event that gate operability issues persist?**
- d) **What involvement does the Dam Safety Regulator have in the continued efforts of Wide Bay Water to rectify these operational difficulties with the gates?**

110. Lenthalls Dam is owned and operated by Wide Bay Water Corporation (WBW) for the purpose of providing urban water supply to the Hervey Bay area. The dam is located on Burrum River. It is regulated as a Category 2 referable dam with a Population At Risk (PAR) of some 270 people if the dam were to fail.

111. The Full Supply Level (FSL) of Lenthalls Dam was increased by 2.0 metres in 2007. Apart from raising the embankment height by 0.6 metres, the new FSL of the dam was achieved by installation of five gates across the existing spillway.

112. The spillway gates rely on buoyancy tanks in the gates filling during the rise in lake levels to the point that the weight of the gate overcomes the friction to the point where they drop down to allow greater flood releases. At the end of the flood event, the buoyancy tanks drain and the gates lift out of the water so that discharge stops.

113. During the first flood event that passed through the completed dam in February/ March 2008, the gates failed to operate as designed. Since the DERM Dam Safety work unit became aware of the issue there has been frequent contact with WBW to attempt to resolve the matter. A copy of all correspondence is available on request.

114. Dam Safety work unit staff were not closely involved in the design or construction of the raised dam (Dam Safety staff have, for example, sat on the expert review panel for other dams). State agencies were involved in the preliminary designs and a reputable dam engineering consultant was involved in the final design. On several occasions it has been thought the final solution has been determined and implemented. However, unfortunately this has not been the case.

115. The DERM *Guidelines on Acceptable Flood Capacity for Dams* (Attachment PHA-47) have been in place since February 2007 and the Schedule of Upgrades (contained in Table 3 of that document and reproduced below) details the required spillway capacity for referable dams.

Tranche	Required minimum flood discharge capacity	Date by which the required minimum flood capacity is to be in place for existing dams
1	25 per cent of AFC or 1:500 AEP flood event (whichever is the bigger flood)	These dams must be upgraded as soon as possible
2	50 per cent of AFC or 1:2000 AEP flood event	1 October 2015

	(whichever is the bigger flood)	
3	75 per cent of AFC	1 October 2025
4	100 per cent of AFC	1 October 2035

Table 3: Schedule for dam safety upgrades

116. In its current state, even if all the spillway gates do not open, Lenthalls Dam can still pass a 1:50,000 AEP flood event. This is about 68% of the ultimately required Acceptable Flood Capacity and, as such, already satisfies the Tranche 2 requirement. When this is considered in combination with WBW's ability to partially open the gates during events such as those during the 2010-2011 wet season, it is considered on balance that there is not a very high risk that failure of the gates to fully open will cause failure of the dam.

117. Compliance action has certainly been considered over the operation of the spillway gates and whether there was a need to expedite finding a solution to achieve reliable operation of the gates. There are a number of issues to be considered in making such a decision. These include:

- a. While, in principle, the lack of reliability of the Lenthalls Dam spillway gates would seem to be related to the inability of the opening forces on the gates to overcome the friction loads, the precise solution to the problem is not immediately evident. (DERM dam safety has not attempted to undertake our own analysis of these loadings as it is considered to be primarily an issue to be addressed by WBW and their consultants.)
- b. Because WBW currently complies with the spillway adequacy requirement, it is difficult see any such compliance action succeeding.
- c. WBW are undertaking appropriate studies to determine the cause of the problem and to determine appropriate solutions to remediate the problem. Any compliance action undertaken by DERM would be to see that these studies are undertaken using notices issued under s.356 of the WSA.
- d. WBW continue to keep DERM dam safety informed of the results of these studies. The most recent briefing was on 23 November 2011. For this briefing WBW provided the following reports (copies are available on request):

	Report	Area covered by report
1	Memo from GHD to WBW dated 11 October 2011	Progress on Lenthalls crest gates solution: Results of hydrodynamic modelling of flow over the gates
2	SKM File note of 18 October 2011	Preliminary estimate of the static head on the gates
3	Memo from GHD to WBW dated 19 October 2011	Progress on Lenthalls crest gates solution: Results of hydrodynamic modelling of

		flow over the gates
4	Memo from GHD to WBW dated 7 November 2011	Concept development, Lenthalls Crest Gates
5	Letter from Glen Hobbs and Associates to Allens Arthur Robinson date 11 October 2011	Discusses the loads on the gates as assessed by GHD and some of the practical difficulties of relying on spoilers to modify the hydrodynamic loads on the gates.
6	Memo from GHD to WBW dated 16 November 2011	Progress on concept to solve gate operational issues

DERM considers that these reports illustrate the complexity of the problem and that WBW are using multiple well credentialed consultants to resolve the issue.

- e. WBW have significantly improved the EAP since the problem became apparent and seem to be investing a lot of time and effort in preparing the dam for flood operations and operating the dam during flood events.
- f. Because Lenthalls Dam is not at risk of 'imminent failure' the emergency powers contained in Chapter 4 of the WSA do not apply.
- g. Given Lenthalls Dam's current spillway adequacy and the specialised nature of the problem, there is no evidence to suggest that these studies would proceed any quicker if compliance action was undertaken.

118. My personal view is that WBW have learnt a great deal about the operation of gated dams since the problems with the gates became apparent and I believe they are now doing as much as they can to correct the gate operational problems.

Item 12: Flood event report review

It is identified in Mr Allen's statement that there is no formal set work procedure for reviewing flood event reports whether triggered under an EAP or a flood mitigation manual.

- a) In your opinion, would it be desirable to have a formal work procedure for reviewing flood event reports in place?**
- b) If a formal work procedure would be desirable, would you recommend that the process set out in that procedure differ from the process that was actually employed in any material way? If so, how?**

119. Separate answers are provided for event reports required for Flood Mitigation Manuals (FMMs) and Emergency Action Plans (EAPs).

120. For FMM flood event reports, except in insignificant flood events the reviewer of the report will need to have an in depth knowledge of the particular dam and its prescribed operation. Similarly, each major flood will be different to previous

flood events and may require different issues to be addressed. Event reports currently only will be received for two FMMs (3 dams) and their review would only be given to officers with appropriate expertise. It is not considered good use of resources in preparing a formal work procedure for the limited situations especially given the possibility of significant changes to the manuals in the near future. Apart from indicating the reviewer must make reference to the approved FMM I am unsure if any very specific guidance can be provided.

121. There may be some benefit in producing a 'work procedure' which covers the review of EAP flood event reports.

122. However, if a 'work procedure' is produced, it needs to be recognised that:

- a. The prime reason for EAP 'flood events reports' has been to ensure that any potential damages or design issues that have become evident during the passage of a significant flood are identified and documented for attention subsequent to the passage of the next flood event.
- b. EAP flood event reports also ensure some form of documentation of the event that occurred which will enable future debriefing and review of flood operational practices.
- c. While significant flood events usually occur in the wet season, it needs also to be recognised that there can also be significant flood events outside the nominal wet season.
- d. If the DERM Dam Safety work unit is not advised of the implementation of EAPs, the DERM Dam Safety work unit would need to independently determine whether an EAP has been triggered.
- e. Because the WSA provisions only apply to referable dam owners, DERM has no power to require Local Disaster Management Groups (LDMGs) to contribute to the report and any such comment would need to be obtained on a co-operative basis.
- f. There is a variance in practices across referable dam owners with some dam owners activating their EAPs for smaller events that would impose very little additional risk to the safety of their dams and the safety of those downstream. Some EAPs are even activated before Full Supply Levels are reached e.g. Lenthalls Dam. There is little to be gained in requiring event reports to be produced in those situations.
- g. If compliance action is to be considered on the quality or the content of EAP flood event reports, there will need to be further modification to section 9 the Queensland Dam Safety Management Guidelines or the dam safety conditions being more specific on what is to be included in the event reports and enabling DERM to take comments made by the LDMGs into account.

123. I would suggest that, if a work procedure was to be developed to cover Emergency Event Reporting, it would have to be initially based on what was done following the 2010-2011 wet season. This involved:

- a. A survey (by phone and email) of referable dam owners to determine whether their EAPs had been triggered.
- b. For those EAPs that had been triggered, the issuance of a reminder of the requirement contained in Dam Safety Condition DS13 that they had to provide an emergency event report.
- c. On receipt of the report, it was reviewed for dam safety implications by a Dam Safety work unit engineer.
- d. If any issues were identified, those issues would be raised with the relevant dam owner to determine the dam owner's plans to address the issue.

124. Now, with the involvement of the dam owner in meeting of the LDMGs, there is also the opportunity to address the EAP 'learnings' into the dam owner's EAP.

Item 13: It is identified in Mr Allen's statement that while it is theoretically a requirement that a Dam Safety Regulator be notified within 48 hours that an EAP has been triggered, in practice this is done inconsistently.

- a) In your opinion would it be desirable to have this notification Obligation enforced?**
- b) If the notification obligation is enforced in practice, would you recommend that the time for the notification to be given be changed, either to allow more or less time after the EAP is triggered for notification to be given?**

125. The overall purpose of the EAP Dam Safety Condition is to ensure the dam owner has procedures in place to effectively deal with emergency situations.

126. The role of the Dam Safety Regulator is to intervene, as required, and to provide advice if needed. The Dam Safety Regulator also provides briefings to senior management of DERM. In most cases it is preferred that the dam owner's expert engineer (who should have a more in-depth knowledge of the particular dam) take the lead in responding to an emergency situation.

127. The 48 hour notification requirement was included in the safety conditions in the expectation that dam owners would develop their EAPs such a way that the EAP was only triggered for very significant flow events or emergency situations. The Queensland Dam Safety Management Guidelines refer to an EAP identifying "emergency conditions which could endanger the integrity of the dam and which require immediate action".

128. Most dam owners have nevertheless opted to activate their EAPs in flood situations at much smaller events. In most small flood events there is no real reason for the Regulator to be informed.
129. There may, however, be occasions where enforcement of this requirement is necessary but it needs to be left to the discretion of the decision maker.
130. As stated in previous statements, the issue as to whether or not there is an urgent requirement to notify the regulator of an EAP being activated probably depends on the circumstances of the particular event.
131. If it is a genuine emergency involving lives at risk or potentially at risk from dam failure then the preference is to firstly notify those who need to know in an emergency response sense to ensure appropriate actions are taken when needed and notification of the regulator is still important but of lower priority (hence the 48 hour requirement).
132. The prime purpose of the notification is to brief senior DERM management and to act as a trigger for the Emergency Event Report requirement. However, the reporting only becomes due after the completion of the event. While this is not a problem for most dams, some dams such as Burdekin Falls Dam can discharge floodwaters for months and the required timing of the event report may need to be considered with some flexibility. Also, if subsequent events occur (as happened in the 2010-2011 wet-season), the Dam Safety work unit would rather the dam owners invest their time managing the dam rather than finalising the Event Report within the nominated timeframe.
133. The 48 hour notification time would normally be too long a period of time for the Dam Safety work unit to take any operational action in relation to the incident. It was originally nominated to ensure that DERM was notified in a reasonable time after the urgency of the original emergency had subsided so that action could be taken to ensure remedial actions were initiated if damages occur or deficiencies were identified during the event. This notification time (48 hours) is probably about the correct time.
134. The vast majority of incidents relate to non-referable dams. For such dams, good relationships with Emergency Management Queensland and the State Disaster Coordination Group generally mean that the Dam Safety work unit hears of emerging events as they happen. When notified of such an event, the usual process would be for Dam Safety staff to try to inspect the site and to determine whether remedial actions are required or, if not possible, to advise those reporting the incident on what should be done. If necessary, the emergency powers could be utilised although it has not been necessary to date because of the nature of the incident or the cooperation of the dam owner. Unfortunately the Large Referable Dam Assessment Program is nearing completion and DERM Dam Safety will not be resourced to undertake this activity in the longer term.
135. Digital versions of EAPs are now becoming available and senior Dam Safety staff will be able to access them outside normal working hours.

136. Any decision to take compliance action against the referable dam owner would have to be made after considering the consequences of failing to notify the Dam Safety Regulator.

Item 14: Flood mitigation manual review

In Mr Allen's statement a summary is given of the process of approval for the flood mitigation manuals for Wivenhoe and Somerset Dams and North Pine Dam prepared during 2011 ('the Interim Flood Manuals') up to 7 September 2011 and it is said at paragraph 30 that "negotiations are continuing".

- a) **To the extent it is not already described in Mr Allen's statement of 12 September 2011, what was the process for the assessment and approval of the Interim Flood Manuals?**
- b) **What was the basis for the decision to approve each of the Interim Flood Manuals?**

Mr Allen should attach all documents evidencing the assessment and approval process for the Interim Flood Manuals including the completed Assessment and Decision Forms (Attachment C to DS5.3).

137. The Commission published an Interim Report on 1 August 2011 which recommended an interim review and a long term review of:

- a. The Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam; and
- b. The Manual of Operational Procedures for Flood Mitigation at North Pine Dam.

138. The process for the Interim Flood Mitigation Manuals is set out below.

Approval Process for Revision 8 of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (W&S FMM Rev 8)

139. Seqwater submitted their first draft version for comment on 26 August 2011.

140. Following this there were several rounds of DERM commenting on the latest draft version, Seqwater responding to those comments and providing updated drafts. DERM's lawyers and Seqwater's legal representatives were extensively involved throughout the process.

141. On 29 September 2011 Seqwater submitted W&S FMM Rev 8 to DERM for approval by delivering a letter with two hardcopies and an electronic copy to the Dam Safety unit at Mineral House.

142. When Seqwater submitted W&S FMM Rev 8 for approval, it also included a letter from Seqwater's independent peer reviewer, Mr Len MacDonald, stating that he was satisfied with the content.
143. I was the Assessing Officer under DERM Dam Safety work procedure DS 5.3 and recommended approval of W&S FMM Rev 8.
144. A copy of the briefing note CTS-17203/11 is attachment **PHA-48**. For security reasons the actual W&S FMM Rev 8 has been removed. I understand that Seqwater provided a copy of W&S FMM Rev 8 to the Commission and a redacted version was available on the internet. Material within the briefing note that is the subject of legal professional privilege has also been redacted.
145. The briefing note was presented to the Acting Director-General Mr Wall at a meeting on 30 September 2011 attended by:
- a. Mr Wall.
 - b. Myself.
 - c. Mr Robert (Bob) Reilly, General Manager OWSR
 - d. Mr [REDACTED] Acting Associate Director-General, Operations and Environmental Regulator.
 - e. [REDACTED] Acting Director Legislative Development Services.
 - f. [REDACTED] Executive Officer, Inquiry Recommendations Implementation Group.
 - g. [REDACTED] Principal Lawyer, Legal Services.
146. The then Acting Director-General DERM, Mr Terry Wall was the Decision Maker and on 30 September 2011 he directed that the W&S FMM Rev 8 be approved by way of Gazette Notice. The Gazette Notice was published on 1 October 2011, functioning as an approval under the WSA for a period of 5 years from the date of approval (the date of approval of the W&S FMM Rev 8 and the date it came into effect was therefore 1 October 2011).
147. A copy of the Gazette Notice is attachment **PHA-49**.
148. As I was not the Decision Maker, it would not be appropriate for me to address the basis for the decision to approve the W&S FMM Rev 8 except to say that I believe that matters are well set out in attachment **PHA-48** and the Decision Maker had the opportunity to ask questions regarding the brief at a meeting as detailed above.

Approval Process for Revision 6 of the Manual of Operational Procedures for Flood Mitigation at North Pine Dam (NP FMM Rev 6)

149. Seqwater submitted their first draft version for comment on 12 September 2011.
150. Following this there were several rounds of DERM commenting on the latest draft version, Seqwater responding to those comments and providing updated drafts. DERM's lawyers and Seqwater's legal representatives were extensively involved throughout the process.
151. There was more technical revision work in the NP FMM Rev 6. Given the difficulties in the January 2011 flood event in opening the gates at higher Lake Levels, Seqwater submitted a revised gate opening schedule (Appendix C of NP FMM Rev 6) to ensure that the spillway gates were opened sooner to ensure that the problems that occurred in January 2011 did not recur.
152. Aside from the more secure gate operations, the following table summarises the benefit of the consequences of earlier gate openings for the January 2011 flood event:

January 2011 Flood Event	Maximum Headwater EL (m)	Maximum Discharge (m ³ /sec)
Actual Operations ¹	41.11	2850
Revision 5 Stage-Gate opening	41.123	2738
Revision 6 Stage-Gate opening	40.541	3106

The consequences of the revised gate operating schedules are summarised in Attachment A to my DS 5.3 Decision recommendation form.

There are also benefits in being able to pass a greater proportion of the Acceptable Flood Capacity for North Pine Dam although this has not been quantified to any great degree to date.

153. On 10 October 2011 Seqwater submitted NP FMM Rev 6 to DERM for approval by delivering a letter with two hardcopies and an electronic copy to the Dam Safety unit at Mineral House.
154. When Seqwater submitted NP FMM Rev 6 for approval, it also included a letter from Seqwater's independent peer reviewer, Mr Len MacDonald, stating that he was satisfied with the content.
155. I was the Assessing Officer under DERM Dam Safety work procedure DS 5.3 and recommended approval of NP FMM Rev 6.
156. A copy of the briefing note CTS-17720/11 is attachment **PHA-50**. For security reasons the actual NP FMM Rev 6 has been removed. I understand that Seqwater provided a copy of NP FMM Rev 6 to the Commission and a redacted version is available on the internet. Material within the briefing note that is the subject of legal professional privilege has also been redacted.

¹ January 2011 Flood Event, Report on the operation of North Pine Dam, 11 March 2011

157. The briefing note was presented to the Acting Director-General Mr Wall at a meeting on 11 October 2011 attended by:
- a. Mr Wall.
 - b. Myself.
 - c. Mr Robert (Bob) Reilly, General Manager OWSR
 - d. [REDACTED] Acting Director Legislative Development Services.
 - e. [REDACTED] Principal Lawyer, Legal Services.
158. The then Acting Director-General DERM, Mr Terry Wall was the Decision Maker and on 11 October 2011 he directed that NP FMM Rev 6 be approved by way of Gazette Notice. The Gazette Notice was published on 11 October 2011, functioning as an approval under the WSA for a period of 5 years from the date of approval (the date of approval of the NP FMM Rev 6 and the date it came into effect was therefore 11 October 2011).
159. A copy of the Gazette Notice is attachment **PHA-51**.
160. A copy of the Schedule of Authorities pursuant to NP FMM Rev 6 is attachment **PHA-52**.
161. As I was not the Decision Maker, it would not be appropriate for me to address the basis for the decision to approve the NP FMM Rev 6 except to say that I believe that matters are well set out in attachment **PHA-50** and the Decision Maker had the opportunity to ask questions regarding the brief at a meeting as detailed above.

Approval Process for Revision 9 of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (W&S FMM Rev 9)

162. Following the approval of W&S FMM Rev 8, legislative changes were made to the *Water Act 2000* enabling the Minister administering the Act, in certain circumstances, to make declarations of temporary full supply levels to mitigate the impacts of a potential flood.
163. On or around 4 November 2011 Seqwater advised that it wished to amend W&S FMM Rev 8 to include a proposed new Chapter 8 “Declarations of Temporary Full Supply Levels for Flood Mitigation” and consequential amendment. These amendments were proposed to enable releases to drain the dams down to a new temporary full supply level to proceed under the provisions of the Manual. Following this there were several rounds of DERM commenting on the latest draft version, Seqwater responding to those comments and providing updated drafts. DERM’s lawyers and Seqwater’s legal representatives were extensively involved throughout the process.

164. On 10 November 2011 Seqwater submitted W&S FMM Rev 9 to DERM for approval by delivering a letter with two hardcopies and an electronic copy to the Dam Safety unit at Mineral House.
165. I was the Assessing Officer under DERM Dam Safety work procedure DS 5.3 and recommended approval of W&S FMM Rev 9.
166. A copy of the briefing note CTS-19901/11 is attachment **PHA-53**. For security reasons the actual W&S FMM Rev 9 has been removed. I understand that Seqwater provided a copy of W&S FMM Rev 9 to the Commission and a redacted version is available on the internet. Material within the briefing note that is the subject of legal professional privilege has also been redacted.
167. The briefing note was presented to the Director-General Mr Reeves at a meeting on 11 November 2011 attended by:
- a. Mr Reeves.
 - b. Myself.
 - c. [REDACTED], Acting General Manager OWSR.
 - d. [REDACTED] Acting Director Legislative Development Services.
 - e. [REDACTED] Principal Lawyer, Legal Services.
168. The Director-General DERM, Mr James (Jim) Reeves was the Decision Maker and on 11 November 2011 he directed that the W&S FMM Rev 9 be approved by way of Gazette Notice. The Gazette Notice was published on 14 November 2011, functioning as an approval under the WSA for a period of 5 years from the date of approval (the date of approval of the W&S FMM Rev 9 and the date it came into effect was therefore 14 November 2011).
169. A copy of the Gazette Notice is attachment **PHA-54**
170. A copy of the Schedule of Authorities pursuant to W&S FMM Rev 9 is attachment **PHA-55**.
171. As I was not the Decision Maker, it would not be appropriate for me to address the basis for the decision to approve W&S FMM Rev 9 except to say that I believe that matters are well set out in attachment **PHA-53** and the Decision Maker had the opportunity to ask questions regarding the brief at a meeting as detailed above.

Approval Process for Revision 7 of the Manual of Operational Procedures for Flood Mitigation at North Pine Dam (NP FMM Rev 7)

172. Following the approval of NP FMM Rev 6, legislative changes were made to the *Water Act 2000* enabling the Minister administering the Act, in certain circumstances, to make declarations of temporary full supply levels to mitigate the impacts of a potential flood.
173. Seqwater advised that it wished to amend NP FMM Rev 6 to include a new gate opening tables in Appendix C on or around 29 October 2011 and to include proposed new Chapter "Declarations of Temporary Full Supply Levels for Flood Mitigation" and consequential amendment on or around 8 November 2011. These amendments were proposed to enable releases to drain the dams down to a new temporary full supply level to proceed under the provisions of the Manual. Following this there have been several rounds of DERM commenting on the latest draft version, Seqwater responding to those comments and providing updated drafts. DERM's lawyers and Seqwater's legal representatives have been extensively involved throughout the process.
174. NP FMM Rev 7 has not been submitted as at the date of this statement.
175. A copy of all my correspondence in this matter is available upon request.
176. In addition to this activity regarding the Interim Flood Manuals, Seqwater has formed a Steering Committee and is progressing the longer term review of both Flood Mitigation Manuals in accordance with the recommendations contained in the Interim Report of the Queensland Floods Commission of Inquiry.

Answers the following questions, arising from his statement of 16 September 2011 provided to the Commission:

Item 15: Toowoomba CBD Investigations

Reference is made in paragraph 19 to the current Dam Safety Analysis to be completed by 1 December 2011 at the earliest.

- a) **Although the Commission is aware this Dam Safety Analysis is not yet complete, please provide an update on its current status, and likely outcomes.**

177. Subsequent discussions with Toowoomba Regional Council (TRC) indicated that TRC had already engaged consultants GHD to undertake a Failure Impact Assessment (FIA) for the West Creek detention basins and I understand that GHD subsequently provided a copy of the assessment to TRC.
178. With TRC's cooperation the Dam Safety work unit has now obtained a copy of the FIA. The FIA has been certified by a RPEQ in accordance with the provisions of the WSA. It indicates that there is no population at risk if the West Creek detention basins were to fail.
179. A copy of the FIA is available on request.


180. The Dam Safety work unit has commenced reviewing this FIA and will enter into discussions with TRC over the FIA in the near future. Unfortunately, the Dam Safety work unit has not had the resources to progress this matter further at this time,

I make this solemn statement on oath conscientiously believing the same to be true, and by virtue of the provisions of the *Oaths Act 1867*.

Signed . 

Peter Hugh Allen

Taken and declared before me, at Brisbane this ^{24th}..... day of November 2011


.....
Solicitor/~~Barrister~~/Justice of the
Peace/~~Commissioner~~ for Declarations

Our ref: Doc 1781071

17 November 2011

Mr Paul Lack
Assistant Crown Solicitor
Crown Law
GPO Box 5221
BRISBANE QLD 4001

Dear Mr Lack

Department of Environment and Resources – Dams

Please find enclosed a Requirement to Provide Statement to the Commission addressed to Mr Peter Allen, Director of Dam Safety (Water Supply) in the Office of the Water Supply Regulator for the Department of Environment and Resources, relating to questions arising from his statements dated 12 September 2011 and 16 September 2011 respectively.

The material is returnable to the Commission no later than 4 pm, Thursday, 24 November 2011.

If you require further information, please contact Ms Susan Hedge on telephone [REDACTED]

We thank you for your assistance.

Yours sincerely



Jane Moynihan
Executive Director

Encl.

Our ref: Doc 1741373

17 November 2011

Mr Peter Allen
Director, Dam Safety (Water Supply)
Office of the Water Supply Regulator
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the *Commissions of Inquiry Act 1950* (Qld), require Mr Peter Allen, Director, Dam Safety (Water Supply), Office of the Water Supply Regulator, Department of Environment and Resource Management (DERM), to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Allen:

Answers the following questions, arising from his statement of 12 September 2011 provided to the Commission:

Gordonbrook Dam

1. A February 2008 Worley Parsons report identified that Gordonbrook Dam did not have an Emergency Action Plan ('EAP') and made the recommendation that one be prepared for the Dam. On the basis of current information held by the Commission, it appears that no action was taken to follow up this recommendation on the part of DERM or the Dam Safety Regulator, until the letters sent out by DERM in November 2010 to gain assurances from referable dam owners that the EAP for their respective dam was current.
 - a. Was any action taken by DERM between February 2008 and November 2010, in response to the recommendation made by Worley Parsons in its February 2008 report (or for any other reason), to ensure that an EAP was prepared for Gordonbrook Dam? If so, what actions were taken and by whom and when? If not, why not?
2. Has the final form of the EAP and SOP and OMM for Gordonbrook Dam been provided to DERM? If not, will it be completed in time for the 2011/2012 wet season?

3. Is there a complete communications list contained in the EAP; in particular, are residents downstream of the dam identified in the communications list as parties to contact in the event of the dam overtopping?
4. No emergency event report was provided to the Commission in relation to the events at Gordonbrook Dam in the 2010/2011 wet season.
 - a. Was any report provided to DERM by the dam operators?
 - b. If not, what is the usual practice of DERM when no emergency event report is produced?

Flood preparedness – dam safety

5. Gordonbrook Dam has had a number of issues separately addressed, yet it is also one of the seven referable dams identified in Mr Allen's statement that had compliance action initiated against it due to the dam owner's failure to provide assurance of the currency of its EAP.
 - a. A Show Cause Notice was identified as a compliance action that was initiated. Was any other compliance action taken? If so, what action was taken?
 - b. What was the process of deciding to issue a Show Cause Notice?
 - c. What happened in response to the Show Cause Notice?
 - d. What other compliance powers or actions are available to DERM or to Mr Allen specifically to respond to this scenario, or similar breaches?
6. Are letters sent to referable dam owners annually ensuring that EAPs are current, or were the letters sent in November 2010 an action that occurred on one occasion?
7. Are there any other actions that the Dam Safety Regulator has undertaken in the lead up to previous wet seasons to ensure the emergency management procedures of referable dams are prepared and appropriate?
8. Is any action taken by the Dam Safety Regulator prior to a wet season to ensure that dams are safe and operable? For example, Lenthalls Dam operated by Wide Bay Water has five crest gates that have been relatively inoperable since their installation in 2008. What actions could the Dam Safety Regulator take to ensure that referable dams will be able to operate safely as intended throughout the wet season? Would these actions be effective?
9. It was mentioned in Mr Allen's statement that DERM do not approve or review the content of Emergency Action Plans. Emergency Action Plans are merely submitted to DERM to have on file. Is there any other State agency that assesses the content of referable dam EAPs either at the time they are written, or once they are finalised as part of an ongoing procedure of review?
10. If DERM approved EAPs would this improve the process and outcome of the decision?
 - a. Is DERM the most appropriate agency to approve EAPs?

- b. If DERM is not the agency best able to approve or review the content of EAPs, who would be best placed to do this work?

Lenthalls Dam

- 11. How has DERM been involved in the issues with Lenthalls Dam and the inoperability of the gates since their installation on the spillway in 2008?
 - a. Has DERM initiated contact with Wide Bay Water to check up on the status of the gates in a general sense, or specifically before any wet season?
 - b. Have the advantages and disadvantages in issuing a direction or initiating any kind of compliance action been considered by Mr Allen about this problem since 2008?
 - c. Wide Bay Water has conducted a number of investigations into the problems with the gates on its own behalf. Has DERM given any thought to initiating or conducting an independent investigation to assess the options available in the event that gate operability issues persist?
 - d. What involvement does the Dam Safety Regulator have in the continued efforts of Wide Bay Water to rectify these operational difficulties with the gates?

Flood event report review

- 12. It is identified in Mr Allen's statement that there is no formal set work procedure for reviewing flood event reports whether triggered under an EAP or a flood mitigation manual.
 - a. In your opinion, would it be desirable to have a formal work procedure for reviewing flood event reports in place?
 - b. If a formal work procedure would be desirable, would you recommend that the process set out in that procedure differ from the process that was actually employed in any material way? If so, how?
- 13. It is identified in Mr Allen's statement that while it is theoretically a requirement that a Dam Safety Regulator be notified within 48 hours that an EAP has been triggered, in practice this is done inconsistently.
 - a. In your opinion would it be desirable to have this notification obligation enforced?
 - b. If the notification obligation is enforced in practice, would you recommend that the time for the notification to be given be changed, either to allow more or less time after the EAP is triggered for notification to be given?

Flood mitigation manual review

- 14. In Mr Allen's statement a summary is given of the process of approval for the flood mitigation manuals for Wivenhoe and Somerset Dams and North Pine Dam prepared during 2011 ('the Interim Flood Manuals') up to 7 September 2011 and it is said at paragraph 30 that "negotiations are continuing".

- a. To the extent it is not already described in Mr Allen's statement of 12 September 2011, what was the process for the assessment and approval of the Interim Flood Manuals?
- b. What was the basis for the decision to approve each of the Interim Flood Manuals?

Mr Allen should attach all documents evidencing the assessment and approval process for the Interim Flood Manuals including the completed Assessment and Decision Forms (Attachment C to DS5.3).

Answers the following questions, arising from his statement of 16 September 2011 provided to the Commission:

Toowoomba CBD Investigations

15. Reference is made in paragraph 19 to the current Dam Safety Analysis to be completed by 1 December 2011 at the earliest.
 - a. Although the Commission is aware this Dam Safety Analysis is not yet complete, please provide an update on its current status, and likely outcomes.

In answering those questions matters Mr Allen is to:

- provide all information in his possession and identify the source or sources of that information;
- make commentary and provide opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion.

Mr Allen may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

The statement is to be provided to the Queensland Floods Commission of Inquiry by 4.00pm Thursday, 24 November 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.



Commissioner
Justice C E Holmes

GORDONBROOK DAM

Draft Emergency Action Plan

Project Number 3602-70

Cardno (Qld) Pty Ltd
 ABN 57 051 074 992
 Level 11 Green Square North Tower
 515 St Paul's Terrace
 Fortitude Valley Qld 4006
 Locked Bag 4006 Fortitude Valley
 Queensland 4006 Australia
 Telephone: 07 3369 9822
 Facsimile: 07 3369 9722
 International: +61 7 3369 9822
 cardno@cardno.com.au
 www.cardno.com.au

Document Control: Emergency Action Plan

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
Draft	December 2010	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

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- APPENDIX C Safety Inspections
- APPENDIX D Incident Log Form
- APPENDIX E Contact List
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1 INTRODUCTION

1.1 PURPOSE

This Emergency Action Plan (EAP) describes the coordination of necessary actions by South Burnett Regional Council (SBRC) and its officers to provide timely notification to Police, Counter Disaster groups and affected persons in the event of an emergency condition at Gordonbrook Dam.

1.2 NOTIFICATIONS

The responsibilities for notifying others of a potential emergency situation are shown in the following schedule.

Table 1.1 Order of Contact

NOMINATED PERSONS	ORDER OF CONTACT		ALTERNATE (primary contact not available)
	MANDATORY	AS REQUIRED BY SITUATION	
Treatment Plant Operator	Water and Wastewater Engineer		Manager Water and Wastewater
		Manager Water and Wastewater	
Water and Wastewater Engineer	Manager Water and Wastewater		Director of Engineering Services (DES)
Manager Water and Wastewater	Director of Infrastructure		CEO (SBRC)
		DERM Director of Dam Safety Brisbane	
		Dam Safety Consultant	
		SBRC Local Disaster Coordinator (LDC)	
Director of Infrastructure	SBRC Local Disaster Coordinator (LDC)		
		CEO (SBRC)	
		Mayor (SBRC)	
SBRC Local Disaster Coordinator (LDC)		Police (QPS)	Deputy LDC
		State Emergency Service (SES)	
		QLD Fire Service	
		QLD Ambulance Service	
		Local Media	

1.3 DISASTER AND EMERGENCY PLANNING

1.3.1 South Burnett Regional Council Incident Management Plan

The EAP defines the communication protocol and the actions and procedures to be undertaken to declare and manage an emergency at Gordonbrook Dam.

The South Burnett regional Council (SBRC) Disaster Management Plan (currently in draft form) establishes a structure to manage emergencies or disasters on a Council wide basis. The Disaster Management Plan includes the designation of incident managers and directors who, depending on the nature of the incident, will instigate a single or multiple team response.

The function of the Gordonbrook Dam EAP is to support the site team and incident managers and/or director in accordance with the following:

1.3.2 Counter Disaster Planning and Coordination in Queensland

The Department of Emergency Services controls counter disaster coordination and planning in Queensland. There is a tiered structure with regard to the levels of disaster coordination, initially being organised locally. Depending on the scale of the disaster, a Major Incidents Group might be formed for high level Ministerial guidance. A summary of each group's role is outlined below.

Local Disaster Management Group

Local Disaster Management Groups (local groups) manage the response to a disaster at a local level. The Committees are usually chaired by the Mayor. The Local Government Chief Executive Officer is usually the Executive Officer of the committee. Local Government Counter Disaster Committees develop and maintain Local Disaster Management Plans for their areas. These Local Government Committees are best placed to decide what resources are needed, when they are needed, and how best to apply such resources so as to minimise hardship and suffering. They play a key role in the Queensland Disaster Management System.

District Disaster Management Group

There are 23 Disaster Districts in Queensland, which are based on the Police Districts. The senior Police Officer in each district is designated as the District Disaster Coordinator who chairs a District Disaster Management Group (DDMG). These DDMGs comprise representatives from regionally-based Queensland Government departments who are able to provide and coordinate whole-of-government support to disaster stricken communities. The Disaster Districts perform a 'middle' management function within the Disaster Management System by providing coordinated State Government support when requested by Local Governments.

The State Disaster Coordination Group

The State Disaster Coordination Group is the working body of the State Disaster Management Group (State Group) at State level. SDCG members are designated liaison officers from each of the Departments represented on the State Group. This Group is the primary mechanism through which coordinated whole-of-government State level support is provided to disaster-stricken communities.

The State Disaster Management Group.

The State Disaster Management Group (State Group) is established as the principal organisation under the Act for the purposes of disaster management throughout the State. In particular, the State Group is responsible for disaster mitigation and disaster planning and preparation at a State level and for coordinating whole-of-government response and recovery operations prior to, during, and after a disaster impact. This includes accessing interstate and/or Commonwealth assistance when local and State resources are exhausted or not available.

The State Group comprises Chief Executive Officers (CEOs) from all Queensland Government Departments. The CEO of the Department of the Premier and Cabinet is the Chair, while the Executive Director of Emergency Management Queensland is the Executive Officer.

Major Incidents Group (MIG).

The Queensland Government has established a MIG to provide high level Ministerial guidance and support in the event of a significant incident with major community consequences.

Emergency Events and Action Procedures

A detailed set of procedures has been developed for various scenarios that may pose a risk to Gordonbrook Dam. Each procedure is laid out in the form of a clear description to support the decision or required action.

Each procedure documents a series of events that trigger a decision or action. A summary of key triggers is given in Tables 4 and 5.

Limitations

The EAP covers only the situation at the storage itself. The effect of a dam failure on the downstream residents (a Failure Impact Assessment carried out by Worley Parsons in June 2008) is included in the analysis data provided by SBRC. The evacuation of downstream residents will be undertaken by the Queensland Police Service (QPS). It should be noted that severe flooding potentially requiring evacuations can occur without failure of the dam.

The EAP does not cover any emergencies related to the water treatment plant.

1.4 ROLES AND RESPONSIBILITIES

The Schedule of Roles and Responsibilities nominates the position / title of each officer responsible for given actions or roles under the EAP.

Contact details of relevant positions or agencies are included in Appendix 5 – Contact List.

Table 1.2 Schedule of Roles and Responsibilities

Position	Alternative Position	Duty
Treatment Plant Operator	Relief Operator	<ul style="list-style-type: none"> > Lead the site team from site. > Unlock gates to ensure ready access to SBRC staff. > Contact Water and Wastewater Engineer
Water and Wastewater Engineer (SBRC Nanango)	Manager Water and Wastewater SBRC	<ul style="list-style-type: none"> > Inspect storage facility as soon as safe access is possible. > Monitor and record situation (incl photos). > Prepare periodic status reports for Director of Infrastructure.
Manager Water and Wastewater SBRC	Director of Infrastructure	<ul style="list-style-type: none"> > Monitor and evaluate emergency situation. > Instruct Water and Wastewater Engineer on any required remedial or preventative actions. > Report as necessary to Director of Infrastructure,
Director of Infrastructure	Local Disaster Coordinator	<ul style="list-style-type: none"> > Keep Mayor and CEO informed of emergency situation. > Liaise with Local Disaster Management Group.
Local Disaster Coordinator		<ul style="list-style-type: none"> > Assess impacts of emergency on an ongoing basis. > Keep Mayor and CEO informed of impacts. > Liaise with Local Disaster Management Group. > Initiate Local Counter Disaster Management Plan, if required.

2 GENERAL INFORMATION ABOUT GORDONBROOK DAM

Table 2.1 General Information and Dam Parameters

Parameter	Value
GENERAL	
Owner of dam:	South Burnett Regional Council (Formerly Kingaroy Shire Council)
Property description:	Lot 467/FY838992, Kingaroy, Queensland. Additional lots inundated by reservoir depending on levels.
Construction completed:	Original construction 1942. Second stage including raising embankment, lengthening and raising of existing spillway and construction of concrete ogee crest spillway and training walls, 1987-88.
Licence or development permit number:	
Date of last Failure Impact Assessment:	June 2008
Name of water course:	Stuart River
Catchment area	600 km ²
Storage Capacity	6,800 ML
Surface Area of Storage	130 Ha
Access description	The dam is accessed via a private gravel road that leads off from the Memerambi-Gordonbrook Road, 10 km west of the Bunya Highway. A map is provided in Appendix A
Owner of dam:	South Burnett Regional Council (Formerly Kingaroy Shire Council)
DESCRIPTION OF MAIN DAM EMBANKMENT	
Type	Compacted earth fill with downstream filter drain and grass cover and upstream dry pitched stone protection
Maximum Height	19.2m to embankment crest
Total Crest length	Approx 400m
Width at Crest	5.8m
Maximum Width at Base	119.0m
Crest level	RL 398.2 (AHD)
SPILLWAY	
Type	Uncontrolled ogee mass concrete weir
Total Length	80.0 m
Width at Crest Level	6.3m (Mass concrete weir width)
Maximum Spillway Discharge Capacity	1950 m ³ /s A RL 397.2 m AHD
Low Flow Crest level	RL 391.5 m AHD

Parameter	Value
Crest Level	RL 391.5 m AHD
DIVERSION CONDUITS	
Under Embankment	
Diameter	300 mm diameter tunnel
Length	Approx 140 m
Pipe Type	Unknown
Under Spillway	
Diameter	300 mm diameter pipe
Length	Approx 6.5m
Pipe Type	Steel
OUTLET WORKS TO TREATMENT PLANT	
Type	Concrete tower with pumps
INSTRUMENTATION	
Piezometers	5 No. standpipe piezometers
Seepage measurement	One V Notch Weir and 3 un-gauged filter drainage outlets
Reservoir storage level gauge	Telemetry to Nanango

3 DOCUMENTATION AND REPORTING

3.1 INCIDENT LOG

An Incident Log shall be maintained on site by the Water and Wastewater Engineer. Activities and decisions undertaken during any incident shall be recorded in chronological order in the Incident Log.

The Incident Log shall contain the following information as a minimum:

- A description of the incident / event.
- Time and date of the incident /event.
- Time and date of all actions.
- Regular recordings of water level.
- Regular recordings of rainfall.
- Instrumentation recordings.
- Description of observed damage.
- Photographs and / or sketches of observed damage.
- Details of communication which took place during the emergency.

Any further comments considered necessary.

Incident Logs (refer Appendix 4) shall be supported by other relevant documentation and photographs.

Comments regarding the adequacy of the EAP and any recommended changes to the EAP should be included.

3.2 REPORTING

Details of the incident / event and all actions taken shall be documented and reported to relevant SBRC staff and to the Dam Safety Regulator.

4 EMERGENCY EVENTS AND ACTIONS – FLOODING

4.1 CRITICAL STABILITY LEVEL

The critical stability level for Gordonbrook Dam is RL 398.2m AHD, the elevation of the crest of the main dam embankment. With any higher water level the embankment will overtop and likely fail.

4.2 FLOOD RELATED EVENTS

The Spillway Adequacy Assessment Report prepared by Worley Parsons in July 2008 states that the expected Dam Crest Flood (DCF) is the 1:5,000 year AEP flood; with an outflow of 2,542 m³/s; the Acceptable Flood Capacity is 3,239 m³/s which would overtop the dam embankment.

The report also states that according to AFC Guidelines the spillway will need to be modified to accommodate 75% of the AFC by October 2025. Modification of procedures and trigger levels will be required subsequent to any spillway augmentation works which are undertaken in the future.

4.3 FLOOD TRIGGER LEVELS

The following flood trigger events have been identified from review of the following reports:

- Spillway Adequacy Assessment Report,
- Comprehensive Dam Safety Inspection Report,
- Dam Failure Impact Assessment.

Table 4.1 Flood Trigger Events

Trigger Description	EAP Number
Storage level is at RL 391.0 (0.5m below spillway crest level) and further rain is forecast	5.1
Storage level is at RL 391.5 (spillway crest level) and further rain is forecast	5.2
Storage Level is at RL 396.7 (1.5m below Dam Crest Level) and further rain is forecast.	5.3
Storage Level rises above RL 397.7 (0.5m below dam crest level) and overtopping is imminent.	5.4

4.4 NON FLOOD RELATED EVENTS

The following non-flood related events have been identified where some emergency action may be necessary.

Table 4.2 Non Flood Related Trigger Events

Trigger Description	EAP Number
Increase in seepage or new area of seepage	5.5
Anomalies in piezometer readings	5.6
Earthquake reported in the vicinity of the dam	5.7
Movement of dam embankment	5.8
Damage to dam embankment	5.9

5 EMERGENCY ACTION PLANS

5.1 STORAGE LEVEL IS AT RL 391.0 (0.5M BELOW SPILLWAY CREST LEVEL) AND RISING

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event.

TREATMENT PLANT OPERATOR	WATER AND WASTEWATER ENGINEER
> Notify the Water and Wastewater Engineer of storage water level.	> Review weather forecast
FURTHER RAIN FORECAST	
> Inspect spillway.	> Ensure that the spillway is clear of debris

5.2 STORAGE LEVEL IS AT RL 391.5 (SPILLWAY CREST LEVEL)

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event.

TREATMENT PLANT OPERATOR	WATER AND WASTEWATER ENGINEER
> Notify the Water and Wastewater Engineer of storage water level.	> Review weather forecast

5.3 STORAGE LEVEL IS AT RL 396.7 (1.5M BELOW DAM CREST LEVEL) AND FURTHER RAIN IS FORECAST

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

-
- › Inform the Manager Water and Wastewater immediately. Liaise with Manager during the course of the emergency.
 - › Using the latest rates of rise, calculate the time the water level will reach RL 398.2m (Design Dam Crest Level) and advise Manager Water and Wastewater.
 - › Continue to monitor water level and rate of change in level on an hourly basis.
 - › Immediately undertake inspection of those parts of the dam and spillway which are visible and accessible. During the inspection, note rainfall, water level, signs of slumps, erosion, springs, cracks or any deformation which could be classified as damage to the dam.
 - › Photograph and record.
 - › Note and report any anomalies to the Manager Water and Wastewater (3).
- › Advise the Director of Infrastructure (DES) the SBRC Regional Council Local Disaster Coordinator (LDC) and Queensland Police Service (QPS).
 - › Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.
 - › Advise Director of Infrastructure.
 - › Keep Director of Infrastructure updated on situation
 - › Advise the SBRC Regional Council Local Disaster Coordinator (LDC) to contact all residents located within the inundation zone and warn them that evacuation is possible.

WHEN WATER LEVEL REACHES RL397.2m

- › Relay water levels back to Director of Infrastructure.
 - › Continue to liaise with Manager Water and Wastewater.
- › Inform South Burnett Regional Council Local Disaster Management Group and QPS that the storage is approaching but still 1.0m below the dam crest level and the possible need for evacuation of downstream residents.
 - › Inform the Director of Infrastructure of the situation.
 - › Request South Burnett Regional Council Local Disaster Management Group to close roads as necessary. Potential road closures listed in Appendix F.
 - › SES and Police to establish communication with the Local Disaster Management Group and to confirm when the roads and public areas are closed. During the closure, relay the water level to South Burnett Regional Council Local Disaster Management Group.
 - › If requested, arrange preparation of media briefing for the Director of Infrastructure.

WHEN DAMAGE IS OBSERVED

- › Advise the Director of Infrastructure (4) and proceed with EAP 5.8.
 - › In case of new area of seepage or increased seepage is observed, proceed to EAP 5.5.
- › Proceed with EAP 5.8.
 - › In case of new area of seepage or increased seepage, proceed to EAP 5.5.

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

IF WATER LEVEL RISES ABOVE RL 397.7m

> Proceed with EAP 5.4.

> Contact Local Disaster Management Group and recommend evacuation of all affected residents downstream of the dam. Minimum 3 hours notice required for evacuations.

WHEN WATER LEVEL DROPS BELOW RL 396.7m AND NO MORE RAIN IS FORECAST

> Proceed with EAP 5.2.

> Proceed with EAP 5.2.

5.4 STORAGE LEVEL RISES ABOVE RL 397.7 (0.5M BELOW DAM CREST LEVEL) AND OVERTOPPING IS IMMINENT

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

- › Inform the Manager Water and Wastewater immediately. Liaise with Manager during the course of the emergency.

- › Advise Director of Infrastructure and Local Disaster Coordinator of Dam level and the possibility of overtopping of the dam embankment.
- › Advise the Dam Safety Regulator of the water level and the possibility of overtopping of the dam embankment.
- › Check progress of evacuations with QPS.

- › Evacuate all but two operational site staff from the vicinity of the dam.
- › Using the latest rates of water level rise, calculate the time to dam overtopping level (RL 398.2m).
- › Instruct two staff members to remain at the dam site to monitor the water level and status of the dam.
- › Each member is to be accounted for and allocated a safe position upstream of the main dam embankment.

- › Advise the Director of Infrastructure of situation and evacuation progress.
- › If requested, arrange preparation of media briefing for the Director of Infrastructure.

- › Continue to monitor water level and rates of change in level hourly, IF POSSIBLE, but do not venture onto the main dam embankment.
- › Report regularly to the Director of Infrastructure. Note readings and reports in Incident Log. Photograph.
- › Note and report any anomalies or damage to the Director of Infrastructure

WHEN DAMAGE IS OBSERVED

- › Advise the Director of Infrastructure and proceed with EAP 5.9.
- › Continue to liaise with Manager Water and Wastewater

- › Proceed with EAP 5.9.
- › In case of new area of seepage or increased seepage, proceed to EAP 5.5.

WHEN WATER LEVEL DROPS BELOW RL 396.7m AND NO MORE RAIN IS FORECAST

- › Proceed with EAP 5.3.

- › Proceed with EAP 5.3.

5.5 INCREASE IN SEEPAGE OR NEW AREA OF SEEPAGE IS OBSERVED IN THE DOWNSTREAM EMBANKMENT BATTER OR SPILLWAY DRAIN

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

- › Notify the Manager Water and Wastewater of any noticeable increase or changes in seepage (seepage rate or colour) or surface slumping on any dam embankment.
- › Liaise with Manager Water and Wastewater throughout the emergency

- › Declare an Incident.
- › Inform the Manager Assets (4) of the situation.
- › Assemble and activate Incident Management Team. (Disaster Management Coordinator to be involved)

- › Monitor the situation by measuring the rate of seepage flow and observe the clarity of the seepage flow. Keep notes and photographs for the Incident Log.
- › Complete the Incident Log.

- › Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (Procedure to be supplied) within 72 hours of the Incident.
- › Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.

IF TURBID SEEPAGE IS NOTED

- › Advise the Director of Infrastructure and proceed with EAP 5.9.

- › Proceed with EAP 5.9.

AFTER THE EVENT

- › Complete the Incident Log and submit to Director of Infrastructure.

- › Review and complete the Incident Log.
- › Stand down the Incident Management Team and close the Incident.

5.6 ANOMALIES IN PIEZOMETER READINGS

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

-
- | | |
|---|--|
| <ul style="list-style-type: none">› Notify the Manager Water and Wastewater of any noticeable increase or changes in piezometer readings. | <ul style="list-style-type: none">› Review results |
|---|--|
-

IF RESULTS INDICATE POTENTIAL INSTABILITY OR FAILURE

- › Immediately perform a Routine Dam Safety Inspection (To be supplied in SOP). During the inspection, note signs of slumps, erosion, springs/seepage, cracks, or deformation which could be classified as damage to the dam.
-

WHEN DAMAGE TO THE DAM IS OBSERVED

- | | |
|--|---|
| <ul style="list-style-type: none">› Advise the Director of Infrastructure and proceed with EAP 5.9.› Liaise with Manager Water and Wastewater throughout the process. | <ul style="list-style-type: none">› On receipt of the damage report, proceed with EAP 5.9 |
|--|---|
-

5.7 EARTHQUAKE IS REPORTED IN THE VICINITY OF THE DAM

WATER AND WASTEWATER ENGINEER	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none">› Inform the Director of Infrastructure that an earthquake has been felt in the area.› Liaise with Manager Water and Wastewater.› If possible, contact Geoscience Australia to ascertain epicentre and magnitude of earthquake (contact details below)	<ul style="list-style-type: none">› Declare an Incident› Inform the Director of Infrastructure of the situation.› Assemble and activate Incident Management Team. (Disaster Management Coordinator to be involved)
<ul style="list-style-type: none">› Immediately perform a Routine Dam Safety Inspection (To be supplied in SOP). During the inspection, note signs of slumps, erosion, springs/seepage, cracks, or deformation which could be classified as damage to the dam.› Monitor the situation, keeping notes and photographs for the Incident Log and the Routine Dam Safety Inspection.	<ul style="list-style-type: none">› Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (To be supplied in SOP) within 72 hours of the Incident.› Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.
WHEN DAMAGE TO THE DAM IS OBSERVED	
<ul style="list-style-type: none">› Advise the Director of Infrastructure and proceed with EAP 5.9.	<ul style="list-style-type: none">› On receipt of the damage report, proceed with EAP 5.9
AFTER THE EVENT	
<ul style="list-style-type: none">› Complete the Incident Log and submit to Director of Infrastructure.	<ul style="list-style-type: none">› Review and complete the Incident Log.› Stand down the Incident Management Team and close the Incident.

Contact Information for Geoscience Australia

Phone: Switchboard: +61 2 6249 9111
Sales Centre/product information: 1800 800 173
Earthquake information: 1800 655 739
Media Hotline: 1800 882 035

Fax: +61 2 6249 9999

5.8 MOVEMENT OF DAM EMBANKMENT

WATER AND WASTEWATER ENGINEER	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none">› Inform the Director of Infrastructure that movement has been noticed.	<ul style="list-style-type: none">› Declare an Incident.› Inform the CEO (SBRC) of the situation.› Assemble and activate Incident Management Team. (Disaster Management Coordinator to be involved)
<ul style="list-style-type: none">› Immediately perform a Routine Dam Safety Inspection (To be supplied in SOP). During the inspection, note any signs of slumps, erosion, springs, cracks or any deformation, which could be classified as damage to the dam.› Monitor the situation, keeping notes and photographs for the Incident Log and the Routine Dam Safety Inspection.	<ul style="list-style-type: none">› Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (To be supplied in SOP) within 72 hours of the Incident.› Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.
IF MOVEMENT HAS RESULTED IN DAMAGE TO THE DAM	
<ul style="list-style-type: none">› Advise the Director of Infrastructure and proceed with EAP 5.9.	<ul style="list-style-type: none">› On receipt of the damage report, proceed with EAP 5.9
AFTER THE EVENT	
<ul style="list-style-type: none">› Complete the Incident Log and submit to Director of Infrastructure.	<ul style="list-style-type: none">› Review and complete the Incident Log.› Stand down the Incident Management Team and close the Incident.

5.9 DAMAGE TO DAM OR SPILLWAY

WATER AND WASTEWATER ENGINEER	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none">› If damage to any part of the dam is noticed, report it immediately to the Director of Infrastructure.	<ul style="list-style-type: none">› Declare an Incident.› Assemble Incident Management Team.› Attend site and inspect the damage.› Inform the CEO of the situation.
<ul style="list-style-type: none">› Assess and report the extent of damage to the Director of Infrastructure.	<ul style="list-style-type: none">› Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.› Relay details of the damage to the Dam Safety Consultant. Information that should be relayed includes:<ul style="list-style-type: none">– The type of damage;– The location of damage;– Water level;– Weather forecast;– Specific details of damage, e.g. flow and colour of seepage, size of cracks (length, width, orientation), size of slumps, sink holes etc.› If necessary, arrange for the Dam Safety Consultant to inspect the damage and any repairs and, if necessary, undertake a Special Dam Safety Inspection (Procedure to be supplied in SOP).
<ul style="list-style-type: none">› Monitor the situation and keep the Director of Infrastructure advised. Note any changes in the nature of the damage.› If instructed by the Director of Infrastructure, support any evacuations as required.	<ul style="list-style-type: none">› Decide whether or not to instigate immediate repairs.<ul style="list-style-type: none">– If repairs are not undertaken, the damage is to remain monitored.– If the situation is considered serious enough, inform Local Disaster Management Group of the need to evacuate affected downstream residents before the Incident escalates to a Major Incident.
<ul style="list-style-type: none">› Coordinate repairs on site in accordance with instruction from the Director of Infrastructure.› Regularly update the Director of Infrastructure on progress and record all relevant events in the Incident Log.› On completion of the repairs, monitor and report to the Director of Infrastructure.	<ul style="list-style-type: none">› If repairs are to be undertaken, the Dam Safety Consultant is to be consulted over the specification of the repairs. Materials and/or services may be obtained through existing SBRC suppliers or as decided otherwise by the Director of Infrastructure.

WATER AND WASTEWATER ENGINEER

MANAGER WATER AND WASTEWATER

ON COMPLETION OF REPAIRS

- | | |
|---|--|
| <ul style="list-style-type: none">› Monitor situation and report to the Director of Infrastructure. | <ul style="list-style-type: none">› If repairs appear to have stabilised the damage, confirm with the Dam Safety Consultant and close the Incident.› The Dam Safety Consultant is to confirm the closure of any Incident associated with damage to the dam.› The Dam Safety Consultant is to identify any required follow up repairs or works. Document these required works in the Incident Log and in the Dam Data Book. |
|---|--|
-

AFTER THE EVENT

- | | |
|---|---|
| <ul style="list-style-type: none">› Complete the Incident Log and submit to Director of Infrastructure. | <ul style="list-style-type: none">› Review and complete Incident Log. |
|---|---|
-

APPENDIX A

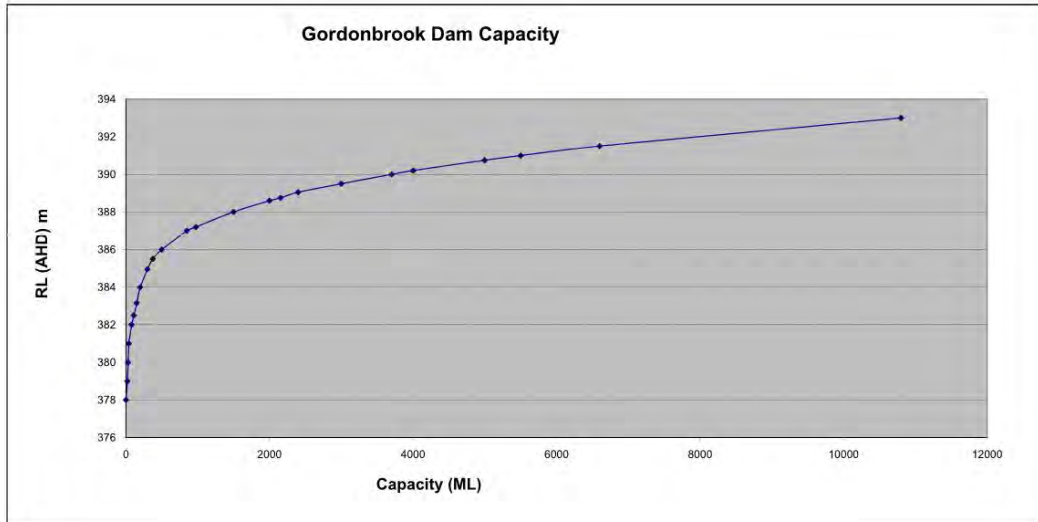
Access to Gordonbrook Dam

The dam is accessed via a private gravel road that leads off from the Memerambi-Gordonbrook Road, 10 km west of the Bunya Highway. This is shown in the map below.



APPENDIX B

Storage Capacity



APPENDIX C

Safety Inspections

Inspection Type	Responsible Officer	Purpose	Required Frequency
Routine Visual Inspection	Treatment Plant Operator	Identification and reporting of deficiencies by visual observation by operating personnel as part of their duties at the storage.	Weekly generally, but continuous during significant rain/flood events.
Routine Dam Safety Inspection (Procedure from SOP)	Engineer Water and Wastewater	Identification and reporting of deficiencies, by structured observation of the dam and surrounds (including saddle dams), with recommendations for corrective actions.	Monthly
Annual Dam Safety Inspection (Procedure from SOP)	Experienced RPEQ	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; and by applying current criteria and prevailing knowledge. Equipment used in every day operations should be test operated to identify deficiencies.	Yearly
Comprehensive Dam Safety Inspection (Procedure from SOP)	Experienced RPEQ	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; safety management programs and safety documentation, and by applying current criteria and prevailing knowledge. All equipment should be test operated to identify deficiencies. Consider also: <ul style="list-style-type: none"> ▶ Draining the water draw-off tower for internal inspection. ▶ Diver inspection of submerged structures and equipment. 	Five-yearly
Special Dam Safety Inspection (Procedure from SOP)	Experienced RPEQ	Examination of a particular feature of a dam for some special reason (e.g. after earthquakes, heavy floods, rapid drawdown, emergency situation) to determine the need for preventive or corrective actions.	As required

APPENDIX D

Incident Log Form

Form 1 : Incident Log

Site / Location:	Gordonbrook Dam
Date of Incident:	
Time of Incident:	
Incident Reported by:	
Time of Incident Notification	

Description of Incident (attach extra pages if required). Include comment on adequacy of the EAP and recommended changes to the EAP.

Description of any damage, harm or nuisance caused (attached extra pages if required).

Incident Log (Continued)

Communications and Actions during the incident (attach extra pages, photos and sketches if required):

No.	Date	Time	Water Level	Rain (mm)	Photo Number	Action Taken
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Signed		Date	
--------	--	------	--

Forward a copy of the completed form (all pages and attachments) to the Director of Infrastructure.

Reviewed by Director of Infrastructure.

Additional comments:.....

Signed		Date	
--------	--	------	--

APPENDIX E

Contact List

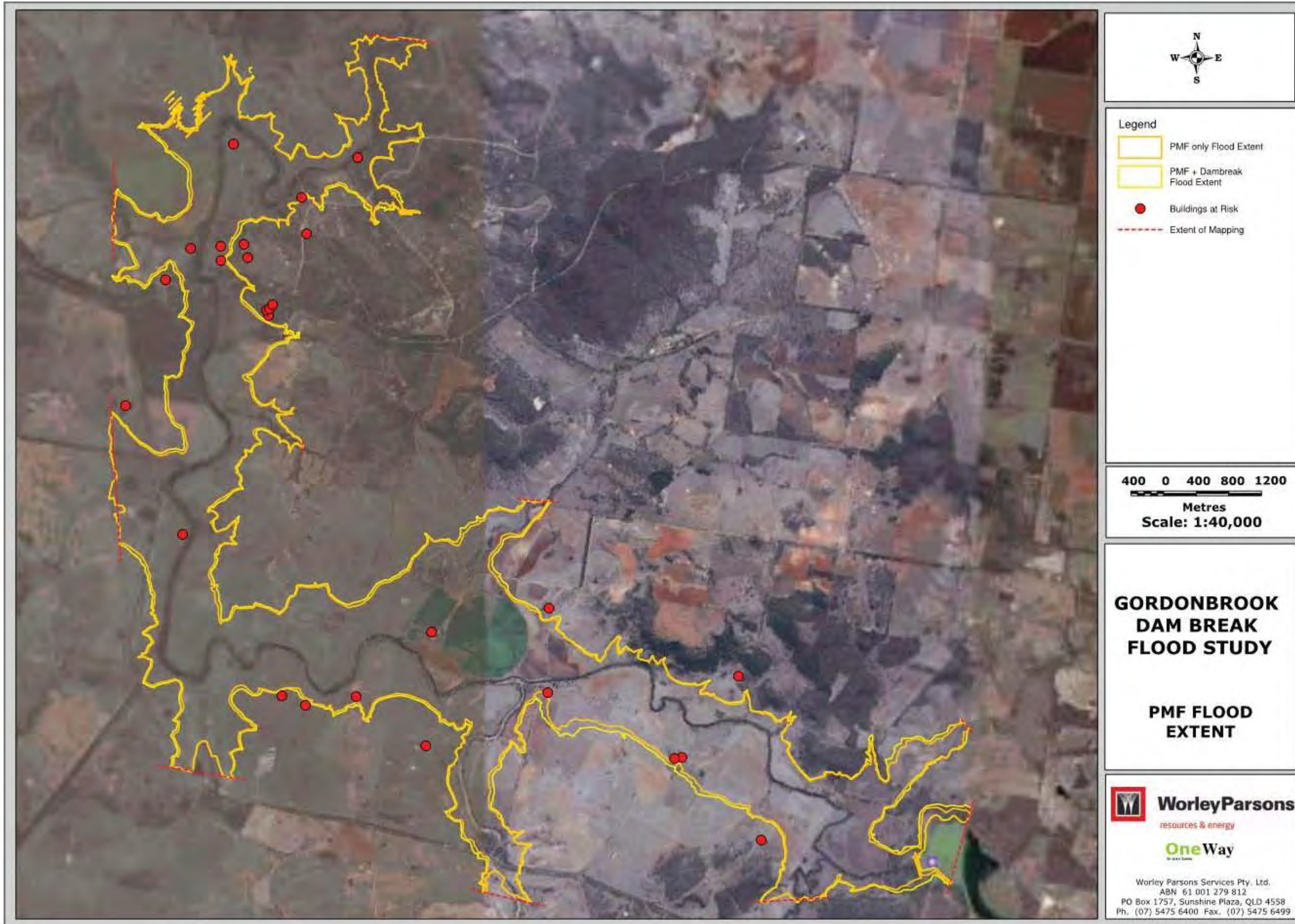
Title	Name	Mobile	Phone (w)	Phone (A/H)	Facsimile	Email
South Burnett Regional Council						
Treatment Plant Operator –Based on Site	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]
Reserve Treatment Plant Operator	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]
Water and Wastewater Engineer Nanango Office		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
Manager Water and Wastewater			[Redacted]	[Redacted]	[Redacted]	[Redacted]
Director of Engineering Services (DES)			[Redacted]	[Redacted]	[Redacted]	[Redacted]
CEO			[Redacted]			[Redacted]
Mayor	David Carter					
South Burnett Regional Council Disaster Management Group						
Local Disaster Coordinator (LDC)	TBA					
Deputy LDC	TBA					
Parties Affected by Dam Failure						
Primary						
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
Interstate Pacific			[Redacted]	[Redacted]		
[Redacted]	[Redacted]		[Redacted]	[Redacted]		

Title	Name	Mobile	Phone (w)	Phone (A/H)	Facsimile	Email
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Secondary						
Isis Hardware & Rural Pty Ltd	Isis Hardware & Rural Pty Ltd		[Redacted]	[Redacted]		
[Redacted]	[Redacted]					
Mirrinbeena Holdings Pty Ltd			[Redacted]	[Redacted]		
[Redacted]	[Redacted]					
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
[Redacted]	[Redacted]		[Redacted]	[Redacted]		
Local Counter Disaster Groups Kingaroy			Emergency No.	General No.		
Police (Kingaroy)			000	07 4160 4900		
State Emergency Service (Kingaroy)			000	07 4162 5794		kingaroyeses@eftel.net.au
QLD Fire Service Regional Office (Kingaroy)			000	07 4162 7100		
Ambulance (Kingaroy)			000			

Title	Name	Mobile	Phone (w)	Phone (A/H)	Facsimile	Email
External Organisations						
DERM Director of Dam Safety Brisbane.	Peter Allen	[REDACTED]	[REDACTED]		[REDACTED]	[REDACTED]
Dam Safety Consultant Worley Parsons (New contact name required)			[REDACTED]			

APPENDIX F

Flood Maps





GORDONBROOK DAM

Interim Emergency Action Plan

Prepared for South Burnett Regional Council

Version 2.0
September 2011

Cardno (Qld) Pty Ltd
 ABN 57 051 074 992
 Level 11 Green Square North Tower
 515 St Paul's Terrace
 Fortitude Valley Qld 4006
 Locked Bag 4006 Fortitude Valley
 Queensland 4006 Australia
 Telephone: 07 3369 9822
 Facsimile: 07 3369 9722
 International: +61 7 3369 9822
cardno@cardno.com.au
www.cardno.com.au

Document Control: Interim Emergency Action Plan					
Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
Interim	December 2010	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

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1 INTRODUCTION

1.1 PURPOSE

This Emergency Action Plan (EAP) describes the coordination of necessary actions by South Burnett Regional Council (SBRC) and its officers to provide timely notification to Police, Counter Disaster groups and affected persons in the event of an emergency condition at Gordonbrook Dam.

1.2 NOTIFICATIONS

The responsibilities for notifying others of a potential emergency situation are shown in the following schedule.

Table 1.1 Order of Contact

Nominated Person	Order of Contact		Alternate (primary contact not available)
	Mandatory	As Required by Situation	
Treatment Plant Operator	Engineer Treatment and Quality Water and Wastewater (T&Q – W&WW)		Manager Water and Wastewater
		Manager Water and Wastewater	
Engineer (T&Q – W&WW)	Manager Water and Wastewater		Director of Infrastructure (DoI)
Manager Water and Wastewater	Director of Infrastructure		CEO (SBRC)
		DERM Director of Dam Safety Brisbane	
		Dam Safety Consultant	
		SBRC Local Disaster Coordinator (LDC)	
Director of Infrastructure	SBRC Local Disaster Coordinator (LDC)		
		CEO (SBRC)	
		Mayor (SBRC)	
SBRC Local Disaster Coordinator (LDC)		Police (QPS)	Deputy LDC
		State Emergency Service (SES)	
		QLD Fire Service	
		QLD Ambulance Service	
		Local Media	

1.3 DISASTER AND EMERGENCY PLANNING

1.3.1 South Burnett Regional Council Incident Management Plan

The EAP defines the communication protocol and the actions and procedures to be undertaken to declare and manage an emergency at Gordonbrook Dam.

The South Burnett regional Council (SBRC) Disaster Management Plan establishes a structure to manage emergencies or disasters on a Council wide basis. The Disaster Management Plan includes the designation of incident managers and directors who, depending on the nature of the incident, will instigate a single or multiple team response.

The function of the Gordonbrook Dam EAP is to support the site team and incident managers and/or director in accordance with the following:

1.3.2 Counter Disaster Planning and Coordination in Queensland

The Department of Emergency Services controls counter disaster coordination and planning in Queensland. There is a tiered structure with regard to the levels of disaster coordination, initially being organised locally. Depending on the scale of the disaster, a Major Incidents Group might be formed for high level Ministerial guidance. A summary of each group's role is outlined below.

Local Disaster Management Group

Local Disaster Management Groups (local groups) manage the response to a disaster at a local level. The Committees are usually chaired by the Mayor. The Local Government Chief Executive Officer is usually the Executive Officer of the committee. Local Government Counter Disaster Committees develop and maintain Local Disaster Management Plans for their areas. These Local Government Committees are best placed to decide what resources are needed, when they are needed, and how best to apply such resources so as to minimise hardship and suffering. They play a key role in the Queensland Disaster Management System.

District Disaster Management Group

There are 23 Disaster Districts in Queensland, which are based on the Police Districts. The senior Police Officer in each district is designated as the District Disaster Coordinator who chairs a District Disaster Management Group (DDMG). These DDMGs comprise representatives from regionally-based Queensland Government departments who are able to provide and coordinate whole-of-government support to disaster stricken communities. The Disaster Districts perform a 'middle' management function within the Disaster Management System by providing coordinated State Government support when requested by Local Governments.

The State Disaster Coordination Group

The State Disaster Coordination Group is the working body of the State Disaster Management Group (State Group) at State level. SDCG members are designated liaison officers from each of the Departments represented on the State Group. This Group is the primary mechanism through which coordinated whole-of-government State level support is provided to disaster-stricken communities.

The State Disaster Management Group

The State Disaster Management Group (State Group) is established as the principal organisation under the Act for the purposes of disaster management throughout the State. In particular, the State Group is responsible for disaster mitigation and disaster planning and preparation at a State level and for coordinating whole-of-government response and recovery operations prior to, during, and after a disaster impact. This includes accessing interstate and/or Commonwealth assistance when local and State resources are exhausted or not available.

The State Group comprises Chief Executive Officers (CEOs) from all Queensland Government Departments. The CEO of the Department of the Premier and Cabinet is the Chair, while the Executive Director of Emergency Management Queensland is the Executive Officer.

Major Incidents Group (MIG)

The Queensland Government has established a MIG to provide high level Ministerial guidance and support in the event of a significant incident with major community consequences.

Emergency Events and Action Procedures

A detailed set of procedures has been developed for various scenarios that may pose a risk to Gordonbrook Dam. Each procedure is laid out in the form of a clear description to support the decision or required action.

Each procedure documents a series of events that trigger a decision or action. A summary of key triggers is given in Tables 4.1 and 4.2.

Limitations

The EAP covers only the situation at the storage itself. The effect of a dam failure on the downstream residents (a Failure Impact Assessment carried out by Worley Parsons in June 2008) is included in the analysis data provided by SBRC.

The evacuation of downstream residents will be undertaken by the Queensland Police Service (QPS). It should be noted that severe flooding potentially requiring evacuations can occur without failure of the dam.

The EAP does not cover any emergencies related to the water treatment plant.

1.4 ROLES AND RESPONSIBILITIES

The Schedule of Roles and Responsibilities nominates the position / title of each officer responsible for given actions or roles under the EAP.

Contact details of relevant positions or agencies are included in Appendix 5 – Contact List.

Table 1.2 Draft Emergency Action Plan

Position	Alternative Position	Duty
Treatment Plant Operator	Relief Operator	<ul style="list-style-type: none"> ➤ Contact Water and Wastewater Engineer ➤ Lead the site team from site ➤ Unlock gates to ensure ready access to SBRC staff
Engineer (T&Q – W&WW) (SBRC)	Manager Water and Wastewater SBRC	<ul style="list-style-type: none"> ➤ Inspect storage facility as soon as safe access is possible ➤ Monitor and record situation ➤ Prepare periodic status reports for Director of Infrastructure
Manager Water and Wastewater SBRC	Director of Infrastructure SBRC	<ul style="list-style-type: none"> ➤ Monitor and Evaluate emergency situation ➤ Instruct Water and Wastewater Engineer on any required remedial or preventative actions ➤ Report as necessary to Director of Infrastructure
Director of Infrastructure SBRC	Local Disaster Coordinator	<ul style="list-style-type: none"> ➤ Keep mayor and CEO informed of emergency situation. ➤ Liaise with Local Disaster Management Group
Local Disaster Coordinator	Deputy Local Disaster Coordinator	<ul style="list-style-type: none"> ➤ Assess impacts of emergency on an ongoing basis ➤ Keep Mayor and CEO informed of impacts ➤ Liaise with Local Disaster Management Group ➤ Initiate Local Counter Disaster Management Plan

2 GENERAL INFORMATION ABOUT GORDONBROOK DAM

Table 2.1: General Information and Dam Parameters

Parameter	Value
GENERAL	
Owner of dam:	South Burnett Regional Council (Formerly Kingaroy Shire Council)
Property description:	Lot 467/FY838992, Kingaroy, Queensland. Additional lots inundated by reservoir depending on levels.
Construction completed:	Original construction 1942. Second stage including raising embankment, lengthening and raising of existing spillway and construction of concrete ogee crest spillway and training walls, 198788.
Licence or development permit number:	
Date of last Failure Impact Assessment:	June 2008
Name of water course:	Stuart River
Catchment area	600 km ²
Storage Capacity	6,800 ML
Surface Area of Storage	130 Ha
Access description	The dam is accessed via a private gravel road that leads off from the Memerambi-Gordonbrook Road, 10 km west of the Bunya Highway. A map is provided in Appendix A
Owner of dam:	South Burnett Regional Council (Formerly Kingaroy Shire Council)

DESCRIPTION OF MAIN DAM EMBANKMENT

Type	Compacted earth fill with downstream filter drain and grass cover and upstream dry pitched stone protection
Maximum Height	19.2m to embankment crest
Total Crest length	Approx 400m
Width at Crest	5.8m
Maximum Width at Base	119.0m
Crest level	RL 398.2 (AHD)

SPILLWAY

Type	Uncontrolled ogee mass concrete weir
Total Length	80.0 m
Width at Crest Level	6.3m (Mass concrete weir width)
Maximum Spillway Discharge Capacity	1950 m ³ /s @ ARL 397.2 m AHD
Crest level	RL 391.5 m AHD

Parameter	Value
DIVERSION CONDUITS	
<i>Under Embankment</i>	
Diameter	300 mm diameter tunnel
Length	Approx 140 m
Pipe Type	Unknown
<i>Under Spillway</i>	
Diameter	300 mm diameter pipe
Length	Approx 6.5m
Pipe Type	Steel

OUTLET WORKS TO TREATMENT PLANT	
Type	Concrete tower with 2 x pumps

INSTRUMENTATION	
Piezometers	5 No. standpipe piezometers
Seepage measurement	One V Notch Weir and 3 un-gauged filter drainage outlets
Reservoir storage level gauge	Hydrostatic pressure gauge linked to Telemetry/SCADA to Nanango

2.1 Gordonbrook Dam Catchment and Flood Hydrology

The following information provide details of Gordonbrook Dam's catchment and flood hydrology (Design rainfall data and flood routing results) as determined from Gordonbrook Dam Spillway Adequacy Assessment 2008 (Worley Parsons).

Item	Description
Table 2.1	RAFTS design Inflows and Outflows for Gordonbrook Dam for various durations
Table 2.2	Storage routing results for critical storm durations.
Table 2.3	Rainfall Depths/Intensities for all events

Figure 2.1	Gordonbrook Dam Catchment
Figure 2.2	Frequency Curves for Maximum Inflow and Outflow for Gordonbrook Dam
Figure 2.3	Estimated peak flood storage levels for Gordonbrook Dam
Figure 2.4	Gordonbrook Dam Catchment IFD Design Rainfall Intensity
Figure 2.5	Gordonbrook Dam Catchment Rainfall Frequency Curve



LEGEND

- RAFTS U/S Subcatchments
- RAFTS D/S Subcatchments
- Watercourse



**GORDONBROOK
DAM BREAK
FLOOD STUDY**

APPENDIX 1

**RAFTS
SUB-CATCHMENT
BREAKDOWN**



WorleyParsons
resources & energy

OneWay
by one team

Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
PO Box 1757, Sunshine Plaza, QLD 4558
Ph. (07) 5475 6400 Fax. (07) 5475 6499

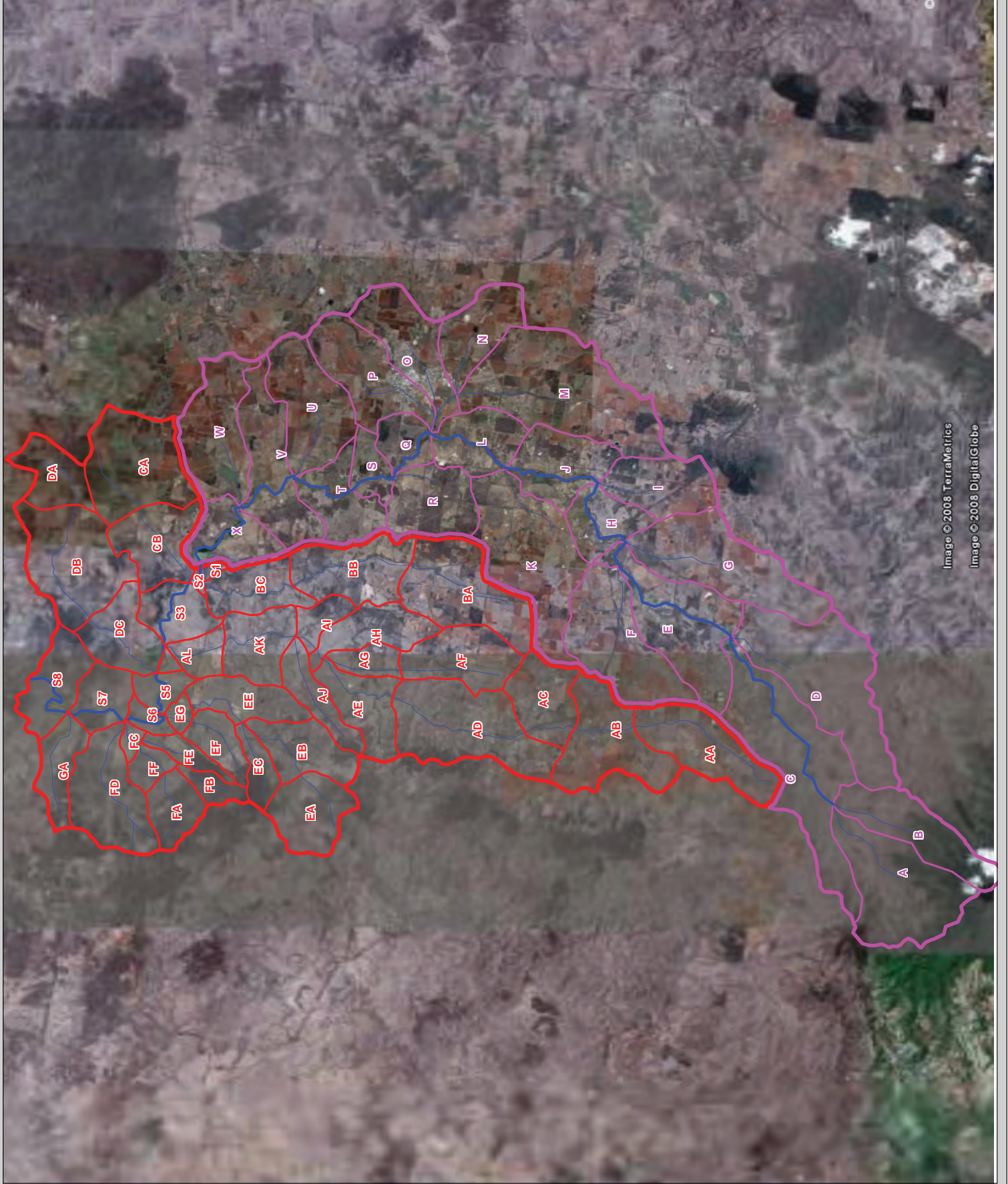


Image © 2008 TerraMetrics
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Table 2.1 RAFTS design Inflows and Outflows for Gordonbrook Dam for various durations

Inflows

Duration (hrs)	RAFTS Inflow to Gordonbrook Dam (m ³ /sec)				
	AEP (1 in Y Years)				
	50	100	2,000	50,000	PMF
1	142	176	618	1405	2186
3	273	337	1133	3001	5180
6	361	462	1586	4097	6891
12	448	583	1923	4829	7905
24	472	599	2169	4835	7536
36	434	552	2118	4611	7072
48	374	485	1859	3985	6194
72	365	466	1260	3115	5070
Max. Flow	472	599	2169	4835	7905

Outflows

Duration (hrs)	RAFTS Outflow from Gordonbrook Dam (m ³ /sec)				
	AEP (1 in Y Years)				
	50	100	2,000	50,000	PMF
1	136	170	540	1200	1891
3	262	323	1003	2569*	4597*
6	351	446	1421	3656*	6286*
12	434	559	1801	4544*	7536*
24	453	578	2061	4652*	7305*
36	412	526	2041	4497*	6923*
48	360	464	1819	3916*	6053*
72	350	446	1217	2973*	4905*
Max. Flow	453	578	2061	4652*	7536*

* Outflow overtopping the embankment

Figure 2.2 Frequency Curves for Maximum Inflow and Outflow for Gordonbrook Dam

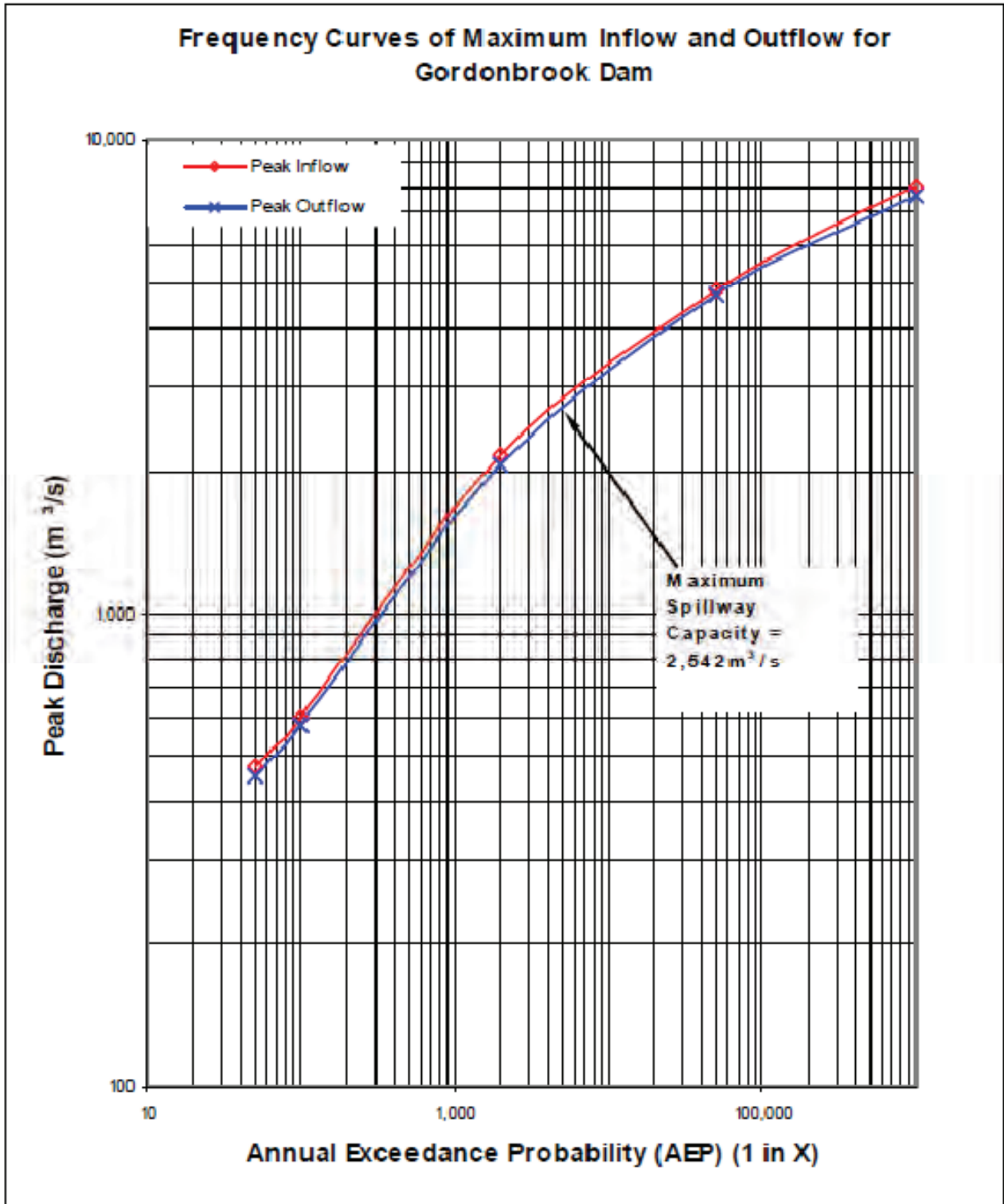


Table 2.2 Storage routing results for critical storm durations.

AEP	AEP 1 in Year	Storm Duration (hr)	Dam Inflow (m ³ /sec)	Dam Discharge (m ³ /sec)	Dam Peak Storage EL (m, AHD)	Dam Crest Level (m AHD)	Remark
2E-02	50	24	472	453	393.63	398.20	
1E-02	100	24	599	578	394.03	398.20	
1E-03	1,000	24	1,641	1,570	396.35	398.20	
5E-04	1,900	24	2,103	2,002	397.20	398.20	FF
2E-04	5,000	24	2,699	2,542	398.20	398.20	DCF
1E-04	10,000	24	3,404	3,239	399.22	398.20	AFC
2E-05	50,000	24	4,835	4,652	400.33	398.20	
1E-05	100,000	24	5,335	5,132	400.64	398.20	
1E-06	1,000,000	12	7,905	7,536	401.98	398.20	PMP

Figure 2.3 Estimated peak flood storage levels for Gordonbrook Dam

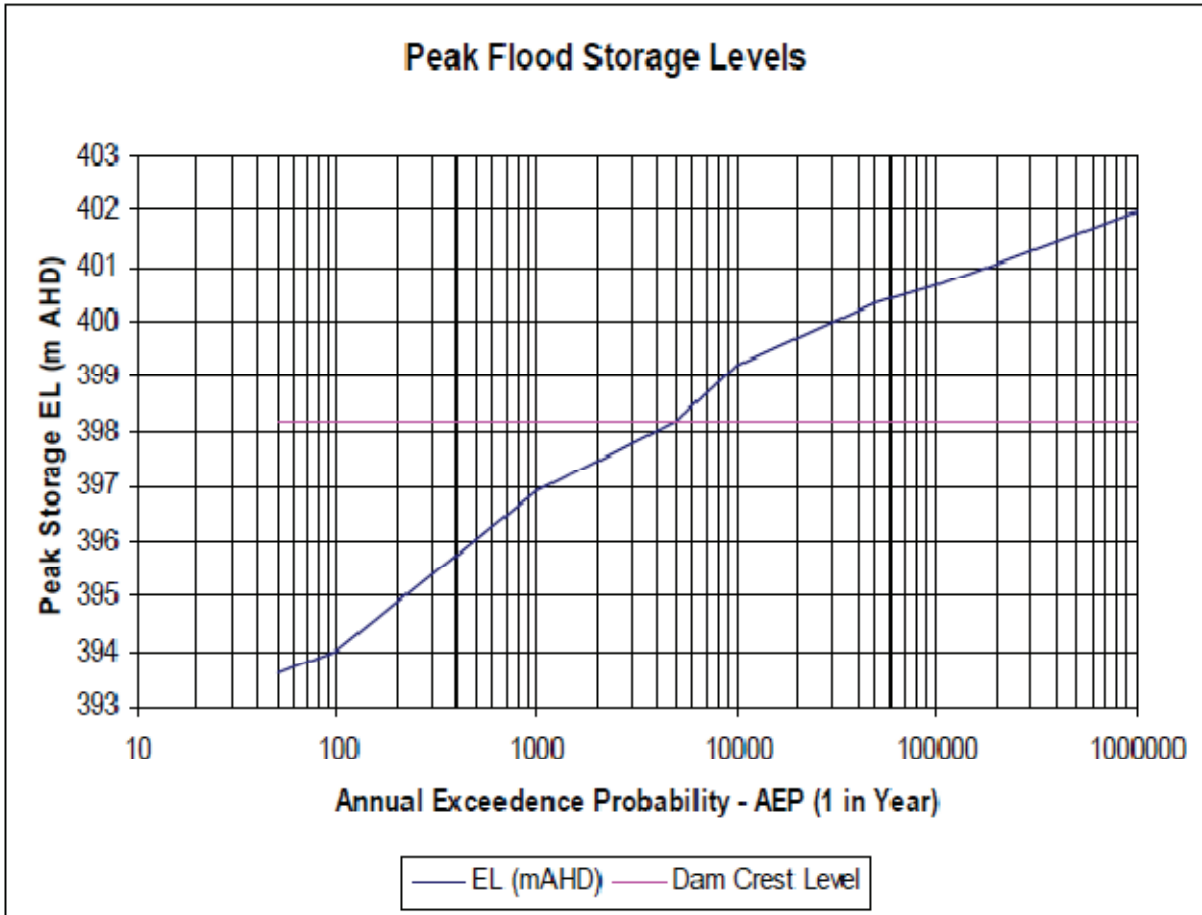


Figure 2.4: Gordonbrook Dam Catchment IFD Design Rainfall Intensity

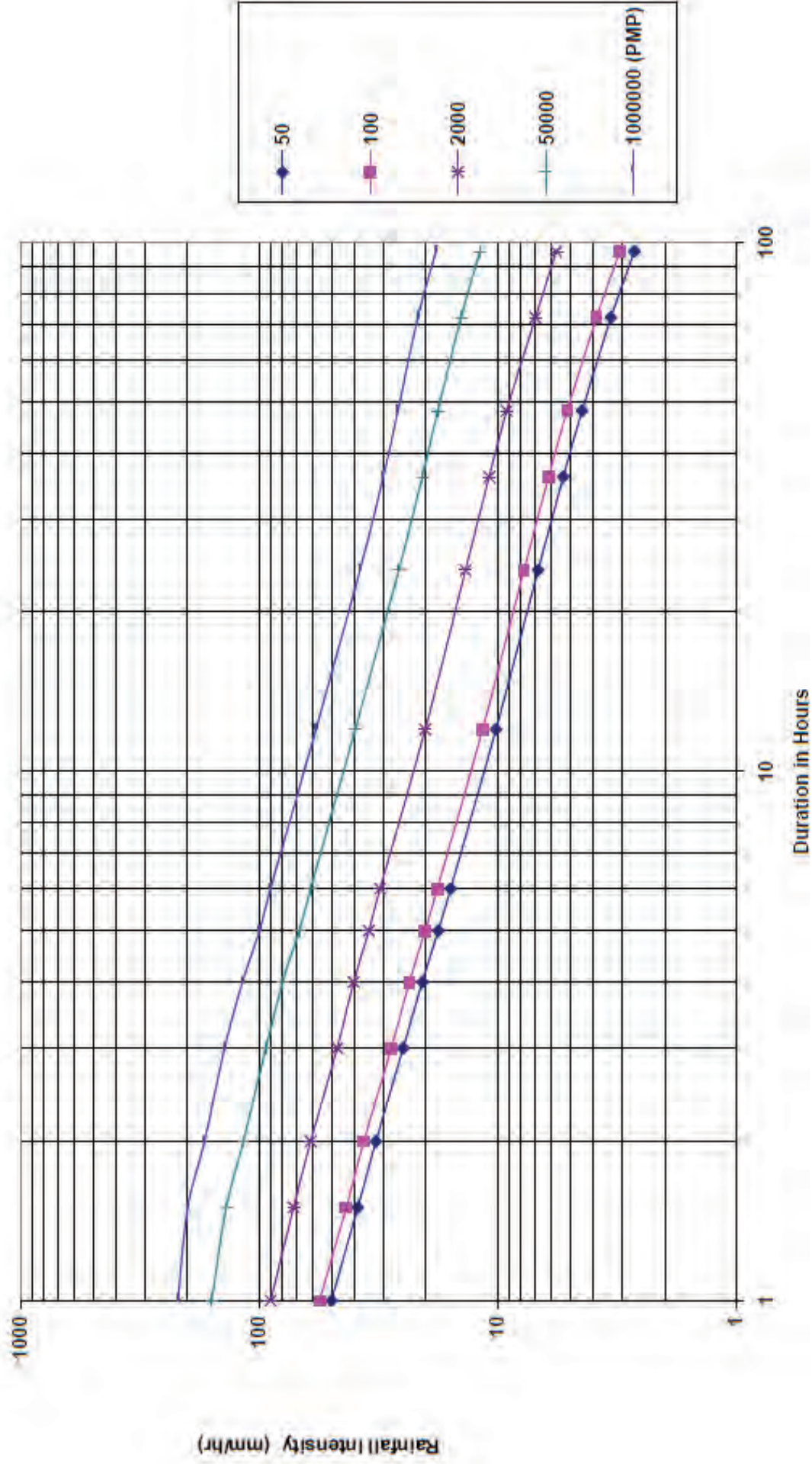


Figure 2.5 Gordonbrook Dam Catchment Rainfall Frequency Curve

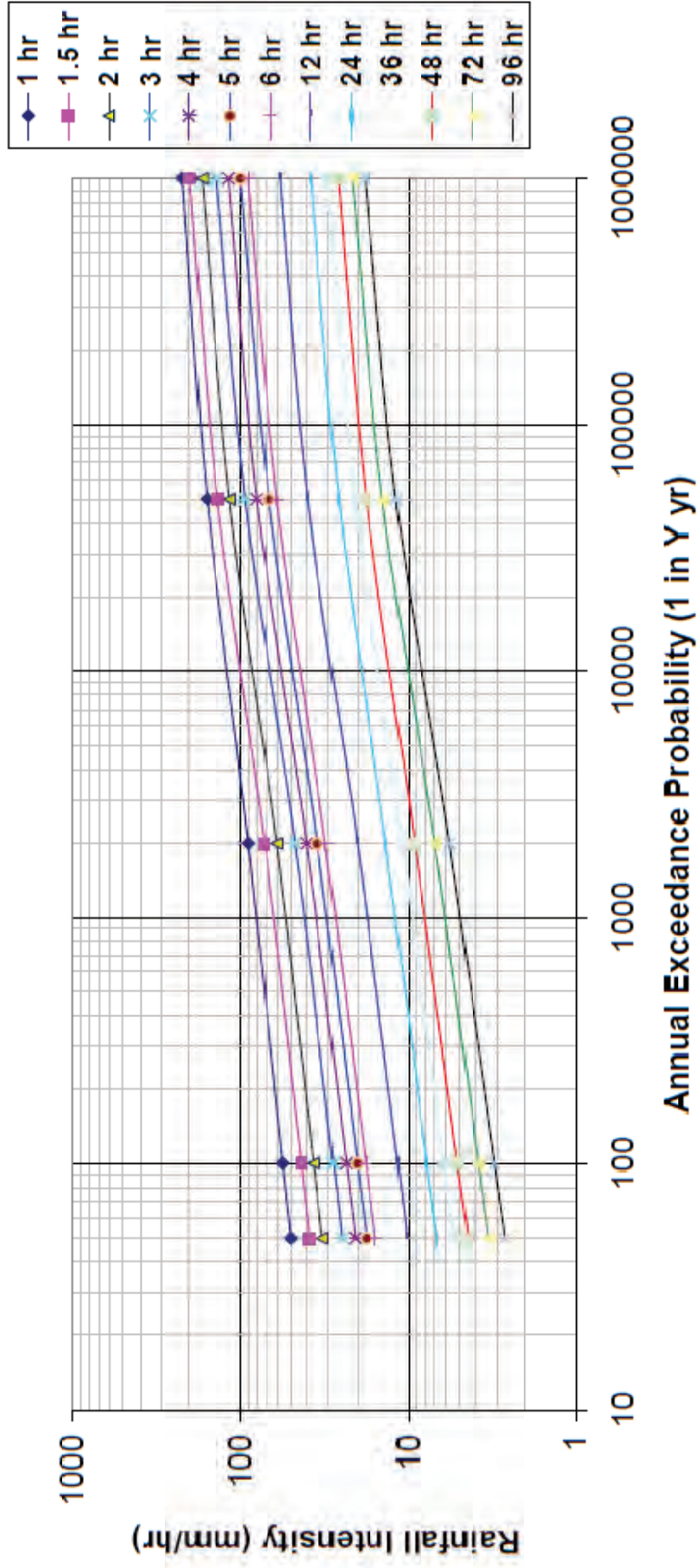


Table 2.3 Rainfall Depths/Intensities for all events

Rainfall Depth (mm)	1	1.5	2	3	4	5	6	12	24	36	48	72	96
50	50	58	65	75	83	89	95	122	163	192	213	242	257
100	56	65	73	84	94	101	108	139	187	221	246	278	297
2000	90	108	122	142	161	174	187	242	328	391	441	501	547
50000	159	207	234	283	319	341	367	476	626	749	858	1032	1146
PMP	220	300	340	420	470	500	540	700	910	1090	1260	1560	1750
Ratio													
50	0.23	0.19	0.19	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.17	0.16	0.15
100	0.25	0.22	0.21	0.20	0.20	0.20	0.20	0.20	0.21	0.20	0.20	0.18	0.17
2000	0.41	0.36	0.36	0.34	0.34	0.35	0.35	0.35	0.36	0.36	0.35	0.32	0.31
50000	0.72	0.69	0.69	0.67	0.68	0.68	0.68	0.68	0.69	0.69	0.68	0.66	0.65
PMP	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PMPDepth	220	300	340	420	470	500	540	700	910	1090	1260	1560	1750

3 DOCUMENTATION AND REPORTING

3.1 INCIDENT LOG

An Incident Log shall be maintained on site by the Water and Wastewater Engineer. Activities and decisions undertaken during any incident shall be recorded in chronological order in the Incident Log.

The Incident Log shall contain the following information as a minimum:

- A description of the incident / event.
- Time and date of the incident /event.
- Time and date of all actions.
- Regular recordings of water level.
- Regular recordings of rainfall.
- Instrumentation recordings.
- Description of observed damage.
- Photographs and / or sketches of observed damage.
- Details of communication which took place during the emergency.

Any further comments considered necessary.

Incident Logs (refer Appendix 4) shall be supported by other relevant documentation and photographs.

Comments regarding the adequacy of the EAP and any recommended changes to the EAP should be included.

3.2 REPORTING

Details of the incident / event and all actions taken shall be documented and reported to relevant SBRC staff and to the Dam Safety Regulator.

4 EMERGENCY EVENTS AND ACTIONS – FLOODING

4.1 CRITICAL STABILITY LEVEL

The critical stability level for Gordonbrook Dam is RL 398.2m AHD, the elevation of the crest of the main dam embankment. With any higher water level the embankment will overtop and likely fail.

4.2 FLOOD RELATED EVENTS

The Spillway Adequacy Assessment Report prepared by Worley Parsons in July 2008 states that the expected Dam Crest Flood (DCF) is the 1:5,000 year AEP flood; with an outflow of 2,542 m³/s; the Acceptable Flood Capacity is 3,239 m³/s which would overtop the dam embankment.

The report also states that according to AFC Guidelines the spillway will need to be modified to accommodate 75% of the AFC by October 2025. Modification of procedures and trigger levels will be required subsequent to any spillway augmentation works which are undertaken in the future.

4.3 FLOOD TRIGGER LEVELS

The following flood trigger events have been identified from review of the following reports:

- Spillway Adequacy Assessment Report,
- Comprehensive Dam Safety Inspection Report,
- Dam Failure Impact Assessment.

Table 4.1 Flood Trigger Levels

Trigger Description	EAP Number	Comments
Storage level is at RL 391.0 (0.5m below spillway crest level) and further rain is forecast	5.1	Monitor level and flow, EAP <u>not</u> activated.
Storage level is at RL 391.5 (spillway crest level) and further rain is forecast	5.2	Monitor level and flow, EAP <u>not</u> activated.
Storage level is at RL 393.0 (1.5m above spillway crest level) and further rain is forecast	5.3	Activate EAP
Storage level is at RL 394.0 (2.5m above spillway crest level) and further rain is forecast	5.4	Activate EAP
Storage Level is at RL 396.7 (1.5m below Dam Crest Level) and further rain is forecast.	5.5	Activate EAP
Storage Level rises above RL 397.7 (0.5m below dam crest level) and overtopping is imminent.	5.6	Activate EAP

4.4 NON FLOOD RELATED EVENTS

The following non-flood related events have been identified where some emergency action may be necessary.

Table 4.2 Non Flood Related Trigger Levels

Trigger Description	EAP Number
Increase in seepage or new area of seepage	5.7
Anomalies in piezometer readings	5.8
Earthquake reported in the vicinity of the dam	5.9
Movement of dam embankment	5.10
Damage to dam embankment	5.11

5 EMERGENCY ACTION PLANS

5.1 STORAGE LEVEL IS AT RL 391.0 (0.5M BELOW SPILLWAY CREST LEVEL) AND RISING

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event.
Monitor dam levels and flows.

TREATMENT PLANT OPERATOR	ENGINEER (T & Q - W & WW)
<ul style="list-style-type: none"> ➤ Notify the Engineer (T&Q – W&WW) of storage water level 	<ul style="list-style-type: none"> ➤ Review weather forecast.
FURTHER RAIN FORECAST	
<ul style="list-style-type: none"> ➤ Inspect spillway. 	<ul style="list-style-type: none"> ➤ Ensure that the spillway is clear of debris

5.2 STORAGE LEVEL IS AT RL 391.5 (SPILLWAY CREST LEVEL)

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event.
Monitor dam levels and flows

TREATMENT PLANT OPERATOR	ENGINEER (T & Q - W & WW)
<ul style="list-style-type: none"> ➤ Notify the Engineer (T&Q – W&WW) of storage water level 	<ul style="list-style-type: none"> ➤ Review weather forecast.

5.3 STORAGE LEVEL IS AT RL 393.0 (1.5M ABOVE SPILLWAY CREST LEVEL)

Activate EAP

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event and downstream impacts.

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none"> ➤ Notify the Manager Water and Wastewater of storage water level. Liaise with Manager during the course of the emergency. ➤ Using the latest rates of rise, calculate the time the water level will reach RL 394.0m (2.5m above spillway) and advise Manager Water and Wastewater. ➤ Continue to monitor water level and rate of change in level on an hourly basis. ➤ Undertake routine visual inspection when safe to do so and report any incidents to Manager Water and Wastewater. If Dam is inaccessible, instruct Treatment Plant Operators to conduct routine visual inspection and report ➤ If any incidents observed, proceed with EAP 5.11 	<ul style="list-style-type: none"> ➤ Advise the Director of Infrastructure (DES) and the SBRC Local Disaster Coordinator (LDC) and Queensland Police Service (QPS) that EAP has been activated. ➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation. ➤ Advise the SBRC Local Disaster Coordinator (LDC) to contact all residents located downstream of the Dam that the EAP has been activated. Localised Flooding and road closures are expected.

5.4 STORAGE LEVEL IS AT RL 394.0 (2.5M ABOVE SPILLWAY CREST LEVEL)

Activate EAP

Although this is not an emergency event, it is included in the EAP to provide advance warning of a possible event and downstream impacts. Gordonbrook Dam (and WTP) will be inaccessible due to road closures when dam level is at this height.

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none">➤ Notify the Manager Water and Wastewater of storage water level. Liaise with Manager during the course of the emergency.➤ Establish communication with Treatment Plant Operator and confirm level.➤ Ascertain forecast rainfall and river flows from Bureau of Meteorology (BoM)➤ Using the latest rates of rise, calculate the time the water level will reach RL 396.7m (1.5m below Design Dam Crest Level) and advise Manager Water and Wastewater.➤ Instruct Treatment plant operator to undertake routine visual inspection when safe to do so and report. Report any incidents Manager Water and Wastewater.➤ If any incidents observed, proceed with EAP 5.11➤ Continue to monitor water level and rate of change in level on an hourly basis.	<ul style="list-style-type: none">➤ Advise the Director of Infrastructure (DES) and the SBRC Local Disaster Coordinator (LDC) and Queensland Police Service (QPS) that EAP has been activated.➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.➤ Advise the SBRC Local Disaster Coordinator (LDC) to contact all residents located downstream of the Dam that the EAP has been activated. Localised Flooding and road closures are expected.

5.5 STORAGE LEVEL IS AT RL 396.7 (1.5M BELOW DAM CREST LEVEL) AND FURTHER RAIN IS FORECAST

Activate EAP

Gordonbrook Dam (and WTP) will be inaccessible due to road closures when dam level is at this height.

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none">➤ Inform the Manager Water and Wastewater immediately. Liaise with Manager during the course of the emergency.➤ Using the latest rates of rise, calculate the time the water level will reach RL 398.2m (Design Dam Crest Level) and advise Manager Water and Wastewater.➤ Continue to monitor water level and rate of change in level on an hourly basis.➤ Instruct Treatment Plant operator to immediately undertake inspection of those parts of the dam and spillway which are visible and accessible and report. During the inspection, note rainfall, water level, signs of slumps, erosion, springs, cracks or any deformation which could be classified as damage to the dam.➤ Photograph and record.➤ Note and report any anomalies to the Manager Water and Wastewater (3).➤ LDC to organise and provide Engineer (T&Q - W&WW) safe access to and from WTP.	<ul style="list-style-type: none">➤ Advise the Director of Infrastructure (DES) the SBRC Regional Council Local Disaster Coordinator (LDC) and Queensland Police Service (QPS).➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.➤ Keep Director of Infrastructure updated on situation➤ Advise the SBRC Regional Council Local Disaster Coordinator (LDC) to contact all residents located within the inundation zone and warn them that evacuation is possible.

WHEN WATER LEVEL REACHES RL 397.2m

- | | |
|--|---|
| <ul style="list-style-type: none">➤ Relay water levels back to Director of Infrastructure.➤ Continue to liaise with Manager Water and Wastewater. | <ul style="list-style-type: none">➤ Inform South Burnett Regional Council Local Disaster Management Group and QPS that the storage is approaching but still 1.0m below the dam crest level and the possible need for evacuation of downstream residents.➤ Inform the Director of Infrastructure of the situation.➤ Request South Burnett Regional Council Local Disaster Management Group to close roads as necessary. Potential road closures listed in Appendix F.➤ SES and Police to establish communication with the Local Disaster Management Group and to confirm when the roads and public areas are closed. During the closure, relay the water level to South Burnett Regional Council Local Disaster Management Group.➤ If requested, arrange preparation of media briefing for the Director of Infrastructure. |
|--|---|

ENGINEER (T & Q - W & WW)

MANAGER WATER AND WASTEWATER

WHEN DAMAGE IS OBSERVED

- Advise the Director of Infrastructure (4) and Proceed with EAP 5.8.
- In case of new area of seepage or increased seepage is observed, proceed to EAP 5.5.
- Proceed with EAP 5.8.
- In case of new area of seepage or increased seepage, proceed to EAP 5.5.

IF WATER LEVEL RISES ABOVE RL 397.7m

- Proceed with EAP 5.4
- Contact Local Disaster Management Group and recommend evacuation of all affected residents downstream of the dam. Minimum 3 hours notice required for evacuations.

**WHEN WATER LEVEL DROPS BELOW RL 396.7m
AND NO MORE RAIN IS FORECAST**

- Proceed with EAP 5.2
- Proceed with EAP 5.2.

5.6 STORAGE LEVEL RISES ABOVE RL 397.7 (0.5M BELOW DAM CREST LEVEL) AND OVERTOPPING IS IMMINENT

Activate EAP

Gordonbrook Dam (and WTP) will be inaccessible due to road closures when dam level is at this height.

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none"> ➤ Inform the Manager Water and Wastewater immediately. Liaise with Manager during the course of the emergency. 	<ul style="list-style-type: none"> ➤ Advise Director of Infrastructure and Local Disaster Coordinator of Dam level and the possibility of overtopping of the dam embankment. ➤ Advise the Dam Safety Regulator of the water level and the possibility of overtopping of the dam embankment. ➤ Check progress of evacuations with QPS.
<ul style="list-style-type: none"> ➤ Evacuate all but two operational staff from the vicinity of the dam. LDC to organise and provide safe access to and from WTP and dam spillway for operational staff onsite. ➤ Ensure communication to Manager of Water and Wastewater and SBRC LDC. ➤ Using the latest rates of water level rise, calculate the time to dam overtopping level (RL 398.2m). ➤ Instruct two staff members to remain at the dam site to monitor the water level and status of the dam. ➤ Each member is to be accounted for and allocated a safe position upstream of the main dam embankment. 	<ul style="list-style-type: none"> ➤ Advise the Director of Infrastructure of situation and evacuation progress. ➤ If requested, arrange preparation of media briefing for the Director of Infrastructure.
<ul style="list-style-type: none"> ➤ Continue to monitor water level and rates of change in level hourly, IF POSSIBLE, but do not venture onto the main dam embankment. ➤ Report regularly to the Director of Infrastructure. ➤ Note readings and reports in Incident Log. ➤ Photograph. ➤ Note and report any anomalies or damage to the Director of Infrastructure 	
<p>WHEN DAMAGE IS OBSERVED</p>	
<ul style="list-style-type: none"> ➤ Advise the Director of Infrastructure and proceed with EAP 5.9. ➤ Continue to liaise with Manager Water and Wastewater 	<ul style="list-style-type: none"> ➤ Proceed with EAP 5.9 ➤ In case of new area of seepage or increased seepage, proceed to EAP 5.5
<p>WHEN WATER LEVEL DROPS BELOW RL 396.7m AND NO MORE RAIN IS FORECAST</p>	
<ul style="list-style-type: none"> ➤ Proceed with EAP 5.3 	<ul style="list-style-type: none"> ➤ Proceed with EAP 5.3.

5.7 INCREASE IN SEEPAGE OR NEW AREA OF SEEPAGE IS OBSERVED IN THE DOWNSTREAM EMBANKMENT BATTER OR SPILLWAY DRAIN

Activate EAP

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTEWATER
<ul style="list-style-type: none"> ➤ Notify the Manager Water and Wastewater of any noticeable increase or changes in seepage (seepage rate or colour) or surface slumping on any dam embankment ➤ Liaise with Manager Water and Wastewater throughout the emergency 	<ul style="list-style-type: none"> ➤ Declare an Incident ➤ Inform the Manager Assets (4) of the situation. ➤ Assemble and activate Incident Management Team. (Disaster Management Coordinator to be involved)
<ul style="list-style-type: none"> ➤ Monitor the situation by measuring the rate of seepage flow and observe the clarity of the seepage flow. Keep notes and photographs for the Incident Log. ➤ Complete the Incident Log. 	<ul style="list-style-type: none"> ➤ Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (Procedure to be supplied) within 72 hours of the Incident. ➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.
IF TURBID SEEPAGE IS NOTED	
<ul style="list-style-type: none"> ➤ Advise the Director of Infrastructure and proceed with EAP 5.9. 	<ul style="list-style-type: none"> ➤ Proceed with EAP 5.9.
AFTER THE EVENT	
<ul style="list-style-type: none"> ➤ Complete the Incident Log and submit to Director of Infrastructure. 	<ul style="list-style-type: none"> ➤ Review and complete the Incident Log. ➤ Stand down the Incident Management Team and close the Incident.

5.8 ANOMALIES IN PIEZOMETER READINGS

Activate EAP

ENGINEER (T & Q - W & WW)

MANAGER WATER AND WASTEWATER

- Notify the Manager Water and Wastewater of any noticeable increase or changes in piezometer readings.

- Review results

IF RESULTS INDICATE POTENTIAL INSTABILITY OR FAILURE

- Immediately perform a Routine Dam Safety Inspection (refer to Gordonbrook Dam SOP16). During the inspection, note signs of slumps, erosion, springs/seepage, cracks, or deformation which could be classified as damage to the dam.

WHEN DAMAGE TO THE DAM IS OBSERVED

- Advise the Director of Infrastructure and proceed with EAP 5.9
- On receipt of the damage report, proceed with EAP. 5.9
- Liaise with Manager Water and Wastewater throughout the process.

5.9 EARTHQUAKE IS REPORTED IN THE VICINITY OF THE DAM

Activate EAP

ENGINEER (T & Q - W & WW)

- Inform the Director of Infrastructure that an earthquake has been felt in the area.
- Liaise with Manager Water and Wastewater.
- If possible, contact Geoscience Australia to ascertain epicentre and magnitude of earthquake

Contact Information for Geoscience Australia

Phone: Switchboard: +61 2 6249 9111

Sales Centre/product information: 1800 800 173

Earthquake information: 1800 655 739

Media Hotline: 1800 882 035

Fax: +61 2 6249 9999

MANAGER WATER AND WASTEWATER

- Declare an Incident
- Inform the Director of Infrastructure of the situation.
- Assemble and activate Incident Management Team. (Local Disaster Management Coordinator to be involved)

- Immediately perform a Routine Dam Safety Inspection (Refer to Gordonbrook Dam SOP16). During the inspection, note signs of slumps, erosion, springs/seepage, cracks, or deformation which could be classified as damage to the dam.
- Monitor the situation, keeping notes and photographs for the Incident Log and the Routine Dam Safety Inspection.

- Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (Refer to Gordonbrook Dam SOP23) within 72 hours of the Incident.
- Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.

WHEN DAMAGE TO THE DAM IS OBSERVED

- Advise the Director of Infrastructure and proceed with EAP 5.9.

- On receipt of the damage report, proceed with EAP 5.9

AFTER THE EVENT

- Complete the Incident Log and submit to Director of Infrastructure.

- Review and complete the Incident Log.
- Stand down the Incident Management Team and close the Incident.

5.10 MOVEMENT OF DAM EMBANKMENT

Activate EAP

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTWATER
<ul style="list-style-type: none">➤ Inform the Director of Infrastructure that movement has been noticed.➤ Immediately perform a Routine Dam Safety. During the Dam Safety Inspection (Refer to Gordonbrook Dam SOP 16), note any signs of slumps, erosion, springs, cracks or any deformation, which could be classified as damage to the dam.➤ Monitor the situation, keeping notes and photographs for the Incident Log and the Routine Dam Safety Inspection.	<ul style="list-style-type: none">➤ Declare an Incident.➤ Inform the CEO (SBRC) of the situation.➤ Assemble and activate Incident Management Team. (Disaster Management Coordinator to be involved)➤ Brief the Dam Safety Consultant to undertake a Special Dam Safety Inspection (For procedure refer to Gordonbrook Dam SOP 23) within 72 hours of the Incident➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation.
IF MOVEMENT HAS RESULTED IN DAMAGE TO THE DAM <ul style="list-style-type: none">➤ Advise the Director of Infrastructure and proceed with EAP 5.9	<ul style="list-style-type: none">➤ On receipt of the damage report, proceed with EAP 5.9
AFTER THE EVENT <ul style="list-style-type: none">➤ Complete the Incident Log and submit to Director of Infrastructure.	<ul style="list-style-type: none">➤ Review and complete the Incident Log.➤ Stand down the Incident Management Team and close the Incident.

5.11 DAMAGE TO DAM OR SPILLWAY

Activate EAP

ENGINEER (T & Q - W & WW)	MANAGER WATER AND WASTWATER
<ul style="list-style-type: none"> ➤ If damage to any part of the dam is noticed, report it immediately to the Director of Infrastructure 	<ul style="list-style-type: none"> ➤ Declare an Incident. ➤ Assemble Incident Management Team. ➤ Attend site and inspect the damage. ➤ Inform the CEO of the situation.
<ul style="list-style-type: none"> ➤ Assess and report the extent of damage to the Director of Infrastructure. 	<ul style="list-style-type: none"> ➤ Advise the Dam Safety Regulator that the EAP has been activated and of the general situation. ➤ Relay details of the damage to the Dam Safety Consultant. Information that should be relayed includes: <ul style="list-style-type: none"> • The type of damage; • The location of damage; • Water level; • Weather forecast; • Specific details of damage, e.g. flow and colour of seepage, size of cracks (length, width, orientation), size of slumps, sink holes etc. ➤ If necessary, arrange for the Dam Safety Consultant to inspect the damage and any repairs and, if necessary, undertake a Special Dam Safety Inspection (Refer to Gordonbrook Dam SOP 23).
<ul style="list-style-type: none"> ➤ Monitor the situation and keep the Director of Infrastructure advised. Note any changes in the nature of the damage. ➤ If instructed by the Director of Infrastructure, support any evacuations as required. 	<ul style="list-style-type: none"> ➤ Decide whether or not to instigate immediate repairs <ul style="list-style-type: none"> • If repairs are not undertaken, the damage is to remain monitored. • If the situation is considered serious enough, inform Local Disaster Management Group of the need to evacuate affected downstream residents before the Incident escalates to a Major Incident.
<ul style="list-style-type: none"> ➤ Coordinate repairs on site in accordance with instruction from the Director of Infrastructure. ➤ Regularly update the Director of Infrastructure on progress and record all relevant events in the Incident Log. ➤ On completion of the repairs, monitor and report to the Director of Infrastructure. 	<ul style="list-style-type: none"> ➤ If repairs are to be undertaken, the Dam Safety Consultant is to be consulted over the specification of the repairs. Materials and/or services may be obtained through existing SBRC suppliers or as decided otherwise by the Director of Infrastructure.

ENGINEER (T & Q - W & WW)

MANAGER WATER AND WASTWATER

ON COMPLETION OF REPAIRS

- Monitor situation and report to the Director of Infrastructure.
- If repairs appear to have stabilised the damage, confirm with the Dam Safety Consultant and close the Incident.
- The Dam Safety Consultant is to confirm the closure of any Incident associated with damage to the dam.
- The Dam Safety Consultant is to identify any required follow up repairs or works. Document these required works in the Incident Log and in the Dam Data Book.

AFTER THE EVENT

- Complete the Incident Log and submit to Director of Infrastructure.
- Review and complete Incident Log

APPENDIX A

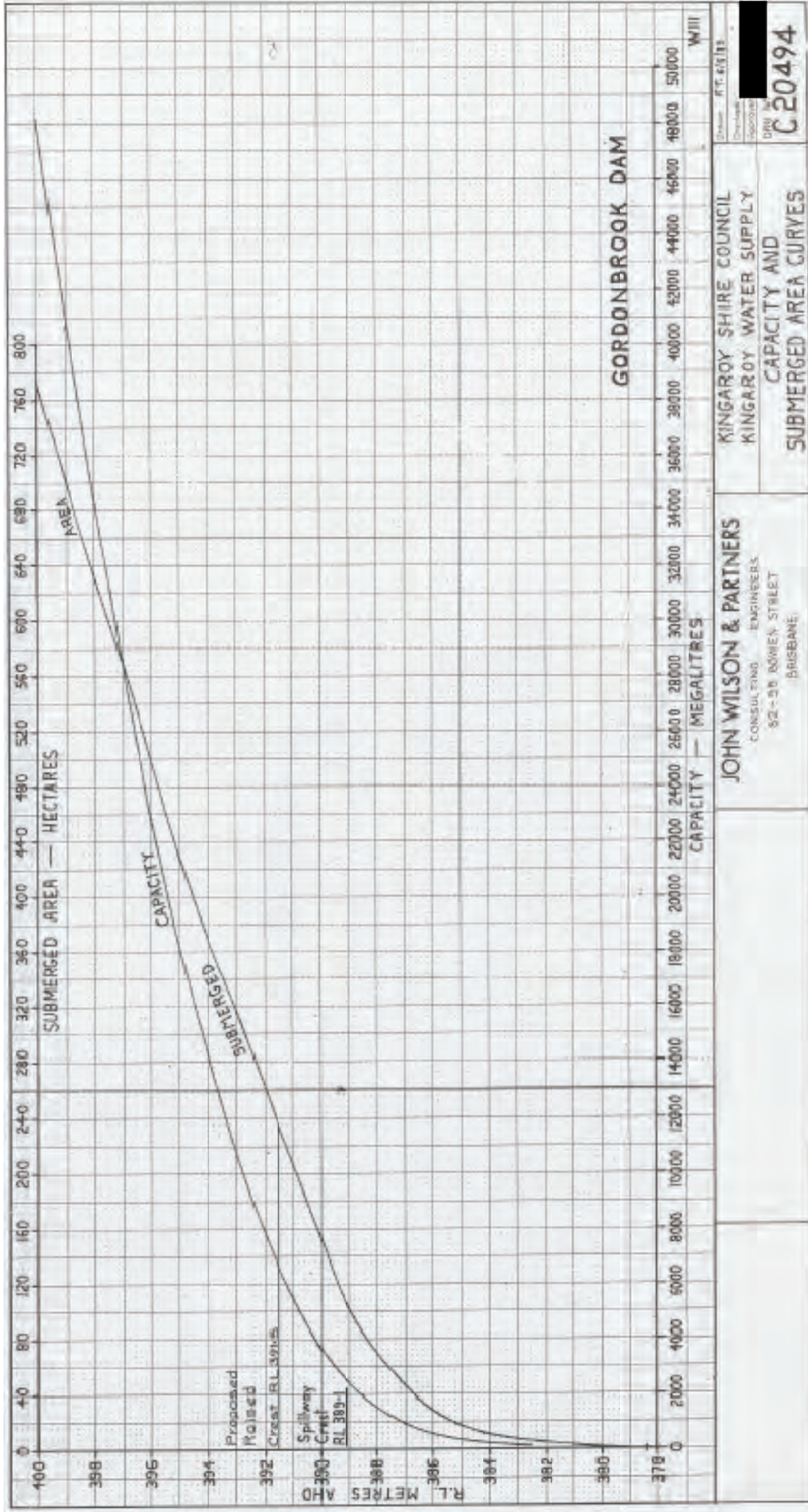
Access to Gordonbrook Dam

The dam is accessed via a private gravel road that leads off from the Memerambi-Gordonbrook Road, 10 km west of the Bunya Highway. This is shown in the map below.



APPENDIX B

Storage Capacity



APPENDIX C

Safety Inspections

	Responsible Officer	Purpose	Required Frequency
Routine Visual Inspection	Treatment Plant Operator	Identification and reporting of deficiencies by visual observation by operating personnel as part of their duties at the storage.	Weekly generally, but continuous during significant rain/flood events.
Routine Dam Safety Inspection (Procedure from SOP16)	Engineer Water and Wastewater	Identification and reporting of deficiencies, by structured observation of the dam and surrounds (including saddle dams), with recommendations for corrective actions.	Monthly
Annual Dam Safety Inspection (Procedure from SOP17)	Experienced RPEQ	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; and by applying current criteria and prevailing knowledge. Equipment used in every day operations should be test operated to identify deficiencies.	Yearly
Comprehensive Dam Safety Inspection (Procedure from SOP17)	Experienced RPEQ	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; safety management programs and safety documentation, and by applying current criteria and prevailing knowledge. All equipment should be test operated to identify deficiencies. Consider also: • Draining the water draw-off tower for internal inspection. • Diver inspection of submerged structures and equipment.	Five-yearly
Special Dam Safety Inspection (Procedure SOP23)	Experienced RPEQ	Examination of a particular feature of a dam for some special reason (e.g. after earthquakes, heavy floods, rapid drawdown, emergency situation) to determine the need for preventive or corrective actions.	As required

APPENDIX D

Incident Log Form

APPENDIX D

Incident Log Form



Site/Location:	Gordonbrook Dam
Date of Incident:	
Time of Incident:	
Incident Reported by:	
Time of Incident Notification	
Description of Incident (attach extra pages if required). Include comment on adequacy of the EAP and recommended changes to the EAP.	
Description of any damage, harm or nuisance caused (attach extra pages if required)	



South Burnett
Regional Council

FORM 1

Incident Log (Continued)

Communications and Actions during the incident (attach extra pages, photos, sketches if required)

No.	Date	Time	Water Level (m)	Rain (mm)	Photo number	Action Taken
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Signed		Date	
<p>Forward a copy of the completed form (all pages and attachments) to the Director of Infrastructure. Reviewed by Director of Infrastructure. Additional Comments:</p>			
Signed		Date	

APPENDIX E

Contact List

Title	Name	Mobile	Phone (w)	Phone (A/H)	Facsimile	Email	Address	Lot/RP	Building Flood #
South Burnett Regional Council									
Treatment Plant Operator –Based on Site	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Relief Treatment Plant Operator	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Water and Wastewater Engineer Nanango Office	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Manager Water and Wastewater	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Director of Engineering Services (DES)	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
CEO	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Mayor	David Carter		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
South Burnett Regional Council Local Disaster Management Group									
Local Disaster Coordinator (LDC)	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Deputy LDC	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]		
Primary Parties Affected by Dam Failure									
Troy J Pinwill	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	Oakdean Road	FY1022	H2, H16, H26
Cameron and Monica Carseldine	[Redacted]		[Redacted]	[Redacted]	[Redacted]	[Redacted]	Cooleys Road	FY1022	H3

Title	Name	Mobile	Phone (w)	Phone (A/H)	Facsimile	Email	Address	Lot/RP	Building Flood #
Primary Parties Affected by Dam Failure	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	B0204	H4, H5, H6
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	FTZ37183 3 FY1981	H7 H17
Interstate Pacific	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	B0203 RP197463	H8 H18
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	P156218 RP165376	H12
Primary Parties Affected by Dam Failure	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165401 RP164803 RP216835	H14 H11, H24 H13
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165376	N1
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165376	N2
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165376	N3
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165 401	N4
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165401	N5
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165400	N6
	[Redacted]	[Redacted]	[Redacted]	[Redacted]			[Redacted]	RP165400 RP165400	N7 N8

Title	Name	Mobile	Phone (w)	Phone (AH)	Facsimile	Email	Address	Lot/RP	Building Flood #
Primary Parties Affected by Dam Failure									
Isis Hardware & Rural Pty Ltd	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Memerambi Gordonbrook Road [Redacted]	FY1022	H1
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Memerambi Gordonbrook Road	FY1023	H15
Mirrabeena Holdings Pty Ltd	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Memerambi Gordonbrook Road	191624	H21
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	2 Chinchilla Wondai Road	156218	H9, H22, H23, H27
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	3 Chinchilla Wondai Road	197463	H10?
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Chinchilla Wondai Road	197463	H10?
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Wilkes Road [Redacted]	165376	H19
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	Wilkes Road	164803	H25
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	McKenzie Road [Redacted]	P166377	H20
SUNWATER	SUNWATER		13 15 89	13 15 89					
Local Counter Disaster Groups Kingaroy									
Police (Kingaroy)			000	07 4160 4900					
State Emergency Service (Kingaroy)			000	07 4162 5794		kingaroyes@efel.net.au			
QLD Fire Service Regional Office (Kingaroy)			000	07 4162 7100					
Ambulance (Kingaroy)			000						

APPENDIX F

Flood Maps



LEGEND
● Buildings

400 0 400 800 1200
Metres
Scale: 1:40,000

GORDONBROOK DAM BREAK FLOOD STUDY

APPENDIX 4

LOCATION OF BUILDINGS WITHIN THE FLOODPLAIN



Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
PO Box 1757, Sunshine Plaza, QLD 4558
Ph. (07) 5475 6400 Fax. (07) 5475 6499





LEGEND

-  DCF Inundation Extent
-  DCF + Dambreak Inundation Extent
-  Extent of Mapping
-  Buildings at Risk

400 0 400 800 1200



Metres

Scale: 1:40,000

GORDONBROOK DAM BREAK FLOOD STUDY

DCF DAM BREAK FLOOD EXTENT



WorleyParsons
resources & energy





OneWay
by earthlink


Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
PO Box 1757, Sunshine Plaza, QLD 4558
Ph. (07) 5475 6400 Fax. (07) 5475 6499





Legend

-  PMF only Flood Extent
-  PMF + Dambreak Flood Extent
-  Buildings at Risk
-  Extent of Mapping

400 0 400 800 1200

 Metres
 Scale: 1:40,000

GORDONBROOK DAM BREAK FLOOD STUDY

PMF FLOOD EXTENT



WorleyParsons
 resources & energy
OneWay
 by one team


Worley Parsons Services Pty. Ltd.
 ABN 61 001 279 812
 PO Box 1757, Sunshine Plaza, QLD 4558
 Ph. (07) 5475 6400 Fax. (07) 5475 6499





LEGEND

-  Sunny Day Inundation Extent
-  Extent of Mapping
-  Buildings at Risk

400 0 400 800 1200

 Metres
 Scale: 1:40,000

**GORDONBROOK
DAM BREAK
FLOOD STUDY**

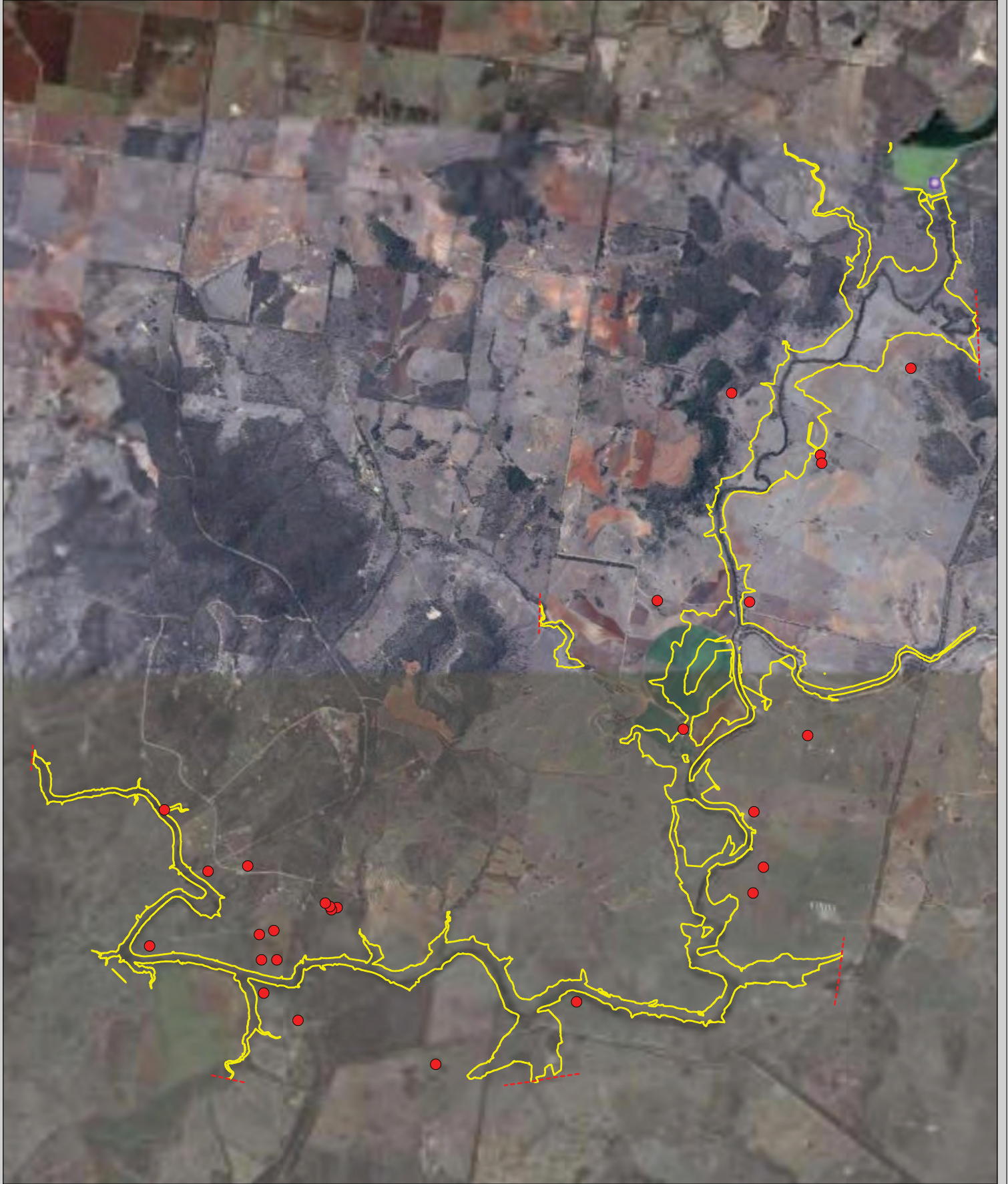
**SUNNY DAY
DAM BREAK
FLOOD EXTENT**



WorleyParsons
resources & energy

OneWay
by worleyparsons

Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
PO Box 1757, Sunshine Plaza, QLD 4558
Ph. (07) 5475 6400 Fax. (07) 5475 6499



GORDONBROOK DAM

Operation and Maintenance Manual



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Gordonbrook Dam Operation and Maintenance Manual

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List of abbreviations

AHD	Australian Height Datum (metres)
AMTD	Adopted Middle Thread Distance
DCF	Dam Crest Flood
DCL	Dam Crest Level
DERM	Department of Environment and Resource Management
dia	Diameter
EAP	Emergency Action Plan
EL	Elevation Level (metres)
EMP	Environmental Management Plan
EMS	Environmental Management System
FSL	Full Supply Level
ha	hectare (10,000m ²)
kl/d	kilolitres per day
km ²	square kilometre
LB	Left Bank
m	metre
m ²	square metre
ML	Mega (million) litres
mm	millimetre
m ³ /s	cubic metre per second
PMF	Probable Maximum Flood
RB	Right Bank
ROL	Resource Operations License
SBRC	South Burnett Regional Council
SOP	Standing Operating Procedure
WHS	Workplace Health and Safety
WP	Work Procedure
WTP	Water Treatment Plant

1 Overview

1.1 About this manual

1.1.1 General

This Operations and Maintenance Manual contains the guidelines, procedures, and instructions for operation and maintenance of Gordonbrook Dam.

The manual has three main sections: Overview (1), Operations (2), and Maintenance (3).

1.1.2 Use of this manual

The South Burnett Regional Council personnel and its contractors must operate and maintain Gordonbrook Dam in accordance with this manual.

This manual does not cover every possible event and situations can occur when the procedures in the manual are not appropriate. For example, a conflict may occur between the procedures in this manual and the requirements of Workplace Health and Safety or Environmental Management. If good reason exists for a variation, written approval must be sought from the Water and Wastewater Engineer. If the Water and Wastewater Engineer cannot be contacted in advance and the situation is urgent (and not covered by the Emergency Action Plan), personnel may use their best judgement and inform the Water and Wastewater Engineer about the variation as soon as reasonably possible. If the variation is likely to continue, the Water and Wastewater Engineer must be asked to incorporate the changed procedure into the manual.

This manual is designed to be living document; it is expected that there will be considerable changes and additions to this manual over time. Corrections of errors or proposed changes to the manual are to be submitted to the Water and Wastewater Engineer for consideration.

1.1.3 Regulatory dam safety documentation

The manual is part of the regulatory dam safety documentation that consists of the following:

- Gordonbrook Dam: Standing Operating Procedures
- Gordonbrook Dam: Operation & Maintenance Manual (this manual)
- Emergency Action Plan: Gordonbrook Dam

- Gordonbrook Dam: Data Book Part 1 - Text
- Gordonbrook Dam: Data Book Part 2 – Drawings

In an emergency the procedures in the Emergency Action Plan take precedence over this manual.

1.2 Kingaroy Water Supply Scheme

Gordonbrook Dam (Figure 1-1) is located on the Stuart River at AMTD 83 km upstream from its confluence with the Boyne River and approximately 20 kms by road north of Kingaroy.

The main purpose of the dam is the supply of water to the town of Kingaroy via the Water Treatment Plant situated on the Left Bank immediately upstream of the main embankment.

The storage formed behind the Gordonbrook Dam holds 6600ML with a surface area of 236 hectares and has an average depth of 2.8 metres. The catchment area for the Dam is approximately 600 sq km. The average annual rainfall being approximately 200 to 300 mm.

Figure 1-1 Aerial view of the dam.



Figure 1-2 Location diagram of Gordonbrook Dam.



Water is not released directly from the dam if the storage level is below the spillway crest level of RL391.500m AHD as the diversion line used during construction, the drain pipe through the spillway and the river release pipe and valve at the left side of the spillway are no longer in use. Attempts to operate these valves may result in damage and must only be done under instruction and supervision of the South Burnett Regional Council Water and Wastewater Engineer.

The only water regularly released into the River Stuart downstream of the Dam is about 600 kl/day which is backwash water from the Water Treatment Plant filters. This backwash water is first pumped into holding settlement basins before release into the river. The discharged water quality must comply with Environmental Protection Agency (EPA) requirements.

Construction of the dam was completed in 1942. The dam is owned and operated by the South Burnett Regional Council.

KINGAROY WATER SUPPLY SCHEME
Gordonbrook Dam Operation and Maintenance Manual

Figure 1-3 Gordonbrook Dam Spillway.



Table 1-1 Overview of the Gordonbrook Dam details.

Overview

Dam Name	Gordonbrook Dam
Storage Name	Gordonbrook Dam
Location	Latitude 26° 26' 64" S Longitude 151° 44' 9.6" E 26.4349, 151.736 UTM 56J 373965 7075533
Shire	Kingaroy
Nearest Town	Kingaroy
Stream and AMTD	Stuart River AMTD 155.7 km
Catchment Area	600 km ²
Average rainfall	200 - 300 mm annually

Main Dam

Type	Zoned Earth and rockfill
Full Supply Level (FSL)	RL391.500m AHD
Storage capacity at (FSL)	6600 ML
Storage area at (FSL)	236 ha
Dam Crest Level (DCL)	RL398.20m AHD
Crest length along axis (main)	400 m

embankment)

Spillway

Spillway type	Uncontrolled Ogee-type crest
Spillway crest level	RL391.500m AHD
Crest length	80 m
Spillway capacity for DCF	1950 ML

Intake Tower

Description	The Intake Tower supplies the Water Treatment Plant only and serves no purpose in the operation of Gordonbrook Dam.
-------------	---

In addition to the main dam, there are three shallow settling basins with earth embankments on the downstream left bank which collect backwash water from the treatment plant before discharge into the Stuart River.

Figure 1-4 Site Layout



1.3 Associated documents

1.3.1 Standing Operating Procedures

The Standing Operating Procedures (SOPs) for Gordonbrook Dam should be read in conjunction with this manual. Where the manual describes the ‘how’ of an operation, the SOPs highlight the ‘what’, ‘who’ and ‘when’.

Where appropriate the headings of this manual incorporate the number(s) of the SOP(s) that cover the same topic. Similarly, the first two digits used in the number of each Work Procedure indicate the SOP number on which they are based. The list that follows indicates the South Burnett Regional Council SOPs that apply to the Operation and Maintenance of Gordonbrook Dam:

Table 1-2 List of relevant Standing Operating Procedures.

SOP 00	Organisational structure and responsibilities
SOP 01	Verification of emergency. Contact numbers
SOP 02	Loss of communication during an emergency event
SOP 03	Accident and incident reports
SOP 04	Notification of Uncontrolled Spillway Discharge
SOP 05	Inspection, testing and maintenance of mechanical and electrical equipment
SOP 06	Health and Safety
SOP 07	Dam Log Book
SOP 08	Storage inspection and control of noxious weeds
SOP 09	Hazardous substance spillage in the dam catchment area
SOP 10	Algae monitoring
SOP 11	Instrumentation surveillance and data recording
SOP 12	Environmental protection
SOP 13	Storage Supervisor training
SOP 14	Dam security and restricted areas
SOP 15	Documentation control and review
SOP 16	Owners routine dam safety inspection
SOP 17	Regulatory dam safety 5 yearly inspections
SOP 18	Assignment of responsibility
SOP 19	Normal Operation Criteria
SOP 20	Data Reporting
SOP 21	Emergency Action Plan
SOP 22	Attendance at dam
SOP 23	Requirements for inspection during and after emergency events (Refer to EAP)

1.3.2 Emergency Action Plan

The Emergency Action Plan (EAP) is activated when a spillway discharge is likely or when the dam embankment develops a problem that has the potential to endanger downstream life and property. The EAP lists the occasions and details by who, how, and when the EAP is activated. A copy of the EAP is available at the dam site and the South Burnett Regional Council's Nanango Office.

Operating personnel must know the contents of the EAP, know what events activate the EAP, and follow its procedures. In the event of an emergency situation, the procedures in the Emergency Action Plan take precedence over this manual.

1.3.3 Drawings

The South Burnett Regional Council holds copies of the construction and 'as built' drawings of Gordonbrook Dam. Printed copies of the 'as built' drawings are held at the dam site and Nanango office. In addition, a full set of dam drawings is contained in Volume 2 of the Gordonbrook Dam Data Book.

1.3.4 Workplace Health and Safety and Environmental Standards

All the South Burnett Regional Council work must comply with the appropriate WHS and EMS standards and procedures. This manual assumes that personnel are conversant with the relevant WHS and EMS systems. Copies of all WHS and EMS procedures are available at the South Burnett Regional Council's Nanango office. Some procedures – such as: Entry and Work in Confined Spaces and Restricted Access – include forms that need to be completed as part of the procedure.

1.3.5 Resource Operation Licence (ROL)

Gordonbrook Dam is filled from and discharges into the Stuart River, however the South Burnett Regional Council has no exclusive right to the water. In addition, the dam's operation regime must be optimised to minimise its environmental impact. The balancing of these requirements rests with the Department of Environment and Resource Management (DERM) , who have detailed the South Burnett Regional Council's rights and obligations as well as those of other stakeholders, in the Resource Operation Licence (ROL) for the Burnett Basin Resource Operations Plan issued to the South Burnett Regional Council.

A copy of the ROL is held in the South Burnett Regional Council's Nanango office.

Attachment 5.4B, 5.4C and 5.4D of the Burnett Basin ROP details the operating rules for the Stuart River. Attachment 5.4A is reserved for future amendments.

1.3.6 Development Permit and Dam Safety Conditions

The construction of dams – and similar large structures – requires a Development Permit under Queensland's Integrated Planning Act. The Gordonbrook Dam Development Permit lists all the conditions related to the structural, operational, and environmental safety aspects of the dam and its management, including the retention and control of the records relating to the dam's construction, operation, and maintenance history.

This manual conforms to the requirements specified in the Gordonbrook Dam Development Permit. A copy of the permit is held in South Burnett Regional Council's Nanango Office.

1.3.7 Water Information

The South Burnett Regional Council remotely monitors all stream and level gauges that can provide important information for the managing of the water storages under its control.

Upstream flows are recorded at Weens Bridge 97.1km AMTD.

1.3.8 Others

The authors of this manual have also taken into account the contents of some, if not all, of the following documents:

KINGAROY WATER SUPPLY SCHEME
Gordonbrook Dam Operation and Maintenance Manual

Table 1-3 Relevant documentation

REPORT TITLE	DATE	AUTHOR	LOCATION
Proposed Raising of Gordonbrook Dam on the Stuart River Design Report	Dec83	John Wilson & Partners	Nanango Office
Burnett Basin Resource Operations Plan	May2011	Department of Environment and Resource Management (DERM)	www.derm.qld.gov.au/wrp/burnett_rop.html

2 Operation

2.1 Operational objectives

The operation of Gordonbrook Dam must meet the following criteria:

1. Gordonbrook Dam and all its associated structures, facilities, and spaces shall be operated and monitored in accordance with:
 - Gordonbrook Dam Operations and Maintenance Manual (this manual).
 - The South Burnett Regional Council policies and approved practices,
 - The Burnett Basin Resource Operating Licence and/or Development Permit.
 - Kingaroy Water Supply Scheme requirements (Water Treatment Plant)
 - Good engineering and water management standards and practices.

2. There is no reliable facility to make water releases from Gordonbrook Dam except via the disused River Outlet pipe and the Water Treatment Plant and these must be scheduled to comply with:
 - Burnett Basin Interim Resource Operations Licence.
 - The South Burnett Regional Council's Customer Charter.
 - Environmental requirements of the EPA.
 - All applicable supply agreements and licences.

2.2 Monitoring the dam (SOP 16)

2.2.1 General

The Storage Supervisor must monitor the dam by regularly inspecting its structures and reading the instruments that measure its conditions. The Storage Supervisor also must keep a record of the observations and make reports.

The monitoring of the dam site involves the regular inspection of the embankments and the structures contained within the embankments, the reading of the dam instruments, and the reading of the meteorological instruments located at the Water Treatment Plant.

How to do such inspections is detailed in [Section 2.2.4](#) which details how to inspect embankments and concrete structures.

2.2.2 Keeping the dam logbook (SOP 07)

The Storage Supervisor must keep a dam log book to record operations and maintenance activities such as:

- Equipment testing
- Major planned and unplanned maintenance and special one off jobs at the dam
- Dam storage and dam site inspections
- Functional testing of mechanical equipment
- Painting programs
- Catchment inflows, releases, and storage levels
- Incidents and accidents
- Reports sent and received (both written and verbal)
- Special instructions received or given
- Notices of amendments to dam documents

The Storage Supervisor may also use the logbook to record weather observations and any other event relevant to the operation and maintenance of the dam and the dam site.

SOP 11 includes a sample layout for a dam logbook. Other formats are acceptable as long as they are complete and follow a consistent layout.

The dam logbook must be kept on site and be available to the South Burnett Regional Council personnel and dam safety auditors; ideally, a copy of the dam logbook should be kept in the Nanango Office and scanned at monthly intervals to be stored electronically.

2.2.3 Reporting observations and measurements (SOP 16)

The Storage Supervisor must record and report all dam instrument readings, using the forms supplied by the Water and Wastewater Engineer on a monthly basis.

The Water and Wastewater Engineer will trend, assess, and file the data. The Water and Wastewater Engineer will also recommend what, if any, remedial or follow-up action should be taken.

In the case of possible adverse or unusual findings, the Storage Supervisor shall immediately contact his supervisor, and the Water and Wastewater Engineer instead of solely relying on his written report to reach its destination.

2.2.3.1 Reporting storage and flow data (SOP 15)

The Storage Supervisor shall forward the following information to the Water and Wastewater Engineer Nanango on a monthly basis:

- Storage level data
- Rainfall summary
- Flow rate of water released
- Instrumentation readings

2.2.4 Inspecting the embankments



Take precautions to avoid snake bites and sprained ankles whilst walking in long grass and uneven surfaces on the embankment faces.

The main dam wall is 400 m long across the Left Embankment crest, 5.8 m wide and 16 m above the foundations. It is an earth and rockfill embankment with its spillway located at the right abutment.

Figure 2-1 Upstream Embankment



Figure 2-2 Downstream Embankment



Gordonbrook Dam is a Category 1 Dam, which means that its failure has the potential population at risk of less than 100 persons. To ensure that the dam is in good condition, the Storage Supervisor must monitor the dam for signs of stress and/or damage and keep records of all inspections and promptly report all events or findings that concern dam safety. Accordingly, the Gordonbrook Dam Storage Supervisor must, every three months, check the condition of the main embankment (Figure 2-1 & Figure 2-2).

The Gordonbrook Dam has an uncontrolled ‘ogee crest type’ spillway (Figure 2-3). The outlet discharges into a rock and earthen channel which in turn discharges into the Stuart River. The spillway discharge channel has two lateral drop structures (Figure 2-4).

Figure 2-3 Spillway



Figure 2-4 Drop Structures



When inspecting an embankment, the operator must look for the following signs of stress:

- Seepage
- Cracking such as piping and transverse and longitudinal cracking
- Instability such as demonstrated by slides and bulging
- Depressions such as sinkholes, and minor depressions and
- Maintenance deficiencies such as inadequate slope protection, surface runoff erosion, inappropriate vegetation growth, debris, and animal burrows.

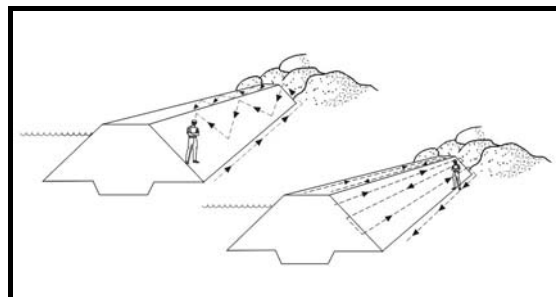


Figure 2-5 Systematically inspecting an embankment

Inspections must be carried out systematically in a defined pattern (Figure 2-5).

WP 16-01. Inspecting embankments

1. Look at the embankment from a distance so that you can see differences in the colour and density of vegetation that may identify wet areas
2. Walk the embankment slopes as many times as is necessary to see the entire surface in either a zigzag or parallel pattern
3. Stop regularly slowly turning around to see the embankment from different perspectives and to find deficiencies that you otherwise may overlook
4. Walk along the groin of the embankment looking for runoff erosion and seepage
5. Inspect the crest of the embankment as if it were the slope; using the same patterns and the same techniques
6. Regularly pause and look around looking for new angles and for things you may have overlooked

7. Check the alignment of the crest to detect any sign of horizontal movement. Look for lines you can use for reference. If necessary, use binoculars
8. Look along the line formed by the water surface and the slope of the embankment to detect any change in the slope of the embankment

2.2.4.1 Inspecting for seepage

The operator must be especially alert for any changes in embankment seepage – the slow passage of water through the embankment or the foundation (figure). A little seepage is normal, but it becomes a concern when soil particles are dislodged and carried by the flow or when it builds large pressure cells inside the embankment or the foundation. It requires a trained eye to recognize the symptoms.

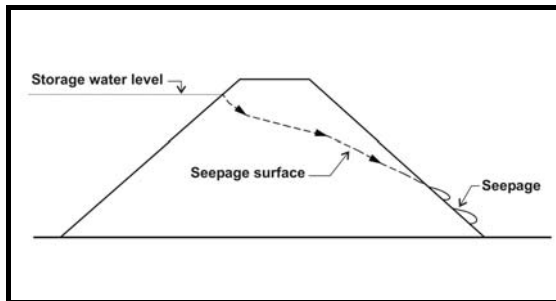


Figure 2-6 Seepage on the slope of an embankment

Embankment seepage that is not adequately intercepted and drained can cause an embankment slide (Figure 2-6)

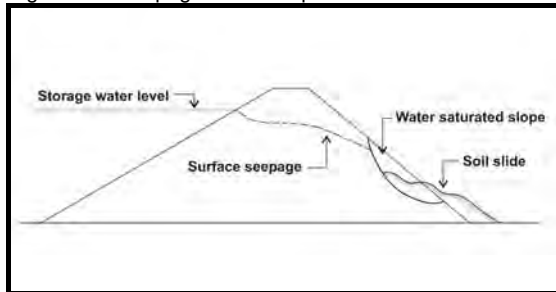


Figure 2-7 A shallow embankment slide

Apart from endangering an embankment's stability, slides can obstruct spillways and outlet works, displace slope protection, and lead to even larger slides.

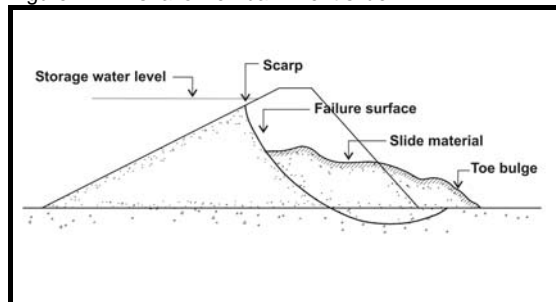


Figure 2-8 A deep seated embankment slide

A shallow embankment slide (Figure 2-7) is characterised by arc-shaped cracks, a shallow but steep slope, and a surface shaped like a hammock.

Deep-seated slides (Figure 2-8) are characterised by arc-shaped cracks, a well-defined scarp, and a toe bulge

WP 16-02. Investigating and describing embankment instabilities

When you observe a slide or instability on an embankment do the following:

1. Photograph the area and record the date, the location, the extent, and the nature of the displacement.
2. Look for surrounding cracks.
3. Probe the area for loose surface material.
4. Look for seepage nearby.
5. Seek help from an experienced person if you are in doubt of the seriousness of the slide, or don't know what action to take.
6. Continue monitoring the area for further changes.

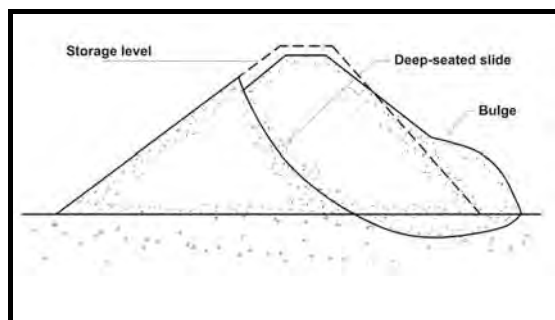


Figure 2-9 Bulging due to a deep seated slide

A deep-seated slide is not always as obvious as implied in figure. Sometimes, you may only see a slight bulge (Figure 2-9)

or by bulging due to lateral spreading (Figure 2-10).

If you see such a bulge it can be caused by a deep-

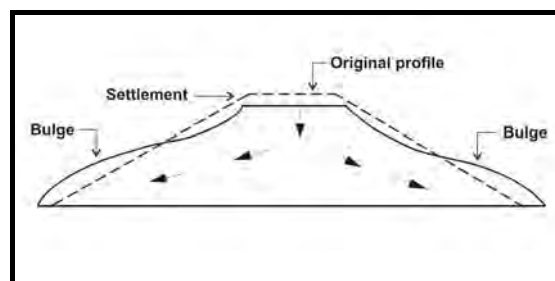


Figure 2-10. Bulging due to lateral spreading

Seepage may appear as a wet area or as a 'spring'.

To know whether seepage is changing it needs to be measured by the operator. To make this possible, seepage is collected by a system of channels

ending at measuring weirs. After the measurements have been made and recorded, they can be plotted with previous readings to detect unusual changes or trends.

WP 16-03. Monitoring seepage

1. Watch for areas with water-loving vegetation, or areas that seem greener and lusher than others. If they occur do a close and detailed inspection, report the findings, and seek expert advise
2. Ensure that all drains and channels that intercept seepage are clean and in good condition
3. Check the turbidity of the seepage by filling a glass jar and holding it against the light. Keep the filled jar for comparison with previous and

- later samples. High turbidity implies soil movements that may cause piping or subsidence. If it is turbid report immediately and seek expert advise
4. Measure the depth of water flowing over the seepage weir, convert the reading into a flow rate, and record together with the date, time, recent rainfall, and storage level
 5. Compare the reading with previous readings especially readings that were taken under similar weather conditions and storage levels.
 6. Report and seek expert advice if the readings appear abnormal

2.2.4.2 Inspecting for piping

Concentrated seepage through an embankment or its foundation may result in piping – centralised erosion at the seepage exit point. If the pipe is below the water level, local turbidity may indicate its presence caused by the dislodged soil particles dispersed into a cloudy suspension.

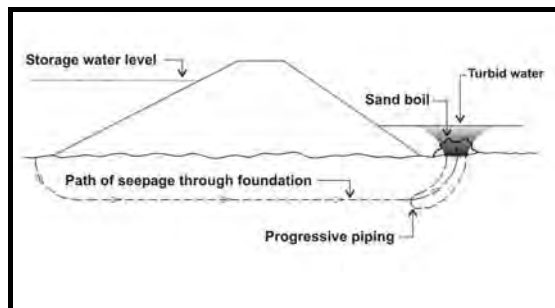


Figure 2-11 Piping caused by seepage through the embankment's foundation

Not all piping has water coming out. As is shown in figure, piping may also occur when parts of the embankment subsides into the rock cavities of an embankment foundation.

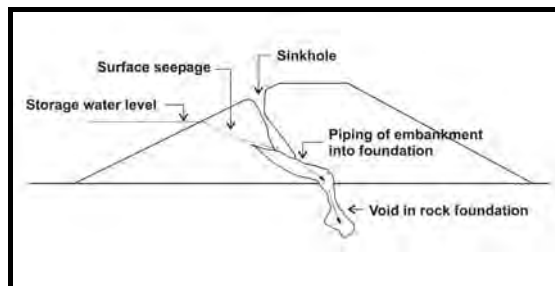


Figure 2-12. Embankment piping into voids in rock foundations

The recording and reporting of piping is similar to that of cracking highlighted in section.

2.2.4.3 Inspecting for cracking

Cracking usually occurs when there is uneven settlement such as often happens between adjacent fills. Such cracks can be transverse (Figure 2-13) and longitudinal (Figure 2-14).

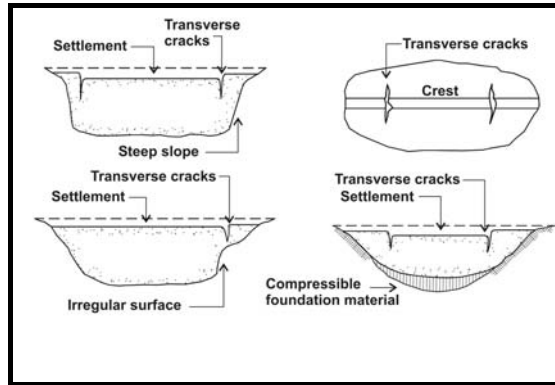


Figure 2-13. Types of transverse cracking

in the compressibility of the foundations.

Transverse cracks (Figure 2-13) are roughly perpendicular to the crest of the dam. They indicate differential settlement; usually near the abutments in u-shaped or trapezoidal shaped valleys. It can be due to the construction methods used, to differences in fill materials, or to variations

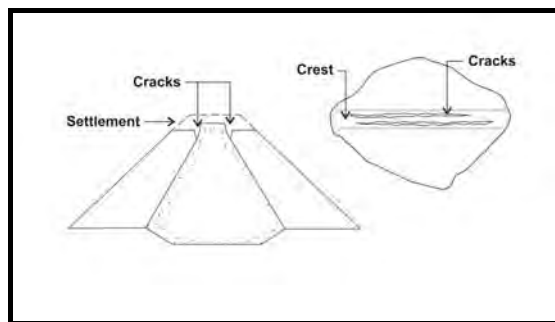


Figure 2-14 Longitudinal cracking

an unstable slope.

Longitudinal cracks (Figure 2-14) occur parallel to the crest of the dam. Longitudinal cracks are a sign of uneven settlement between adjacent embankment zones of differing compressibility, or the onset of a scarp caused by

Not all settlement causes cracks. Uneven embankment settlement, embankment spreading, or surface erosion may cause shallow depressions or sinkholes (Figure 2-15), but no clear cracks. If you find a depression follow WP 28-04.

WP 16-04. Investigating and recording an embankment depression

1. Take a photograph and record the date, location, size and depth.
2. Probe for voids.
3. Continue to monitor the depression.
4. If unsure about what to do seek help from an experienced person.

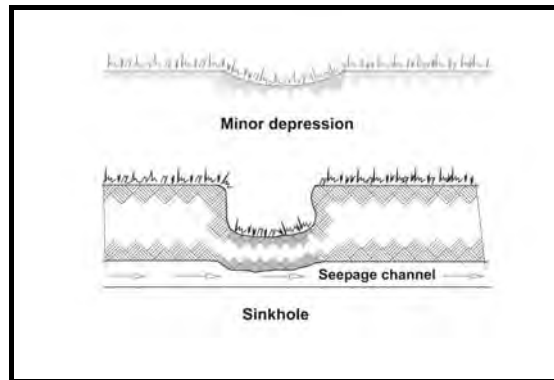


Figure 2-15. Depressions and sinkholes

Sinkholes are different from depressions. They are caused by the removal of subsurface embankment or foundation material, often due to seepage.

When cracks or sinkholes are found the operator must follow WP 28-05.

WP 16-05. Investigating and recording cracks in an embankment

1. Take photos and record the date, location, depth, length, width, and the offset of the cracks.
2. Report the cracks and seek help to investigate the cracks and determine their cause.
3. Continue to monitor the cracks and its surrounding area for further changes.

Any remedial action will depend on the findings of this investigation.

2.2.4.4 Inspecting for other deficiencies

When inspecting the embankments the operator must also check for the presence of the following deficiencies.

- **Inadequate slope protection.** Unprotected areas or areas where the protection is damaged, may lead to beaching and undermining of the embankment.
- **Surface runoff.** Surface runoff may cause gullies and/or ruts. They are often initiated by erosion from vehicles or livestock following the same track over and over.
- **Inappropriate vegetative growth.** Excessive vegetation and/or deep-rooted shrubs and trees may obscure the embankment surface or may become a future source of piping or sinkholes when the roots die. Inappropriate vegetation makes it difficult for the operator to inspect the embankment
- **Debris.** Dead trees and limbs in the storage and on the embankment – especially near the outlet works and the spillway inlets – can create blockages that may affect the operation of the outlet works or the spillway.
- **Animal burrows.** Burrows and the diggings of burrowing animals and their predators – especially at or just below the maximum water level may lead to problems such as piping, sinkholes, and excessive seepage.

Figure 2-16 Spillway Chute



The EL of the spillway crest is 391.5m AHD, 6.7 m below the crest of the crest of the main embankment.

2.2.5 Inspecting downstream areas

The drain pipes through the spillway prevent uplift of the spillway concrete, the flap gated outlets are downstream of the spillway and can only be inspected at times of no flow. The diversion conduit pipe through the embankment and the river release pipe through the left side of the spillway are no longer in use and no attempt should be made to open these valves unless under the instruction and supervision of the Water and Wastewater Engineer of the South Burnett Regional Council.

The condition of the valves, pipework and associated structures however, must be monitored and condition reported.

Figure 2-17 Diversion conduit outlet pit



Figure 2-18 Drain pipe outlet i



The condition of the downstream area around the spillway outlet structure and the spillway channel is almost as critical as the downstream side of the embankment and the spillway itself.

Monitoring these areas is similar to monitoring embankments. If defects are found, investigate, document, and report them as soon as possible.

2.2.6 Reading the dam instruments (SOP 011)

2.2.6.1 General

Gordonbrook Dam has standpipes to allow measurement of the conditions within the embankment foundation, the movement of the most critical sections of the main embankment, and ground water levels immediately downstream of the foundation cut-off.

WP 11 01 Reading dam instruments and reporting the findings

The Gordonbrook Dam Storage Supervisor shall read and record the following:

1. Daily record:
 - Rainfall gauge reading
 - Dam reservoir level
2. Fortnightly
 - Measure water levels in dam standpipes
3. Monthly enter into the dam logbook:
 - Findings of the dam wall structure inspection.

2.2.6.2 Measuring the Standpipes

Figure 2-19 A typical standpipe



WP 11 02 Reading dam standpipes

The Gordonbrook Dam Storage Supervisor shall read and record the standpipes fortnightly:

1. Remove the pvc cap from the standpipe.
2. Measure water levels in dam standpipe by lowering a small weight on a tape measure into the pipe until the weight is heard to touch the water:
3. Note the reading on the tape measure.
4. Repeat step 2 and average the readings and record.

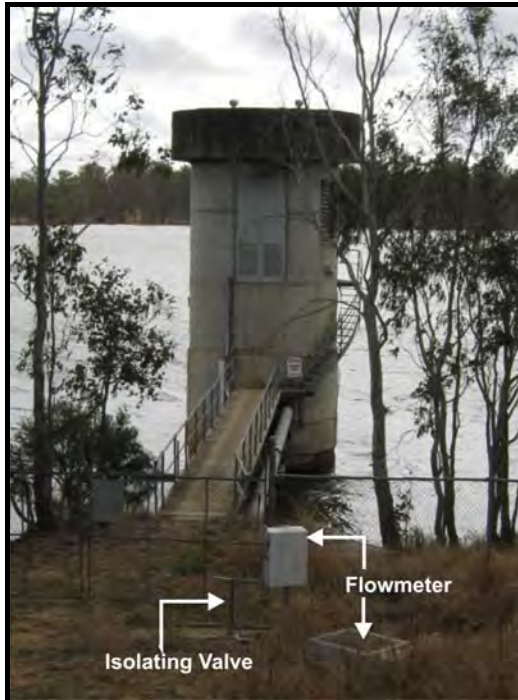
2.2.6.3 Measuring surface movement

South Burnett Regional Council surveyors measure the surface movement points once a year. The Storage Supervisor must keep the areas around the measuring points clear, viewable, and free of damage. The Storage Supervisor may also be asked to assist the surveyor.

The surface movement points are used to determine the differential settlement within the dam structure.

2.2.6.4 Measuring storage water level

Figure 2-20 The inlet tower.



The storage level of Gordonbrook Dam is measured at the outside of the Intake Tower near the entrance door

The gauge is read at 6:00 am each morning by the Dam or Water Treatment Plant operator.

The Intake Tower is used solely to supply water to the Water Treatment Plant and its operation is not described in this manual.

2.2.6.5 Measuring rainfall

The Storage Supervisor must measure and record daily rainfall. Rainfall includes any precipitation that results from dew or fog. Under a world wide meteorological convention a day is based on Greenwich Mean Time. Allowing for time difference, this means that in Queensland a day goes from 9.00 am to 9.00 am. Therefore, a rain gauge, as all other meteorological instruments, are read each day at 9.00 am. If for any reason the measuring receptacle is emptied outside the normal reading time, the measurement and the time are recorded in the remarks section of the field book for adding to the normal reading later. WP 15 03 is a shortened version of the procedure described in the Surface Observations Handbook of the Bureau of Meteorology. The recorded rainfall measurements are reported monthly.

WP 11-03 Reading a rain gauge

When the precipitation is 20 mm or less

1. Remove the measure from the gauge and place on a level surface so that the measure is vertical, or hold the measure firmly near the top with finger and thumb so that it hangs vertically.
2. Bring water surface to eye level to eliminate parallax.
3. Read the amount to the nearest 0.2mm, which is the nearest division, rounding off to the next highest division.
4. Repeat step 2 and 3 to confirm.

When the precipitation is greater than 20 mm

1. Tip water from the measure glass into the gauge so that the remaining level in the measure glass is below the 20mm division—this allows for any water on the outside of the measure to drain into the gauge. Hold the measure firmly near the top with finger and thumb so that it hangs vertically.
2. Bring water surface to eye level to eliminate parallax.
3. Read the amount to the nearest 0.2mm, which is the nearest division, rounding off to the next highest division.
4. Repeat step 2 and 3 to confirm first reading and discard the water. Carefully, pour the water from the container into the measure avoiding loss of catch, reread the amount as in 2 & 3.

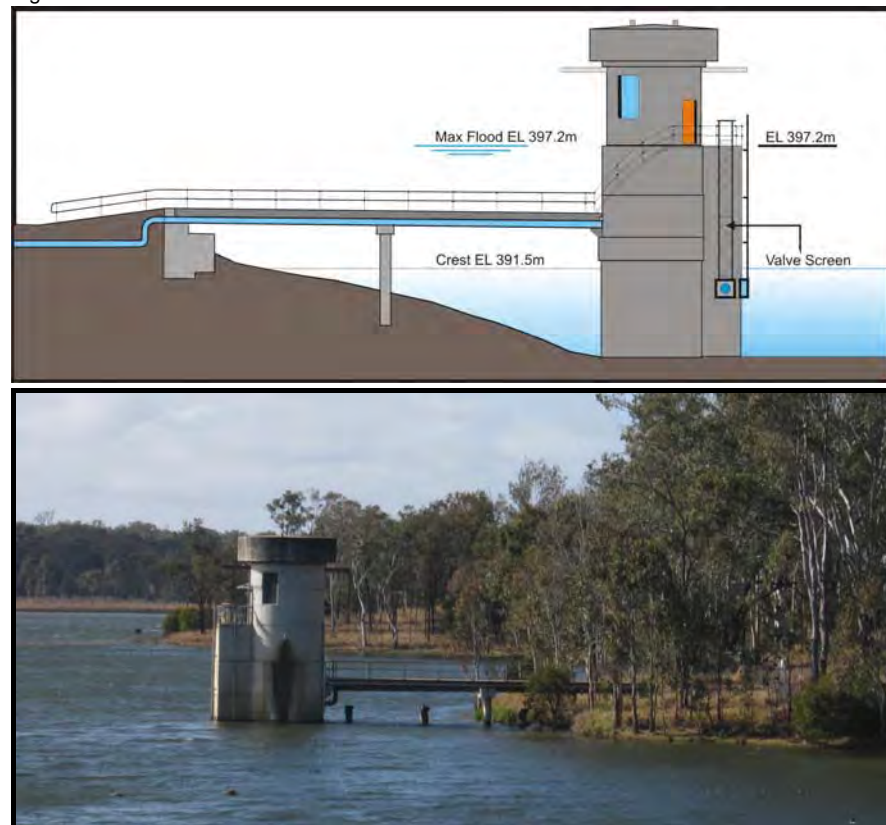
2.3 Operating the inlet, outlet, and spillway

2.3.1 Overview of the inlet and outlet

Gordonbrook Dam has a river release pipe near the Left side of the spillway but this is no longer in use and the valve must not be operated unless under the instruction and supervision of the Water and Wastewater Engineer of the SBRC.

The only riparian water release is via the Water Treatment Plant – about 600kl/d of filter backwash water. The quality of this water must satisfy environmental requirement before release into the Stuart River, Water for the treatment plant is drawn from the storage via the Intake Tower (Figure 2-21)

Figure 2-21 Water Treatment Plant Intake Tower



The outlet to the river is via a series of three sedimentation basins (Figure 2-22 & Figure 2-23). These basins are part of the WTP and their operation and maintenance is not covered by this manual.

Figure 2-22 Sedimentation Basin



Figure 2-23 Outlet Weir



Figure 2-24 The spillway

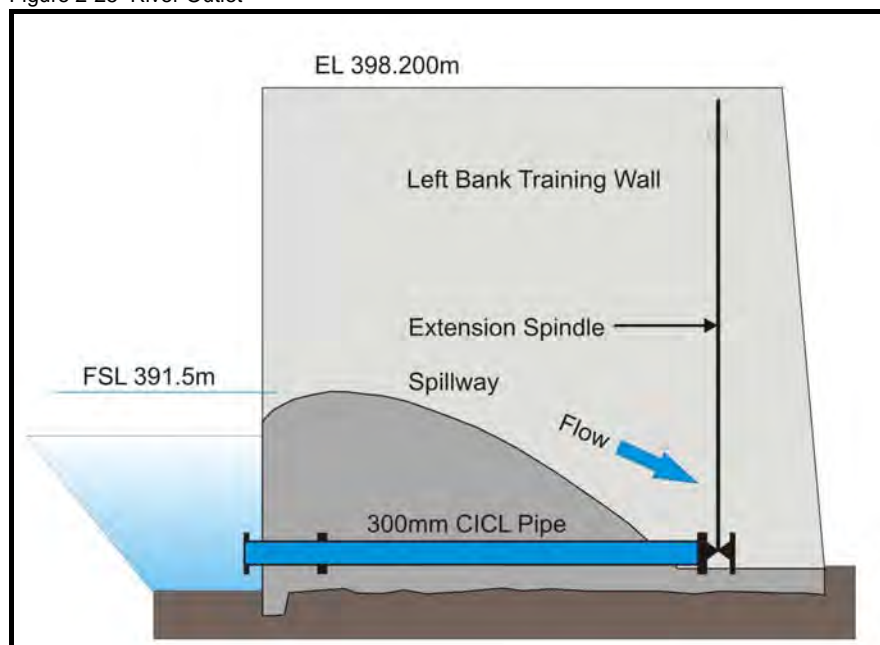


The dam's spillway (Figure 2-24) is comprised of an 80 m long uncontrolled ogee crest constructed of mass concrete and flanked by converging side walls. A curved approach channel channels the flow towards the spillway crest. The chute contains two concrete drop structures.

2.3.1.1 Controlling outflow using the River Outlet

There are two methods of making a release from the Gordonbrook Dam. The river outlet through the Left side of the spillway (Figure 2-25) consists of a 300mm diameter cast iron cement lined pipe open at the upstream end and terminating in a cast iron gate valve. The valve has a spindle extension and is operated manually from the top of the Left Hand training wall. This valve must only be operation under instruction from the SBRC Water and Wastewater Engineer.

Figure 2-25 River Outlet



The second and most regularly used method of release is via the Water Treatment Plant. This method is an integral function of the WTP and is not described in detail in this manual.



A total release from the WTP of Gordonbrook Dam is approximately 600 kL/day and water quality must comply with environmental requirements.

2.3.2 The spillway

Figure 2-26 The Spillway Chute



The Gordonbrook dam spillway is an integral part of the dams operation (Figure 2-26). It is used to discharge flood water from the storage.

The spillway includes a curved approach channel with a constant bed, a fixed crest mass concrete spillway, a converging concrete lined chute and two concrete drop structures (Figure 2-4). Training walls are sited upstream of the spillway crest on both sides of the spillway. The uncontrolled ogee crest of the spillway has a maximum width of 80 m. The spillway is flanked on either side over its entire length by vertical retaining walls. The crest of the spillway is at EL 391.500 m (FSL). The spillway continues with a concrete lined and natural rock chute. Other than keeping the spillway clear of debris there are no operational requirements for the spillway.

2.4 Managing the storage

2.4.1 Monitoring water quality

Environmental water quality monitoring is conducted at Gordonbrook Dam. The ROL requires that South Burnett Regional Council measure and record details of physio-chemical and biological conditions of the headwater and tailwater on a quarterly basis. The following parameters are measured:

- dissolved oxygen
- conductivity
- pH
- turbidity
- temperature
- nutrients
- suspended solids
- chlorophyll *a*

Water sampling is undertaken by the Sampling Officer in accordance with South Burnett Regional Council's Water Quality Sampling procedures.

2.4.2 Monitoring blue-green algae levels (SOP 10)

Blue green algae (cyanobacteria) are naturally occurring microscopic aquatic bacteria. Generally they are blue-green in colour which becomes apparent when populations bloom. Some species have the potential to produce toxins which may cause adverse health impacts and aesthetics, hence monitoring of levels in storages is conducted.

The South Burnett Regional Council's Blue-Green Algae Monitoring procedure details the sampling method, frequency and reporting procedures for blue green monitoring. The Dam has been assessed as a Priority 2 facility based upon its storage characteristics and the presence of the Kingaroy Water Supply Water Treatment Plant. As such, it is monitored for blue-green algae on a minimum fortnightly basis. A contingency plan has been prepared for the dam.

The destratifier mounted on a pontoon significantly reduces the BGA levels in the storage ([Figure 2-27](#)).

Figure 2-27 Destratifier (Picture taken from the Intake Tower)



2.4.3 Storage inspection (SOP 08)

The Storage Supervisor shall inspect the storage perimeter quarterly for unauthorised activities, changes in vegetation, outbreaks of noxious weeds, and damage to banks and beaches. Normally this is best done by boat.

The results of the inspection should be recorded in the Dam Logbook. In addition, unusual findings should be reported immediately to the SBRC Water and Wastewater Engineer Manager.

2.4.4 Control of noxious weeds (SOP 08)

The Storage Supervisor shall be familiar with the identification of weeds that are present within the dam site and nearby areas. New outbreaks of weeds should be reported to the Environmental Representative, and controlled using best practice management where practicable. All care should be taken to ensure that South Burnett Regional Council's operations do not aid the spread of weeds and weed seeds.

2.5 Knowing the dam's power supply

2.5.1 Source of supply

The dam area does not require an electric power supply.

Electricity for the inlet tower is supplied from the local HV power grid through a transformer pole to a pole mounted distribution board and is part of the WTP operation.

2.6 Maintaining dam site safety and security (SOP 14)

2.6.1 General

The sections that follow specify requirements for **Environmental** and Workplace Health and Safety. Maintaining security

The dam and the dam site present many hazards, especially for persons who have not had the necessary training. South Burnett Regional Council and its site personnel are jointly responsible for ensuring that people will not be injured.

Thoughtfully erected and well-maintained signs and fences help to minimise accidents and deter trespassing. Hazard signs warn people about the hazards that lay ahead. No Trespassing signs, whilst not foolproof, aid in preventing members of the public from entering potentially dangerous areas.

The effectiveness of signs and fences depends on how well site-personnel monitor and maintain the condition of these signs and fences. To help Storage Supervisors control access into restricted areas, Gordonbrook Dam has a security key system.

Figure 2-28 Security gate and fence



WP 14 01 Monitoring security of fencing, gates, and buildings

Daily:

1. Scan all fences, gates, and buildings for signs of break-in or damage.
2. Report any unlawful entry or wilful damage to the operations manager and the local police.
3. Arrange for immediate repairs of any damage. If full repair is not immediately possible make temporary repairs.

6-monthly:

1. Inspect all fences, gates, buildings, lights, security alarms, and fire safety equipment.
2. Arrange for any necessary repairs to be scheduled for maintenance, unless you repair it immediately.

Sometimes, signs alone are not enough. All work areas require awareness training for people to fully appreciate its hazards.



Further details for the control of site access and site security can be obtained from the South Burnett Regional Council's Water and Wastewater Engineer.

2.6.2 Using signs for safety and information (SOP 14)

As explained in section 2.6.1, signs help to warn people about the dangers ahead. Signs are also used to broadcast information of general interest or to promote the organisation that owns the dam.

The Storage Supervisor needs to maintain all the signs so that they stay clearly visible and in good condition, especially the warning and prohibition signs. Failure to do the latter will hold the dam owner liable if an accident occurred that could be attributed to the failure to warn. Failure to keep the signs clean, visible, and legible also reflects on the organization and the people who work for it. Signs that are dirty and/or damaged give the impression that South Burnett Regional Council does not care.

WP 14 02 Monitoring the condition of permanent signs

1. Regularly scan the condition of all signs. Inspect all signs twice a year.
2. Repair or replace any damaged or defaced sign as soon as is possible.
3. If a warning or hazard needs to be replaced, but no replacement is immediately available, erect a temporary sign.
4. Clean any signs that are dirty. Replace signs that are fading.

Temporary hazards need to be delineated by temporary signs or by barriers.

WP 14 03 Erecting temporary signs

Fencing a work area:

1. Erect barricade boards or barricade ribbon around any work area that people may fall or stumble into or where they may injure themselves. (Barricade boards, barricade tape and all traffic signs can be purchased from any traffic sign supplier. Signs can also be hired from plant hire firms).
2. If the worksite is left open overnight erect flashing orange warning lights.
3. If working near a road put up advance warning signs and work-in-progress signs in accordance with the Queensland Manual for Uniform Traffic Control Devices (QMUTCD). If the signs need to be on a public road it may need to be authorised by the road authority to give a road sign legal status. Copies of the QMTUCD can be ordered from Queensland Transport by phoning 07 3834 5488. Police stations also have a copy.

Temporary closure of a public area:

1. The temporary closure of a public area because of the presence of a hazard should be signed and/or barricaded as for the 'demarcating a work area'.
2. The temporary closure of a public area for any other reason than the presence of a hazard should be simply posted with a sign that states its closure and the reason for the closure.
3. If the temporary closure involves a full public area, it is worthwhile to advertise this in the local or regional paper.

When an accident happens and the condition of a sign – or the lack of a sign – is a contributing cause, it may be necessary to present formal evidence that a systematic needs analysis was undertaken and that the signs were regularly inspected and maintained. A well-kept signs register provides that evidence. It should have a map that shows the location of all signs and a register that defines the signs and states their warrant, date of erection, and the nature and dates of the inspections and maintenance they had.

2.6.3 Maintaining hygiene standards

The Gordonbrook Dam has public areas with ablution facilities, but they are owned and operated by the South Burnett Regional Council. They are not the responsibility of the Dam Supervisor.

2.6.4 Inducting new employees and visitors (SOP 22)

No person is allowed to enter the work area of the dam site without having received the necessary induction training. The induction shall be formal and site specific and is the responsibility of the Operations Supervisor or his nominated delegate. For visitors such training can be very basic, covering only the essentials – akin to the induction given to aircraft passengers on take-off – but for employees it needs to be more extensive. A short-term solution is to have a fully trained employee accompany all visitors who have not been inducted.

2.6.5 Protecting the environment (SOP 09 and 12)

South Burnett Regional Council relies on Gordonbrook Dam personnel to help it meet its legal obligations and to be pro-active in protecting the dam’s environment. As the owners and Operators of a facility that has a profound effect on the natural and man-made environment, SBRC staff have a special duty to manage it sensibly and for the good of the community.



Details for the handling of Chemicals and Hazardous Substances can be found in the WTP Management System.

Many of the environmental issues that involve the dam and the dam site are covered by legislation and the Gordonbrook Dam’s development permit. The activities involve controlling weeds, the storing and using of chemicals and fuels, and containing spillages.

WP 09 01 Isolating the spillage of hazardous substances



The spillage of hazardous substances that may be harmful to people, or may be harmful to the local flora and fauna, or may enter the storage, river, or the water table must be isolated and cleaned without delay.

1. The spillage of a hazardous substance within the South Burnett Regional Council controlled area of the dam site shall be treated in accordance with the South Burnett Regional Council’s WH&S policies.
2. On becoming aware of a spillage of a hazardous substance outside the South Burnett Regional Council controlled area, but within the catchment of the storage the spillage shall be reported to nearest Police Station and the Operations Supervisor and shall take steps to intercept the spillage if it threatens to leak into the storage.

2.6.5.1 Environmental Management System Emergency manual

South Burnett Regional Council has policies and guidelines for dealing with environmental emergencies. Details are available from South Burnett Regional Council’s Water and Wastewater Engineer.

2.6.6 Reporting of incidents and accidents (SOP 03)

Accidents are events that resulted in injuries or material damage. Incidents are events that could have resulted in an accident. Both types of events should be recorded and reported. The reasons are twofold: (1) to have an authoritative record if the event leads to litigation and (2) to learn from the event and use the experience to stop it from happening again.

3 Maintenance

3.1 General

The maintenance section is centred on the main components of the dam: Embankments, Storage; and Spillway.

3.1.1 Drawings

South Burnett Regional Council holds copies of the construction and ‘as built’ drawings of Gordonbrook Dam at the Nanango Office.

3.1.2 Maintenance Schedules and Work Instructions

Section 3.32 contains copies of the Gordonbrook Dam Maintenance Schedule and Work Instructions that must be followed for the maintenance of this facility. These Work Instructions must be complied with and not be varied unless agreed to in writing by the Water and Wastewater Engineer.

3.2 Embankments, and storage

3.2.1 Equipment Schedules

3.2.1.1 Mechanical Equipment Schedule

Table 3-1 Mechanical Equipment Schedule – embankments and storage.

Location	Item	Manufacturer	Details
Downstream Embankment toe – Left Bank Conduit Outlet	Discharge sluice valve	Unknown	Size 6"
Embankment – Left Bank upstream end of Conduit	Sluice Valve	Unknown	Size 6" Inaccessible
Upstream entry to conduit	Flood gate flap valve	Unknown	Size 10" Inaccessible
Upstream entry to conduit	Trashscreen	Unknown	Drawing
River Outlet - Spillway	Sluice Valve	Unknown	Size 300mm

3.3 Maintenance Schedule and Work Instructions

This section contains the maintenance schedule a

3.3.1 Maintenance Schedule

Table 3-2 Maintenance Schedule

No.	Description	J	F	M	A	M	J	J	A	S	O	N	D
1	Operational Inspection. Including embankments, crest spillway, concrete structures valves, fences and signs										X		
2	Read and record standpipes		X			X			X			X	
3	Remove trees from embankments						X						
4	Slash, burn or poison grass on embankments if necessary							X					
5	Storage perimeter inspection			X			X			X			X

3.3.2 Main Assets Covered By Work Instructions

Table 3-3 Main Assets covered by Work Instructions

Doc. No.	Description	Assets Inspected/Maintained
10	12 Monthly Dam Safety Inspection	Main Embankment & Crest Wall Main Dam Groyne Inlet Tower Valve Structures Drainage and filling lines Ponded Areas Spillway
11	3 Monthly Operation Inspection	Dam Log Book Head Water Gauge Rainfall Gauge Signs/fences Storage perimeter
12	Annual Flood Operations Preparation	

GORDONBROOK DAM – STANDING OPERATING PROCEDURES

DOCUMENT CONTROL SHEET

Controlled Copy Number - 1

Distribution List

Copy	Position
1	Operations Supervisor (Gordonbrook Dam)
2	Manager Water and Wastewater (SBRC Nanango)
3	Manager Infrastructure (SBRC)
4	Technical Support Officer (SBRC Nanango)
5	Director, Dam Safety DERM

Document History

Issue-Revision Number	Revision description	Revision date
Issue 1-0	Initial issue	Sept 2011

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

**GORDONBROOK DAM – STANDING OPERATING
PROCEDURES
DOCUMENT CONTROL SHEET
Controlled Copy Number - 2**

Distribution List

Copy	Position
1	Operations Supervisor (Gordonbrook Dam)
2	Manager Water and Wastewater (SBRC Nanango)
3	Manager Infrastructure (SBRC)
4	Technical Support Officer (SBRC Nanango)
5	Director, Dam Safety DERM

Document History

Issue-Revision Number	Revision description	Revision date
Issue 1-0	Initial issue	Sept 2011

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

GORDONBROOK DAM – STANDING OPERATING PROCEDURES

DOCUMENT CONTROL SHEET

Controlled Copy Number - 3

Distribution List

Copy	Position
1	Operations Supervisor (Gordonbrook Dam)
2	Manager Water and Wastewater (SBRC Nanango)
3	Manager Infrastructure (SBRC)
4	Technical Support Officer (SBRC Nanango)
5	Director, Dam Safety DERM

Document History

Issue-Revision Number	Revision description	Revision date
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Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

**GORDONBROOK DAM – STANDING OPERATING
PROCEDURES
DOCUMENT CONTROL SHEET
Controlled Copy Number - 4**

Distribution List

Copy	Position
1	Operations Supervisor (Gordonbrook Dam)
2	Manager Water and Wastewater (SBRC Nanango)
3	Manager Infrastructure (SBRC)
4	Technical Support Officer (SBRC Nanango)
5	Director, Dam Safety DERM

Document History

Issue-Revision Number	Revision description	Revision date
Issue 1-0	Initial issue	Sept 2011

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

Approved Date:
Manager Water and Wastewater

GORDONBROOK DAM – STANDING OPERATING PROCEDURES

DOCUMENT CONTROL SHEET

Controlled Copy Number - 5

Distribution List

Copy	Position
1	Operations Supervisor (Gordonbrook Dam)
2	Manager Water and Wastewater (SBRC Nanango)
3	Manager Infrastructure (SBRC)
4	Technical Support Officer (SBRC Nanango)
5	Director, Dam Safety DERM

Document History

Issue-Revision Number	Revision description	Revision date
Issue 1-0	Initial issue	Sept 2011

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

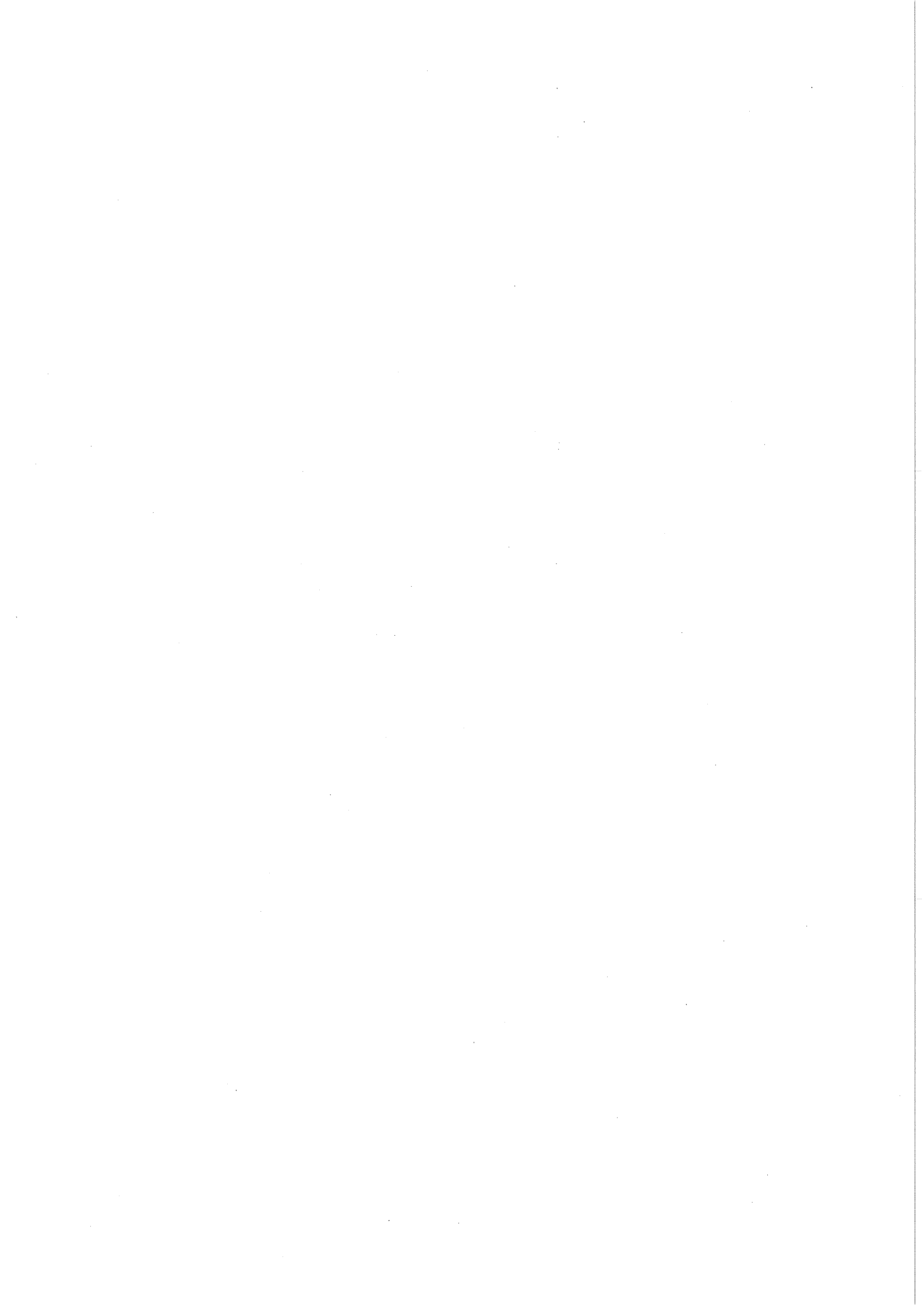
Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater

Approved Date:

Manager Water and Wastewater



GORDONBROOK DAM

INDEX TO STANDING OPERATING PROCEDURES

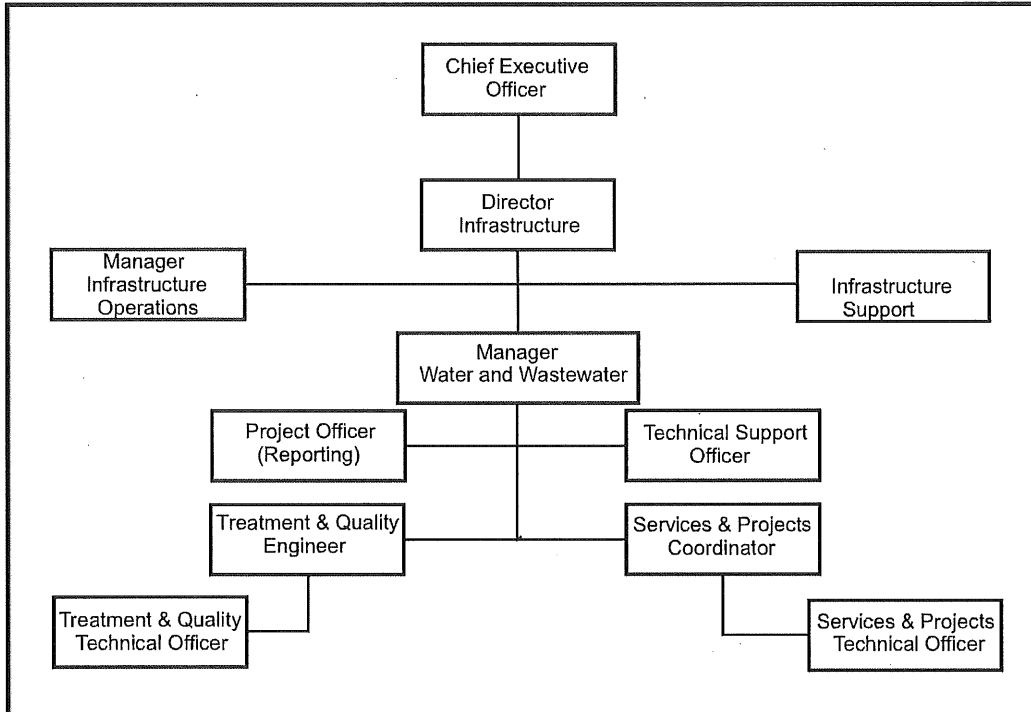
Procedure	Procedure description
SOP 00	Organisational structure and responsibilities
SOP 01	Verification of emergency contact numbers
SOP 02	Loss of communication during an emergency event
SOP 03	Accident and Incident Reports
SOP 04	Notification of uncontrolled spillway discharge
SOP 05	Inspection, testing, and maintenance of mechanical and electrical equipment
SOP 06	Health and Safety
SOP 07	Dam Logbook
SOP 08	Storage inspection and control of noxious weeds
SOP 09	Hazardous substance spillage in the dam catchment
SOP 10	Algae monitoring and testing
SOP 11	Instrumentation surveillance and data recording
SOP 12	Environmental protection
SOP 13	Storage Supervisor training
SOP 14	Dam security and restricted areas
SOP 15	Documentation control and review
SOP 16	Routine dam safety inspection by the dam operator
SOP 17	Annual and 5 yearly dam safety inspections
SOP 18	Assignment of responsibility
SOP 19	Normal operation criteria
SOP 20	Data reporting
SOP 21	Emergency Action Plan
SOP 22	Attendance at dam
SOP 23	Requirements for an inspection after emergency events
SOP 24	5 Yearly Failure Impact Assessments

SOP 00 GORDONBROOK ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES DAM

Purpose

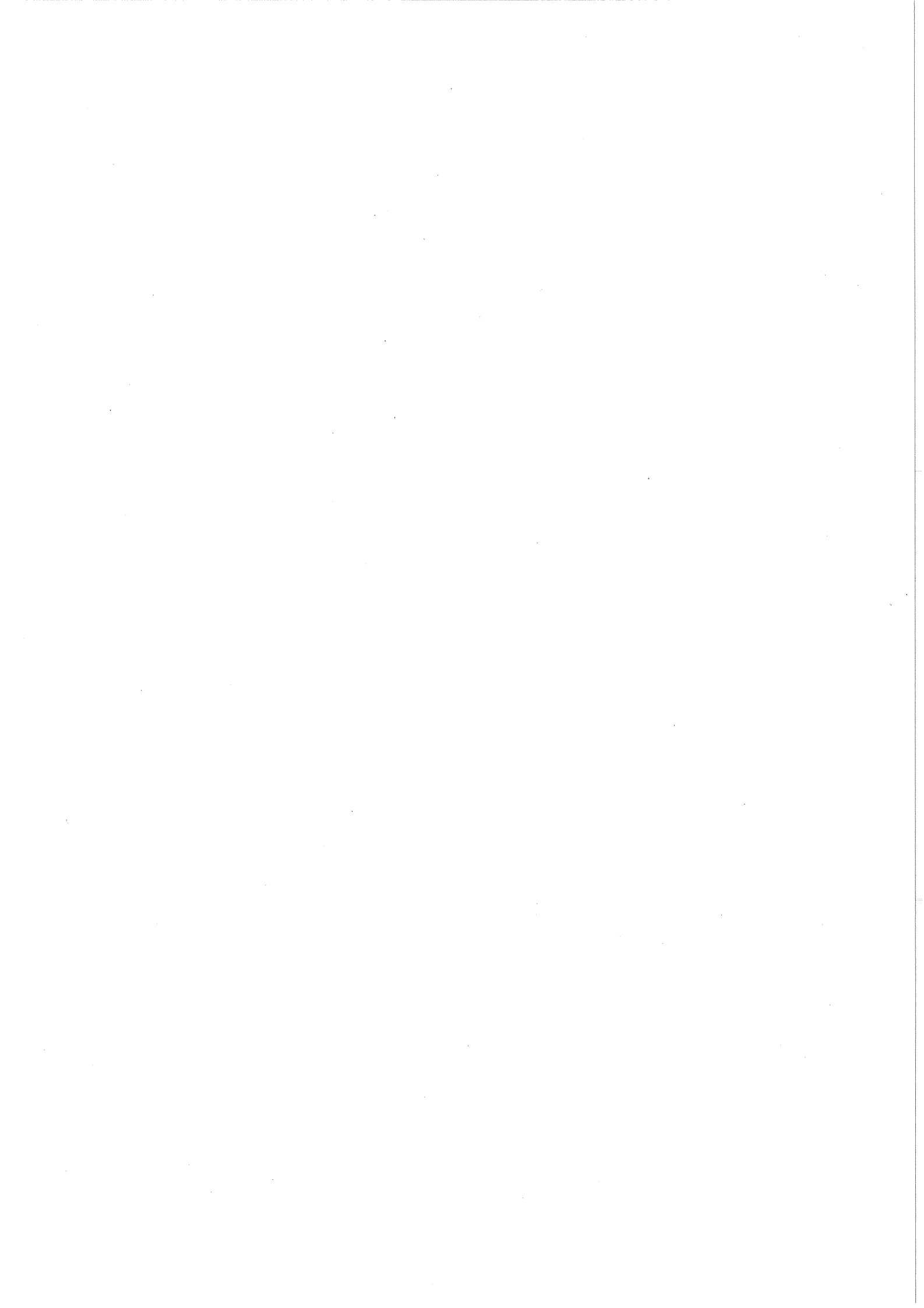
To explain Gordonbrook’s organisational structure relating to the safety of Gordonbrook Dam and the functional responsibilities of the personnel it refers to.

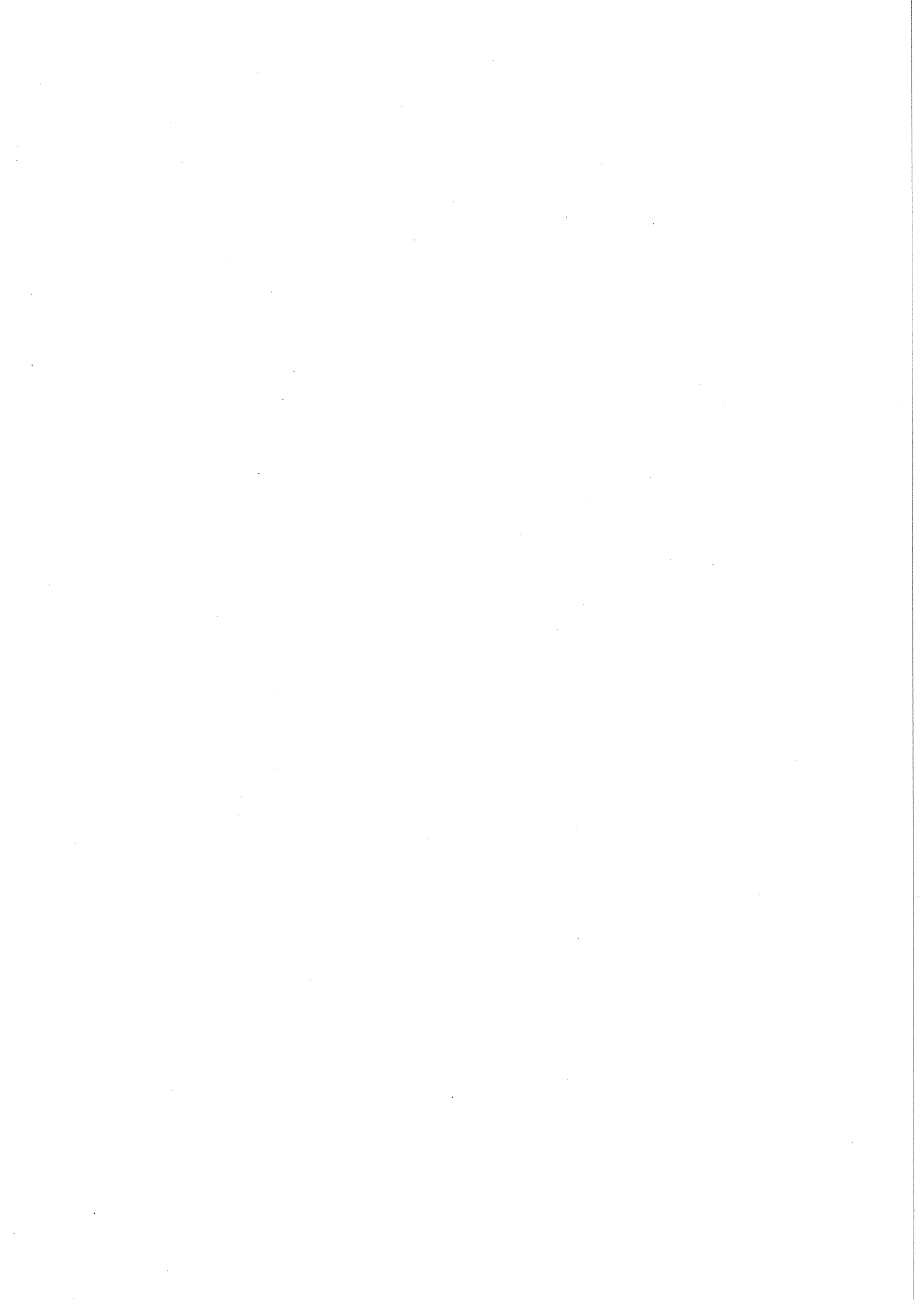
South Burnett Regional Council (dam-safety) organisational chart for Gordonbrook Dam



Functional responsibilities

Chief Executive Officer (CEO)	The person responsible to the SBSC for the overall management of Gordonbrook Dam
Director Infrastructure	The person responsible to the CEO for the overall management of Gordonbrook’s water supply assets and water delivery services
Manager, Water and Wastewater	The person responsible to the Director Infrastructure for overall management of Gordonbrook Dams water supply operation and maintenance services





**SOP 03 GORDONBROOK ACCIDENT AND INCIDENT REPORTS
DAM**

Purpose

To report site events that did affect or could have affected the structural safety of the dam, the safety of people, or the safety of third party property and to flag such events as an opportunity for improvement.

Scope

Part A of this procedure applies to events at Gordonbrook Dam, which are related to the structural safety of the dam.

Part B of this procedure applies to events at SunWater Dam, which are related to WPH&S and the Environment.

Definitions

- Incident. A dam site event that could have affected the safety of the dam, injured people, or damaged third party property, if it had not been for good luck or alternatively, may later show to have been an accident
- Accident. A dam site event that did affect the structural safety of the dam, injured people, or damaged third party property

PART A Events Related to Structural Safety

References

Actions

The **Manager Infrastructure Operations** shall

- Have in place a system for assessing incidents and accidents related to dam safety – to identify opportunities for improvements to Kingaroy Shire Water Supply Scheme’s technical standards, policies, and procedures

The **Manager Water and Wastewater**

- Provide the **Manager Infrastructure Operations** – when requested or when incidents or accidents related to dam safety come to his attention – with detailed and reasoned recommendations why-and-how or why-not the Gordonbrook Dam -safety procedures should be improved

The **Director Infrastructure** shall

- Insist that all dam site incidents or accidents are recorded, reported, and assessed, and if he considers this warranted refer these reports to specialists for expert advise, before deciding what action to take.

The **Manager Water and Wastewater** shall

- Advise the **Manager Infrastructure Operations** if in his or her opinion an incident or accident warrants a review of existing standards, practices, or procedures and recommend what action to take

The **Manager Infrastructure Operations** shall:

- Ensure that this procedure – where it involves matters under his control – is implemented and adhered to
- Ensure that employees under his control know how to recognise and handle incidents and accidents. (Refer to SOP 13 Training, SOP 16 Routine Inspections,)
- Keep a register of all accident and incident reports related to safety of the dam for consideration at the next dam safety inspection or review

The **Operations Supervisor** shall:

SOP 03 GORDONBROOK ACCIDENT AND INCIDENT REPORTS DAM

- Ensure that all accidents and incidents related to the structural safety of the dam are promptly and comprehensively recorded and reported
- Send an Alert Fax or phone call immediately
- Record each accident or incident event in the dam logbook

Records

- Dam logbook
- Alert Fax
- Incident Form

PART B Events Related to WPH&S and the Environment

References

For reporting on events related to WPH&S and the Environment refer to the SBRC's WPH&S Standards and the Environmental Management System.

- SBSC Incident Investigation procedure
- SBSC Incident Form

The purpose of the system is:

1. To specify reporting and response requirements for all SBSC Workplace Health & Safety & Environmental incidents including near misses.
2. To rate the risk potential for all reported incidents & near misses.
3. To identify and action non-conformances & improvement opportunities in relation to the requirements of SBSC's WH&S, Environmental, Quality and Business Management Systems.

SOP 04 GORDONBROOK DAM

NOTIFICATION OF UNCONTROLLED SPILLWAY DISCHARGE

Purpose

To notify residents close downstream of Gordonbrook Dam, the Manager Infrastructure Management, and the Operations Supervisor, that an uncontrolled spillway discharge is about to occur or has occurred.

Scope

This procedure applies to the operation and maintenance of the Gordonbrook Dam and residents downstream.

References

- Gordonbrook Dam – Operation and Maintenance Manual
- Emergency Action Plan, Gordonbrook Dam
- SOP 01. Verification of emergency contact numbers

Actions

The **Manager Water and Wastewater** shall:

- Ensure that the procedure is implemented and adhered to
- Ensure that the Gordonbrook Dam is sufficiently resourced to cope with an uncontrolled spillway discharge
- Ensure that the Gordonbrook EAP is up-to-date and can be activated at short notice

The **Operations Supervisor** shall:

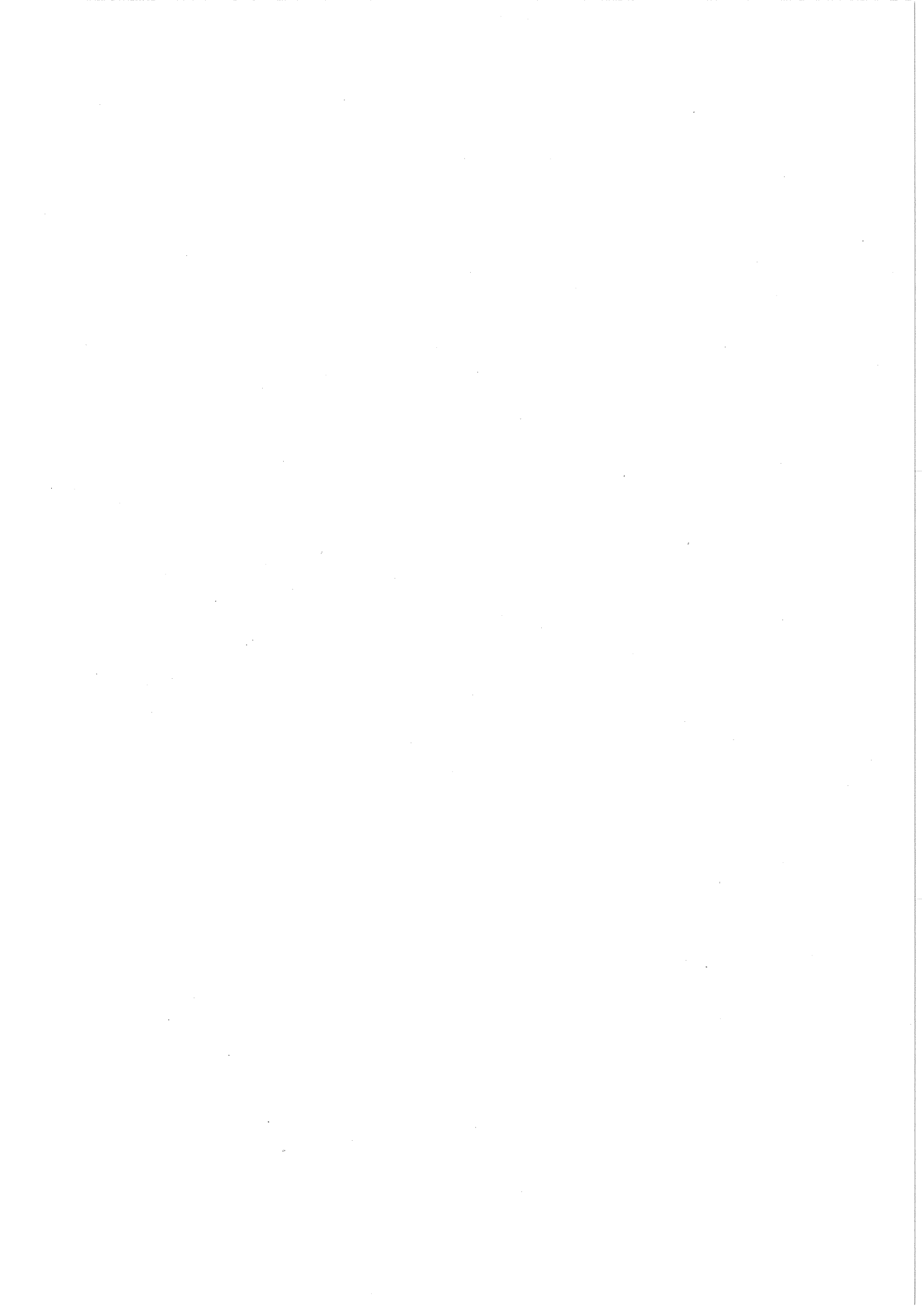
- Ensure that the dam site personnel are adequately trained, resourced, and rostered to handle an uncontrolled spillway discharge
- Ensure that the EAP is fully implemented and adhered to in case of an uncontrolled discharge.
- Monitor and record the rises in storage levels during times of heavy rainfall in the dam catchment area.
- Follow the Gordonbrook EAP Section on – Emergency Events and Actions
- Enter all relevant details of storage rises, spillway flows, stream flows (at the gauging stations), and rainfall in the record sheet provided in the EAP while water is flowing over the spillway.
- Compile the Emergency Event Report as detailed in the EAP
- Make entry in Dam logbook as per SOP 07.

Records

- EAP – Emergency Event Report
- Dam logbook (

Appendixes

Nil.



Purpose

To ensure all mechanical and electrical equipment critical to the effective operation of Gordonbrook Dam is regularly tested to minimise the risk of failure when required and to ensure that all operators remain familiar with the equipment.

Scope

This procedure applies to the Operation and Maintenance of Gordonbrook Dam and it is relevant to the Manager Water and Wastewater and Operations Supervisor.

Abbreviations

MW&W	Manager Water and Wastewater
OS	Operations Supervisor
SOP	Standing Operating Procedure
WTP	Water Treatment Plant

Definitions

Nil

Actions

The **Manager Water and Wastewater** shall:

- Implement this procedure and ensure its adherence.
- Ensure that personnel are adequately trained and resourced for their tasks.

The **Operations Supervisor** shall:

- Ensure that regular tests and inspections of mechanical and electrical equipment are appropriately scheduled.
- Ensure that any necessary repair to critical mechanical and electrical equipment is done promptly, efficiently and effectively.
- Ensure that the nature and scope of all tests and inspections conform to the Gordonbrook Dam Operations and Maintenance Manual.

The **Operations Staff** shall:

- Monitor and test the condition of the regulation and isolating valves, as detailed in the Maintenance Schedule for Gordonbrook Dam.
- Regularly monitor and test communications and backup power supplies.
- Report any malfunction or condition which cannot be resolved on site to the Manager Water and Wastewater.
- Enter date of inspection with reference to Work Order in Dam Log Book.

Records

Dam Operating Log Book (refer SOP 07)

**SOP 05 GORDONBROOK
DAM**

**INSPECTION, TESTING, AND
MAINTENANCE OF
MECHANICAL AND
ELECTRICAL EQUIPMENT**

References

Gordonbrook Dam – Operations and Maintenance Manual,

Appendixes

Nil

Purpose: To

- Specify responsibility and accountability for managers, supervisors, WHSOs, safety representatives, other employees and contractors in respect of managing workplace health and safety within SBSC; and
- define requirements for consultation and communication of WH&S issues;
- specify methods for health promotion.

Scope: This Standard applies to all SBSC employees and contractors.

Directive:

1. Managers and supervisors shall promote the implementation and application of, and monitor compliance with SBSC's Workplace Health and Safety Management System (WHSMS), and allow time and provide resources for employees to carry out their respective roles and responsibilities in respect of WH&S. Managers and supervisors are also responsible for promulgating information on WH&S issues, provided by WHSMS representatives, and discussing these issues with relevant personnel.
2. All employees and contractors shall comply with the requirements of the WHSMS and WH&S legislation.
3. The responsibilities and accountabilities specified in this Standard should be discussed with employees during Achievement Development Planning processes.
4. All parties shall comply with the consultative arrangements described in this Standard.

PART A: Responsibilities and Accountabilities:
CEO and Senior Management:

- Demonstrate leadership and commitment to best practice WH&S Management within SBSC.
- Approve SBSC's WH&S and Rehabilitation and Return to Work Policies.
- Approve WH&S Objectives & Targets.
- Review reports on WH&S performance, Standards, business processes and related matters, and consider and make decisions on recommendations and proposals to manage health and safety within SBSC.
- Provide reports on WH&S performance and other matters as relevant to the SBSCV Executive.

Manager Infrastructure Management (as WHSMS System Owner):

- Ensure adequate skilled resources are available for development, implementation and maintenance of SBSC's Workplace Health and Safety Management System (WHSMS).
- Approve WHSMS documentation.

All Managers:

- Publicly demonstrate commitment to and promote the Workplace Health & Safety Policy, Objectives and Targets, and the application of the SBSC WHSMS, and monitor WH&S performance within their respective Business Groups.
- ▬ Provide adequate resources to achieve WH&S objectives within their Business Groups.
- ▬ Review investigations into serious incidents, dangerous occurrences, vehicle accidents, and adverse incident trends, and direct appropriate corrective/preventive actions.

Responsibility, Accountability, Consultative Arrangements and Communication

Director Infrastructure:

- Develop the strategy for, and direct the development and implementation of the SBSC WHSMS and associated Standards, Forms and operational controls.
- ▬ Maintain up-to-date all WH&S compliance requirements relevant to SBSC and ensure incorporation of these requirements into updated WHSMS Standards.
- ▬ Develop WH&S Objectives & Targets and submit to the OMT for endorsement, through the WHSMS Liaison Group.
- ▬ Compile Management Review reports and present to the OMT.
- ▬ Provide reports and recommendations on WH&S performance, legislative changes, and changes in business process, to ensure effective management of WH&S, to the Chief Executive, EMT/OMT and/or for submission to the Board/Audit and Corporate Governance Committee.
- ▬ Ensure third-party certification to AS/NZS 4801:2001 is achieved and maintained for the **SBSC WHSMS**.
- Maintain oversight of incidents management, corrective actions and rehabilitation and return to work programs.

Workplace Health & Safety Coordinator for all SBSC:

- Facilitate the development, implementation, certification and continual improvement of SBSC's Workplace Health & Safety Management System (WHSMS), under the direction of the Director Infrastructure.
- ▬ Provide ongoing advice and support to the Centres and other Business Groups in the development of WHSMS Action Plans, incidents and rehabilitation management, and identification and risk management of specific WH&S hazards.
- ▬ Provide or coordinate training for staff to raise the level of awareness and knowledge of WH&S issues and risk management processes.
- ▬ Coordinate WHSMS internal audits.
- ▬ Oversight compilation of WH&S statistics and analysis of incidents for reporting to the Executive, and dissemination to managers and employees with WH&S responsibilities.

- Maintain an overview of staff compliance with WHSMS policies, procedures, work documentation and controls in liaison with relevant parties, and provide advice on corrective action when required.
- ▬ Establish and maintain communication, monitoring and measurement programs in respect of WH&S, and provide regular reports and recommendations to management on performance in these areas.
- ▬ Maintain knowledge of WH&S legislation, professional standards and industry trends, assess impacts or application for the WHSMS, and provide associated recommendations.

SBSC WHSMS Liaison Group members:

- Promote the implementation and application of the WHSMS within the respective Business Group and within the SBSC offices.
- ▬ Communicate WH&S information, requirements of WHSMS Standards, and Executive decisions in relation to WH&S matters, to managers and employees within their Groups who have responsibility for WH&S.
- ▬ Review WHSMS Standards to ensure that they address the needs of their Business Group, within legislative requirements.
- ▬ Monitor progress of their Business Groups against WHSMS Action Plans, and provide associated reports back to the WHSMS Liaison Group.

Responsibility, Accountability, Consultative Arrangements and Communication

●
Senior Managers

- Demonstrate leadership and commitment to best practice health and safety management through participation in formal and informal meetings, workplace visits and hazard inspections, etc.
- ▬ Ensure adequate time is allocated for employees to carry out their WH&S duties and responsibilities.
- ▬ Appoint WHSOs and Rehabilitation and Return to Work Coordinators and ensure that they complete and maintain currency of the required training¹, establish WH&S Committees in accordance with this Standard, and facilitate election and training² of health and safety representatives (HSRs) as requested by staff.
- ▬ Ensure the implementation of the WHSMS against Action Plans and Objectives and Targets.
- ▬ Monitor and ensure compliance with the requirements of the WHSMS and health and safety legislation.
- ▬ Ensure incident and hazard reporting is undertaken in accordance with WHSMS Standards, that incidents and hazards are investigated, and that effective corrective/preventive action is taken; refer any unresolved issues, including safety hazards associated with existing infrastructure, through appropriate channels.
- ▬ Ensure all new employees and contractors are provided with WH&S awareness induction training, identify WH&S training needs of employees (including training in internal policies, procedures and instructions), ensure that employees complete training (including refresher training), and that licences and Certificates of Competency are maintained as required under legislation.

- Ensure registration of plant is maintained in accordance with legislation.
- ┆ Ensure the regular inspection and maintenance of workplace area, fixtures and fittings, and servicing, maintenance and inspection of plant and structures to ensure that there is no risk to health and safety (workplace inspections are required to be undertaken by the WHSO at least annually).
- ┆ Implement processes to ensure that plant supplied to SBSC is safe, and that the design of new buildings or other structures to be used as a workplace is in accordance with Australian Standards and does not expose persons to health or safety hazards.
- ┆ Ensure provision of appropriate Personal Protective Equipment and Clothing to employees.
- ┆ Ensure that emergency response and evacuation plans are in place and tested on a regular basis.
- ┆ Ensure consultation with employees, including consultation on any workplace changes that may have a health and safety component.
- ┆ Take measures to ensure that other people, such as the public, visitors to the site including other workers (eg: delivery driver employed by another company), are not exposed to health and safety risks arising from the workplace and the conduct or activities of the business.
- ┆ Implement procedures to ensure that **WH&S** management responsibilities are effectively addressed in any arrangements with contractors conducting work for SBSC.

1 A person is qualified as a **WHSO** if they are the holder of a current certificate of authority of appointment as a workplace health and safety officer prescribed under section 31 of the Workplace Health and Safety Regulation 1997. To obtain this certificate, a person must satisfactorily complete an approved workplace health and safety officer course conducted by an authorised accredited provider or a Registered Training Organisation as required by sections 31 and 32 of the Workplace Health and Safety Regulations 1997. Any person who has done a course with an approved training provider can become a Rehabilitation and Return to Work Coordinator. After completing the course the person should register with **Q-COMP**.

2 Under **WH&S** legislation, workplace health and safety representatives are to undertake the following training: '30630QLD Course in functioning as a workplace health and safety representative'.

SOP 07 GORDONBROOK DAM LOGBOOK DAM

Purpose

To maintain a chronological, comprehensive, readily available, and up-to-date record of all dam-site events and activities including major works in relation to the operation and maintenance, and dam and public safety of Gordonbrook Dam.

Scope

This procedure applies to the operation and maintenance of Gordonbrook Dam

Definitions

Nil

References

Gordonbrook Dam – Operations and Maintenance Manual. Section 2.2.2 – Keeping the dam logbook

Actions

The **Manager Water and Wastewater** shall:

- Ensure that the procedure is implemented and adhered to
- Provide the necessary resources for the keeping of a Dam Logbook

The **Operations Supervisor** shall:

- Photocopy the previous months entries in the Dam Logbook and safely store them with the copies of pages of previous entries in a secure location remote from the Logbook location.

The **Operations Officer**, shall

- Make the minimum entries into the logbook for the SOPs specified in the attached schedule. In general the logbook entries should reflect the dates and references of events and observations such as:
 - Dam safety inspections
 - Equipment testing
 - Summary of accidents and incidents that involve the safety of the dam
 - Major planned and unplanned maintenance
 - Start, finish, and Q_{max} of controlled and uncontrolled flood discharges with a reference to the applicable EAP event report
 - Alteration, replacement, or removal of part of the dam's structure, appurtenances, or equipment
 - Reports given or received
 - Any other event that may become historically significant; and finally,
 - If there was no logbook entry during the preceding four weeks, enter a note to certify that all maintenance and inspections were completed in accordance with the approved Work Instructions.
- Make the log book available for perusal by the Dam Safety Inspection Team during their 1-Year and 5-Year Dam safety inspections and as requested by the MDS or the TSE

Records

Not applicable

Appendixes

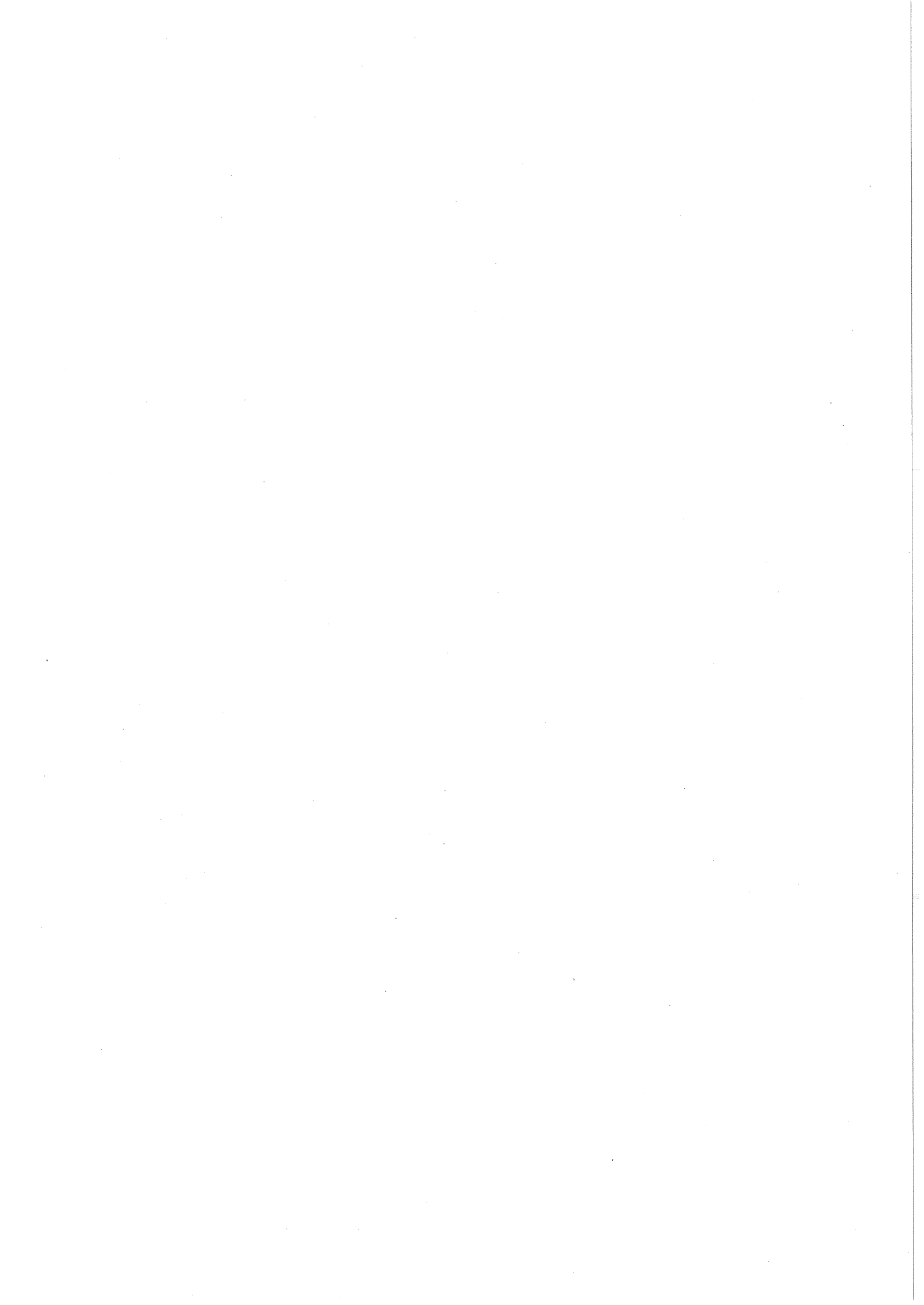
Appendix 1: Schedule of Logbook Entries for SOPs Specified

**SOP 07 GORDONBROOK DAM LOGBOOK
DAM**

APPENDIX 1

SCHEDULE OF LOGBOOK ENTRIES FOR SOPS SPECIFIED

SOP NUMBER	FREQUENCY OF ENTRY	LOGBOOK ENTRY / INFORMATION REQUIRED
SOP 04	Monthly	The maximum daily release for the month was xx ML on "date"
SOP 16	Monthly	All rainfall and storage level data have been collected and transmitted for input to SWIMS. All instrumentation readings have been recorded and surveillance report sent to Manager Water and Wastewater
SOP 05	Monthly	All operation and maintenance work has been carried out in accordance with Work Order (numbers) during the month. For details refer to the relevant work orders listed above.
SOP 1	Annually (by 1 st Oct)	Verified names, Telephone numbers etc. in EAP and transmitted amended Notification List to Manager Infrastructure.
SOP 11	Annually	Surface Settlements Points surveyed by Surveyor on "date" Standpipe readings on "date"
SOP 16	Annually	The annual inspection was carried out by the Manager Water and Wastewater on "date". Refer to Annual Inspection Report for details. (any major issues could be entered into the log book)
SOP 17	5 yearly	The 5 Yearly Comprehensive inspection and training was carried out on "date". The inspection team members were (list names of team members). Refer to 5 yearly Comprehensive Inspection Report for details.
SOP 02	As Required	Communication lost at "Time and Date" dam operated in accordance with EAP and O&M Manual. Communication reinstated at "Time and Date". (If communication lost during an emergency event refer to Emergency Event Report for details)
SOP 03	AS Required	Short description of accident or incident and date and time of occurrence. Alert Fax sent to "name" on "date".
SOP 04	As Required	Discharge over spillway commenced at "Time and Date" Maximum Discharge of XX cumecs or Maximum height above spillway crest occurred at "Time and Date" Discharge over spillway ceased at "Time and Date" (If the EAP was activated include the following statement: "For details refer to Emergency Event Report")
SOP 05	AS Required	Inspection of (Equipment) was carried out in accordance with Work Order (number) on "date"



**SOP 09 GORDONBROOK HAZARDOUS SUBSTANCE SPILLAGE IN
DAM THE DAM CATCHMENT**

- If the chemical spill is contaminating the water used by the public and customers, notify affected the customers immediately to stop taking water and erect signs (if available) to warn the public of the danger
- If you know the chemical and its properties and if you are wearing the
- appropriate Personal Protection Equipment and if it is possible and safe to do so, attempt to either:
 - contain the spill by installing impermeable barriers
 - by placing absorption pads; or
 - by guiding the spill into a temporary storage
 - Do not return to the site until you have been advised that it is safe to do so by Emergency Services

Manager Water and Wastewater responsibilities:

Dealing with ongoing effects

- Direct all media contacts to the Corporate Relations Manager
- Direct all member of the public contacts to the Customer Support Manager
- Direct all family contacts to Human Resources Manager
- Perform any corrective actions as advised by your supervisor/manager (this may include securing the site to prevent access by the public; and cleanup/remediation actions)
- Cooperate with any Fire, Police and Workplace Health and Safety
- Queensland investigations
- Cooperate with any SunWater investigation

Emergency Response Plan - Major Chemical Spill

ROLES OF MANAGEMENT

Senior Management

- Nominate an Emergency Event Co-ordinator to take charge of activities to manage the event
- Report to the Director Infrastructure and Chief Executive Officer on the status of the event
- Provide resources and logistical support to manage the event as required (including staff and contractors, plant and equipment, design and engineering support)

Emergency Event Co-ordinator

- Maintain a log of response events including the names of those involved and witnesses to the event, and contacts with Emergency Services and other regulatory authorities
- Co-ordinate the SunWater response with Emergency Services on-the-ground
- Co-ordinate the on-the-ground response to the event including:
 - Security of the event site
 - Support services for witnesses and those involved
 - Communication channels (telephone, radio, data communications runners)
 - Continuation of delivery of services, if appropriate
 - Interim repair of critical infrastructure, if appropriate
 - Interim reconnection of electrical supply and other services, if appropriate
 - Advise the Senior Manager of any requests for information or material from regulatory authorities

**SOP 09 GORDONBROOK HAZARDOUS SUBSTANCE SPILLAGE IN
DAM THE DAM CATCHMENT**

Health Safety Environment Quality (HSEQ)

- Record the incident notification and confirm the details of the event for
- escalation
- Liaise with Corporate Counsel and General Manager to organise a SunWater
- investigation team

Corporate Counsel

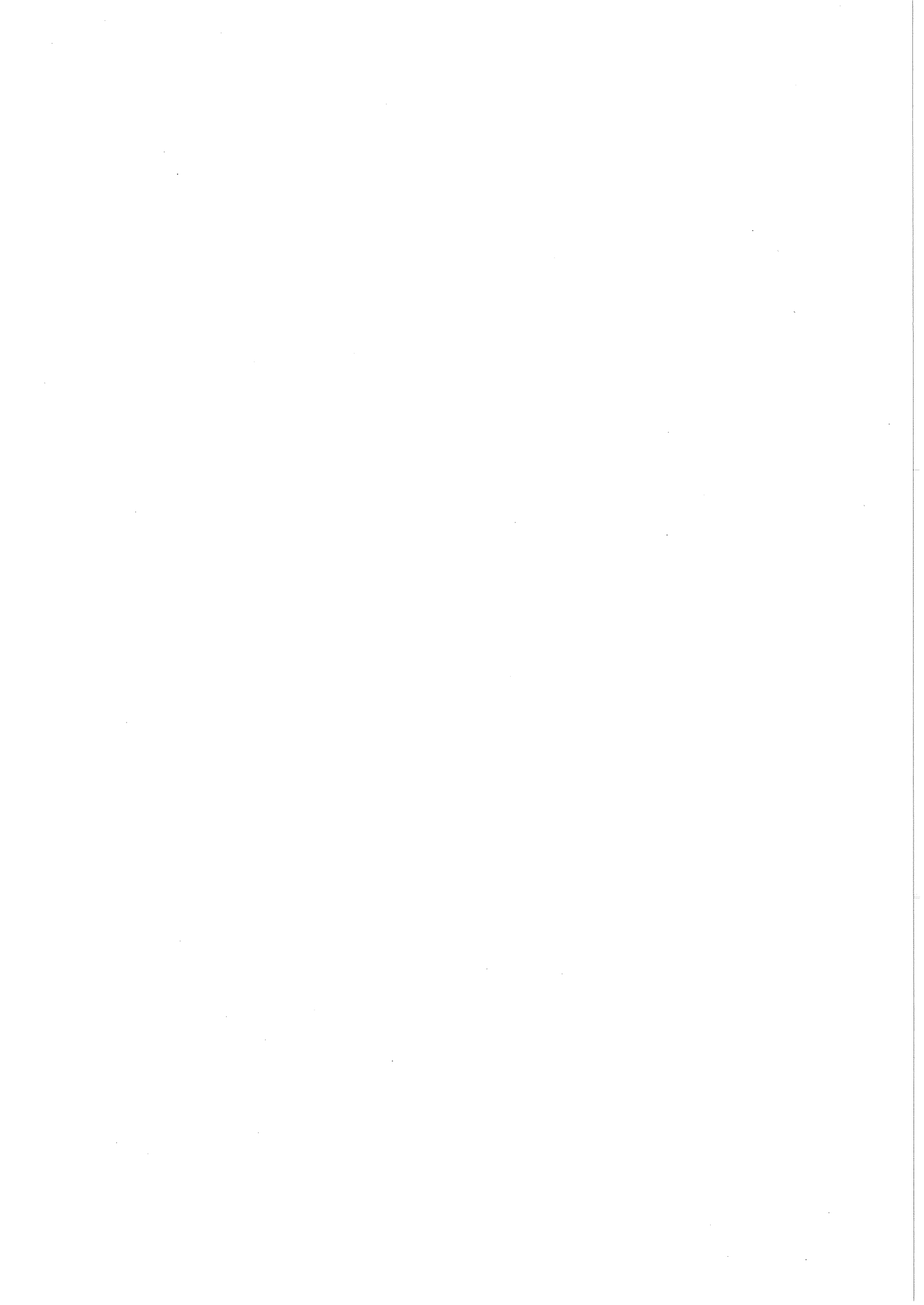
- Take the lead in managing a SBSC investigation of the incident, if deemed necessary
- Provide legal advice to on-the-ground staff dealing with regulatory enquiries
- Provide legal advice to staff dealing with media enquiries
- Respond to all enquiries by external lawyers
- Respond to all enquiries by regulatory bodies

Human Resources

- Provide/organise support services and counselling for staff, contractors and family members, as appropriate
- Maintain appropriate human resource records of the event
- Provide ongoing return-to-work support, as appropriate

Corporate Relations

- Deal with all media enquiries
- Draft all media responses
- Provide advice to on-the-ground staff dealing with media enquiries



NOT APPLICABLE
Refer to Water Treatment Plant procedure

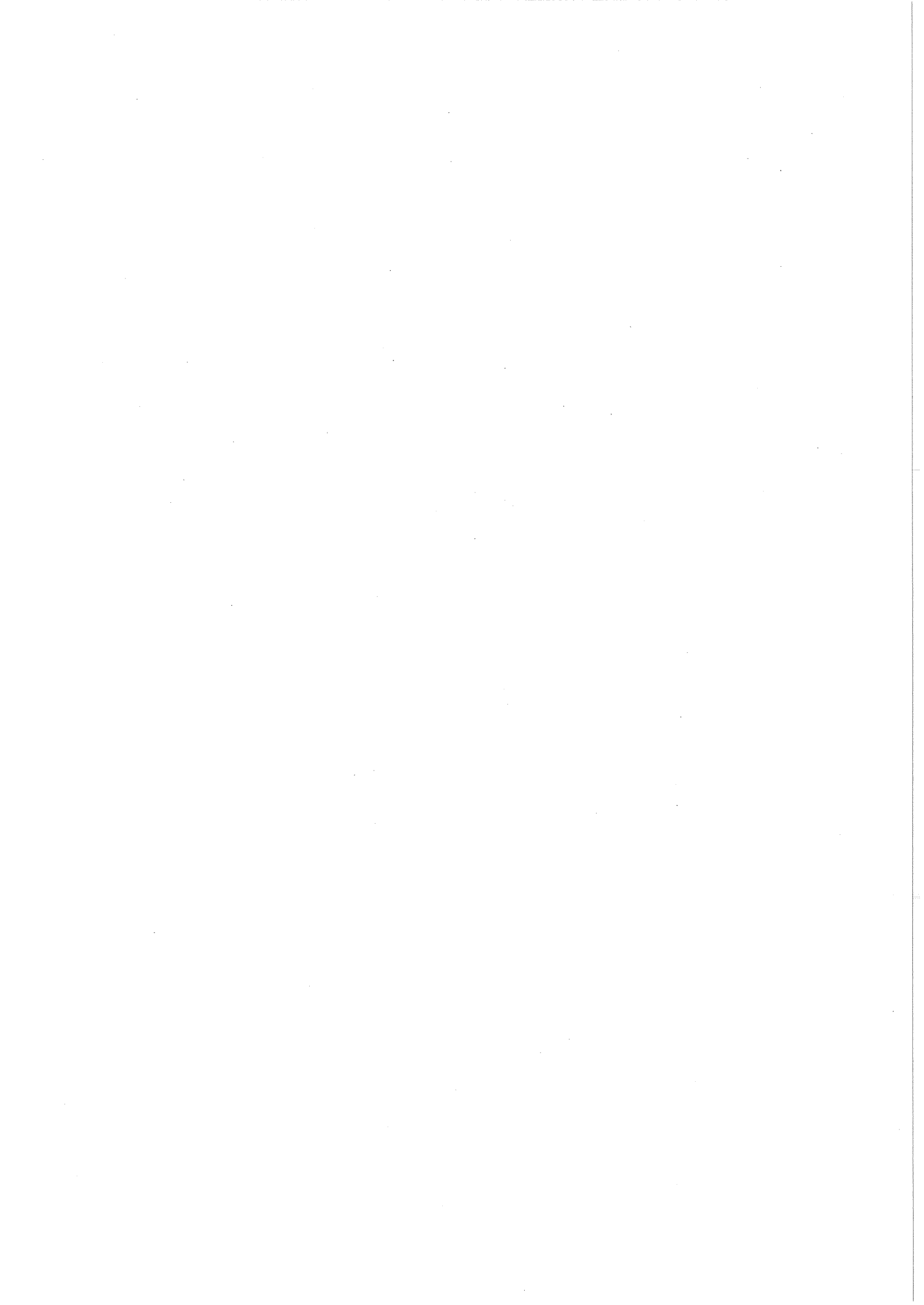




The South Burnett Shire Council and its employees have a responsibility to maintain the Gordonbrook Dam, its storage and catchment in a manner which will not cause harm to the environment and to respond in a responsible manner to any situation which may adversely affect the environment.

The **Manager Water and Wastewater** must ensure that all operations of the Dam comply with the following:

- The Queensland Government **Environmental Protection Act 1994** which can be found on the Internet at <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/E/EnvProtA94.pdf>
- The South Burnett Regional Council's **Environmentally Relevant Activities (ERAs)**
<http://www.southburnett.qld.gov.au/web/guest/environmental-related-activities>
- The South Burnett Regional Council's Natural Resource Management -
<http://www.southburnett.qld.gov.au/web/guest/natural-resource-management>



Purpose

To ensure that dam personnel involved in the operation and maintenance of Gordonbrook Dam are adequately trained in safe work practices, operation, dam inspection techniques and have knowledge of possible dam safety deficiencies.

Scope

This procedure applies to the operations and maintenance of Gordonbrook Dam

Definitions

Nil

References

- Operations & Maintenance Manual
- South Burnett Regional Council WHS Management System
- South Burnett Regional Council EMS Management System

Actions

The **Manager Water and Wastewater** shall

- Conduct regular reviews of the minimum standard of training required for dam operating personnel
- Develop and Facilitate training courses for operating personnel, including:
 - A Three Day Generic Dam Safety Operators Course, and
 - On-site Training and Assessment, carried out in conjunction with the 5 yearly Comprehensive Dam Safety Inspections or as required.
- Maintain a Dam Safety Training Register.
- Ensure that the sections of this procedure that are within his authority are implemented and adhered to
- Provide adequate training, training time, and training resources for the employees under his or her control
- Ensure that training programmes are implemented and completed within the nominated time

The **Operations Supervisor** shall:

- Ensure all personnel are adequately trained to carry out their assigned duties, and are aware of any potential hazard associated with these duties
- Ensure that the operators have attended a Training Course and have completed onsite training and assessment.
- Maintain a Training Register that has the name of each employee with a list of the employees' qualification(s), training received, and license(s) held. License records shall include the licence number and expiry date. For verification each record shall carry the signature of the person making the entry and the person to whom the entry refers.
- Prepare for and with each employee, a training program that is based on their needs and their tasks and review this program every 12 months. Such program shall include refresher training

The **Operations Officer** shall:

- Make him or herself available for training as required
- Seek to receive training for activities about which he or she is not confident

Records

Annual training program

Training Register (Maintained by Operations Supervisor)

Dam Safety Training Register (Maintained by **Manager Water and Wastewater**)

Appendixes

Nil

Appendix 1:
CONTENTS OF DAM SAFETY OPERATORS COURSE

1 The Need for Dam Safety and the Role of the Dam Operator

Purpose To make Dam Operators aware of the law as it applies to the owning and operating of dams.

Outcomes Operator awareness of the Water Act where it pertains referable dams, Workplace Health and Safety Act, Integrated Planning Act, the owner-regulator relationship, the difference between referable and non referable dams, the importance of dam safety, failure impact assessments and 5-yearly re-assessments, Emergency Action Plans, Standing Operating Procedures, Data Books, Safety Reviews, and Operation and Maintenance Manuals.

2 Understanding and Applying Standing Operating Procedures

Purpose To provide Dam Operators with a detailed understanding of the purpose and contents of Standing Operating Procedures.

Outcomes Operator awareness of the importance of adhering to Standing Operating Procedures for SunWater owned and operated dams
Operator awareness of the importance of uniformity
Operator understanding of the structure of Standing Operating Procedures, and how they may be amended
Demonstrated ability to apply Standing Operating Procedures

3 Understanding and Applying Emergency Action Plans

Purpose To provide Dam Operators with a clear understanding of Emergency Action Plans and how and when to apply these plans.

Outcomes Operator awareness of the importance of effective communication with the Police, Local Counter Disaster Authorities, and other persons nominated in the EAP during a flood or emergency event
Operator awareness of the need to channel all communications with the outside through a single spokesperson
Operator understanding of the importance of regular updating of the Notification List and their involvement in keeping the list up-to-date
Operator understanding of the need to maintain regular contact with the Local Counter Disaster Groups in order to maintain confidence in the security of the Dam

4 Inspection of Embankment Dams

Purpose To provide Dam Operators with a set of simple guidelines for conducting a routine inspection of a dam embankment

Outcomes Operator ability to describe the characteristics of an embankment dam
Operator ability to describe the different types of embankment dams

Operator ability to list the principal features of an embankment dam and describe the functions of each feature

Operator ability to describe the procedures for inspecting the upstream slope, downstream slope, crest and seepage collection drains of an embankment dam

5 Inspection of Concrete and Masonry Dams

Purpose To provide dam operators with the skills needed to inspect concrete and masonry dams and to detect and assess condition deficiencies.

Outcomes Operator ability to describe the different types of concrete and masonry dams

Operator ability to describe the characteristics of concrete and masonry dams

Operator ability to describe the different methods of concrete and masonry construction

Operator ability to list the principal features of a concrete or masonry dam and describe the functions of each feature

Operator ability to identify the following types of condition deficiencies:

- Cracking
- Concrete deterioration such as Disintegration; Spalling; Efflorescence; Drummy concrete; Pop-outs, pitting, and scaling; Chemical attack; Metal corrosion; and Erosion
- Surface defects such as Honeycomb; Stratification; Form slippage; Stains; Impact damage; and Displacement
- Leakage and seepage
- Maintenance concerns such as Faulty drainage; Undesirable vegetation; Debris; Joint condition; Previous repairs; and Environmental conditions

Operator ability to explain the potential consequences of each type of condition deficiency.

Operator ability to decide what to do when finding condition deficiencies.

6 Inspection of Foundations, Abutments, and Reservoir Rim

Purpose To provide dam operators with the skills needed to inspect and assess the condition of the rim of a dam reservoir.

Outcomes Operator awareness of the importance of inspecting the rim of a dam reservoir

Operator awareness of the different aspects of inspecting the rim of small, medium, and large dam reservoirs

Operator ability to identify and assess condition deficiencies in the rim of a dam reservoir and an ability to determine whether they affect the safety and integrity of the dam now, or may do so later

Operator awareness to record and report the findings for future reference

7 Inspection of Spillways and Outlet Works

Purpose	To provide dam operators with the skills needed to inspect spillways and outlet works and to detect and assess condition deficiencies.
Outcomes	Operator command of spillway and outlet works terminology; the knowledge to describe functions, classifications, and configurations; and the ability to name the major spillway and outlet works components Operator ability to name the various structures or features used in spillways and outlet works and describe the function served by each structure or feature Operator ability to inspect the entrance, intake, control, water conveyance, energy dissipation, and return components of spillways and outlet works Operator ability to identify the following types of condition deficiencies: Deterioration of materials; Obstructions; Slope and wall failure; Unstable channel floors; Defective joints; Misalignment; Abnormalities on flow surfaces; Drainage problems; Foundation and backfill problems; Damaged or missing equipment Sufficient knowledge to understand the potential consequences of each type of condition deficiency for the spillway or outlet works and for the dam Operator knowledge of what to do when finding condition deficiencies

8 Inspection and Testing of Gates, Valves and Other Mechanical Systems

Purpose	To provide dam operators with the skills needed to inspect and test gates, valves, and other mechanical systems and on how to assess their condition
Outcome	Operator ability to describe the various types of mechanical systems used in dams, their functions, and their operating principles and to explain how mechanical systems relate to the other components of a dam Operator ability to explain the importance of periodic inspection and maintenance of dam mechanical systems Operator ability to list the problems commonly found in mechanical systems and how to find them Operator knowledge of how to inspect and test mechanical systems efficiently and thoroughly, and how to record the results of an inspection Understand the importance of knowing how mechanical items can fail and how to limit the failure effects

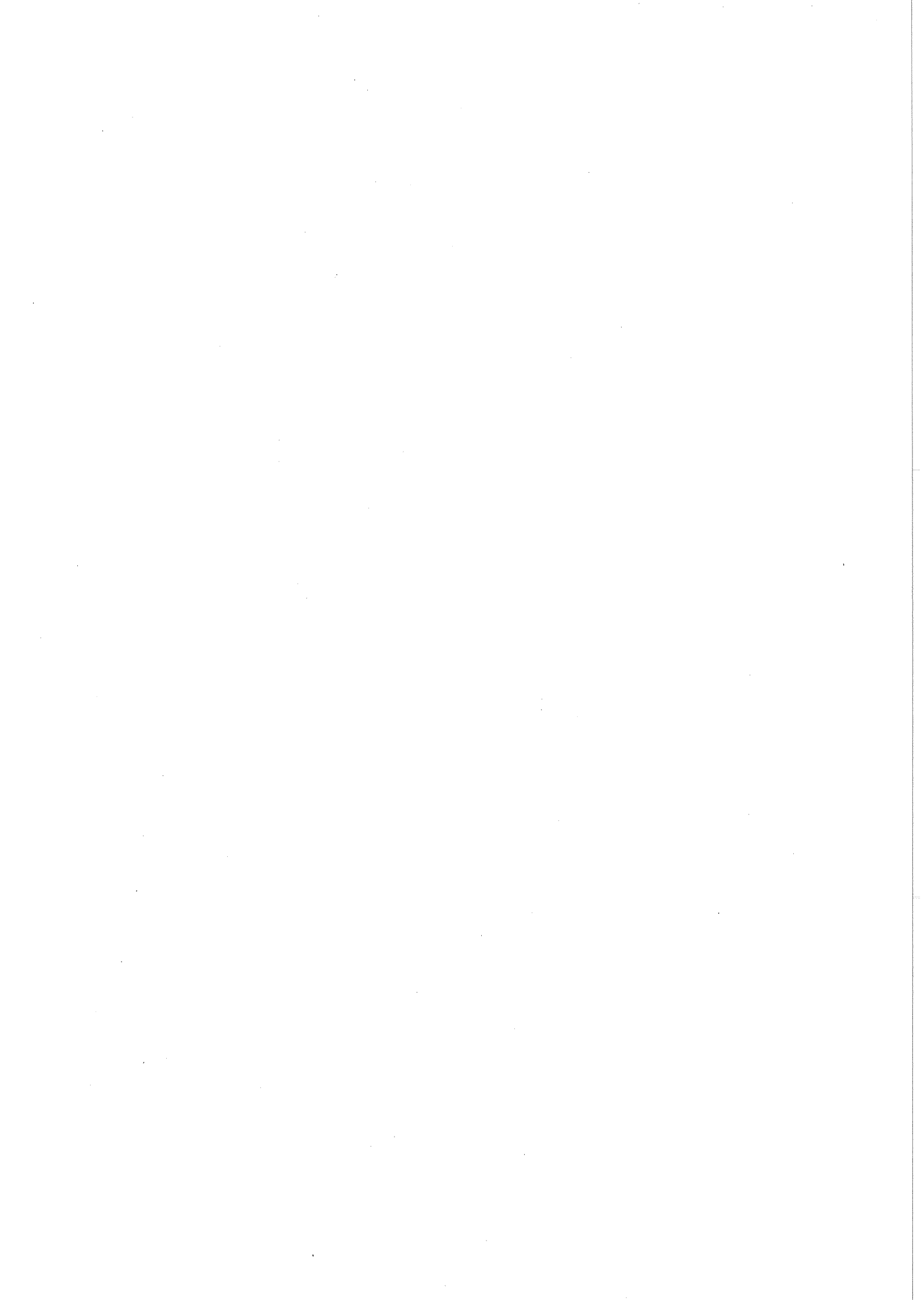
9 Instrumentation and Monitoring for Embankment and Concrete Dams

Purpose	To teach what dam instruments measure and how to read and interpret these readings
Outcomes	Operator ability to describe the different types of dam instruments and the basic function of each Operator ability to describe what the instruments are measuring and to read and interpret each instrument Operator understanding of the reason why readings must be recorded

Operator knowledge about why, what, when, how, and how much data and information to send to Manager Dam Safety each month

10 Low Voltage Safety and Resets

- | | |
|---------|--|
| Purpose | To explain the dangers of working around Low Voltage live electrical apparatus and how to do so safely. |
| Outcome | Operator knowledge and skills to safely access electrical cabinets, switchboards, or control gear to isolate or to reset |



SITE ACCESS AND SECURITY

PURPOSE

To outline access protocols including access restrictions at each workplace to ensure security of South Burnett Regional Council (SBRC) property and to protect employees and third parties from harm arising from any workplace site, activities, plant, equipment and substances.

SCOPE

This Standard applies to site access to and security of all SBRC infrastructure and property.

RESPONSIBILITY

The **Manager Water and Wastewater** and **Operations Supervisor** are responsible for managing Site access to all Gordonbrook Dam infrastructure and property in accordance with SBRC standards.

PROCEDURES

1. Master Key System.

A MASTER KEY SYSTEM SHALL BE IMPLEMENTED WITH THE FOLLOWING LEVELS OF ACCESS:

Level 1 High Voltage Access

Level 2 Low Voltage Access (Control rooms, offices and other buildings)

Level 3 Other Gate/Building Access

In addition, individual facility keys compatible with the keying system above shall be installed at selected sites, where there is a requirement for contractors and visiting personnel, as authorised by the Manager Infrastructure, to access the individual facility on a short term basis.

THE MASTER KEY SYSTEM IS A REGISTERED KEY DESIGN RESTRICTING THE DUPLICATION OR CUTTING OF ADDITIONAL KEYS. THE OPERATIONS MANAGER OR OPERATIONS ADMINISTRATOR SHALL APPROVE THE CUTTING OF ADDITIONAL KEYS IN WRITING BEFORE KEYS ARE CUT.

2. Assessment of Other Restricted Areas.

In addition to the above, the Manager Infrastructure and/or the relevant Workplace Health & Safety Officer will assess the areas under their control to determine other areas where access should/can be restricted, who should be given access, how access can be restricted, and/or the signs required. In assessing access restrictions, the following should apply:

Public access to SBRC workplaces and infrastructure will be strictly limited. Unless otherwise authorised, and where practicable, all visitors and contractors will sign in and be accompanied on the sites at all times.

It is recognised that restriction of public access to SBRC sites will not always be practicable. In any case, and particularly for critical assets which may be a target for sabotage, theft or vandalism, or where there are public safety risks, the Manager Infrastructure must undertake a risk assessment and discuss alternative methods of controlling access and securing the sites with the relevant Manager, e.g. signage, fencing, screens, more secure entry points (e.g. stronger doors, windows), stronger locking mechanisms, cameras, alarms etc.

In compiling the Restricted Access Register (see below), any areas where it is not practicable to restrict access, and any alternative arrangements to manage access and security, as agreed with the Business Manager, should be noted.

Vehicle access to the sites will be restricted.

All hazardous substances will be labelled and stored in locked cabinets.

All specified dangerous goods will be stored at the workplace in such a way as to prevent a person without operations manager permission entering the workplace (or depot/store etc) or accessing a specified dangerous good at the workplace.

All electrical cabinets will be locked.

Access to equipment, machinery and attractive items is to be restricted.

All mobile plant and vehicles will be locked when not in use.

THE Manager Infrastructure WILL ENSURE THE COMPILATION OF A RESTRICTED ACCESS REGISTER, DESIGNATING THE RESTRICTED AREAS AND THE PERSONS AUTHORISED TO ACCESS THOSE AREAS. A SAMPLE RESTRICTED ACCESS REGISTER IS INCLUDED AT ATTACHMENT A. CENTRE AND SITE SUPERVISORS WILL BE RESPONSIBLE FOR ENSURING THAT ACCESS RESTRICTIONS ARE ENFORCED. WHERE POSSIBLE ALL RESTRICTED AREAS SHALL BE DESIGNATED WITH APPROPRIATE WARNING SIGNS. ACCESS RESTRICTIONS WILL BE COVERED IN INDUCTION TRAINING (EMPLOYEES AND CONTRACTORS).

3. LOCKS

Locks shall meet the following standards:

The lock furniture on buildings shall meet the relevant standards for buildings and electrical installations;

Only Lockwood 234B padlocks shall be fitted to gates. Consideration is to be given to installation of shielding around the lock (e.g. installation of the bolt in a pipe or similar), so that the lock cannot be removed (e.g. through use of bolt cutters).

4. KEY REGISTER

The Technical Support Officer shall be responsible for maintaining a key register. Individuals shall sign for keys when issued. Operations Administrators must ensure that keys are returned by the individual prior to the individual exiting the employ of SBRC, or no longer requires the key to carry out his/her duties.

5. ACCESS BY SBRC STAFF

Relevant local SBRC staff shall be issued with a key for the appropriate access level on a permanent basis if used regularly. The Manager Infrastructure shall determine the level of access.

6. ACCESS BY CONTRACTORS AND VISITING SBRC STAFF

Contractors and visiting SBRC staff shall be issued with a facility key after a Contractor / Project induction (includes induction into any relevant Work Plan, Work Method Statement for access to the facility, for the duration of the job/Project. Individuals shall be required to sign the key register and return the key when the job is completed.

7. ACCESS BY THIRD PARTIES

SBRC keys shall not be issued to third parties for permanent access under any conditions. Where a third party requires access to a SBRC Site, the following procedure and conditions shall apply.

The third party shall apply in writing to SBRC identifying the Site, the reason for the access, the individuals requiring access, and the period of access required.

The Manager Infrastructure shall consider the written application and either approves or refuse the application and forward a reply to the third party.

The following conditions shall apply to third party access:

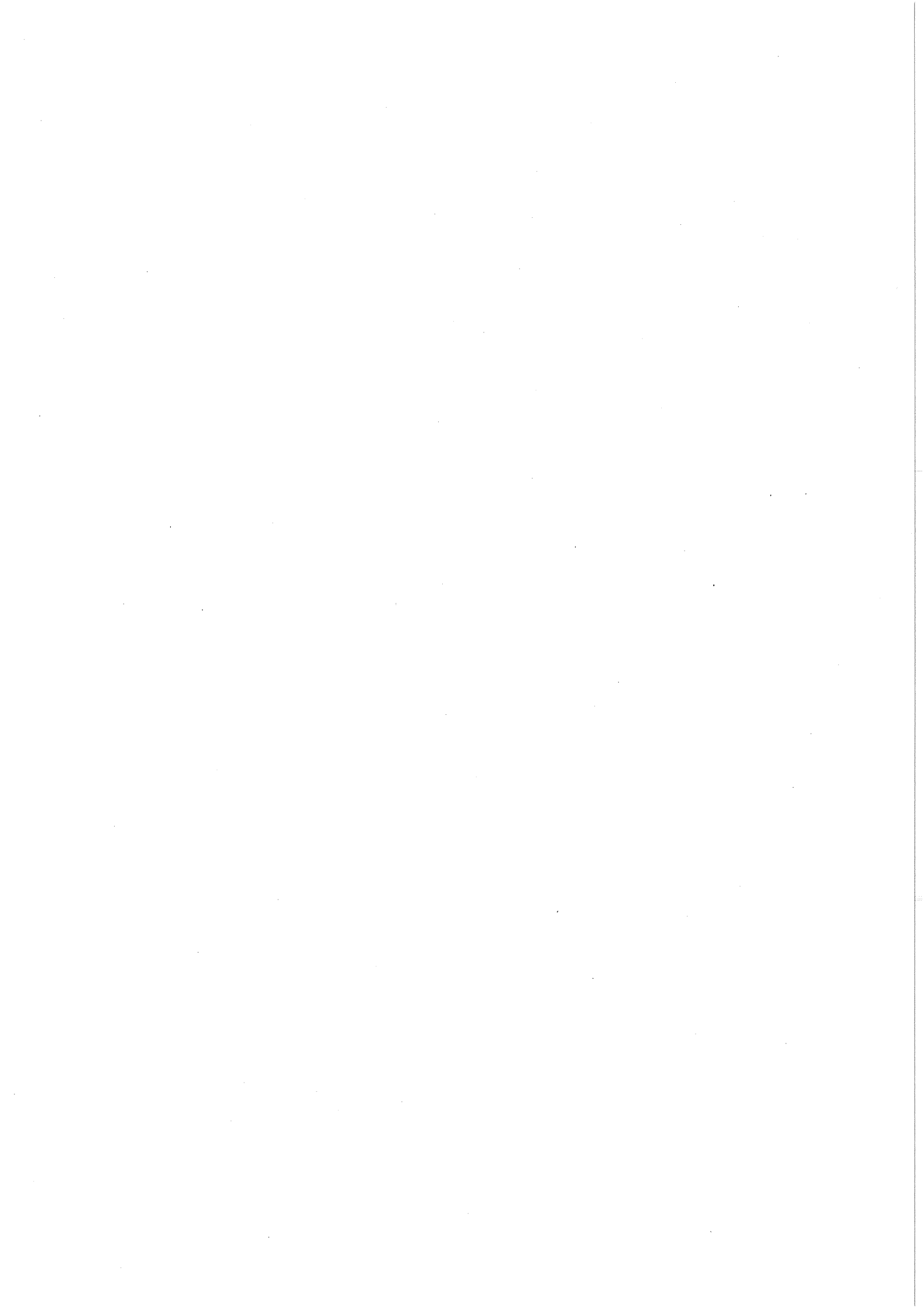
1. Access is granted only for specific purposes and to specific individuals for a specified period (as stated in the reply to the third party).
2. SBRC requires a notice from the third party from their insurer that the authorised individuals are fully insured against death, injury, loss or damage whilst accessing the SBRC Site, with the notice renewable each year if access is to continue.
3. The individuals accessing the Site must undertake a SBRC induction (contact details provided in the correspondence to the third party).
4. The Site is to be left clean and tidy at all times.
5. Any activities of the individual are not to interfere with SBRC operations. The third party is responsible for compliance with any regulatory requirements associated with their activities.
6. Where applicable, the third party shall supply at their cost a good quality padlock (Lockwood 234B or similar) to be fitted into the chain on the gate.
7. The lock shall be installed in separate links of the chain (not other locks) to alleviate the locking out of other parties by mistake.

8. The padlock shall be clearly marked with the third parties name either by engraving on the lock or stamping and drilling a tag to be closed into the lock staple when locking.
9. Electric etching or scratching with a sharp object is not acceptable as these usually become illegible over time.
10. The third party shall provide SBRC with a duplicate key and the name and phone number of a contact person should SBRC need to contact them for any reason in the future. Failure to maintain a current contact may result in the lock being removed.
11. The key to the lock shall not be given to others or access granted to others for reasons other than those detailed in the approval.
12. The gate should not be left open for extended periods whilst unattended.
13. SBRC staff shall immediately remove any unmarked locks found on SBRC gates and report the incident to the Manager Infrastructure.
14. SBRC reserves the right to withdraw permission for this access at any time without notice or reason.

ATTACHMENT A

Figure 1.0 – Restricted Access Register

AREA	RESTRICTION	PERSON RESPONSIBLE FOR ACCESS CONTROL	PERSON AUTHORISED TO ENTER	SIGNS REQUIRED
Site perimeter *Note individual areas and areas where access cannot be practicably restricted	Fences and gates Gates to be locked out of hours	Site/Centre Supervisor	All Employees	Authorised persons only Authorised persons only
Building entrances *List buildings	All visitors or contractors must sign in and be accompanied at all times	Site/Centre Supervisor	All Employees	Authorised persons only
Maintenance workshops / sheds	Maintenance personnel only	Site/Centre Supervisor	Maintenance personnel	Authorised persons only
Pump stations	Restricted entry to the pump station	Site/Centre Supervisor	Authorised Operators and Maintenance personnel	Authorised persons only
Dams/Weirs *Note where access cannot be practicably restricted	Restricted entry onto the wall and into galleries etc	Site/Centre Supervisor	Authorised Operators and Maintenance personnel	Authorised persons only
Hazardous goods storage area	Locked and authorised access only	Site/Centre Supervisor and relevant personnel	Operations Supervisor and relevant personnel	Authorised persons only
Roofs	Authorised access only	As defined by Project Manager	Personnel trained in Work at Heights	Authorised persons only
Fixed ladders	Authorised access only	As defined by Project Manager	Personnel trained in Work at Heights	Authorised persons only
Confined Spaces	Locked and authorised access only	As defined by Project Manager. (Entry Permit required)	Personnel trained in Confined Space Entry	Authorised persons only
Water Treatment Plant	Authorised access only	Site/Centre Supervisor	Trained Maintenance Personnel	Authorised persons only



Purpose

To ensure controlled documents such as the Standing Operating Procedures, Operation & Maintenance Manuals and Emergency Action Plans are reviewed and updated in accordance with the requirements of the Development Permit conditions, and that the Data Book and Data Book Documentation Library is maintained.

Scope

This procedure applies to control and review of all dam safety management documentation pertaining to Gordonbrook Dam

Definitions

- Controlled Document: A certified document subject to managerial control over its content, distribution, and storage.
- Controlled Copy: A copy of a controlled document that itself is also controlled

References

DERM Queensland Dam Safety Management Guidelines Feb 2002
DERM Development Permits Conditions
SOP 00 Organisational Structure and responsibilities
SOP 01 Verification of emergency contact numbers

Actions

The **Manager Infrastructure** shall:

- Ensure that adequate resources are available for the Manager Water and Wastewater to Manage the documentation review and control requirements of the Dam Safety Management Program for Gordonbrook Dam
- Authorise the issue of all EAPs, SOPs, and Operation and Maintenance Manuals and their amendments, with the exception of the following amendments, which have been delegated to the Manager Water and Wastewater for approval:
 - Updating and issuing EAP Notification List annually
 - Updating and issuing changes to Work Instruction resulting from the continuous improvement/review model above to optimise the maintenance strategy.

The **Manager Water and Wastewater** shall:

- Review drafts and recommendations for amendments to the EAPs, SOPs and Operation and Maintenance Manuals submitted by the Technical Services Engineer to ensure that they meet the requirements of the Queensland Dam Safety Management Guidelines.
- Advise the **Manager Infrastructure** of the appropriateness of the amendments and documentation before approval.
- Audit the Data Book and associated Documentation Library to ensure it is being regularly updated
- Maintain the Duplicate Dam Safety Documentation Library in Brisbane
- Comply with the requirements of Development Conditions DS 7 and DS 8 and, meet with the Operations Manager, Operations Supervisor, and Operations Officer to review the, SOPs, and Operation and Maintenance Manual annually by 1st of March for their appropriateness, currency, and possible improvement
- Comply with the requirement of Development Permit Condition DS 13 and review the EAP at least every 5 years and after each major flood event.
 - Draft and recommend all amendments to the SOPs, and Operation and Maintenance Manual and EAPs,
- Send Memo to **Manager Infrastructure** to confirm that the annual documentation review required by the Development Permit Conditions has been completed by 1st March even if no amendments have been issued for the 12 month period.
- On receipt of approval from the **Manager Infrastructure** transmit amendments to SOPs, O&M Manuals and EAPs with appropriate Transmittal Advice Forms to all controlled copy holders.

- Maintain a QA Documentation Register of the amendments and the Transmittal Advice Form responses.
- Update the Data Book as required when significant events occur at the dam, when updated criteria have been developed such as acceptable flood capacity, design earthquake, risk assessment and remedial works.
- Maintain the Data Book Documentation for Gordonbrook Dam by cataloguing new documents received into the Business Centre Dam Safety Documentation Library and sending a numbered copy of each document to the **Manager Infrastructure** for entry into the Duplicate Dam Safety Documentation Library.
- After each major emergency event or when a major deficiency is found, arrange a meeting (debrief) with the Manager Infrastructure the Operations Supervisor, and the Operations Officer to identify where the EAP, SOPs, and O&M Manual fell short and/or how they could be improved

The Operations Supervisor shall:

- Advise the **Manager Water and Wastewater** where a change to a SOP, O&M Manual, or EAP is advisable because of an upgrade or replacement of equipment, a forced change to a work process, a new safety issue, or a desirable improvement
- Ensure that amendments to SOPs, EAP, and/or the O&M Manual are inserted in the controlled documents held in the office and on the dam site
- Promote awareness among the employees under his control about the purpose and contents of the SOPs, EAP, and O&M Manual
- Ensure that all authorised changes to the EAP, SOPs, and Operation and Maintenance Manual are implemented immediately

All personnel shall:

- Be alert to sections in the SOPs, EAP, and O&M Manual that could be improved and bring these sections to the notice of their supervisor with suggestions, where possible, on what changes to make

All holders of controlled copies shall:

- Destroy or mark "superseded" any page or copy of a Standing Operating Procedure, Operation and Maintenance Manual, and Emergency Action Plan that has been replaced

Records

- QA Documentation Register of the amendments and the Transmittal Advice Form responses.

Appendixes

Nil

SOP 16 GORDONBROOK ROUTINE DAM SAFETY INSPECTIONS DAM BY THE DAM OPERATOR

Purpose

To ensure that dam safety inspections are carried out regularly and to a consistent standard

Scope

This procedure applies to the operation and maintenance of Gordonbrook Dam

Definitions

Nil

References

Gordonbrook Dam – Operations and Maintenance Manual

- Section 2.2 – Monitoring the Dam
- Section 3.3 - Maintenance Schedules and Work Instructions

SOP 11 Instrumentation surveillance and data recording

SOP 14 Dam Security and restricted areas

SOP 20. Data reporting

Actions

The **Manager Water and Wastewater** shall:

- Ensure that this procedure is implemented and adhered to
- Advise the **Manager Infrastructure** when reports are received from the **Operations Officer** or **Operations Supervisor** that indicate events or findings adverse to the safety of the dam
- Ensure operators are trained in accordance with SOP13.

The **Operations Supervisor**, shall:

- Ensure a regular inspection of the dam and its appurtenant structures is carried out in accordance with the relevant Work Order and as detailed in the relevant Operation and Maintenance Manual Work Instruction. Report its findings and—if applicable—any resulting recommendation, to the **Manager Water and Wastewater**
- Immediately, advise the **Manager Water and Wastewater** of any finding or any report that indicates events or observations that may concern the safety of the dam
- Send copies of all findings and reports that may concern the safety of the dam to the **Manager Infrastructure**
- Immediately advise the **Manager Water and Wastewater** by phone—in addition to the sending of copies—of events or findings that can be or are a possible threat to the immediate safety of the dam unless already done so by the **Operations Officer**
- Routinely inspect/monitor, record, and report as specified in the relevant O&M Manual Work Procedures and Work Instructions and SOP13as detailed in the Work Orders.
- In addition on a weekly basis scan the embankment, spillway, inlet Tower and valve structures in conjunction with other routine tasks being undertaken at the Dam.
 - Immediately report any unusual observations to the **Manager Water and Wastewater**.
 - If unusual observations are observed record in the dam logbook, the date and nature of the inspection, the findings, the recommendations, and the persons who were given a report.

Records

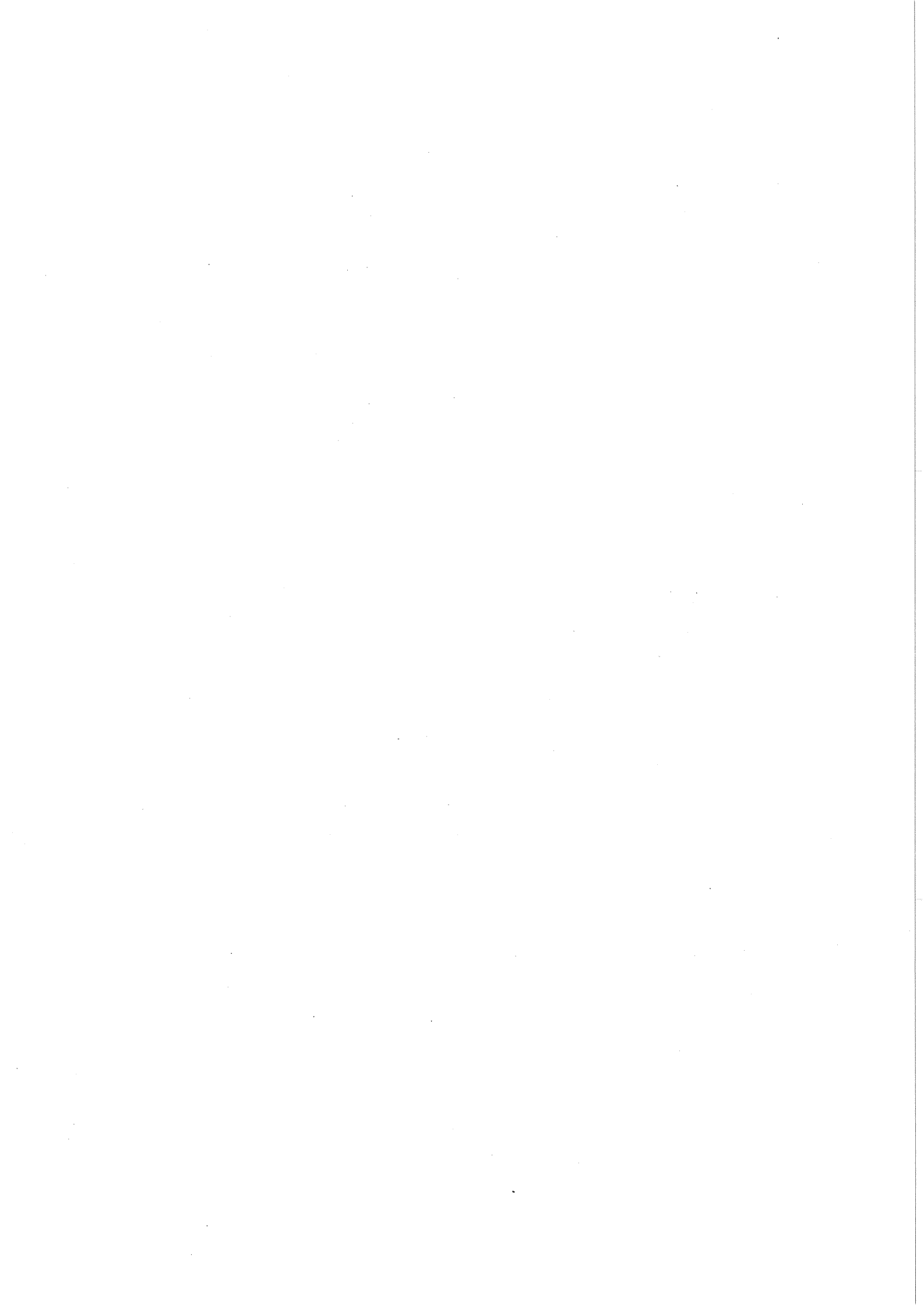
Dam logbook (refer SOP 07)

Work Orders / Work Instructions

Monthly Instrumentation Surveillance Reports

Appendixes

Nil



**SOP 17 GORDONBROOK ANNUAL AND 5-YEARLY DAM SAFETY
DAM INSPECTION**

- Manager Infrastructure
- The Operations Supervisor
- Ensure that recommendations approved are included in the Refurbishment Program or O&M SLA works program
- Ensure that this procedure— where it involves matters under his or her control – is implemented and adhered to
- Ensure all plant and equipment relative to the operation and maintenance of the dam is ready for visual inspection during the annual dam safety inspection
- Ensure dam personnel are available to assist the dam surveillance team during the annual inspection

The **Operations Officer** shall:

- Ensure all plant and equipment is ready for visual inspection and condition assessment
- Assist the inspection team when requested
- Record the events in the dam logbook

The **Manager Water and Wastewater** shall:

- Examine the annual inspection report and recommends to the **Manager Infrastructure** the priority of any capital remedial works that may have been identified.

PART B – 5 yearly Comprehensive Inspections

Actions

The **Director Infrastructure** shall:

- Ensure that the **Manager Water and Wastewater** has a current practising certificates issued by the Board of Professional Engineers of Queensland (RPEQ)
- Consider and/or direct any action required as recommended by the **Manager Water and Wastewater**
- Liaise with the **Manager Water and Wastewater** to ensure that the recommendations will be considered for inclusion in the Refurbishment Program, SLA works program and Gordonbrook budget estimates.

The **Manager Water and Wastewater** shall:

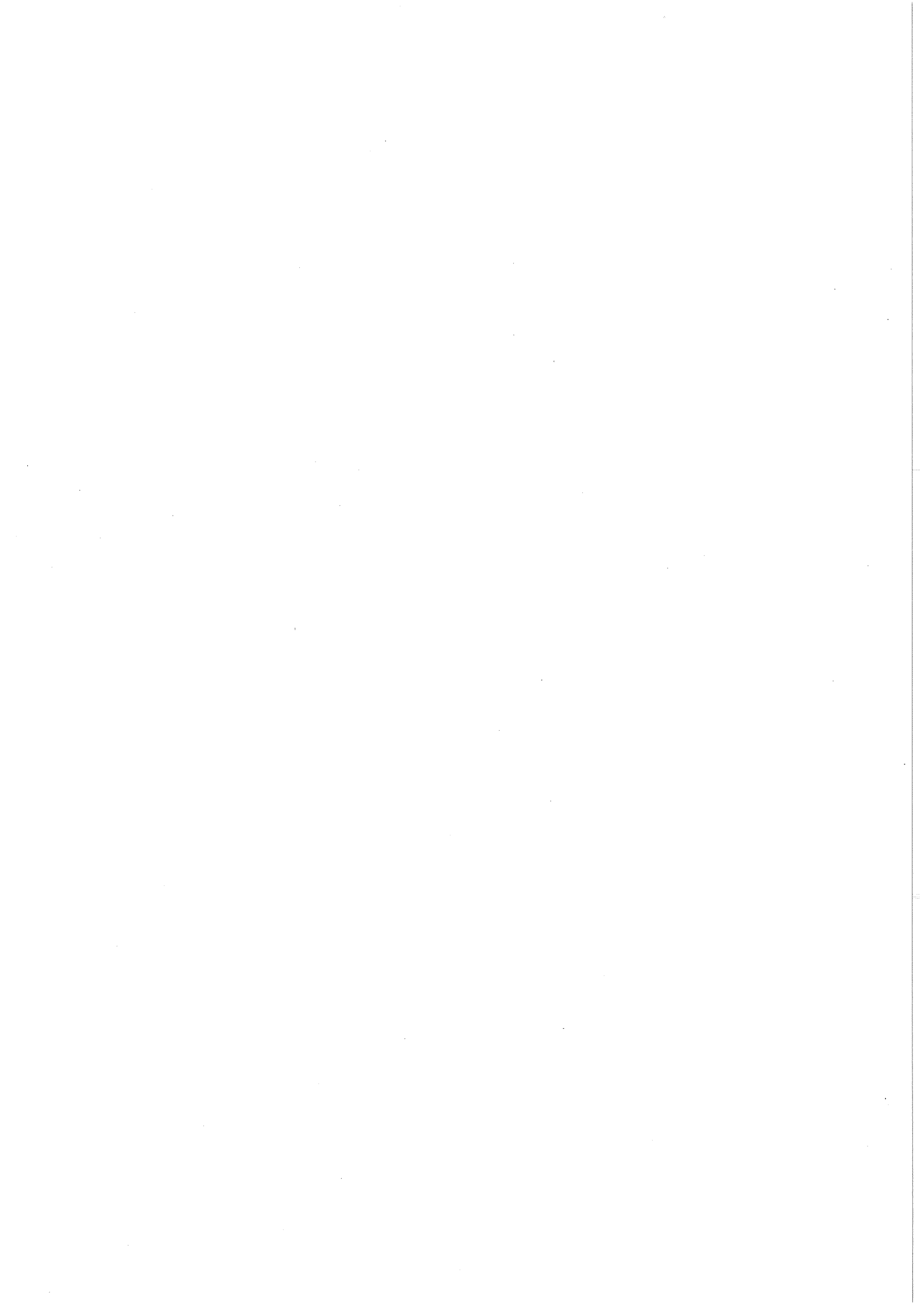
- Assume the status of team leader of the 5 yearly Comprehensive Inspection and liaise with the **Manager Infrastructure** with regard to the timing of the inspection
- Audit the Dam Safety management Program and review documentation for the dam including:
 - SOPs
 - Operation & Maintenance Manuals
 - Emergency Action Plans
 - Data Books
 - Surveillance and inspection program and records
 - Facilitate on-site Dam Safety Training and Site assessment of operators
- Write sections of the report relevant to the audit of the Dam Safety Management Program, review of documentation and training.

The **Director Infrastructure** shall:

- Review the sections of the report written by the **Manager Water and Wastewater** and other specialist members of the inspection team relating to the condition assessment of the dam and appurtenant structures and compile the final report

The **Manager Water and Wastewater** shall:

- Provide a written report in the Gordonbrook 5 Yearly Comprehensive Inspection Standard Format with findings and recommendations within 3 months of completing the inspection, and issue a copy of this report to each of the following personnel:
 - The Manager Infrastructure



SOP 18 GORDONBROOK ASSIGNMENT OF RESPONSIBILITY DAM

Purpose

To ensure that all personnel involved in the Dam Safety Management Program and the associated operation and maintenance of the Gordonbrook dam are fully aware and understand their responsibilities and authorities

Scope

This procedure applies to the Dam Safety Management Program and associated operation and maintenance activities of Gordonbrook Dam

Definitions

Nil

References

- Queensland Dam Safety Management Guidelines – February 2002
- Gordonbrook Dam Development Permit Conditions
- Gordonbrook Dam – Operations and maintenance Manual
- Emergency Action Plan – Gordonbrook Dam
- SOP 07 – Dam logbook

Actions

The **Manager Infrastructure** shall:

- Ensure that Gordonbrook's Dam Safety management program meets the requirements of the Water Act 2000 , the Dam Safety Management Guideline - Feb 2002, the Development Permit Conditions are achieved for compliance and that the **Manager Water and Wastewater** is competent and adequately trained

The **Manager Water and Wastewater** shall:

- Develop, Maintain and Manage Gordonbrook's Dam Safety Management Program and provide professional advise to the Manager Infrastructure on all matters related to Dam Safety.
- Develop Standards for all QA documentation relating to Dam safety, including:
 - Operation and Maintenance Manuals
 - Standing Operating Procedures
 - Emergency Action Plans
- Review all dam safety inspection reports
- Facilitate 5Yearly Dam Safety Inspections by assuming the position of inspection team leader.
- Develop and Facilitate Dam Safety Training Programs for Technical Services Engineers and Dam Operators
- Audit the Dam Safety Management Programs to ensure that they are operating within the requirements of the Queensland Dam Safety Management Guidelines and Development Permit Conditions
- Facilitate portfolio dam safety management by liaising with the Regulator.
- Maintain and Manage the Dam Safety Management Program
- Have day-to-day control of, and ensure that all controlled copies of the QA documentation including EAPs, SOPs and Operation and Maintenance Manuals are up-to-date, by issuing changes with transmittal advise forms and maintaining a QA documentation register.
- Ensure the, SOP, O&M Manual and EAP are reviewed annually in accordance Development Permit Conditions DS 07, DS08 and DS 13 respectively and notify Manager Infrastructure that this has been Done.
- Ensure all other Development Permit Conditions are complied with
- Carry out annual inspection and prepare written reports
- Liaise with the Manager Infrastructure and take part in the 5 Yearly Comprehensive Inspections
- Maintain Dam Safety Instrumentation Database and evaluate data on regular basis.

**SOP 18 GORDONBROOK ASSIGNMENT OF RESPONSIBILITY
DAM**

- Ensure that this procedure is implemented and adhered to
- Account for the overall standard of operations, maintenance, and site personnel competencies
- Ensure that all employees have an appropriate job description and duty statement and understand what is expected of them

The **Operations Supervisor** shall:

- Prioritise and schedule all maintenance as per the SOPs and O&M Manual or as directed by the Operations Manager
- Roster all personnel
- Oversee all operation and maintenance activities
- Ensure that all site personnel are adequately resourced and trained for their tasks

The **Operations Officer** shall:

- Carry out operations in accordance with the O&M Manual
- Manage all planned and unplanned maintenance
- Maintain the dam logbook and other dam site records and report, including Work Orders, as directed by the Operations Supervisor
- Assign daily tasks to operating personnel at the dam and ensure it is carried out correctly and in a workmanship like manner
- Follow the EAP as applicable

Records

Job Descriptions
Duty Statements
Training Registers

Appendices

Nil

SOP 19 GORDONBROOK NORMAL OPERATION CRITERIA DAM

Purpose

To ensure that under normal conditions the dam is operated and maintained in accordance with the SOPs, O&M Manuals, and any special prescribed operating limits such as valve opening limits, or restricted FSL due to stability limits.

Scope

This procedure applies to the operation and maintenance of Gordonbrook Dam

Definitions

Nil

References

Standing Operating Procedures for Gordonbrook Dam
Gordonbrook Dam – Operations and Maintenance Manual
South Burnett Regional Council WHS Management System
South Burnett Regional Council Environmental Management System (EMS)
Resource Operations Licence (ROL) for Kingaroy Water Supply Scheme

Actions

The **Manager Water and Wastewater** shall

- Ensure that this procedure is implemented
- Ensure that the Gordonbrook Dam SOPs, and the Gordonbrook Dam O&M Manual are being adhered to
- Ensure all work is carried out in accordance with the requirements of the Gordonbrook WH&S system and the EMS

The **Operations Supervisor** shall:

- Ensure that site personnel are adequately resourced and trained
- Ensure that maintenance work is appropriately targeted, planned, scheduled, and carried out in accordance with the O&M Manual and relevant Work Instructions.
- Carry out all prescribed and scheduled tasks as per Work Orders
- Ensure that the dam's appurtenances maintain a sufficient state of readiness to cope with a large flood event
- Ensure that river releases are made on time, at the agreed flow rate, and at the agreed volume
- Complete Dam Logbook entry as per SOP 07

Records

Dam logbook (refer SOP 07)

Appendixes

Nil

Purpose

To ensure all data required is collected, recorded, and distributed.

Scope

This procedure applies to the operation and maintenance of Gordonbrook Dam

Definitions

Nil

References

South Burnett Regional Council WHS Management System
South Burnett Regional Council EMS Management System
Emergency Action Plan Gordonbrook Dam
Gordonbrook Dam Operation and Maintenance Manual

Actions

The **Water and Wastewater Manager** shall:

- Ensure that the procedure is implemented and adhered to

The **Operations Supervisor** shall:

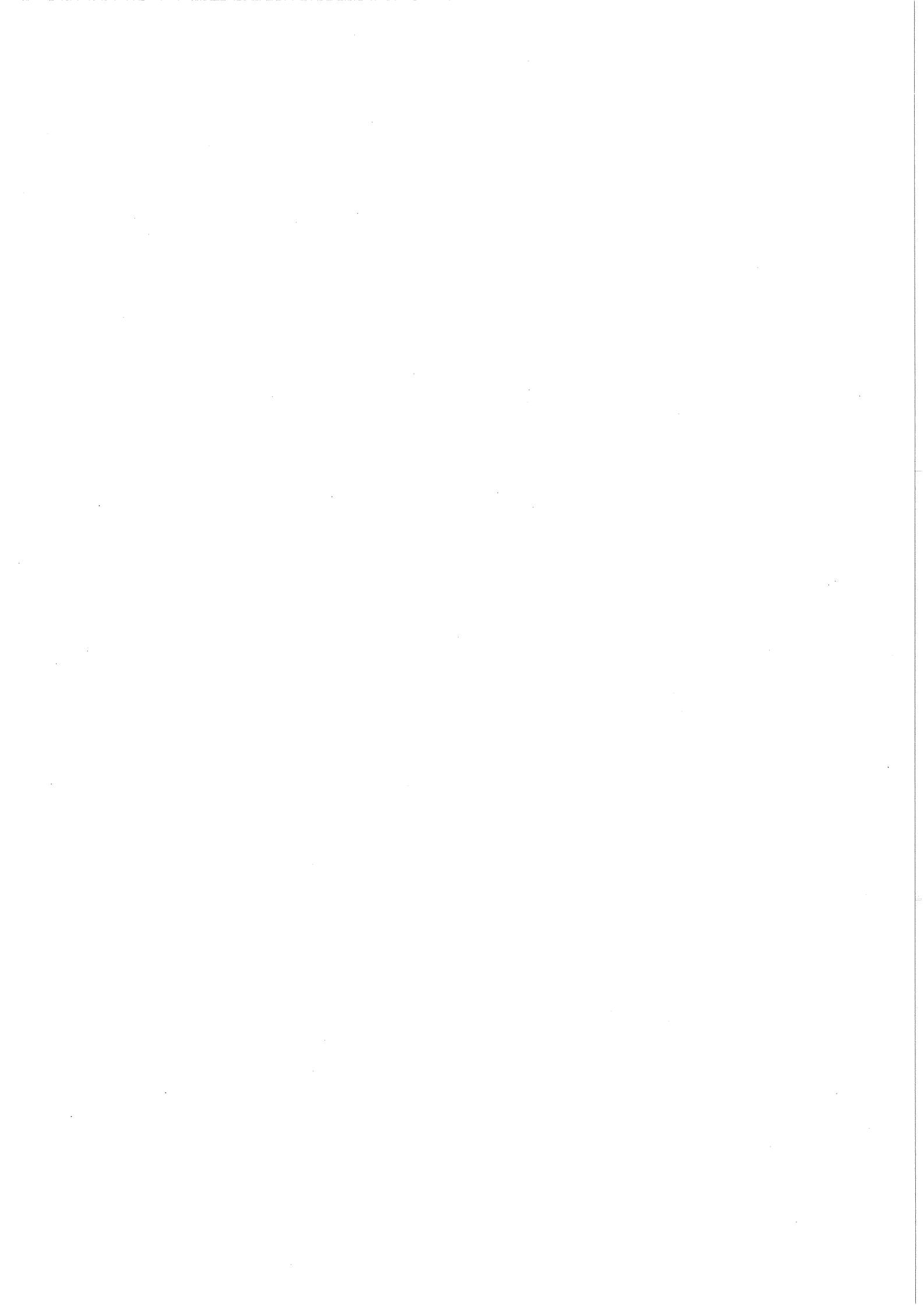
- Ensure that he is given the resources and the training to carry out his task
- Ensure that the required data are collected, filed, and distributed correctly and on time
- Collect, record and transmit as specified in the relevant SOP, WPH&S or EMS the following data
 - Rainfall records - transmit to SBRC office and Bureau of Meteorology
 - Storage water-levels
 - Accident and incident details (SBRC WPH&S Management System)
 - Hazardous spillages in the catchment (EMS)
 - Dam Safety Instrument readings (SOP 11)
 - Algae monitoring, sampling, and testing (EMS)

Records

Emergency Event Report
Alert Fax
Dam Surveillance reports

Appendixes

Nil



Purpose

To identify emergency conditions which could endanger the integrity of Gordonbrook Dam and which require immediate action, prescribe procedures to be followed by management and operations personnel in the event of an emergency and provides timely warning to emergency management agencies to implement protection for downstream communities.

Scope

This procedure applies to the development, and implementation of Gordonbrook Dam Emergency Action Plan.

Definitions

Nil

References

- DERM Queensland Dam Management Guidelines February 2002
- Gordonbrook Dam Development Permit issued by DERM
- SOP 00. Organisational structure and responsibilities
- SOP 01. Verification of emergency contact numbers
- SOP 02. Loss of communication during an emergency event
- SOP 15. Documentation control and review
- SOP 18. Assignment of responsibility
- SOP 22. Attendance at dam
- Gordonbrook Dam – Operation and Maintenance Manual Section 2.5

Actions

The **Manager Infrastructure** shall

- Ensure the Manager Water and Wastewater has adequate resources to liaise between SBRC and the local Counter Disaster Organizations and Local Authority
- Ensure the Manager Water and Wastewater has adequate resources to enable the implementation of the requirements of the EAP.

The **Manager Water and Wastewater** shall

- Approve the Emergency Action Plan for Gordonbrook dam.
- Ensure the Emergency Action Plan for Gordonbrook Dam is prepared in accordance with the Queensland Dam Safety Management Guidelines and the Development Permit Conditions
- Develop the first Draft of any amendments to the EAP
- Conduct desk top training for operating personnel of the EAP simulating emergency conditions in conjunction with the 5 yearly Comprehensive Inspections
- Audit the Dam Safety Management Program to ensure that this procedure has been implemented
- Oversee the development of Gordonbrook Dam Emergency Action Plan
- Facilitate meetings with all concerned parties including the Local Authority, The District Disaster Coordinator or the Disaster District Manager from the Department of Emergency Services and the Queensland Police Service
- Ensure the Counter Disaster Plans are linked to the EAP by co-operating with the State Emergency Service who is responsible for development of the Counter Disaster Plan.
- Ensure the EAP is kept up to date and effective
- Be proactive in developing 5 yearly large scale exercises involving coordination between the local Counter Disaster Agencies and Local authority.
- Ensure enough personnel are trained to enable the dam to be manned 24 hours a day during prolonged emergency events
- Ensure adequate facilities are available for the accommodation of staff during a prolonged emergency event.

- Ensure that annual training of all staff involved in the implementation of the EAP is carried out

The **Operations Supervisor** shall

- Ensure that all operation personnel involved with the implementation of the requirements of the EAP are adequately resources for the task.
- Activate the EAP and operate the dam in accordance with its requirements when prevailing adverse conditions dictate

Records

Training Registers

Appendixes

Nil

Purpose

To address levels of attendance corresponding to the various operational states of the dam

Scope

This procedure applies to the operation and maintenance of Gordonbrook Dam

Definitions

Operational state of the dam The current or imminent status of the condition of a dam together with its immediate physical environment

References

- Emergency Action Plan

Actions

The **Manager Infrastructure** shall

- Ensure an appropriate staffing level for each operational state of the dam

The **Manager Water and Wastewater** shall:

- Ensure that staffing levels at Gordonbrook Dam are appropriate for the current operational state of Gordonbrook Dam and are adequate to enable the actions specified in the Emergency Action Plan to be fully implemented.

The **Operations Supervisor** shall:

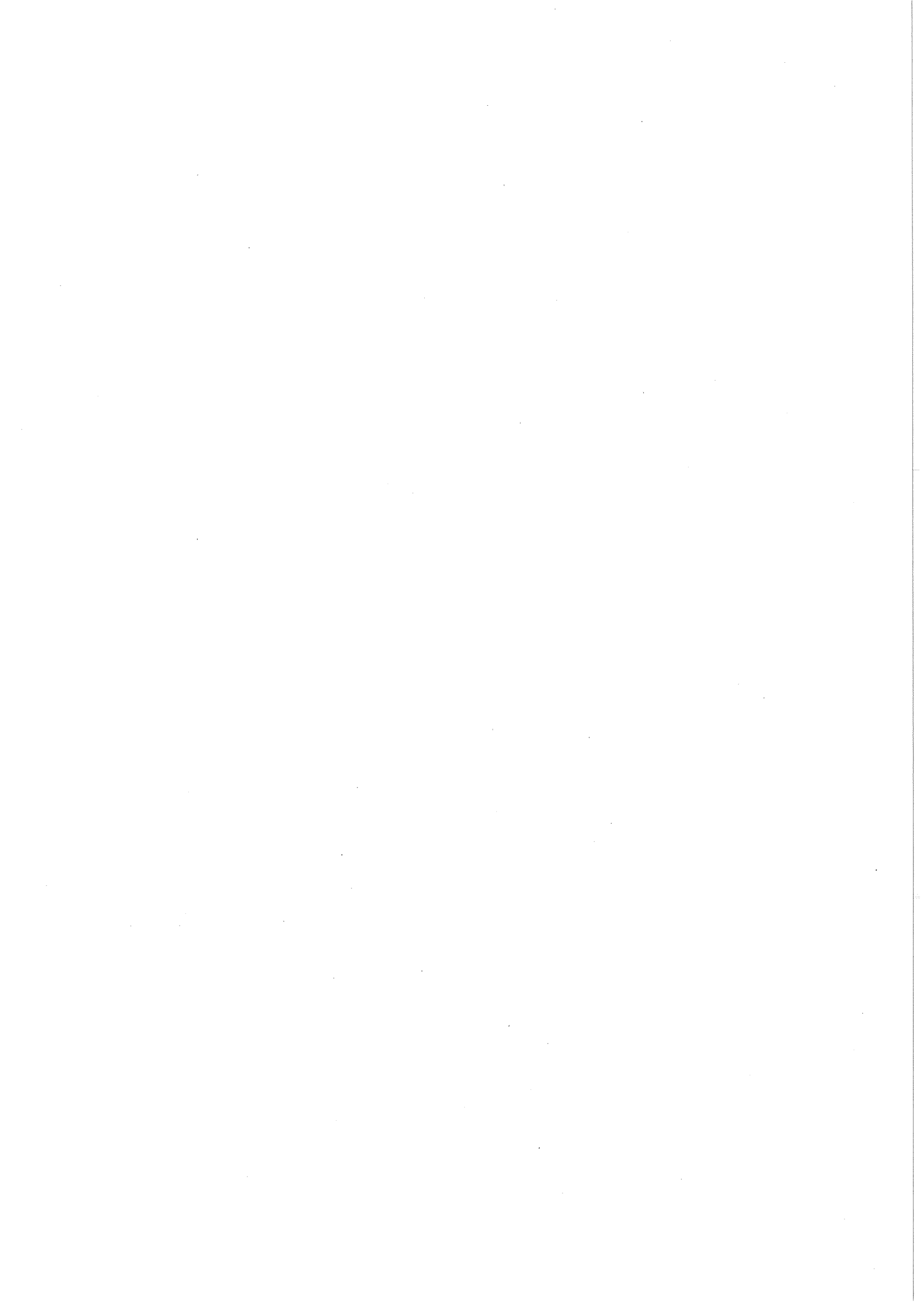
- Seek a change in dam staffing levels of Gordonbrook Dam whenever the operational state of the dam changes or an emergency event is detected or imminent

Records

Nil

Appendixes

Nil



**SOP 23 GORDONBROOK REQUIREMENTS FOR INSPECTION
DAM AFTER EMERGENCY EVENTS**

Purpose

To comply with the requirements of Condition DS 9 of the Development Permit Conditions for Gordonbrook Dam by ensuring ensure that special inspections are carried as requested by the Chief Executive, Department of Environment and Resource Management (DERM). These inspections are carried out on a particular feature of the dam identified as having a possible deficiency or has been subject to abnormal loading conditions following an emergency event.

Scope

This procedure applies to Special Inspections of Gordonbrook Dam following emergency events

Definitions

Nil

References

- DERM. Queensland Dam Safety Management Guidelines. February 2002
- DERM Development Permit Conditions
- Gordonbrook Dam – Operations and Maintenance Manual Section 2.2
- Emergency Action Plan – Gordonbrook Dam
- Emergency Event Report

Actions

The **Director Infrastructure** shall

- If the findings of a Special Inspection indicate that repairs are needed consult with the Manager Infrastructure and the Manager Water and Wastewater to determine the appropriate response and ensure that all agreed repairs are started forthwith

The **Manager Water and Wastewater** shall

- Ensure a special inspection is carried out:
 - If notified by the **Manager Infrastructure** that the emergency event report indicates that a particular feature of the dam has developed a possible deficiency subject to the abnormal loadings during the emergency event.
 - If requested by the by the Chief Executive DERM.
- Carry out a Special Inspection.
- Notify and consult with the **Manager Infrastructure** to ensure that funds are available to undertake any remedial works recommended by the Special Inspection Report.
- Provide one copy of the Special Inspection Report to Chief Executive DERM within 1 month of the inspection being completed as per the Development Permit Conditions.
- Examine the emergency event report and advise the **Manager Infrastructure** what the implications of the report's findings are, and if a special inspection is required.
- Examine the Special Inspection Report and advise the **Manager Infrastructure** what the implications of the report's findings are, and if any remedial works are required.
- Undertake – or arrange for a specialist dams engineer to undertake – a Special Dam Inspection immediately after or, during an emergency event that involves the dam
- Ensure that the **Manager Infrastructure** is briefed immediately after the inspection and confirm this briefing with a written report within 1 week after the inspection.
- Prepare briefs for any remedial works identified and oversee all repairs
- When repairs have been completed arrange for the data book to be updated

Records

- Emergency Event Report
- Special Inspection Report
- Data Book

Appendixes

Nil

Purpose

To ensure a failure Impact assessment is carried out on Gordonbrook Dam at 5-yearly intervals from June 2008 in accordance with the provisions of the Guidelines for Failure Impact Assessment of Water Dams (April 2002)

Scope

This procedure applies to reassessment of the Failure Impact Category of Gordonbrook Dam which was assessed with a Failure Impact Category of 1 in the Development Permit issued by DERM.

Definitions

Referable Dam:	A dam defined as referable under the Water Act 2000
Failure Impact Rating:	A measure of the population at risk should a dam fail (FIR)
Category 1 FIC	2-100 people at risk should a dam fail
Category 2	>100 people at risk should a dam fail
RPEQ:	A Professional Engineer who holds a current practising certificate – in his or her accredited field of expertise – issued by the Board of Professional Engineers of Queensland under the Professional Engineers Act 2002 (Qld)
Action Plan	A written document that specifies the ‘what’, ‘why’, ‘who’, and ‘when’ of a ‘one-off’ task

References

- Water Act 2000
- Queensland Dam Safety Guidelines (February 2002)
- Guidelines for Failure Impact Assessment of Water Dams (April 2002)

Actions

The **Manager Infrastructure** shall

- Budget for 5-yearly failure Impact Failure Assessments for Gordonbrook Dam
- If the findings of the Failure Impact Assessment indicate that corrective action is desirable, develop an Action Plan in consultation with the Manager Water and Wastewater.

The **Manager Water and Wastewater** – in consultation with the **Manager Infrastructure** – shall:

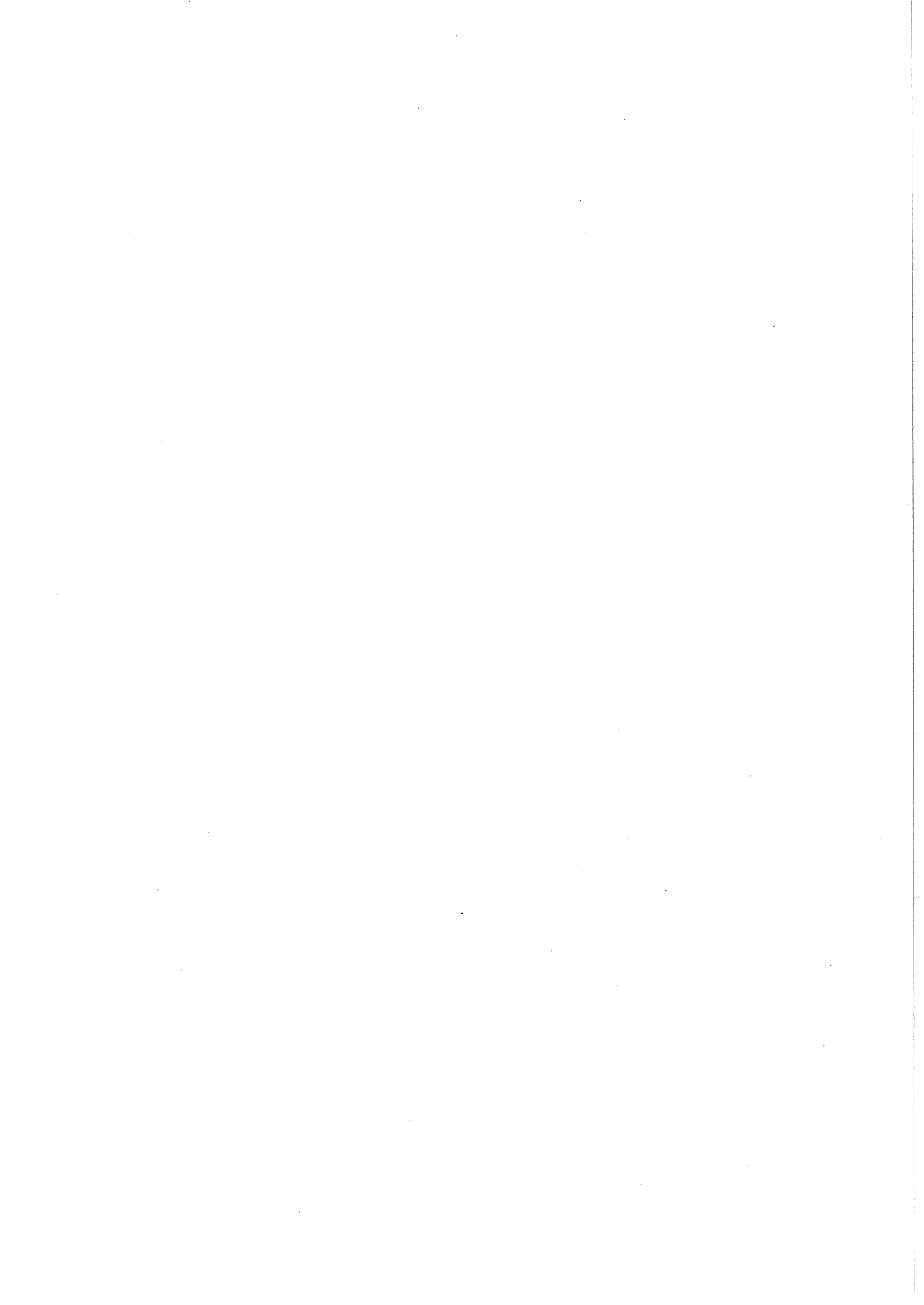
- Arrange for a Registered Professional Engineer – who is not an employee of South Burnett Regional Council – to undertake the 5-yearly Failure Impact Assessment of Gordonbrook Dam as detailed in the Guidelines for Failure Impact Assessment of Water Dams
- Ensure that the Registered Professional Engineer undertaking the assessment supplies a written report with findings and recommendations within 2 months of completing each re-assessment, and that a copies of the report is send to each of the following people:
 - 2 copies to the **Manager Infrastructure**
 - 1 copy to the Dam Data Book.
- Ensure that the Registered Professional Engineer also supplies all the data and documents on which the assessment was based in a format that readily lends itself for regular (5-yearly) updates and file them for future use and reference
- Examine the report and advise the **Manager Infrastructure** what the implications of the report’s findings are and what action – if any – must be taken.
- Send 1 copy of the report to the Department of Environment and Resource Management (DERM) c/o. The Director of Dam Safety

Records

Failure Impact Assessment Report
Data Book

Appendixes

Nil



Attachment PHA-40

Typical Condition DS 13 (current November 2011)

Condition DS 13 - Emergency Action Plans and Event Reports

1. The Dam Owner must maintain an Emergency Action Plan (EAP) for [Name] Dam in accordance with this condition and the *Queensland Dam Safety Management Guidelines*.
2. Where the reservoir headwaters are such that inundation of any upstream land upon which dwellings are situated is likely, such dwellings must be considered in the preparation of any Emergency Action Plan.
3. The EAP must cover the potential failure of any part of the structure that can put a population at risk either upstream or downstream and include such failure modes as:
 - a. Sunny day failure.
 - b. Piping and overtopping failure of the dam under extreme flooding conditions.
 - c. Failure of control structures such as spillway, intake and outlet works.
4. Inundation mapping shall be developed as outlined in the *Queensland Dam Safety Management Guidelines*, and shall be at a sufficiently large scale to easily identify those areas subject to possible danger. Mapping shall be developed for critical failure modes identified in the EAP.
5. The EAP must be disseminated to those who have responsibilities under the EAP and shall:
 - a. Determine and identify those conditions that could forewarn of an emergency and specify the actions to be taken and by whom.
 - b. Identify all jurisdictions, agencies, entities and individuals who could be involved in the EAP (for example, local governments, the Queensland Police, State Emergency Services, upstream and downstream businesses and residents), including:
 - [Name of Local Government Association].
 - Local Government Counter Disaster Committee.
 - Any additional group with responsibilities under the Emergency Action Plans.
 - c. Identify primary and secondary communication systems, both internal (between persons at the dam) and external (between dam personnel and outside entities).
 - d. Identify key resources, special tools, equipment, keys and where they can be located if required in an emergency.
 - e. List and prioritise key persons and entities involved (including contact details) in the notification process and the roles and responsibilities assigned to them.
6. The Dam Owner must ensure the contact details in the EAP are up to date at all times and are reviewed by the **1st day of November** of each calendar year:
 - a. Where amendments are made to any EAP, a copy of the updated document is to be forwarded to the Dam Safety Regulator by the **30th day of November** of that same calendar year.
 - b. Where no amendments are necessary, a written notification confirming that the EAP has been reviewed shall be signed by the Dam Owner and forwarded to the Dam Safety Regulator by the **30th day of November** of that same calendar year.

7. The Dam Owner must ensure the readiness of dam operators with an annual desktop or field emergency training exercise to be undertaken in conjunction with the annual review above.
8. In all emergencies, the Dam Owner must respond in accordance with the EAP, and must notify the Dam Safety Regulator within two (2) days. The notification shall include a brief description of the event and the time of activation of the EAP.
9. Within thirty (30) days of the event the Dam Owner must prepare an Emergency Event Report and provide a copy of the report to the Dam Safety Regulator. The Emergency Event Report must include:
 - a. A description of the event.
 - b. Instrumentation readings (where appropriate).
 - c. Description of any observed damage.
 - d. Photographs.
 - e. Details of communication and actions which took place during the emergency.
 - f. How the EAP was implemented during the event and comment on the adequacy of the EAP and any changes proposed

IM 4.6 Issuing a Show Cause Notice

WIR/2005/1892 – Version 2

Endorsed 27/11/2009

by Peter Artemieff, Director, Water Industry Asset Management and Standards Office of the Water
Supply Regulator

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Version history

Version	Date	Comment
1	21/02/2007	Original Approval
2	27/11/2009	<ul style="list-style-type: none">• Updated to reflect new Water Supply (Safety and Reliability) Act 2008• inclusion of additional obligations for service providers• new and updated templates
2.1	24/02/2011	Under review - internet access removed

Purpose

To provide a process to follow when issuing a show cause notice prior to issuing a compliance notice to a service provider. This work practice only refers to show cause notices issued to a service provider for failing to comply with the *Water Supply (Safety and Reliability) Act 2008* (the Act) in relation to one or more of the following:

- Regulator requested information
- Regulator directed water restriction
- Water efficiency management plan (WEMP)
- Strategic asset management plan (SAMP)
- System leakage management plan (SLMP)
- Customer service standards (CSS)
- Drought management plan (DMP)
- Outdoor water use conservation plan (OWUCP)
- Water advice notices
- Annual Report(s) for SAMP, SLMP, DWQMP, system operating plan (SOP), water advices and/or CSS
- Audit report for SAMP, SLMP and/or DWQMP
- Review of SAMP, SLMP, DWQMP and/or DMP

The issuing of a show cause notice prior to a spot audit is dealt with under work practice *IM 4.7 Conducting a Spot Audit*.

Rationale

The *Water Supply (Safety and Reliability) Act 2008* (the Act) allows the regulator to give written notice to a service provider to provide information reasonably required for the regulator to perform the regulator's functions (s. 13).

Under section 42 of the Act, the regulator may issue a direction to a service provider to impose a water restriction if the regulator considers-

- there is a significant threat to sustainable and secure water supply in an area outside the SEQ region or a designated region; and
- it is necessary or desirable to impose a restriction under section 41 of the Act.

The Act requires each service provider to have an approved strategic asset management plan (SAMP) for ensuring continuity of supply of each of the service provider's registered services (s. 70).

Section 79 of the Act requires each water service provider to prepare a system leakage management plan (SLMP) directed at minimising water losses from leakage from the water service provider's distribution system (Note: excludes a water service provider who only provides drainage services).

Section 95 of the Act requires each drinking water service provider to prepare a drinking water quality management plan (DWQMP) to protect public health.

Section 115 of the Act requires each service provider, who does not have a contract for supply of registered services with all of its customers, to prepare customer service standards (CSS). This is to ensure customers who do not have a contract with the service provider for the supply of registered services (a service contract) are protected by standards relating to the supply.

Section 123 of the Act requires each water service provider to prepare a drought management plan (DMP). This requirement does not apply to a water service provider to the extent the provider is supplying water services to a customer who holds a water entitlement or to a water service provider who only supplies drainage services.

Each water service provider who provides a retail water service outside the south east Queensland region (or a designated region) must have an approved outdoor water use conservation plan (OWUCP) (s. 133). The OWUCP is for reducing outdoor water use and promoting efficient outdoor water use by customers of the service provider. Service providers that were in existence as at 22 May 2009 have 2 years from that date to prepare the OWUCP. Service providers that commence after 22 May 2009 have 2 years to comply with section 133.

Section 139 of the Act requires a water service provider to give a water advice notice to an occupier of residential premises, who is not the owner, stating the volume of water supplied to the premises during each billing period for the premises. Section 1154 of the *Water Act 2000* provides that s. 139 (previously s. 429S of the *Water Act 2000*) of the Act does not apply to an existing service provider (except Brisbane and Gold Coast City Councils who were required to provide water advices by 1 January 2008) in the SEQ region or a designated region until 1 July 2009 and for an existing service provider outside the SEQ region or a designated region until 16 November 2011. Service providers are required to annually report on

- water advices given; and
- complaints about water advices.

Section 360V of the *Water Act 2000* requires the Queensland Water Commission to prepare a system operating plan (SOP) when there is a water security program for the south east Queensland region (or a designated region). A SOP is to facilitate the achievement of the desired levels of service objectives for the region. At the time of writing the South East Queensland System Operating Plan was in force. The SOP applies to the South East Queensland Water Grid Manager, Queensland Manufactured Water Authority,

Brisbane City Council, Ipswich City Council and the Queensland Water Commission.

Sections 141(1)(b) and 142(3) of the Act requires that a service provider must annually report on and measure the service provider's performance with the desired levels of service objectives and other obligations and requirements that apply to the service provider under the SOP.

Service providers are required to comply with the approved/registered SAMP, SLMP, CSS, DWQMP, DMP and SOP.

Service providers with an approved SAMP, SLMP, DWQMP and/or a CSS are required to submit annual report(s) on the above obligations to the regulator. A provider who issues water advice notices to an occupier of residential premises and a provider that is covered by a SOP are also required to report annually on these requirements.

A copy of the annual report must be given to the regulator within 120 business days after the end of the financial year unless the service provider is a local government. A local government may choose to include the annual report information in a report required under s. 531 of the Local Government Act 1993. If the information is included in a s. 531 report, the local government must give the regulator a copy of that report within 30 business days after the report is adopted.

Under the Act, service providers with an approved SAMP, SLMP and/or DWQMP are required to carry out reviews and audits of their SAMP, SLMP and/or DWQMP at intervals set by the regulator. Section 128 requires that a registered DMP must also be reviewed at intervals set by the regulator.

Eligible service providers may apply to the regulator for an exemption from complying with some of the above requirements of the Act.

The regulator may issue a compliance notice to a service provider for contravening a provision of the Act in circumstances that make it likely that the contravention will continue or be repeated.

The Act allows the regulator to issue a compliance notice to a service provider if the regulator or an authorised officer reasonably believes a matter relating to the contravention is reasonably capable of being rectified and it is appropriate to give the person an opportunity to rectify the matter.

The Act (s. 464) requires that the regulator must give a service provider a show cause notice prior to issuing a compliance notice when:

- the regulator proposes to have a spot audit conducted of a SAMP, SLMP or DWQMP (For information on issuing a show cause notice prior to conducting a spot audit please see work practice IM 4.7 Conducting a Spot Audit); or
- the regulator proposes to give a service provider a compliance notice (this does not apply to a compliance notice given to a drinking water service provider or a recycled water provider in relation to a matter involving drinking water or recycled water).

The show cause notice invites the service provider to show cause why the compliance notice should not be given.

A show cause notice must state the following-

- the proposed action (what the regulator proposes to do)
- the grounds for the proposed action
- the facts and circumstances forming the basis for the grounds
- that a submission may be made about the show cause notice
- how the submission may be made
- where the submission may be made or sent
- a day and time within which the submission must be made.

At least 15 business days notice must be given for the service provider to make a submission in relation to the show cause notice (s. 463(2)). When calculating time, the day by which the submission is to be made, the day the show cause notice is taken to have been given and the time it would ordinarily take for the letter to be delivered in the ordinary course of post cannot be counted. If a public holiday(s) falls within the 15 business days, then additional time is to be given (ss. 38 and 39A *Acts Interpretation Act 1954*).

Accordingly, if circumstances permit, it is appropriate to be conservative when setting a time limit. It is recommended that at least 31 calendar days be given, allowing for 15 business days, weekends, public holidays, the day the notice is sent, the day the submission is due and posting time. Depending on the circumstances a period longer than 31 days can be allowed.

If a show cause notice had been issued and a submission is received, the regulator must consider the submission prior to issuing a compliance notice. The regulator, when issuing the compliance notice, must reasonably believe that the person:

- is contravening a provision of this Act; or
- has contravened a provision of the Act in circumstances that make it likely that the contravention will continue or be repeated.

This belief must be reached after due consideration has been given to the submission (s. 465(4)). A person must comply with a compliance notice unless the person has a reasonable excuse. If the submission, in response to the show cause notice discloses a reasonable excuse, there is no point in proceeding with a compliance notice.

The decision to issue a compliance notice will not be the subject of an internal review under s. 511 of the Act. However, the service provider could seek to have the decision to reject the arguments in its submission and/or the decision to issue the compliance notice reviewed pursuant to the *Judicial Review Act 1991* (JR Act).

A service provider can only seek judicial review of decisions of an administrative character made under an enactment (see s. 4 of the JR Act). A service provider can seek a judicial review of a decision that has been made or the failure to make a decision.

Under s. 12 of the JR Act a court may dismiss the judicial review application if it believes there is adequate provision for review under the Act.

Alternatively the regulator may prosecute a service provider for failure to comply with the Act without issuing a show cause notice or a compliance notice.

Note: this work practice only refers to a show cause notice issued prior to issuing a compliance notice to a service provider. For information on issuing a show cause notice prior to conducting a spot audit please see the work practice *IM 4.7 Conducting a Spot Audit*.

Procedure

This work practice is set out below.

A flow chart of this work practice can be found at Attachment A <attachments/im4_6_flowchart_a.pdf> .

Step 1 - When a show cause notice should be issued

If the regulator proposes to give a service provider a compliance notice, the regulator must first issue a show cause notice (this does not apply to a compliance notice given to a drinking water service provider or a recycled water provider in relation to a matter involving drinking water or recycled water).

Consult work practice *IM 4.5 Reminder letters for service provider obligations* for steps to be undertaken prior to issuing a show cause notice relating to non-compliance with SAMP (including review and audit), SLMP (including review and audit), CSS, DMP and annual reporting requirements.

If the written and verbal contacts with the service provider carried out under work practice IM 4.5 have not resulted in the submission of the required documentation then the regulator may issue a show cause notice. A service provider can be prosecuted for failure to comply with a requirement of the Act within the prescribed time, for example, without being issued with a show cause notice or a compliance notice.

All show cause notices are to be prepared by the Brisbane centre of expertise (COE). For service providers that fall under the jurisdiction of regional COE's, the action officer/decision maker in the regional COE should send an email to the Manager, Infrastructure Management enclosing all information relevant to the matter including details of all contacts (verbal and written) with the service provider. The decision maker in Brisbane COE should ensure that a copy of all subsequent correspondence with the service provider regarding this matter is forwarded to the action officer/decision maker in the regional COE.

Accurate and written records of any communications with service providers or other organisations, including verbal communications, must be kept and retained on the relevant file/s.

Step 2 - Prepare show cause notice

The decision maker should ensure that all reasonable efforts have been made to obtain compliance with the relevant section of the Act from the service provider prior to making the decision to issue a show cause notice.

This step should only be undertaken:

- where an appropriate response has not been received to the letter and follow up verbal contact reminding the service provider of their obligations under the Act, or
- the decision maker considers that the service provider's response is inadequate.

See steps 3 and 4 of the work practice *IM 4.5 Reminder letters for service provider obligations*. If a service provider advises that it will not comply, the department may opt to prosecute immediately.

The decision maker ensures that a draft show cause notice and covering letter is prepared. The decision maker may appoint an action officer or the decision maker may also be the action officer to carry out any investigation into suspected non-compliance with the Act by a service provider.

A show cause notice must be issued to a service provider prior to issuing a compliance notice for failure to comply with the following requirements under the Act:

- notice requiring service provider to provide information reasonably required (s. 13)

- regulator issued direction for water restriction (s. 42)
- submission of a SAMP (s. 73)
- submission of a SLMP (s. 82)
- submission of a CSS (s. 115)
- submission of a DMP (s. 123)
- submission of an OWUCP (s. 133)
- submission of an annual report for SAMP, SLMP, CSS, SOP and/or water advices (s. 141)
- submission of a SAMP/SLMP/CSS review (through the annual report or otherwise)
- submission of SAMP/SLMP audit (s. 108)
- complying with SAMP, SLMP, CSS, OWUCP, SOP and/or water advices
- the giving of water advices to occupiers of residential premises.

A show cause notice does not need to be issued to a service provider prior to issuing a compliance notice for failure to comply with the following requirements under the Act (s. 464(2)):

- submission of a DWQMP
- submission of an annual report for DWQMP
- submission of a DWQMP review (through the annual report or otherwise)
- submission of a DWQMP audit
- direction to a service provider to require a customer to prepare a WEMP.

Where the service provider is a company, the action officer should arrange for an ASIC search to confirm the company's current registered office address. Where the registered office address is different to the address in the service provider register kept by OWSR, two draft notices should be prepared - one showing the registered office address and one showing the address as listed in the service provider register.

The action officer gives the draft show cause notice, covering letter and all other relevant documentation including details of any contact with the service provider to the decision maker. If the decision maker approves the content of the draft show cause notice and covering letter and agrees that the show cause notice should be issued then the notice must be checked and approved by the Dedicated Legal Officer (DLO) prior to the notice being issued.

Show cause notices and the covering letter for service providers are to be saved electronically under: G:\WIR\Infra_Mgmt\Service Provider Reviews\ (and then under the service provider name). A copy of the final show cause notice should be filed electronically under G:\WIR\Infra_Mgmt\Service Provider Reviews\,General\Show cause & Compliance.

Once the DLO has approved the wording in the show cause notice, the documentation should be returned (through the decision maker) to the action officer. The action officer then prepares a final version (including file copy) for signature by the decision maker.

See Attachment B <attachments/im4_6_show_cause_samp_b.pdf> for a template for a cover letter and show cause notice for non submission of a SAMP.

See Attachment C <attachments/im4_6_show_cause_slmp_c.pdf> for a template for a cover letter and show cause notice for non submission of a SLMP.

See Attachment D <attachments/im4_6_show_cause_css_d.pdf> for a template for a cover letter and show cause notice for non submission of CSS.

See Attachment E <attachments/im4_6_show_cause_dmp_e.pdf> for a template for a cover letter and show cause notice for non submission of DMP.

See Attachment F <attachments/im4_6_sc_samp_review_f.pdf> for a template for a cover letter and show cause notice for a review of a SAMP.

See Attachment G <attachments/im4_6_sc_slmp_review_g.pdf> for a template for a cover letter and show

cause notice for a review of a SLMP.

See Attachment H <attachments/im4_6_sc_samp_audit_h.pdf> for a template for a cover letter and show cause notice for a SAMP audit.

See Attachment I <attachments/im4_6_sc_slmp_audit_i.pdf> for a template for a cover letter and show cause notice for a SLMP audit.

See Attachment J <attachments/im4_6_show_cause_ann_rpt_j.pdf> for a template for a cover letter and show cause notice for non submission of an Annual Report for SAMP, SLMP, CSS and SOP.

See Attachment L <attachments/im4_6_sc_info_request_l.pdf> for a template for a cover letter and show cause notice for not supplying information requested by the regulator under section 13 of the Act.

See Attachment M <attachments/im4_6_sc_water_restrict_m.pdf> for a template for a cover letter and show cause notice for not complying with a regulator direction to impose a water restriction.

See Attachment N <attachments/im4_6_sc_water_adv_n.pdf> for a template for a cover letter and show cause notice for non issuing of water advices to occupiers of residential premises. Non-compliance with this section would only be discovered when the annual report was received from the service provider or if we received a customer complaint regarding non-issue of water advices. This template therefore covers the annual reporting requirements for water advices as well.

Note: Show cause notices must be prepared as separate documents for each requirement not met. They cannot be combined in one show cause notice.

Step 3 - Show cause notice sent to service provider

Once signed by the decision maker the show cause notice and covering letter should be given to the project officer who carries out the following steps:-

- Copies the signed show cause notice and places the copy on the file
- Sends the original signed letter and show cause notice to the service provider, by registered mail (with acknowledgement), on the day of signing, or using some other method where the date of delivery can be confirmed. (where the service provider is a company as referenced in Step 1 above, two notices will be sent with respective covering letters)
- Records appropriate details in Recfind, in accordance with local office processes and relevant departmental standards (i.e. registers the file copy in Recfind)
- Places the file copy of the signed documents on or with the service provider file, as appropriate
- Returns the service provider file to the action officer/decision maker.

Step 4 - Submission about the show cause notice received/not received from service provider

Service providers may respond in a number of ways to the show cause notice.

4.1 Submission received from service provider

Check the submission received from the service provider.

If a show cause notice has been issued and a submission received, the regulator must consider the submission prior to issuing a compliance notice. The regulator, when issuing the compliance notice, must believe that the person is contravening or has contravened the Act, that the matter is capable of being rectified and that it is appropriate to give the person a notice to rectify the matter. This belief must be

reached after due consideration has been given to the submission (s. 465(4)). A person must comply with a compliance notice unless the person has a reasonable excuse. So if the submission in response to the show cause notice discloses a reasonable excuse, there is no point in proceeding with a compliance notice.

If the decision maker is not satisfied with the submission and believes it is appropriate to issue a compliance notice proceed to step 5.

4.2 No submission received from service provider

If the requirement of the Act has still not been met and no submission has been made, then the decision maker may issue a compliance notice.

The action officer/decision maker may choose to contact the service provider to discuss the show cause notice and the outstanding requirement prior to issuing a compliance notice.

If the service provider is contacted by phone the action officer/decision maker should listen to and record any explanation given for non-compliance, if one is offered. The service provider should then be advised that the department is considering issuing a compliance notice.

Accurate and written records of any communications with service providers or other organisations, including verbal communications, must be kept and retained on the relevant file/s.

Proceed to step 5 if a compliance notice is to be issued. If an extension of time request is made or received from the service provider in response to verbal contact refer to step 4.11

4.3 SAMP received from SP

Refer to work practice *IM 1.1 Processing a strategic asset management plan (SAMP) submitted for approval* for the process to be undertaken if the service provider sends the SAMP to the regulator in response to the above step.

4.4 SLMP received from SP

Refer to work practice *IM 8.1 Processing a System Leakage Management Plan* for the process to be undertaken if the service provider sends the SLMP to the regulator in response to the above step.

4.5 CSS received from SP

Refer to work practice *IM 2.1 Processing a customer service standard (CSS) received from a service provider* for the process to be undertaken if the service provider sends the CSS to the regulator in response to step 3.

4.6 DMP received from SP

Refer to work practice *IM 9.1 Processing a Drought Management Plan* for the process to be undertaken if the service provider sends the DMP to the regulator in response to step 3.

4.7 Annual report received from SP

Refer to work practice *IM 5.1 Processing an annual report for service provider obligations* for the process to be undertaken if the service provider sends the annual report for SAMP, SLMP, CSS, SOP and/or water advice (or an amended report including SAMP or SLMP review information) to the regulator in response to

step 3.

4.8 SAMP audit report received from SP

Refer to work practice *IM 1.3 Processing a Regular Audit Report for a Strategic Asset Management Plan* (this work practice is not approved at time of writing) for the process to be undertaken when the regular audit report is received in response to step 3.

4.9 SLMP audit report received from SP

Refer to work practice *IM 8.3 Processing a Regular Audit Report for a System Leakage Management Plan* (this work practice is not approved at time of writing) for the process to be undertaken when the regular audit report is received in response to step 3.

4.10 Other requirement/information received from SP

Refer to the appropriate work practice for the process to be undertaken when other requirement or requested information is received in response to step 3.

4.11 Request for extension of time received from SP

If the service provider requests an extension of time for the submission of the required document on reasonable grounds, the decision maker should ensure that a letter is prepared advising that extensions of time can not be granted under the Act. See attachment K <attachments/im4_6_ext_time_submiss_k.pdf> for a letter template.

Step 5 - Issue a compliance notice

Refer to work practice OWSR 3.2 Issuing a compliance notice (this work practice is not approved at time of writing) for action to be taken in the following circumstances:-

- If a response is received but the decision maker considers the response unacceptable
- If no response is received from the service provider
- If a response was received, timeframe agreed to, but then not met by the service provider
- If it is ascertained that there is no reasonable excuse for non-compliance.

Note: the above list is not necessarily all inclusive. The decision maker will need to exercise discretion in deciding when a compliance notice should be issued. If the service provider responds that it will not comply, the decision maker may instruct Legal Services that he/she wishes to proceed with prosecution without first issuing a compliance notice.

The issuing of a show cause notice process is complete

Responsibilities

Sections 464 and 465 of the Act give the regulator power to:

- Issue a show cause notice
- Issue a compliance notice

The regulator can delegate these powers to an appropriately qualified officer of the department (s.15). However, delegation does not prevent the regulator from exercising the above powers.

The *Water Supply (Infrastructure) Delegation (No. 1) 2009* delegates the powers of the regulator under sections 464 and 465 of the Act to:

- General Manager, Office of the Water Supply Regulator;
- Director, Water Industry Asset Management & Standards, Office of the Water Supply Regulator; and
- Manager, (Infrastructure Management), Water Industry Asset Management & Standards, Office of the Water Supply Regulator.

Decision makers must ensure they have, at the time of making their decision, a current delegation allowing them to make their decision. This is important as instruments of delegation can be revoked and replaced from time to time.

Definitions

"the Act" – means the *Water Supply (Safety and Reliability) Act 2008* and references to sections means sections of the Act.

"action officer" – means the person to whom the decision maker gives the responsibility of preparing a show cause notice under the Act. The action officer may also be the decision maker.

"annual report" – means a report prepared by a service provider under s. 141(1) of the Act.

"audit report" – means an audit report prepared by a service provider under s. 108 of the Act.

"business day" – means any day that is not a Saturday or Sunday or a public holiday, special holiday or bank holiday in the place where the relevant act is to be or may be done.

"Centre of Expertise" – means the departmental office in a centre responsible for Office of the Water Supply Regulator activities in a region. These centres are currently Brisbane, Toowoomba, Cairns and Western Queensland (administered by the Toowoomba office).

"COE" – means Centre of Expertise.

"chief executive" – means the Director-General, Department of Environment and Resource Management.

"compliance notice" – means a notice issued by the regulator to a service provider under s. 780 (of the Act).

"CSS" – means a customer service standard.

"CSS annual report" – means an annual report about a CSS, prepared under s. 141 (of the Act).

"customer service standard" – means a CSS prepared by a service provider under s. 115 of the Act, or changed under ss. 119 or 120 of the Act, and given to the regulator.

"decision maker" – means the person deciding to send a show cause notice to a service provider, under this work practice. This must be the regulator or a person who has been delegated the relevant powers of the regulator under the Act. For more information, see the "Responsibilities" section of this work practice.

"Dedicated Legal Officer" – means the Principal Lawyer from Legal Services outposted to the Office of the Water Supply Regulator or the Principal Project Officer, Legislative Advice.

"department" – means the Department of Environment and Resource Management.

"DLO" – means Dedicated Legal Officer.

"DMP" – means a drought management plan.

"drinking water" –

1. drinking water means water, for human consumption, intended primarily as water for drinking, whether or not the water is used for other purposes.
2. drinking water does not include—
 - i. water that is food as defined under the *Food Act 2006*; or
 - ii. water taken or supplied for domestic purposes under the *Water Act 2000*.

"drinking water quality management plan" – means a plan about the storage, treatment, transmission or reticulation of water for drinking by a drinking water service provider prepared under s. 95 of the Act and

approved under s. 99 of the Act.

"drinking water service" – means a water service that is—

- a. the treatment, transmission or reticulation of water for supply as drinking water; or
- b. water collection in a water storage, if the water in the storage—
 - i. includes recycled water; and
 - ii. is used to augment a drinking water supply.

"drinking water service provider" – means a water service provider for a drinking water service.

"drought management plan" – means a plan prepared by a service provider under s. 123 of the Act and registered by the department under s. 128 of the Act.

"DWQMP" – means drinking water quality management plan.

"guidelines" - means any guidelines issued by the regulator in relation to SAMP, SLMP, DWQMP, CSS and/or DMP.

"JR Act" – means Judicial Review Act 1991.

"Legal Services" – means a unit within the Strategic Policy and Legal business unit of the department.

"Outdoor water use conservation plan" – means a plan for reducing outdoor water use and promoting efficient outdoor water use by customers, prepared by a service provider under s. 133 of the Act and approved by the department under s. 134 of the Act

"OWSR" – means Office of the Water Supply Regulator.

"OWUCP" – means outdoor water conservation plan.

"registered service" – for a service provider, means a water or sewerage service for which the service provider is registered.

"regulator" – means the Director-General, Department of Environment and Resource Management (DERM).

"SAMP" – means strategic asset management plan.

"SAMP annual report" – means an annual report about an approved SAMP, prepared under s. 141 (of the Act).

"SAMP audit report" – means an audit report on a SAMP prepared under s. 108 (of the Act).

"service provider" – means a water service provider or a sewerage service provider.

"sewerage service"—

1. "Sewerage service" means-
 - a. sewage treatment; or
 - b. the collection and transmission of sewage through infrastructure; or
 - c. the disposal of sewage or effluent.
2. For chapter 2, part 3 of the Act, the term does not include a service supplied by infrastructure, if –
 - a. the infrastructure is used solely for mining purposes; or
 - b. the service is used only by
 - i. the owner of the infrastructure or the owner's guests or employees, including, for example,

- ii. guests at a resort; or
- ii. if the owner of the infrastructure is a body corporate for a community titles scheme under the Body Corporate and Community Management Act 1997-the occupants of lots in the scheme.

"sewerage service provider" – means a person registered under chapter 2, part 3, as a service provider for sewerage service.

"show cause notice" – means a notice issued by the regulator to a service provider under section 464(1) and that complies with s. 463 (of the Act).

"SLMP" – means a system leakage management plan.

"small service provider" – means:

- a. for a retail water service or sewerage service – a service provider with 1,000 or less connections to a registered service; or
- b. for a drinking water service that is the reticulation of water and is not a retail water service - a service provider with 1000 or less connections to a registered service; or
- c. for an irrigation service – a service provider with:
 - i. 100 or less users; or
 - ii. A volume throughput, in any of the last 5 financial years, of 10000 ML or less.
- d. for a water service other than a water service mentioned in paragraph (a), (b) or (c), a service provider:
 - i. With not more than 500 customers; and
 - ii. That mainly provides drainage services or water for domestic purposes or for watering stock.

"SOP" – means a system operating plan.

"SP" – means a service provider.

"strategic asset management plan" – means a plan certified by a registered professional engineer under chapter 2, part 4, division 1 (of the Act).

"system leakage management plan" – means a plan certified by a registered professional engineer under chapter 2, part 4, division 2 (of the Act).

"system operating plan" – means a system operating plan issued by the Queensland Water Commission to facilitate the achievement of the desired levels of service objectives for the region. At the time of writing the South East Queensland System Operating Plan has been issued by the QWC and applies to the Brisbane City Council, Ipswich City Council, Queensland Manufactured Water Authority, Queensland Water Commission and South East Queensland Water Grid Manager.

"Water Act" – means the Water Act 2000.

"water advice" – means a notice given to an occupier of residential premises (where the occupier is not the owner) which states the volume of water supplied to the premises during each billing period for the premises. The notice may also include information about ways to reduce the volume of water used or restrictions applying to the premises.

"water efficiency management plan" – means a plan prepared under chapter 2, part 3, division 6 of the Act.

"Water Industry Compliance Database" – means the database which records information relating to service providers and dams.

"water service" means –

1. "Water service" means-
 - a. water harvesting or collection, including, for example, water storages, groundwater extraction or replenishment and river water extraction; or
 - b. the transmission of water; or
 - c. the reticulation of water; or
 - d. drainage, other than stormwater drainage; or
 - e. water treatment or recycling.
2. For chapter 2, part 3 of the Act, the term does not include a service supplied by infrastructure, if –
 - a. the infrastructure is used solely for mining purposes; or
 - b. the service is used only by-
 - i. the owner of the infrastructure or the owner's guests or employees, including, for example, guests at a resort, or
 - ii. if the owner of the infrastructure is a body corporate for a community titles scheme under the Body Corporate and Community Management Act 1997-the occupants of lots in the scheme.

"water service provider" – means a person registered under chapter 2, part 3 (of the Act), as a service provider for a water service.

"WICD" – means the Water Industry Compliance Database.

References

The following documents should be referenced in conjunction with this work practice:-

- *Water Supply (Safety and Reliability) Act 2008*
- *Water Supply (Infrastructure) Delegation (No 1) 2009*
- Work Practice IM 4.5 – Reminder Letter for Service Provider obligations (WIR/2004/1820 in policy register)
- Work Practice OWSR 2.2 – Decision making guidelines (WIR/2005/2053 in policy register).
- NRW Compliance Investigations Manual (available on insite through the Compliance Coordination Unit website).

Officers involved in this work practice should also be familiar with, and comply with, requirements of the following departmental standards:

- Departmental standard ADM/2005/941 – Paper-based document management
- Departmental standard ADM/2002/965 – Decision making and requests for statements of reasons under the Judicial Review Act 1991
- Departmental standard ADM/2003/1402 – Information privacy.

Legislation

Water Supply (Safety and Reliability) Act 2008

Water Act 2000

Judicial Review Act 1991

Acts Interpretation Act 1954

Attachments

Attachment A - Issuing a show cause notice flowchart <attachments/im4_6_flowchart_a.pdf>

Attachment B - Template for show cause notice for SAMP <attachments/im4_6_show_cause_samp_b.pdf>

Attachment C - Template for show cause notice for SLMP <attachments/im4_6_show_cause_slmp_c.pdf>

Attachment D - Template for show cause notice for CSS <attachments/im4_6_show_cause_css_d.pdf>

Attachment E - Template for show cause notice for DMP <attachments/im4_6_show_cause_dmp_e.pdf>

Attachment F - Template for show cause notice for review of SAMP
<attachments/im4_6_sc_samp_review_f.pdf>

Attachment G - Template for show cause notice for review of SLMP
<attachments/im4_6_sc_slmp_review_g.pdf>

Attachment H - Template for show cause notice for audit of SAMP
<attachments/im4_6_sc_samp_audit_h.pdf>

Attachment I - Template for show cause notice for audit of SLMP <attachments/im4_6_sc_slmp_audit_i.pdf>

Attachment J - Template for show cause notice for annual report for SAMP, SLMP and/or CSS
<attachments/im4_6_show_cause_ann_rpt_j.pdf>

Attachment K - Template for Request for extension of time for submission of required documents
<attachments/im4_6_ext_time_submiss_k.pdf>

Attachment L - Template for show cause notice for regulator request for information
<attachments/im4_6_sc_info_request_l.pdf>

Attachment M - Template for show cause notice for regulator direction of water restriction
<attachments/im4_6_sc_water_restrict_m.pdf>

Attachment N - Template for show cause notice for water advices
<attachments/im4_6_sc_water_adv_n.pdf>

PHA-42

Not used

File number DAM/130/000(1946)

REGISTERED POST

556125684019

18 March 2011

Chief Executive Officer
Cairns Regional Council
PO Box 359
Cairns QLD 4870

Attention: [REDACTED]

DOCUMENT DESPATCHED BY DERM	
File No.	CBD/024213
File Location	DAM 1946
18 MAR 2011	
Action By	[REDACTED]
Registered Y/N	Y
Doc. Code	K/970251

Dear Sir

Show Cause Notice – Breach of development conditions – Moody Creek Detention Basin
Dam Number: Dam ID 1946

I refer to the above dam located on Lot 810 on SP 146132 in the local government area administered by Cairns Regional Council and recent phone discussions with your consultant, Mr [REDACTED], regarding the Emergency Action Plan for the above dam.

Departmental records indicate that your Council has failed to comply with a safety/development condition applying to Moody Creek Detention Basin. Your Council is therefore in breach of section 580 of the *Sustainable Planning Act 2009* (the Act).

Enclosed is a Show Cause Notice, issued pursuant to section 588(2) of the Act, inviting your Council to show cause as to why the department should not give your Council an enforcement notice under section 590 of the Act for this breach. Please note that any representation your Council may wish to make about the notice must be received by the department by the close of business on **18 April 2011**.

Should you have any questions about this matter, please do not hesitate to contact me on [REDACTED]

Yours sincerely

[REDACTED]
[REDACTED]
[REDACTED]
A/Director, Dam Safety (Water Supply)
Delegate of the Chief Executive

Street Address
Floor 3, Mineral House, 41 George Street, Brisbane Queensland 4000

Postal Address
GPO Box 2454, Brisbane, Queensland, 4001

Telephone + 61 7 3239 [REDACTED]
Facsimile + 61 7 3224 [REDACTED]

Website www.derm.qld.gov.au

ABN 46 640 294 485

DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT

SHOW CAUSE NOTICE*Sustainable Planning Act 2009***SHOW CAUSE NOTICE RELATING TO MOODY CREEK DETENTION BASIN
(DAM ID 1946) LOCATED ON LOT 810 ON SP 146132****1.0 Citation**

This notice may be cited as the show cause notice relating to Moody Creek Detention Basin (Dam ID 1946) located on Lot 810 on SP 146132.

2.0 Power to give notice

This notice is given under section 588 of the *Sustainable Planning Act 2009* (Qld) (the Act).

3.0 Reference to person

A reference to the person in this notice is a reference to the person specified in section 4 of the notice.

4.0 Person to whom this notice is given

This notice is given to:

Name: Cairns Regional Council (the person)
Address: 119-145 Spence Street
Cairns QLD 4870

COPY

5.0 Facts and circumstances forming the basis for the belief that an enforcement notice should be given

5.1 The person is the owner of the dam (Dam ID 1946) as shown on the attached map.

5.2 The delegate who has issued this notice reasonably believes the person is contravening a provision of the Act.

5.3 Pursuant to section 590 of the Act if an assessing authority reasonably believes that a person has committed, or is committing, a development offence the assessing authority may give the person an enforcement notice. That notice can require the person to do either or both of the following:

- to refrain from committing the offence
- to remedy the commission of the offence in the way stated in the notice.

5.4 Under section 588 of the Act the assessing authority must give the person a show cause notice inviting the person to show cause why the enforcement notice should not be given.

5.5.1 The delegate who has issued this notice reasonably believes the person has committed and is continuing to commit a development offence in the following way:

- A development offence includes an offence against section 580 of the Act: see the definition of "*development offence*" in Schedule 3 of the Act.
- Section 580 of the Act provides that a person must not contravene a development approval, including any condition in the approval.
- Special Condition 11 of Development Permit 118920 issued under the now repealed *Integrated Planning Act 1997* required the person to prepare an Emergency Action Plan for Moody Creek Detention Basin and provide a copy to the chief executive (Director-General, Department of Environment and Resource Management) by 1 October 2002.
- Development Permit 118920 is a development approval that continues as a development approval under the Act by force of section 801 of the Act as read with the Schedule 3 definition of "*development approval*".
- The chief executive has not received a copy of any Emergency Action Plan for Moody Creek Detention Basin from the person.
- The person has committed and is continuing to commit a development offence by failing to comply with Special Condition 11 of Development Permit 118920 in contravention of section 580 of the Act.

6.0 Representations may be made about the show cause notice

6.1 The person may make representations about this show cause notice as to whether an enforcement notice should be given.

6.2 The representations must be made in writing.

6.3 The representations must be made to:

A/Director, Dam Safety (Water Supply)
Office of the Water Supply Regulator
Department of Environment and Resource Management
Floor 3 Mineral House
41 George Street
GPO Box 2454
Brisbane Qld 4001

Fax (07) 3224 7999

6.4 The representations must be received at the above address by the close of business on **18 April 2011**.

This show cause notice is issued on the 18th day of MARCH 2011.

A/Director, Dam Safety (Water Supply)
A duly authorised delegate of the Director-General
Department of Environment and Resource Management

File number CBD/024220

REGISTERED POST

14 November 2011

Chief Executive Officer
Redland City Council
Corner Bloomfield Street and Middle Street
CLEVELAND QLD 4163

Dear Sir

Crystal Waters Upper and Lower Dams - Dam ID 2002

I am writing in relation to the above mentioned dams located on Lot 1 on Plan Survey Plan 102048 in the local government area administered by the Redland City Council.

In a letter to the Council dated 2 July 2010, the department advised that an extension of time requested by the Council to comply with certain dam safety condition requirements had been granted. The extension to 30 November 2010 required the Council complete the following tasks relating to the safety conditions applied to this dam.

- DS 5 – preparation of the Data Book
- DS 7 – submitting a copy of the Standing Operating Procedures to the Dam Safety Regulator
- DS 11 – submitting a copy of the Comprehensive Inspection Report to the Dam Safety Regulator
- DS13 – submitting a copy of the Emergency Action Plan (EAP) to the Dam Safety Regulator.

It is noted that the Council provided a draft copy of an EAP for the dams to this office on 31 January 2011.

Departmental records indicate that the Council has failed to comply with the above safety/development conditions applying to Crystal Waters Upper and Lower Dams (Dam ID 2002) and therefore in breach of section 580 of the *Sustainable Planning Act 2009* (the Act).

Enclosed is a Show Cause Notice, issued pursuant to section 588(2) of the Act, inviting the Council to show cause as to why the department should not give the Council an Enforcement Notice under section 590 of the Act for these breaches.

Street Address
Floor 3, Mineral House, 41 George Street, Brisbane Queensland 4000

Postal Address
GPO Box 2454, Brisbane, Queensland, 4001

Telephone + 61 7 3239 [REDACTED]
Facsimile + 61 7 3224 7999

Website www.derm.qld.gov.au

ABN 46 640 294 485

Please note that any representation the Council may wish to make about the show cause notice must be received by the department by the close of business on **16 December 2011**.

Should you have any questions about this matter, please do not hesitate to contact me on

[REDACTED]
Yours sincerely

[REDACTED]
Acting Director, Dam Safety
Delegate of the Chief Executive
Office of the Water Supply Regulator

DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT

SHOW CAUSE NOTICE*Sustainable Planning Act 2009***SHOW CAUSE NOTICE RELATING TO CRYSTAL WATERS UPPER AND LOWER DAMS (DAM ID 2002) LOCATED ON LOT 1 OF SURVEY PLAN 102048****1.0 Citation**

This notice may be cited as the show cause notice relating to Crystal Waters Upper and Lower Dams (Dam ID 2002) located on Lot 1 on Survey Plan 102048.

2.0 Power to give notice

This notice is given under section 588 of the *Sustainable Planning Act 2009* (Qld) (the Act).

3.0 Reference to person

A reference to the person in this notice is a reference to the person specified in section 4 of the notice.

4.0 Person to whom this notice is given

This notice is given to:

Name: Redland City Council (the person)
Address: Corner Bloomfield Street and Middle Street
Cleveland Queensland 4163

5.0 Facts and circumstances forming the basis for the belief that an enforcement notice should be given

5.1 The person is the owner of the dam (Dam ID 2002) as shown on the attached map.

5.2 The delegate who has issued this notice reasonably believes the person is contravening a provision of the Act.

5.3 Pursuant to section 590 of the Act if an assessing authority reasonably believes that a person has committed, or is committing, a development offence the assessing authority may give the person an enforcement notice. That notice can require the person to do either or both of the following:

- to refrain from committing the offence

- to remedy the commission of the offence in the way stated in the notice.
- 5.4 Under section 588 of the Act the assessing authority must give the person a show cause notice inviting the person to show cause why the enforcement notice should not be given.
- 5.5.1 The delegate who has issued this notice reasonably believes the person has committed and is continuing to commit a development offence in the following way:
- A development offence includes an offence against section 580 of the Act: see the definition of “*development offence*” in Schedule 3 of the Act.
 - Section 580 of the Act provides that a person must not contravene a development approval, including any condition in the approval.
 - On 17 December 2009, a delegate of the chief executive issued under section 355 of the *Water Supply (Safety and Reliability) Act 2008*, an Information Notice specifying safety conditions to apply to Crystal Waters Upper and Lower Dams. The conditions are contained within a Dam Safety Condition Schedule. As advised in that notice, these safety conditions in the schedule were taken to be conditions taken to apply to a development permit for the dam.
 - Condition DS 5 of the Dam Safety Condition Schedule required the person to prepare a Data Book in accordance with Condition DS 5 and the *Queensland Dam Safety Guidelines* by no later than 31 August 2010.
 - Condition DS 7 of the Dam Safety Condition Schedule required the person to develop Standing Operating Procedures in accordance with Condition DS 7 and the *Queensland Dam Safety Guidelines* and submit a copy of the Standing Operating Procedures to the Dam Safety Regulator by 31 August 2010 and to ensure the Standing Operating Procedures are reviewed by the 31st of August each calendar year.
 - Condition DS 11 of the Dam Safety Condition Schedule required the person to carry out a Comprehensive Inspection of the dam in accordance with Condition DS 11 and the *Queensland Dam Safety Guidelines* on or before 31 August 2010 and submit a Comprehensive Inspection Report to the chief executive within 2 months of completion of the Comprehensive Inspection.
 - By letter dated from Peter Allen, Director of Dam Safety (a delegate of the chief executive) to the person, dated 2 July 2010, the person was granted an extension of time to prepare a Data Book, develop Standing Operating Procedures and carry out a Comprehensive Inspection of the dam to 30 November 2010.
 - No Standing Operating Procedures or Comprehensive Inspection Report, have been received by the chief executive and no advice has been received by the chief executive that a Data Book has been prepared and maintained.
 - Condition DS 13 of the Dam Safety Condition Schedule required the person to prepare and maintain an Emergency Action Plan for the dam in accordance with Condition DS13 and the *Queensland Dam Safety Guidelines* and provide a copy of the document to the Dam Safety Regulator by the 31 August 2010.
 - A draft copy only of the Emergency Action Plan was received by the chief executive on 31 January 2011.
 - The person has committed and is continuing to commit development offences by failing to comply with Conditions DS 5, DS 7, DS 11 and DS

13 of the Dam Safety Condition Schedule for Crystal Waters Upper and Lower Dams in contravention of section 580 of the Act.

6.0 Representations may be made about the show cause notice

6.1 The person may make representations about this show cause notice as to whether an Enforcement Notice should be given.

6.2 The representations must be made in writing.

6.3 The representations must be made to:

A/Director, Dam Safety (Water Supply)
Office of the Water Supply Regulator
Department of Environment and Resource Management
Floor 3 Mineral House
41 George Street
GPO Box 2454
Brisbane Qld 4001

Fax (07) [REDACTED]

6.4 The representations must be received at the above address by the close of business on **16 December 2011**.

This Show Cause Notice is issued on the *14th* day of *NOVEMBER* 2011.

[REDACTED]
[REDACTED]
Acting Director, Dam Safety
A duly authorised delegate of the Director-General
Department of Environment and Resource

Department of Environment and Resource Management

Sustainable Planning Act 2009

Public Service Act 2008

Sustainable Planning Act Delegation (No. 1) 2011

1 Citation

This delegation may be cited as the *Sustainable Planning Act Delegation (No. 1) 2011*.

2 Definitions

For the purposes of this delegation —

Act means the *Sustainable Planning Act 2009*, including all subordinate legislation made under the Act

assessing authority, assessable development, assessment manager, referral agency, or concurrence agency means assessing authority, assessable development, assessment manager, referral agency or concurrence agency within the meaning of and for the purposes of the Act

chief executive means the Director-General of the Department of Environment and Resource Management

DERM means the Department of Environment and Resource Management

IDAS means the Integrated Development Assessment System under the Act.

3 Commencement

This delegation shall commence on the day it is executed.

4 Power to Delegate

This delegation is made under section 103(1) of the *Public Service Act 2008*.

5 Powers Delegated

The powers of the chief executive as an assessment manager, entity under section 378, referral agency or provider of third party advice or comment under section 256 referred to in Schedule 1 and embodied in the sections of the Act referred to in Schedule 1 are delegated to the holders of the offices or positions in the Categories described in Schedule 1.

A reference to a Category in Schedule 1 is a reference to a Category of office or position referred to in Schedule 2 and includes all of the offices or positions listed in the Category in Schedule 2.

6 Revocation

This instrument revokes the *Sustainable Planning Act Delegation (No. 2) 2010*.

7 Entire Document

This delegation is comprised of eleven (11) pages including Schedule 1 and Schedule 2.

8 Delegation

This delegation is made by **John Bradley**, Director-General, Department of Environment and Resource Management.

Signed:

Certified correct for signature Director, Legal Services 22 / 03 / 2011
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John Bradley
Director-General
Department of Environment and Resource Management

Date: 05 / 04 / 2011

Schedule 1

Sustainable Planning Act 2009

Powers established by sections of legislation delegated to categories of offices within the Department of Environment and Resource Management

Section Number	SECTION HEADING	Category A
All sections	All sections of the <i>Sustainable Planning Act 2009</i> , including all subordinate legislation, conferring powers on the chief executive as in force from time to time.	√

Section Number	SECTION HEADING ¹	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10	Category 11	Category 12	Category 13	Category 14	Category 15	Category 16	Category 17	Category 18	Category 19	Category 20	Category 21	Category 22	
Application Stage																								
256	Assessment manager or concurrence agency may seek advice or comment about application	√	√		√		√	√		√	√	√		√	√		√	√		√			√	
260(1)(a)	Applying for development approval — receiving application																				√			
266	Notice about application that is not a properly made application	√	√		√		√	√		√	√	√	√	√				√		√				
267	Notice about properly made application	√	√		√		√	√		√	√	√	√	√				√		√				
Information and Referral Stage																								
271	Referral agency responses before application is made	√	√		√		√			√	√			√	√	√		√		√	√		√	
272	Applicant gives material to referral agency																			√				
274	When application taken not to have lapsed	√	√		√		√			√	√			√	√			√						
276	Information request to applicant	√	√		√		√	√		√	√			√	√			√						
277	Extending information request period	√	√	√	√	√	√	√		√	√	√	√	√	√			√		√			√	
279	Lapsing of application if no response to information request	√	√		√		√			√	√			√	√			√						
280	When application taken not to have lapsed	√	√		√		√			√	√			√	√			√						
281	Referral agency to advise assessment manager of response	√	√		√	√	√	√		√	√	√		√	√		√	√					√	
282	Referral agency assesses application	√	√		√		√			√	√			√	√	√		√					√	
284	Extending referral agency's assessment period	√	√	√	√	√	√	√		√	√	√	√	√	√			√					√	

¹ Descriptions in the Section Heading column are for information purposes only. These descriptions are not to be relied upon as statements of the power delegated by any person exercising a delegation under that particular section of the legislation.

<i>Section Number</i>	<i>SECTION HEADING¹</i>	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10	Category 11	Category 12	Category 13	Category 14	Category 15	Category 16	Category 17	Category 18	Category 19	Category 20	Category 21	Category 22
285	When concurrence agency must give response for particular matters	√	√		√		√	√		√	√			√	√			√					√
287	Concurrence agency's response powers	√	√		√		√			√	√			√	√			√					√
288	Limitation on concurrence agency's power to refuse application	√	√		√		√			√	√			√	√			√					√
290	How a concurrence agency may change its response or give late response	√	√		√		√			√	√			√	√			√					√
291	When advice agency must give response for particular matters	√	√		√		√	√		√	√			√	√					√			√
292	Advice agency's response powers	√	√		√		√			√	√			√	√			√					√
Decision Stage																							
312	When assessment manager must not assess part of an application	√	√					√															
313	Code assessment—generally	√	√		√		√			√	√			√				√					
317	Assessment manager may give weight to later planning instrument, code, law or policy	√	√		√		√			√	√			√				√					
318	Decision-making period—generally	√	√		√	√	√	√		√	√	√	√	√				√					
321	Applicant may stop decision-making period to request chief executive's assistance	√	√		√		√			√	√			√	√			√					
324	Decision generally	√	√		√		√			√	√			√				√					
325	Effect of concurrence agency's response	√	√		√		√			√	√			√				√					
326	Other decision rules	√	√		√		√			√	√			√				√					
327	Decision if application under s 242 requires assessment	√	√		√		√			√	√			√				√					
328	Effect of concurrence agency's response	√	√		√		√			√	√			√				√					
329	Other decision rules	√	√		√		√			√	√			√				√					
331	Deemed approval of applications	√	√		√		√			√	√			√				√					
334	Assessment manager to give notice of decision	√	√		√		√	√		√	√			√				√					
335	Content of decision notice	√	√		√		√	√		√	√			√				√					
336	Material to be given with decision notice	√	√		√		√	√		√	√			√				√					
337	Assessment manager to give copy of decision notice to principal submitter	√	√		√		√	√		√	√			√				√					
348	Agreements	√	√				√			√	√			√	√			√					
Changing or Amending Development Approvals																							
350	Meaning of minor change	√	√				√			√	√			√	√			√					
352	Assessment manager to advise referral agencies about changed applications	√	√		√		√		√	√	√	√	√	√			√	√		√			√
354	Effect on IDAS—changes about matters relating to submissions or information requests	√	√							√	√			√						√			
355	Effect on IDAS—other changes	√	√																	√			
Missed Referral Agencies																							
357	Notice of missed referral agency	√	√		√		√			√	√	√		√	√			√		√			√
Dealing with Decision Notices and Approvals																							
362	Assessment manager to consider representations	√	√				√	√		√	√			√				√					

Section Number	SECTION HEADING ¹	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10	Category 11	Category 12	Category 13	Category 14	Category 15	Category 16	Category 17	Category 18	Category 19	Category 20	Category 21	Category 22
363	Decision about representations	√	√				√	√		√	√			√				√					
367	What is a <i>permissible change</i> for a development approval	√	√		√		√			√	√			√	√			√					
368	Notice about proposed change before request is made	√	√		√		√	√		√	√	√	√	√	√		√	√					√
371	When owner's consent required for request	√	√		√		√	√		√	√			√	√		√	√					
373	Particular entities to assess request for change	√	√		√		√	√		√	√			√	√		√	√					√
374	Responsible entity to assess request	√	√		√		√	√		√	√			√	√		√	√					
375	Responsible entity to decide request	√	√		√		√	√		√	√			√	√			√					
376	Notice of decision	√	√		√		√	√		√	√			√	√		√	√					
378	When condition may be changed or cancelled by assessment manager or concurrence agency	√	√		√		√			√	√			√	√			√					√
381	Assessment manager to cancel approval	√	√				√	√		√	√			√				√					
385	Concurrence agency may advise assessment manager about request	√	√		√		√	√		√	√	√	√	√	√		√	√					√
386	Deciding particular requests	√	√		√		√	√		√	√			√	√		√	√					
387	Assessment manager to decide request	√	√		√		√	√		√	√	√	√	√	√		√	√					
388	Deciding request	√	√		√		√	√		√	√	√	√	√	√		√	√					
389	Assessment manager to give notice of decision	√	√		√		√	√		√	√	√	√	√	√		√	√					
Ministerial IDAS Powers																							
418	Ministerial directions to assessment managers—particular applications	√	√		√		√	√		√	√			√	√		√	√					
419	Ministerial directions to assessment managers—conditions	√	√		√		√	√		√	√			√	√		√	√					
420	Ministerial directions to concurrence agencies	√	√		√		√	√		√	√			√	√		√	√					
421	Ministerial directions to applicants	√					√			√	√			√									
428	Original assessment manager to assist Minister	√	√		√		√	√		√	√			√	√			√					
Miscellaneous Provision																							
434	Refunding fees	√	√				√	√		√	√			√	√			√		√			
Making an Appeal to Court																							
485	Respondent and co-respondents for appeals under div 8	√	√				√	√						√				√					√
487	Respondent and co-respondents for appeals under div 10	√	√				√	√						√				√					
488	How an entity may elect to be a co-respondent	√	√				√	√						√				√					√
Provisions About Offences, Notices and Orders																							
588	Giving show cause notice	√	√				√											√	√				
590	Giving enforcement notice	√	√				√											√	√				
591	Restriction on giving enforcement notice	√	√																				
592	Specific requirements of enforcement notice	√	√																				
596	Assessing authority may take action	√	√				√			√	√			√				√					
597	Proceedings for offences	√	√				√	√						√				√	√				
599	Magistrates Court may make orders	√	√																				

Section Number	SECTION HEADING ¹	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10	Category 11	Category 12	Category 13	Category 14	Category 15	Category 16	Category 17	Category 18	Category 19	Category 20	Category 21	Category 22
		623	Evidentiary aids generally	√	√		√		√	√						√		√		√			
Public Access to Planning and Development Information																							
723	Meaning of available for inspection and purchase	√	√																			√	
728	Documents assessment manager must keep available for inspection and purchase—development application	√	√				√			√	√			√				√			√		
729	Documents assessment manager must keep available for inspection and purchase—general.	√	√				√			√	√			√				√			√		
730	Documents assessment manager must keep available for inspection only	√	√				√			√	√			√				√			√		
731	Documents referral agency must keep available for inspection only	√	√				√			√	√			√				√			√		

Sustainable Planning Regulation 2009

Powers established by sections of legislation delegated to categories of offices within the Department of Environment and Resource Management

Section Number	SECTION HEADING ²	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7	Category 8	Category 9	Category 10	Category 11	Category 12	Category 13	Category 14	Category 15	Category 16	Category 17	Category 18	Category 19	Category 20	Category 21	Category 22
		Dictionary definition “wetland”	Approval of a ‘Map of referable wetlands’																				

² Descriptions in the Section Heading column are for information purposes only. These descriptions are not to be relied upon as statements of the power delegated by any person exercising a delegation under that particular section of the legislation.

Schedule 2

List of offices within the Department of Environment and Resource Management in each category

Note:
Officers in Category A have a delegation for ALL SECTIONS, whether or not specifically mentioned in Schedule 1 for all the areas of responsibility for the department. These officers have all the powers delegated to any other category of officers. Officers in Categories 1, 4, 5, 19 and 20 have powers delegated to the sections specifically mentioned in Schedule 1 for all the areas of responsibility for the department. Prior to exercising the power, the delegate must consult with appropriate persons and officers from relevant areas within the department for the application. Officers in Categories other than Categories A, 1, 4, 5, 19 and 20 have powers delegated to the sections specifically mentioned in Schedule 1 for the identified responsibility.

Category of Officer	Holder of Office
Category A	Deputy Director-General Associate Director-General Assistant Director-General Senior Director reporting to Assistant Director-General, Regional Service Delivery Senior Director, Environment and Natural Resource Regulation Director reporting to Assistant Director-General, Regional Service Delivery Director, Environment and Natural Resource Regulation Regional Services Director, Regional Service Delivery Director reporting to Regional Services Director, Regional Service Delivery General Manager Senior Director reporting to a General Manager Director reporting to a General Manager Director reporting to a Senior Director Director, Water Management
Category 1	Regional Manager, Regional Service Delivery Team Leader reporting to a Regional Manager, Environmental Services, Regional Service Delivery Director Waste Avoidance and Resource Efficiency Program Development Manager reporting to a Regional Manager, Regional Service Delivery Manager reporting to a Director, Environment and Natural Resource Regulation Director, Sustainable Communities and Landscapes, Threatened Species Principal Planning Officer, Regional Service Delivery Principal Advisor, Regional Service Delivery Principal Natural Resource Officer, Regional Service Delivery
Category 2	<u>All sections indicated for Environmental Services / Land Services responsibility³</u> Team Leader, Technical Operations Branch, Environment and Natural Resource Regulation Chief Scientific Advisor, Technical Operations Branch, Environment and Natural Resource Regulation Principal Environmental Officer, Regional Service Delivery Principal Natural Resource Officer Senior Natural Resource Officer Principal Planning Officer Senior Planning Officer Manager, Land Services, Regional Service Delivery

³ This relates to the following:

- items 11 and 12 of table 1 in schedule 7 of the *Sustainable Planning Regulation 2009*,
- items 1, 12, 13, 14, 19, 22, 23, 24, 36, 37, 38, 41, 42, 43, 44, 45 and 46 of table 2 in schedule 7 of the *Sustainable Planning Regulation 2009*;
- items 5, 11, 18, 19, 20, 21, 22 and 23 of table 3 in schedule 7 of the *Sustainable Planning Regulation 2009*;
- items 1, 5, 6, 7, 9 and 12 of table 3 in schedule 6 of the *Sustainable Planning Regulation 2009*; and
- items 1, 3 and 8 of table 4 in schedule 6 of the *Sustainable Planning Regulation 2009*.

Category of Officer	Holder of Office
	Director, Heritage, Natural Resources and Environment Manager, Heritage, Natural Resources and Environment Manager, Threatened Species, Sustainable Landscapes, Queensland Parks and Wildlife Service Manager Cultural Heritage, Regional Service Delivery Regional Cultural Heritage Coordinator, Regional Service Delivery Principal Heritage Officer, Regional Service Delivery Team Leader reporting to a Manager in Environmental Services, Regional Service Delivery
Category 3	<u>All sections indicated for Contaminated Land responsibility</u> Principal Scientific Advisor, Technical Operations Branch, Environment and Natural Resource Regulation Principal Environmental Officer, Technical Operations Branch, Environment and Natural Resource Regulation
Category 4	<u>All sections indicated for Planning and Coordination⁴ responsibility</u> Natural Resource Management Officer Senior Natural Resource Officer Natural Resource Officer Natural Resource Planning Officer Principal Environmental Planning Officer Senior Environmental Planning Officer Environmental Planning Officer Senior Planning Officer Planning Officer Senior Project Officer Project Officer Senior Officer Senior Resource Planning Officer Senior Lands Officer Regional Coordinator, Regional Service Delivery Principal Scientist Principal Conservation Officer Senior Conservation Officer Conservation Officer Principal Biodiversity Planning Officer Senior Biodiversity Planning Officer Biodiversity Planning Officer
Category 5	<u>All sections indicated for Planning and Coordination⁴ responsibility</u> Administration Officer Administration Officer (Planning and Environment) Trainee Project Officer (Planning and Environment)
Category 6	<u>All sections indicated for Referable Dams responsibility</u> Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator Director, Water Industry Asset Management and Standards General Manager, Office of the Water Supply Regulator
Category 7	<u>All sections indicated for Referable Dams responsibility</u> Principal Engineer, Water Industry Asset Management & Standards, Office of the Water Supply Regulator

⁴ Planning and Coordination responsibility is to provide a single agency notice under IDAS where DERM has interests across multiple jurisdictions for the Act. Decisions for particular jurisdictions under the Act will be made by an officer with a specific delegation for that jurisdiction.

Category of Officer	Holder of Office
Category 8	<u>All sections indicated for Referable Dams responsibility</u> General Manager, Office of the Water Supply Regulator
Category 9	<u>All sections indicated for Vegetation Management⁵ responsibility</u> Manager, Vegetation Management Policy Manager, Vegetation Management Strategy Principal Natural Resource Officer, South East, South West Principal Natural Resource Officer (Appeals and Restoration) Principal Natural Resource Officer Resource Management Officer, Emerald Senior Vegetation Management Officer Senior Natural Resource Management Officer Senior Natural Resource Officer (Appeals) Senior Land Resource Officer, Vegetation Management
Category10	<u>All sections indicated for Vegetation Management⁵ responsibility</u> Extension Officer Senior District Advisor Natural Resource Officer Natural Resource Officer (Regional Ecosystem Assessment) Senior Natural Resource Officer (Regional Ecosystem Assessment) Vegetation Management Officer Natural Resource Management Officer Vegetation Management Officer (Assessment & Extension)
Category 11	<u>All sections indicated for Vegetation Management⁴ responsibility</u> Administration Officer (Vegetation Management) Vegetation Management Officer (Administration)
Category 12	<u>All sections indicated for Vegetation Management⁴ responsibility</u> Land Administration Officer
Category 13	<u>All sections indicated for Vegetation Management⁴ responsibility</u> Director, Vegetation Management and Land Planning
Category 14	<u>All sections indicated for Declared Catchment Area responsibility</u> Manager, Central West Region, North Region, South East Region, South West Region Regional Services Director, Regional Service Delivery Regional Manager

⁵ This relates to vegetation clearing or clearing vegetation under schedule 6 or 7 of the *Sustainable Planning Regulation 2009*.

Category of Officer	Holder of Office
Category 15	<u>All sections indicated for Land Resources⁶ responsibility</u> Senior Land Resource Officer Principal Natural Resource Officer Senior Natural Resource Officer Principal Planning Officer Senior Planning Officer Senior Technical Officer Senior Project Officer Land Resource Officer Manager Principal Scientist
Category 16	<u>All sections indicated for Water Resources⁷ responsibility for staff with a Level A competency⁸</u> Administration Officer Administration Officer (Licensing) Administration Officer (Water Management) Administration Officer (Water Licensing) Engineer, Statewide Great Artesian Basin Scheme Implementation Extension Officer Hydrologist Natural Resource Management Officer Natural Resource Officer Operations Officer Operations Officer (Groundwater Drilling) Project Officer Regional Administration Officer Regional Admin Officer (Licensing) Resource Management Officer Senior Administration Officer Senior Administration Officer (Licensing) Senior Technical Officer Technical Officer Technical Officer (Drilling)
Category 17	<u>All sections indicated for Water Resources⁷ responsibility for staff with the stated competency⁸ requirements</u> <u>Sub-category 1 — No competency⁸ requirement</u> Director Manager, Water Management and Use Manager, Water Projects Manager, Water Services Team Leader (Water Authorisations) Principal Policy Officer, Water Management

⁶ This relates to acid sulfate soils, items 44 and 45 of table 2 and item 22 of table 3 in schedule 7 of *Sustainable Planning Regulation 2009*.

⁷ This relates to items 9, 10 and 12 of table 2 in schedule 7 of the *Sustainable Planning Regulation 2009*

⁸ Competency refers to the Sustainable Planning Act Competency when produced, or the Integrated Planning Act Competency in the interim. An officer with a Level B Competency also holds a Level A Competency.

Category 17 continued	<u>All sections indicated for Water Resources⁷ responsibility for staff with the stated competency⁸ requirements</u> <u>Sub-category 2 — Level B competency⁷ requirement</u> Engineer, Statewide Great Artesian Basin Scheme Implementation Extension Officer Hydrologist Leader, Water Resource Management Natural Resource Officer Operations Officer Planning Officer Principal Natural Resource Officer Principal Project Manager Principal Technical Officer (Drilling) Project Officer Project Officer (Water Management) Resource Management Officer Resource Management Officer (Water) Senior Advisor Regulatory Services Senior Hydrologist Senior Natural Resource Officer Senior Planning Officer Senior Policy Officer Senior Project Officer Senior Technical Officer Senior Technical Officer (Drilling) Stream Control Officer Technical Officer Technical Officer (Water Management and Use)
Category 18	Manager, Compliance Support Unit Principal Advisor (Policy Support), Compliance Support Unit Principal Advisor (Training and Regional Support), Compliance Support Unit Manager, Regional Investigations Senior Investigator Regional Investigator Investigator
Category 19	Manager, Implementation and Support Unit, Regional Service Delivery Team Leader, Implementation and Support Unit, Regional Service Delivery Senior Project Officer, Implementation and Support Unit, Regional Service Delivery Manager Business Operations, Implementation and Support Unit, Regional Service Delivery Principal Operations Officer, Implementation and Support Unit, Regional Service Delivery Senior Administration Officer, Implementation and Support Unit, Regional Service Delivery
Category 20	Environmental Support Officer, Regional Service Delivery Senior Administration Officer, Technical Operations Branch, Environment and Natural Resource Regulation
Category 21	Director, Environmental Planning, Natural Resources and Environment
Category 22	Principal Project Officer, Technical Operations Branch, Environment and Natural Resource Regulation

Queensland Dam Safety Management Guidelines

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Queensland
Government
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and Mines

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The Director, Product Marketing
Locked Bag 40
Coorparoo Delivery Centre Q 4151

Copies of this publication are available from:

Director,
Water Industry Asset Management and Standards
GPO Box 2454
Brisbane Q 4000

Phone: +61 7 3224 8762
Fax: +61 7 3224 7999
Web site: www.nrm.qld.gov.au

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1 Introduction

Currently, there are an estimated 300 referable dams in Queensland. These dams fulfil an important role in our society including water supply, hydroelectric power generation, process water management, flood control, sediment and water control and recreation.

The failure of these dams can have significant consequences ranging from loss of life or injury to economic loss and damage to property and the environment. Queensland has had a good dam safety record. However, continuing incidences of dam failures around the world highlight the need and importance of dam safety management programs.

In Queensland, under the *Water Act 2000* and common law, responsibility for the safety of a dam rests with the dam owner. Dam owners may be liable for loss and damage caused by the failure of a dam or the escape of water from a dam. Consequently, dam owners need to be committed to dam safety and have an effective dam safety management program. A dam safety management program is intended to minimise the risk of a dam failing and to protect life and property from the effects of such a failure should one occur.

1.1 Purpose

The aim of this guideline is to describe practices dealing with the construction and management of referable dams and assist dam owners to safely manage their dams and protect the community from dam failure.

It is to be used by:

- owners of referable dams
- operators of referable dams
- employees of referable dam owners and operators
- consultants for referable dam owners and operators.

This guideline outlines best practice in dam safety and is primarily advisory in nature. However, development permit conditions imposed on individual dams under the provisions of the *Water Act 2000* and the *Integrated Planning Act 1997*, may “call up” or reference relevant sections of these guidelines as a way of undertaking particular activities (eg preparing an emergency action plan). To assist users of these guidelines a brief overview of Queensland’s regulatory arrangements for referable water dams is given in section 3.

1.2 Scope

This guideline has been developed specifically for referable dams. However, it may be used by owners of dams which are not referable to develop a dam safety management program.

1.2.1 What is a referable dam?

A dam is referable if:

- a failure impact assessment is required to be carried out under the *Water Act 2000*, and
- that assessment states that the dam has or will have a Category 1 or Category 2 failure impact rating. And
- the chief executive has, under the *Water Act 2000*, accepted the assessment.

In addition, some dams may be made referable by:

- a regulation made under the *Water Act 2000*, or
- the transitional provisions in the *Water Act 2000*.

A failure impact assessment is required when a dam is or will be:

- more than 8 metres in height and have a storage capacity of more than 500 megalitres or
- more than 8 metres in height and have a storage capacity of more than 250 megalitres, and a catchment area that is more than 3 times the surface area of the dam at full supply level.

Additionally, the chief executive may give a dam owner a notice to have a dam failure impact assessed (regardless of its size), if the chief executive reasonably believes the dam will have, a Category 1 or Category 2 failure impact rating.

Referable dams are classified according to categories which are based on the population at risk if the dam fails.

Dams with a Category 1 failure impact rating have between 2 and 100 people at risk.

Dams with a Category 2 failure impact rating have over 100 people at risk.

If less than 2 people are at risk by the dam failing then the dam is not referable under the *Water Act 2000*.

The following are also not referable dams under the *Water Act 2000*:

- a dam containing, or a proposed dam that after its construction will contain, hazardous waste
- a weir, unless the weir has a variable flow control structure on its crest.

The following are not dams under the *Water Act 2000* and therefore cannot be referable dams:

- a rainwater tank
- a water tank constructed of steel or concrete or a combination of steel and concrete
- a water tank constructed of fibreglass plastic or similar material.

The Guidelines for Failure Impact Assessments of Water Dams published by the Department of Natural Resources and Mines (NR&M) provide additional information on undertaking a failure impact assessment to determine the population at risk for a dam.

1.2.2 Replacing old guidelines

This guideline comes into force with the commencement of the dam safety provisions of the *Water Act 2000*. This guideline replaces the 1994 guidelines known as the Queensland Dam Safety Management Guidelines 1994.

2 What is a Dam Safety Management Program?

A dam safety management program is a system that incorporates dam safety values as part of the culture of the organisation and the day-to-day operation of a referable dam. A dam safety management program comprises policies, procedures and investigations which minimises the risk of dam failure.

A dam safety management program includes:

- site investigation
- design
- construction
- operation and maintenance
- surveillance
- remedial action and modification
- abandonment and removal of dams.

Its benefits are that the:

- owner is aware that the dam complies with current engineering standards for safety
- owner is assured that the dam is operated in a safe manner
- owner has the condition of the dam assessed on a regular basis
- owner is prepared for an emergency situation at the dam
- risk of dam failure is minimised.

2.1 Documentation for a safety management program

A dam safety management program should ultimately result in six levels of documentation being available for each dam. These are:

1. Investigation, Design, and Construction Documentation including Data Book, Design Report and As-Constructed Details (or Construction Report)¹
2. Standing Operating Procedures (SOPs)
3. Detailed Operating and Maintenance Manuals (DOMMs)
4. Inspection and Evaluation Reports
5. Dam Safety Review Report ²
6. Emergency Action Plan (EAP).

Dam owners should securely store these documents.

Dam owners should ensure that each of the levels of documentation is identified for inspection and auditing purposes. The documentation could either be combined into a single document or left as groups of documents.

Details on the preparation of these documents and issues to be addressed are outlined in the following sections of this guideline.

- 1 ¹ Where appropriate. For example, the As-Constructed Details (or Construction Report) and Design Report for an older dam may not have been prepared or retained.
- 2 ² Where appropriate. For example, a new dam is unlikely to have had a safety review as these are generally undertaken every 20 years.

2.2 Training of personnel engaged in dam safety

Dam owners should ensure personnel engaged in dam safety related investigations and studies have adequate experience and training relevant to the type of dam and the facilities being managed.

Dam owners should ensure that the operating personnel involved in the day-to-day dam safety activities (as outlined in SOPs and EAPs) are experienced and/ or trained in aspects of operation of the owners dam.

Dam Owners should develop a program for keeping the skills of their dam operation staff up to date through training programs, courses and 'on the job' training.

2.3 Quality management of dam safety management programs

The Australian Standard for Quality Systems AS/NZS ISO 9001-3:1994 (Lam) [Quality Systems - Model for quality assurance in design, development, production, installation and servicing] can be used as a model for the quality assurance required for dam safety.

Developing and maintaining comprehensive documentation for a dam safety management program as described in these guidelines and quality management audits provide elements of a quality management system. Audit points should be identified within the dam safety management program to allow measurement of the effectiveness of the program and its components.

The dam owner, an internal auditor or a third party should conduct quality management audits on a systematic basis. When an internal auditor is used, it may be necessary to establish a management structure in which the dam safety functions are independent of the dam operator.

A quality management audit of documentation should establish:

- adequacy of the policies and the dam safety management program as a whole (systems audit)
- adequacy of the process and the necessary studies used to establish the documentation (process audit)
- adequacy of specific procedures, documentation or a specific investigation (validation audit).

Some of the specific issues, which should be examined in a quality management audit, include:

- the authority for performing activities
- allocation of responsibilities for particular activities
- actions to be undertaken and circumstances for such action.

3 Regulation of Referable Dams

Dam safety of referable dams is regulated to protect the community from dam failure. The chief executive of the Department of Natural Resources and Mines (NR&M) is responsible for regulating referable dams. Dams are regulated by the chief executive through:

- safety conditions imposed on referable dams under the *Water Act 2000* (which are partly based on the failure impact rating of the dam)
- development permits containing conditions imposed under the *Integrated Planning Act 1997*, issued to approve the development of a dam (which are partly based on the failure impact rating of the dam)
- auditing of compliance with dam safety conditions (ie safety conditions imposed under the *Water Act 2000* and development permit conditions imposed under the *Integrated Planning Act 1997*)
- emergency action provisions contained in the *Water Act 2000*.

3.1 Development permits

3.1.1 General

Dam safety conditions attach to development permits and incorporate requirements specific to each individual dam. The safety conditions must be relevant to, but not an unreasonable imposition on, the dam or reasonably required for the dam. Dam owners can appeal against dam safety conditions imposed or changed by the chief executive.

Part of the intention of these conditions is to ensure a dam owner develops a dam safety management program for their dam. These guidelines provide advice on how to develop a dam safety management program. Dam safety conditions may require a dam owner to develop specific plans, procedures and reports that will form part of the dam safety management program. If the specific plans, procedures and reports have already been developed by the dam owner (in accordance with these guidelines), those documents will generally be cited in the conditions for that dam.

For example, each dam will generally be issued with a dam safety condition dealing with Emergency Action Plans. Where a dam already has an Emergency Action Plan, the condition might state:

The current Emergency Action Plan for the dam is Document XX as updated from time to time.

The dam owner must provide one copy of the current Emergency Action Plan to the Chief Executive, Department of Natural Resources and Mines by date.

The contact details contained in the Emergency Action Plan must be reviewed prior to DATE each year.

The Emergency Action Plan must be reviewed at least every five years from (date).

The dam owner must ensure that the current (and changed?) Emergency Action Plan is provided to the following parties

- *Specific local government(s) eg Esk Shire Council*
- *Local counter disaster agencies affected by emergency events .eg Ipswich Counter Disaster Coordination Committee*
- *NR&M - Dam Safety*

- *Any additional group specific to this dam*

In all emergencies, the dam owner must respond in accordance with the Emergency Action Plan.

In the event of an emergency, the dam owner must also, within 7 days of the event, prepare an Emergency Event Report and provide a copy of the report to the Department of Natural Resources and Mines. .

The Emergency Event Report must contain:

- *a description of the event;*
- *instrumentation readings (where appropriate);*
- *description of any observed damage;*
- *photographs;*
- *details of communication which took place during the emergency; and*
- *comment on the adequacy of the EAP*
- *any recommendations or suggested changes to the EAP.*

3.1.2 New Dams and Works that Increase Storage Capacity

A development permit is an approval under the *Integrated Planning Act 1997* which allows “assessable development” to occur according to conditions stated in the permit. The construction of a new referable dam and carrying out work that will increase the storage capacity of a referable dam by more than 10% is “assessable development”. The chief executive has the power under *Integrated Planning Act 1997*, to impose and change dam safety conditions on development permits issued approving these types of development.

A development permit will attach to the land where the referable dam is located. This means it will bind:

- the current owner of the land
- future owners of that land
- any occupier of that land (eg a tenant).

A person wanting to construct a new referable dam under the *Water Act 2000* must apply for and obtain a development permit before starting construction. A dam owner must also obtain a development permit to carry out works that will increase the storage capacity of a referable dam by more than 10%, before that work commences. The *Water Act 2000* requires a development application for these types of assessable development to be supported by evidence that the chief executive has accepted a failure impact assessment of the dam.

Prior to submission of a development application, owners and their consultants should consult with officers of the Dam Safety Group in NR&M to discuss technical details of the development and potential dam safety conditions. The Dam Safety Group provides advice to the chief executive on dam safety conditions to be attached to development permits. Dam owners should ensure that they use relevant guidelines prepared by the chief executive when designing and constructing their dam.

Prior to construction of any referable dam, the chief executive will overview each proposal and may require changes to be made to the proposal prior to granting a dam development permit. Where conflicts of opinion exist, the chief executive may seek advice from independent experts before making a decision.

3.1.3 Development Permits for Existing dams

For existing licenced dams which are referable under the *Water Act 2000* the previous licences for the dams will be taken to be a development permit³ which has dam safety conditions attached. Dam safety conditions applied to this development permit for existing licenced dams will therefore initially originate from the dam's waterworks license under the *Water Resources Act 1989* (Qld). The chief executive also has the power under the *Water Act 2000* to impose and change additional safety conditions on the dams.

These safety conditions are taken to be development permit conditions for the purposes of enforcement.

For existing unlicenced dams, which are referable under the *Water Act 2000*, the chief executive will develop and apply safety conditions under the *Water Act 2000*.

The chief executive also has the power to change those safety conditions if satisfied changes should be made in the interests of dam safety. The safety conditions are taken to be development permit conditions for the purpose of enforcement.

3.2 Auditing

The chief executive, to identify shortfalls in a dam safety management program and areas of non-compliance, may carry out audits of compliance with development permit conditions.

There are two Acts in Queensland which deal with enforcement of dam safety. The *Water Act 2000* contains provisions to enable the chief executive to issue a compliance notice if that Act is contravened (eg fail to carry out a failure impact assessment when one is required). Additionally, as dam safety conditions are development permit conditions for the purpose of enforcement, penalties apply under the *Integrated Planning Act 1997* (Qld) for failing to comply with a development permit condition.

3.3 Emergency action provisions

The chief executive has the power to issue a direction to take emergency action under s.494 of the *Water Act 2000*. This notice is only issued if the chief executive is satisfied or reasonably believes that:

- there is a danger of the failure of the referable dam and
- action is necessary to prevent or minimise the impact of the failure.

If a person fails to comply with a notice without a reasonable excuse, action may be taken. The compliance provisions of the *Water Act 2000* will allow any person to bring an enforcement order proceeding in the District Court and seek a Court order forcing a person to comply with the notice.

In addition, the chief executive has power under the *Water Act 2000* to act to prevent or minimise the impact of a dam failure, if a notice is not complied with. The chief executive can recover any reasonable expenses incurred when taking such action and may also make the expenses incurred a charge on the land.

Emergency action notices also attach to the land where the referable dam is located, binding the owner of the land at the time it is issued and any future owners.

³ Defined under the Integrated Planning Act 1997.

4 Investigation, Design and Construction

4.1 Introduction

Dams engineering is not an exact science as it frequently involves uncertainties beyond prevailing knowledge. It relies heavily on mathematical principles, physical laws, experienced judgement and known safe practices.

Dam safety management requires that critical uncertainties are recognised, investigated and resolved to acceptable risk levels. Consequently, the investigation, design and construction phase of dams engineering plays an important role in dam safety.

At time of writing philosophies of risk assessment and management were starting to influence the design, management and operation of water dams throughout Australia. This guideline embraces those philosophies as far as they have been incorporated in published ANCOLD Guidelines. Dam owners are encouraged to utilise those philosophies to develop management and operation programs. However, this guideline will await broader dam community assessment of the methodologies before incorporating risk management as a recommended approach to management.

4.2 Issues concerning the dam owner

No two dams are the same. There are many issues including safety issues, which a dam owner should consider when developing a dam. Issues that are specific to dam safety include:

- the failure impact rating of the dam (that is whether the dam will have a Category 1 or Category 2 failure impact rating)
- the resources required to adequately address the technical issues associated with the investigation, design and construction of a dam
- the resources required to adequately manage the dam in a safe manner
- dam safety statutory requirements
- the consequences of potential dam failure.

Other issues, while possibly having dam safety implications, are primarily asset ownership issues. These include:

- environmental or downstream impacts which need to be considered
- the economic viability of the dam
- long-term maintenance management implications of dam ownership.

4.3 Consequence assessment

The regulation of referable dams under the *Water Act 2000* is based solely on the population at risk in the event of a dam failure. However, dam designers, on behalf of dam owners, may also wish to consider other potential consequences to determine design standards for a dam. These other consequences may include:

- economic loss of the asset
- commercial losses and social impacts
- impacts due to loss of water supply
- damage to property and infrastructure
- environmental damage.

If the owner wishes to take these factors into account he or she could undertake an assessment of the consequences of dam failure. A methodology for undertaking a consequence assessment can be found in the Australian National Committee on Large Dams (ANCOLD) Guidelines on the Assessment of the Consequences of Dam Failure.

The effort and resources a dam owner should put into a dam safety management program and the scope of the program is related to the consequences of the failure of a dam on life and property, as well as the complexity and novelty of the dam.

Some of the more common scenarios to be considered in consequence assessments include:

- dam break - the uncontrolled release of pondage for 'sunny day' conditions and a range of flood events
- remote floods - flood surges well downstream of dam which can coincide with storage release
- upstream floods - backwater effects of the dam during floods
- water supply loss - failure of pumps, outlet facilities, reservoir pollution etc
- operational problems - accidental opening of flood gates, equipment malfunction etc.

A consequence assessment should provide a profile of the potential damage of dam failure. In cases where failure does not impact on population and is of economic consequence only to the owner, a case may exist for a minimal dam safety management program. In contrast, where the potential for substantial damage costs exist and significant impact on others is likely, dam safety management should be more rigorous.

Dam owners should periodically review the consequence assessment to monitor any change in circumstances such as development downstream. Such developments can make non-referable dams 'referable' and can cause changes to the required design standards.

4.4 Investigation

Many investigations are undertaken when developing a dam. Most focus on comparing alternate sites and determining the viability of a particular site, rather than focussing on dam safety issues. Examples of these investigations include:

- economic assessment of a dam, including water pricing studies
- land use studies
- impact assessment studies, including social, cultural heritage, and environmental studies.

Two areas of investigation predominantly relate to dam safety issues. These are:

4.4.1 Geological and geotechnical investigations

These include geological and geotechnical assessments of the site and materials. They are generally carried out in stages ranging from broad scoping levels to more detailed investigations depending on the findings of each stage. Each stage should be thoroughly planned to ensure that all matters, which may affect dam safety, are identified, investigated and appropriately resolved by the designer.

Investigations should not be limited to the dam site alone. The geology, topography and the depth of water held in the storage area should be considered. This ensures that major leakages, slope instabilities and significant reservoir-induced seismic activities, which may jeopardise the safety of the dam, are considered in the design.

All work undertaken in the geological and geotechnical investigation stage should be properly recorded and presented in a comprehensive report. This will enable the designer to define the extent of any further work required prior to finalising the design. Investigations are generally on going through the construction period as the foundations become fully exposed or the extent of any foundation work, such as grouting, is recognised. Consequently, investigative reports need to be updated and amended as construction proceeds. When construction is complete, a full and comprehensive report should be available as a reference for on-going surveillance of the dam and subsequent safety reviews.

4.4.2 Hydrological investigations

A suite of hydrological investigations should be undertaken to develop dam safety data for the proposed dam. These hydrological investigations, which are independent of yield hydrology⁴, involve:

- developing an appropriate run-off model for the catchment
- calibrating this run-off model with historical flood data where possible
- assessing any operating limitations and criteria, which are to apply to spillway discharges
- assessing the consequences of potential failure of the dam:
 - particularly the population at risk - see NR&M Guidelines for Failure Impact Assessment of Water Dams
 - for best practice purposes to determine other consequences of failure (eg economic and environmental costs) using the ANCOLD Guidelines on Assessment of the Consequences of a Dam Failure (May 2000) if appropriate
 - determining the spillway design standard, spillway design flood and, if the spillway is a gated structure, determining any operating rules which are to be applied.

All work (including documentation of mathematical models) undertaken in hydrological investigations should be properly documented and presented in a comprehensive report. This will enable the designer to finalise the design and will assist subsequent reviews of this aspect of the design.

⁴ Yield hydrology is a major issue for the dam owner but has minor significance to dam safety.

4.5 Design

4.5.1 General

Factors which should be considered during the design of a dam, include:

1. Physical characteristics

- dam type
- location and alignment
- size and shape
- appurtenant works.

2. Geotechnical information

- material properties and availability
- foundation properties and treatment
- geological characteristics
- seismic loadings.

3. Hydraulic aspects

- type of spillway, means of flow control and energy dissipation
- hydrological characteristics
- hydraulic design and water loadings
- stream diversion requirements
- flood mitigation capacity.

4. Stability

- structural capacity of principle elements

5. Construction methods and sequencing

- including watercourse diversion requirements during construction

6. Operational aspects

- operational complexity and reliability
- requirements for ongoing monitoring
- technical capability and availability of operations personnel.

7. Environmental aspects

- environmental impacts including the effects of storage and barriers
- effect on upstream and downstream areas
- magnitude of downstream releases.

4.5.2 Specific Design Requirements

While the way in which these aspects are applied to a particular dam depends on its dam failure impact rating, size, importance, complexity and consequences of a dam failure, the key principles are:

- all dams structures should be designed to suit the loads to be applied to them in accordance with:
 - ANCOLD guidelines
 - relevant Australian Standards
 - notices (compliance and information) issued from time to time by the chief executive
 - generally accepted engineering practices

- in particular, dams must be able to withstand seismic loadings, flood loadings, normal operating loadings, construction loadings, post construction loadings.
- the regional and site geology must be understood and engineering geology models developed to form the basis for design
- the foundations must be capable of supporting the dam structure and controlling seepage
- the reservoir basin and rim must be sufficiently impermeable to prevent excessive losses of water (Any seepage must be controlled and instability must not occur at any stage of reservoir operation.)
- construction materials must be identified to meet site and design requirements
- the spillway size must be established on the basis of accepted engineering standards—ANCOLD Guidelines on Selection of Acceptable Flood Capacity for Dams, 2000 (Hydrological and meteorological information used in the design must be appropriate for the dam locality and dam use)
- the cut-off design must be established on the basis of the loadings, strength of the available materials and the need to control the seepage (For embankment dams, the designer must incorporate adequate lines of defence including properly designed drains and properly designed filters to ensure the long-term integrity of the seepage control system)
- the outlet works must meet the requirements for the reservoir operation and must have provisions for safe operation and maintenance
- provision must be made for the long-term monitoring of the structural performance of the dam and its components
- an appropriate dam safety management program must be developed and adhered to through the investigation, design and construction processes to ensure all matters are properly attended to and adequately recorded.

Some of these factors may have a direct impact on dam safety, while others may have an indirect impact. The dam designer should be a registered professional engineer, highly experienced and with a good knowledge and understanding of dams. In some cases, dam owners may want to establish a review board of experts to provide guidance on the design of the dam. For large projects, dam owners may wish to engage a project design engineer who is assigned technical coordination responsibility for the dam during its design and construction.

These factors influence the construction cost of a dam. The designer should develop a design, which meets accepted safety standards and the needs of the owner (including budget). The designer should be aware of new technology and methods being adopted elsewhere, which may provide cost savings. Such savings should be critically evaluated in terms of possible long-term costs, which may occur should safety and operational problems be experienced with the dam. The more that is known about the site conditions and foundation materials the less conservative the design has to be, resulting in lower construction costs.

The designer should establish specific onsite construction and operational inspection programs for review by appropriate design personnel and technical specialists. These programs should include frequent inspections during construction to confirm that site conditions conform to those assumed for design or to determine if design changes may be required to suit the actual conditions. A major requirement is inspection and approval by the dam designer of the dam foundation and foundation treatment before the placing of dam materials. The final design inspection of the construction should include a complete review of the surveillance undertaken and testing of any operating equipment.

The designer should determine surveillance requirements for the dam including:

- inspections - operational design inspections should continue throughout the life of the project, in accordance with a formal inspection program covering all project features. The inspection program should meet the regulatory requirements specified in the dam safety conditions in the development permit

- instrumentation - as part of the surveillance requirements, there may be a need for instrumentation (eg settlement and foundation pressure). The designer should identify the need for, and position of instrumentation and include a schedule for timely reading, collecting, reducing, and interpreting the data. The design should include an advance determination of critical instrument observations or rates of data change and a plan of action if observations indicate a critical condition may occur. These critical instrumentation figures should be based on the design assumptions.

4.6 Construction

The supervising constructing engineer(s) should be experienced in dams engineering and be able to detect when variations to specified procedures are necessary, or when special attention is required in relation to:

- foundation treatment
- material selection and placement
- material manufacture (eg filters)
- material testing
- stream diversion
- concrete manufacture
- construction equipment selection
- other issues which can affect the safety of the dam.

The constructing engineer should have:

- a comprehensive understanding of the design
- responsibility for technical coordination between design and construction engineers
- responsibility for managing the construction staff to assure compliance with specifications.

One of the most important aspects of dam construction is the foundation inspection. It is seldom possible to fully identify all the characteristics of the foundations of a dam during the investigation stage. Once the foundations have been fully exposed and prepared, there may be a need to amend the design requirements. Inspections by the designer are necessary to confirm any amendments. If unanticipated conditions such as geological features are encountered, the designer must be involved in determining appropriate design changes.

Regular site visits and inspections by the designer and review engineers (where appropriate) are recommended.

4.7 Design and construction documentation

4.7.1 Data Book

Dam owners should compile and maintain a Data Book. A Data Book is a convenient source of information summarising all pertinent records and history. It should encompass the documentation of investigation, design, construction, operation, maintenance, surveillance, remedial action as well as monitoring measurements. A Data Book may be large and consist of several documents eg drawings, electronic data files and printed reports or smaller depending on the type and complexity of the dam.

4.7.1.1 Data Book Checklist

Data Books should include the following information:

General

Table of Contents

Background Information

- Statistical Summary of the main features of the dam
- Aerial Photograph of the Dam (if available)
- Historical Events (prior to construction, during construction and subsequent operation)
- Record of incidents at the dam
- Relevant Correspondence

Geological Information

- Regional Information
- Site Information
- Seismicity
- Relevant Correspondence

Hydrologic Information

- Design Floods
- Current Inflow Design Flood
- Relevant Correspondence
- Failure Impact Assessment
- Consequence Assessment

Foundation Information

- Description
- Design and Analysis
- Treatments
- Construction Records, Changes, and Modifications
- Instrumentation
- Known deficiencies (eg seepage, etc)
- Relevant Correspondence

Dam Structure

- Description
- Design and Analysis
- Treatments
- Construction Materials
- Construction records, changes, and modifications
- Instrumentation
- Deficiencies (eg cracking, etc)
- Relevant Correspondence
- as constructed drawings

Other Features -Spillway, Outlet Works, Mechanical Systems

- Description
- Design and Analysis
- Details of relevant control systems and operating principles
- as constructed drawings



4.7.2 Design Report

On most projects, a Design Report should be compiled once the design and construction stages are completed. However, on major projects, this may have to be staged. The designer should document the design and construction of the dam including:

- Designer's Operating Criteria (DOC), eg gate operating rules and cone valve operation protocols
- design parameters adopted and assumptions made (and their bases)
- methods of analyses
- results of analyses and investigations (numerical and physical)
- hydraulic model testing of final spillway arrangements
- complete set of drawings and specifications
- summary of As-Constructed documentation and other construction information (see 4.7.3).

The Design Report must contain sufficient information so that in the event of any safety problems relating to the dam, information can be quickly and easily obtained to resolve the problem.

When preparing a design report, the designer should consult the checklist of dam technology issues included as Appendix 3 - Checklist of Dam Technology Issues.

4.7.3 As-Constructed documentation

The constructing engineer should provide a complete record of the construction to assist in determining solutions to any safety problem, which may arise during the life of the dam. As a minimum, this record should include:

- decisions to adapt the design to actual field conditions
- as-constructed drawings indicating the actual lines, levels and dimensions to which the structure is built
- construction processes
- systematically compiled and comprehensive photographs and, where appropriate, videos of the construction, with particular coverage of significant events which include:
 - foundation treatment
 - material preparation and placement
 - filters, cut-offs
 - core materials
 - joint preparation
- foundation surface mapping of rock defects
- material test results and comparison with assumed design parameters
- instrumentation data including precise instrument locations and initial instrument readings
- construction inspection reports.

The As-Constructed documentation should be summarised and either incorporated into the Design Report or produced as a separate Construction Report.

5 Operations and Maintenance

5.1 Introduction

Proper operation and maintenance is essential for the continued viability and safety of a dam and its associated structures. Improper operation of a dam may result in dam failure, and poor maintenance can result in abnormal deterioration of the dam, reduced life expectancy of the dam and increase the possibility of dam failure.

Dam owners should have in place an operation and maintenance program, which is described by the following documentation:

- Standing Operating Procedures
- Detailed Operating and Maintenance Manuals
- Recording and Work Assignment system.

5.2 Standing Operating Procedures

Dams are normally designed to operate within a range of operating criteria. A good dam safety management program will ensure that:

- these operating criteria are known
- the dam is operated within these criteria
- the dam is maintained so that it can perform within the established criteria.

This should be done through Standard Operating Procedures (SOPs). These procedures should:

- define responsibilities for actions critical to the safety of the dam
- identify procedures for particular daily activities, which ensure that these activities are done safely, in the same way each time and in accordance with development permit conditions
- ensure appropriate people are notified when unforeseen or unusual events occur.

Dam owners should ensure they operate their dam in accordance with the SOPs.

SOPs are beneficial as they provide information on procedures for a dam (including responsibilities and timings). They help to:

- ensure long term adherence to operating procedures and across changes in ownership and operating personnel
- ensure that a task is completed in the correct, repeatable manner. They reduce the probability of dam threatening situations by providing operating protocols for personnel to follow. Examples of situations, which may be avoided by using appropriate SOPs, include:
 - 'out of date' procedures being applied to activities such that the dam is not operated in the manner expected by others
 - problems not being fixed because dam safety inspections are not performed or are not carried out by appropriate people
 - critical equipment not being checked so that it is not operational when needed
 - the incorrect operation of flood mitigation dams which may result in decreased flood mitigation capability or the amplification or extension of flooding
 - failure to open gated spillways at the appropriate time, which can cause overtopping of the gates and subsequent failure of the dam
 - failure to close gated spillways or outlet works which may empty a reservoir.

SOPs provide documentation of the way in which various tasks are performed and provide a permanent record of actions taken to operate the dam. If action results in an undesirable outcome, SOPs may assist in determining the reason and amendments can be made to the SOP. SOPs enable reviews of an organisation's operations to improve efficiency.

Dam owners should develop SOPs for their dam and operate the dam in accordance with these SOPs. This guideline concentrates on those SOPs, which deal with dam safety issues such as:

- personnel training and procedural issues
- emergency action and incident reporting
- critical operating procedures
- monitoring and surveillance.

When developing SOPs, a dam owner should consider issues, which may affect the complexity of the SOPs including:

- the complexity of dam operations (The more complex the operation is, the more detailed and comprehensive the SOPs should be. For example, detailed SOPs will be required for a dam with a spillway, which is controlled by large, high capacity gates, which could release damaging flood flows downstream in the event of maloperation.)
- degree of backup required
- complexity of spillway arrangements
- simplicity of flow release regimes.

The location of SOPs is critical to their effectiveness. At least one copy of the SOPs should be located where dam operations are controlled and operational decisions are made. This is particularly important for structures with variable flow control.

In addition, to ensure that SOPs remain effective over time, dam owners should ensure each SOP is reviewed annually.

5.2.1 Developing SOPs

There are a number of tests that can be applied to determine whether a SOP needs to be developed for a task. Before writing a procedure for a task, you should consider what the consequences would be if the task was performed incorrectly. That is:

- What costs would be incurred as a result of the task being performed incorrectly?
- What resources would be required to remedy the situation?
- What time would it take to remedy the situation?
- What are the safety implications?
- What are the environmental implications?
- If today was my first day in the job, would I know:
 - Enough about the organisation and its different functional areas to perform the required tasks?
 - With whom I should communicate and what inputs I need, where they come from, how I access them, and whether I need someone's assistance?
 - What to do with the output of my job and to whom I should direct it?
- If the adverse consequences of performing the task incorrectly are minimal, the task may not need to be documented.

5.2.1.1 Comprehensive Checklist of SOPs

Not all of the following SOPs will be applicable to each dam. The requirement for individual SOPs needs to be decided case-by-case. Where applicable, SOPs should be prepared to deal with the following issues.

ISSUE	REASON FOR INCLUSION
Personnel Training and Procedural Issues	
Operator Training	To ensure suitably qualified and experienced people are available to operate the dam
Documentation control and review	To ensure SOPs and other controlled documents are properly updated and only the current version of the procedures is used for dam operations
Undertaking of a Failure Impact Assessment every five years	For compliance with the requirements of the <i>Water Act 2000</i>
Setting of Normal Operation Criteria	To ensure the dam is operated and maintained in accordance with known operating limits eg gate operating limits or restricted FSL's due to stability limits
Emergency Action and Incident Reporting	
Accident and Incident Reports	To ensure incidents which may affect dam safety are documented so that they can be considered in future inspections and safety reviews
Emergency Action Plan (EAPs)	Liaison with affected population, local government and counter disaster organisations
Verification of Emergency Contact Numbers	To ensure EAPs are kept up to date and ready for use
Communication procedures and procedures covering the Loss of Communication during an Emergency Event	To ensure adequate triggering of Emergency Action Plans and to ensure dams are operated properly when communications are restricted
Attendance at dam	To address levels of attendance corresponding to operational states of the dam

ISSUE	REASON FOR INCLUSION
Critical Operating Procedures	
Test operation of critical equipment	To reduce the risk of the equipment not operating as planned. Such a procedure should provide for: <ul style="list-style-type: none"> • an annual pattern of test operation of gates or other crest control devices⁵ • regular testing of backup power supplies • regular testing of sump pumps • regular testing of communications
Pump operation plan for water harvesting that includes monitoring	To minimise the risk of overtopping of the dam through over-pumping
Notification of Spillway Discharge	To ensure emergency planners are aware of significant spillway discharges during flood events
Spillway Gate flood operations including: <ul style="list-style-type: none"> • water level monitoring procedures • discharge Control and flood release protocols including monitoring and warning of areas of impact prior to releases (for campers etc) as required in the Emergency Action Plan • coordination of releases with other dams or downstream tributaries (where appropriate) • communication security and failsafe procedures 	To ensure spillway operations proceed in accordance with agreed procedures which maximise the safety of the dam and minimise disruption to flood affected communities
Bulkhead Gate Installation, Penstock drainage, Trash screen removal and installation	To ensure the safety of operations and maintenance personnel
Confined Space Access	To maximise the safety of people in and around the dam
Monitoring and Surveillance	
Water level monitoring procedures and the monitoring of inflow events	To ensure dam hydrology and spillway performance can be reviewed
Instrumentation surveillance and data recording	To ensure monitoring and surveillance is carried out and the data are rapidly analysed and reviewed
Owners routine dam safety inspection including checklists and reporting requirements	To ensure routine dam safety inspections are carried out consistently and to appropriate standards

5 This SOP must include cracking gate under full load, and raising and lowering gate under no load over full travel

ISSUE	REASON FOR INCLUSION
Monitoring and Surveillance (continued)	
Dam Safety Annual inspections (if annual inspections are required by development permit conditions)	To ensure the inspections are carried out consistently and to appropriate standards
Dam Safety 5 yearly comprehensive inspection (if required by development permit conditions)	To ensure the inspections are carried out consistently and to appropriate standards
Requirement for inspection during and after flood events and after seismic events	To ensure the emergency action plan and any remedial works are triggered during and after such events
Inspection, testing and maintenance of mechanical and electrical equipment	To ensure mechanical equipment can be operated as designed whenever necessary
Log Book	
Maintenance of Dam Log Book	To ensure operations and maintenance activity and associated decisions are recorded
<p>Log book should include major events such as:</p> <ul style="list-style-type: none"> • equipment testing • major planned and unplanned maintenance and special one off jobs at the dam • testing of gate functions • painting programs • flood discharges and reservoir levels • incident details • reports dispatched and received • notification of receipt of changes to documentation (eg SOPs) 	To record major and exceptional events and conformance with procedure

5.2.2 SOPs Checklist

The following comments are suggested to assist in the preparation of SOPs:

- Preliminary pages of the combined SOPs should include:
 - cover sheet
 - title page
 - table of contents
 - revision sheet
 - any necessary certification and/or verification required by the dam owner
 - an aerial photo of the dam if possible.
- In terms of formatting, it is recommended to:
 - bind SOPs in loose-leaf folder so that it is easy to make revisions, additions and updates
 - start each procedure on a new page
 - use a standardised format for each procedure
 - the title of each procedure should be short and adequately identify the task
 - use lists rather than narration to outline instructions and information whenever possible.
- All areas of responsibility in the administration, operation and maintenance of the dam should be clearly indicated in the SOPs. Some of the operational aspects of dam ownership and operation that should be addressed include:
 - operation of equipment at the dam
 - reservoir inflow and flood forecasting
 - authorising spillway flood releases
 - authorising irrigation releases
 - recording reservoir data
 - routine inspection
 - maintenance
 - modification
 - correct method of opening and closing guard gates
 - dam safety and surveillance.
- The operating personnel responsibilities should be specifically identified and should include regularly scheduled duties personnel are required to perform.
- Administrative and operational relationships between the various operating and end user organisations should be detailed. (Both formal and informal agreements should be referenced.)
- Organisational arrangements in the form of flow charts can be beneficial. For example, agreements on allocation of responsibility for operation.
- Write procedures clearly and concisely. Avoid using vague words (for instance use a specific word such as “annually” rather than the word “periodically”).
- Each procedure should identify the step-by-step actions or groups of actions in sufficient detail to describe the task in a logical manner.
- Where appropriate, include drawings, sketches, graphs, manufacturer’s instructions, photographs etc in appendix or text to increase understanding.
- Where appropriate, if a SOP requires a form or forms to be filled out to confirm that a task described in the SOP was undertaken copies of the form should be appended to the SOP.
- Where appropriate, the use of drawings, marked photographs, colour coding and numbering of valves and switches are recommended to supplement step-by-step operation or maintenance instructions. These aids simplify instructions and reduce the chance of error in their use.

5.2.3 Level of Attendance

The owner should ensure that the level of operator attendance for the dam is appropriate for the failure impact rating of the dam as well as the:

- consequences of the dam failure
- proximity of the population at risk and the available warning time
- remoteness of the dam and ease of access during flood events
- reliability of remote sensing and transmission of warning trigger data to offsite control centres
- availability of backup operations personnel
- other activities conducted at or near the dam by the dam operator
- need to trigger Emergency Action Plans
- complexity of gate operations and associated need for skilled operators
- preparedness of operations staff
- inspection post seismic or flood events compared with monitoring as flood event evolves.

For example, the level of attendance for a particular dam with a Category 1 failure impact rating which has simple operating requirements, a distant population at risk and a long warning time, may involve regular visits and inspections (eg daily visits and inspections). In contrast, a dam with a Category 2 failure impact rating with complex operating requirements and a high population at risk in close proximity, may require qualified dam operators in residence and/or an appropriate electronic surveillance, control and communication system. The reliability of electronic systems should be considered in determining the level of attendance during flood events.

Further, a dam owner may wish to assign the operation of a dam to a nominated operator (the dam owner still retains responsibility for dam safety). If this occurs, the dam owner should ensure the nominated operator:

- is aware of the potential damage which could result from the different modes of failure relevant to the dam
- is aware of the Designers Operating Criteria and what constitutes an abnormality
- operates the dam in accordance with SOPs
- participates in dam safety inspections and the surveillance program
- is empowered to initiate Emergency Action Plans should the need arise
- is empowered to communicate directly with the relevant parties (eg advise chief executive of NR&M) should there be a need to operate the dam outside a SOP.

5.3 Detailed Operating and Maintenance Manuals

While a SOP outlines the protocols for operation of a system in the dam (eg water releases by gate operation), Detailed Operations and Maintenance Manuals (DOMMs) address how to operate, maintain and overhaul individual pieces of equipment for a dam and its associated structures (eg the operation, maintenance and replacement of valves and motors for the gates). The dam owner should operate and maintain the dam in accordance with the DOMMs.

The DOMMs are important as equipment, which is operated or maintained in an incorrect or inappropriate manner, can affect the safety of a dam. Significant work should not commence on equipment for a dam and its associated structures without proper authorisation from the dam owner.

The information in the DOMMs should be complete, accurate and up to date and cover all facilities and equipment. Further, for those issues which are critical to the safety of the dam, the dam owner should ensure the DOMMs are reviewed annually so that the manuals remain accurate and up to date.

The manuals should contain the following:

- Work Instructions, which detail the way in which equipment should be operated and outline the steps involved in performing a task. For example, a work instruction may be developed for the use of the gantry crane for placement of bulkheads gates.
- Maintenance Schedules, which detail the asset, description of task, frequency of maintenance and special requirements for servicing and maintaining the equipment. For example, a maintenance schedule should be developed for maintaining and servicing all mechanical and electrical equipment.
- Equipment data sheets or Manufacturer's Manuals, which comprise technical information needed for maintenance, repair and overhaul of equipment. For example, an equipment data sheet or manufacturer's manual should exist for the operation, maintenance, repair and overhaul for the emergency generating set.

Dam owners should ensure that DOMMs developed for their dam reflect the operating complexity, location of the dam and distribution of responsibilities between maintenance and operational personnel. The DOMMs should be located on site at the dam at least for day-to-day use. For procurement and administrative reasons, it may be advisable to hold a second copy in the dam owner's office. This is particularly important for structures with variable flow control.

The DOMMs or at least their drafts should be available prior to the initial filling of the reservoir.

5.4 Recording and Work Assignment system

The Recording and Work Assignment system issues detailed work orders for operational staff (and others such as consultants) and records the outcomes of the order. Work orders originate from requirements of the SOPs and DOMMs. These work orders set out who is responsible for work, supervising responsibilities, recording details of the work and the date of the work. Dam owners should have a Recording and Work Assignment system which is capable of issuing and tracking work orders.

The Recording and Work Assignment system can consist of:

- checklists
- logs
- card files
- computerised systems.

This system plays an important role in verifying work undertaken on the dam for dam safety purposes.

6 Surveillance

6.1 Introduction

Surveillance is the continual examination of the physical condition and operation of a dam. Surveillance programs should be capable of detecting problems or unsafe conditions at an early stage so that corrective measures can be taken and dam safety is not compromised. To obtain a historical context for defects, surveillance should commence as early in the life of the dam as possible to detect the development of any problem or unsafe trends and to provide full background information on a dam's performance.

A dam safety management program begins with the initial investigation of the dam foundation and continues through its design, construction and operation. While many problems may occur and need to be overcome during these phases, there is always a risk that not all problems have manifested themselves or been detected by the time the dam has reached its operational phase.

Any unusual behaviour, regardless of how seemingly insignificant, should be identified and recorded because this may be the forewarning of a newly developed unsafe condition.

The causes and processes of dam failure are varied and the knowledge gained from previous dam failures has contributed to the advancement of specialised knowledge essential to the prevention of further failures. Case histories of dam incidents reveal many remarkable similarities in antecedent conditions and processes of deterioration.

Each dam should have its own surveillance program. The scope of a surveillance program should be appropriate to the size of the dam and storage, the population at risk and other consequences of dam failure, the level of risk at the dam, and the value of the dam to the owner.

A surveillance program should include:

- monitoring of instrumentation
- collection of information or data relating to dam performance (eg investigation, design and construction reports)
- evaluation and interpretation of the data
- a range of inspections, from routine inspections by operational staff through to comprehensive inspections by engineers.

Each of these is considered in more detail in the following sections.

Experienced dams engineers should be consulted on the nature and extent of suitable surveillance programs. Generally, larger more complex structures with novel design features require more detailed and comprehensive surveillance programs. These should be instigated during the design and construction phases and in response to emergent problems.

6.2 Monitoring

Monitoring is the collection, presentation and evaluation of information from measuring devices installed at or near dams. Monitoring is needed:

- to detect deterioration in performance of the dam
- to detect trends or behaviour to establish compliance with design expectations (If the trends

indicate non-compliance with design expectations, remedial action should be initiated.)

- to rectify dam design issues which could not be resolved to high reliability during the design and construction stages (Such issues can only be addressed with a monitoring strategy, which can substantiate design expectations by establishing a correlation with actual behaviour. Some behaviour responds slowly over many years while some may not become evident for many years.)

The designer, review engineer, or inspection engineer should identify the issues that need to be monitored and incorporate appropriate instrumentation into the dam. For instance, for a farm dam, it may be concluded that there is no need for any instrumentation. Forms of monitoring include:

- deformation surveys
- water level measurements (including rainfall)
- seepage and pore pressure measurements
- measurements to confirm design parameters
- foundation pressure management
- stresses in embankments or structural components
- spillway performance and condition
- monitoring of deficiencies (eg cracking or erosion)
- seismic monitoring
- level of surveillance data.

The preferred frequency of monitoring varies over time. Factors influencing the frequency of monitoring include:

- the consequences of a dam failure
- the nature of the behaviour being monitored
- the stage of maturity of the dam (eg monitoring should be more intense during the construction and initial filling stages than during the operational phase)
- the existence of any problems or events (eg special events, such as record floods and earthquakes, will require more intense monitoring).

Dam owners should ensure that dam monitoring programs are reliably executed and that all instrumentation is maintained in a reliable condition and provides accurate readings throughout the life of the dam. Instrumentation available varies according to complexity, robustness and cost. Regardless of the instruments used, the dam owner must be able to ensure that the appropriate standard of monitoring is achieved.

The designer of the dam should determine the monitoring program, instrumentation used and frequency of observations initially in the design and construction phase. Dam owners should have a dams engineer review the appropriateness of the monitoring program, the instrumentation used and the frequency of observation as part of each comprehensive dam safety inspection. Instrumentation may need to be retrofitted if potential problems are identified.

There may be potential for remote monitoring and automation of data collection. However, malfunctions of remote monitoring and automatic data gathering during times of extreme weather conditions suggest that careful consideration be given to the reliability of such systems, especially when some form of operational control relies upon the monitoring. Owners should ensure that backup facilities are available for checking remote monitoring and accessing operational data for the dam during critical periods.

As the design and installation of instrumentation systems is a specialised area of dams engineering, dam owners should engage engineers experienced in this field.

The inclusion of accelerometers in dams in cooperation with wider seismic networks (state or national)

should be considered. This is important in seismically active areas or for large dams where reservoir induced seismicity could occur. Interpretation of data and maintenance of systems should be undertaken by a seismologist.

6.3 Data collection and management

Dam owners are responsible for the collection, storage and presentation of all data associated with the operation and maintenance of a dam. There are two types of data:

- Static data does not change with time. Such data will normally be stored in the data books, dam safety reviews and reports. Static data usually encompasses all design and construction investigations, including the Designers Operating Criteria. Much of this information is found in the Design Report and As-Constructed documentation.

As much of the static data will never be changed, it may be reduced and stored on microfilm or some electronic storage medium. Sufficient, easily accessible information should be kept on hand in Data Books to provide information for any situations which could arise.

- Dynamic data changes with time. It includes data derived from dam safety surveillance, monitoring, operations and maintenance activities. This data is accumulated in the Dam Safety Inspection and Surveillance Reports. Much of the dynamic data is suitable for computer storage and presentation, particularly that arising from monitoring.

For data collection and management purposes, dam owners should be aware of:

- the strengths and limitations of computer storage and retrieval systems (eg ease of access for retrieval of information)
- issues associated with compatibility of computer systems.

Dam owners should ensure that the system used to collect and process the data has facilities to detect the occurrence of “obviously different” data, which can be caused by:

- data recording and transfer errors
- instrumentation malfunction
- abnormal behaviour of the dam.

These situations should be investigated immediately. If the change is attributed to abnormal behaviour, the owner should initiate further investigations to explain the abnormality and ensure that it is not indicative of a worsening dam safety situation. These abnormalities can be a trigger for remedial action.

6.4 Surveillance evaluation

Not all dam deficiencies can be detected by visual inspections. There are many cases where an analysis of surveillance data has detected problems not evident by other means. Surveillance evaluation is an assessment of the safety of a dam in terms of its condition and operation based on data obtained from dam safety inspections and monitoring.

Data is accumulated during the course of surveillance, monitoring and operation of a dam. For ease of understanding, it may be beneficial to reduce this data into graphical form. Dam owners should ensure this data is evaluated on a regular basis to monitor the continued safety of each dam. Data evaluation should be assigned to an experienced dams engineer who should make recommendations based upon their interpretations.

Some examples of how areas of dam performance are considered in a surveillance evaluation include:



- assessment of the available pressure, movement and seepage monitoring data by analysis of the impact (if any) of all monitoring results
- assessment of the seepage from the storage (A plan should be provided showing position, quantity and quality of seepage.)
- the recent movement survey for the dam
- the foundation and embankment pressures being experienced by the dam. A plan showing the position and purpose of the individual piezometers should be provided.

Surveillance evaluation is conducted as part of a periodic dam safety inspection (at five yearly intervals), although evaluation may be undertaken at more frequent intervals or at times of concern.

Following evaluation, a Surveillance Report should be prepared. Experienced dam engineers familiar with the entire history of the dam should prepare this report. The Surveillance Report should:

- review all dam safety inspections and surveillance data for a dam
- identify any anomalous trends
- make recommendations on any actions required to ensure the continued safety of the dam
- summarise and extend previous reports to provide a clear picture of long-term trends.

Anomalies and concerning trends identified in the Surveillance Report should be considered as deficiencies. It is the responsibility of the dam owner to ensure that appropriate remedial actions are taken and documented. Further guidance on surveillance evaluation can be found in Appendix 3.

6.5 Dam safety inspections

One of the most important activities in a dam surveillance program is the frequent and regular dam safety inspection for abnormalities in conditions and deterioration of the dam.

Dam safety inspections are conducted to determine the status of the dam and its features relative to its structural and operational safety. Different types of dam safety inspections should be undertaken for different purposes:

6.5.1 Routine inspections

Purpose:	To identify physical deficiencies of the dam.
Reporting:	There is no standard report for these inspections as they can vary from a short weekly check for a small farm dam to a twice daily dam check using a checklist.
Undertaken by:	The dam owner or field and operating personnel as part of their normal duties at the dam.
Discussion:	<p>Routine Inspections are best carried out by someone involved in the day to day running of the dam. Much of the inspection and observation should be incorporated in the daily work routine of such officers. The Standing Operating Procedures (SOP) should outline the requirements regarding:</p> <ul style="list-style-type: none"> • the timing and frequency of the inspections • who should be involved (In some cases electrical expertise may be needed to inspect some elements of dams.) • the reporting requirements.

6.5.2 Periodic inspections

- Purpose:** Generally carried out by a dams engineer with the purpose of identifying physical deficiencies of the dam by visual examination and review of surveillance data against prevailing knowledge.
- Reporting:** The report should fully document the status of the dam and all defects or unsafe conditions and outline a strategy for taking remedial action (including preliminary costing and, if several defects or conditions are found, prioritisation of actions).
- Undertaken by:** An experienced dams engineer who is a Registered Professional Engineer (RPEQ).
- Discussion:** The inspection should assess all physical aspects of the dam. A periodic inspection requires preparation of checklists, preparation of mechanical equipment, and preparation of access (confined and difficult areas). These inspections are generally carried out on a five yearly basis. However many dam owners may opt to undertake a less extensive periodic inspection more regularly (eg annually). This inspection may exclude aspects of five yearly inspections such as:
- a test operation of all equipment
 - evaluation of all surveillance data
 - major function checks and maintenance inspections. For example:
 - flip bucket dewatering
 - conduit dewatering
 - diver inspection of intake works
 - conduit video inspection.

The timing of the inspection depends on the regional weather pattern. For example, if a distinct wet season exists inspections are best carried out immediately after the wet season, to allow remedial work to be planned and undertaken prior to the next wet season. Guidance on these inspections follows in Appendix 4.

6.5.3 Special inspections

- Purpose:** The examination of a particular physical feature or operational aspect of a dam for some special reason. For example, a special inspection may be carried out on a particular feature of a dam that has been identified as having a possible deficiency or has been subject to abnormal loading conditions.
- Reporting:** The report should fully document the status of the particular physical feature or operational aspect of a dam subject of the investigation as well as any other defects or unsafe conditions and outline a strategy for taking remedial action (including preliminary costing and, if several defects or conditions are found, prioritisation of actions).
- Undertaken by:** A specialist dams engineer.
- Discussion:** These inspections are often carried out with a degree of urgency. It requires some insight into the nature of the feature or defect being investigated to determine what specialist needs to be engaged to carry out the inspection. The inspection will address only issues that relate to the subject feature and is in addition to the regular and periodic inspections. Guidance on these inspections follows in Appendix 4.

6.5.4 Comprehensive inspections

- Purpose:** A periodic inspection of the dam and a review of the owner's whole dam safety management program.
- Reporting:** The report should assess all aspects of the dam safety management program and fully document:
- deficiencies identified in the dam safety management program and its documentation
 - a strategy for overcoming the deficiencies (including prioritisation of actions if several deficiencies are identified).
- Guidance on these inspections follows in Appendix 4.
- Undertaken by:** An experienced dams engineer who is a RPEQ.
- Discussion:** This inspection should incorporate:
- a periodic inspection
 - an assessment of the appropriateness and adequacy, the effectiveness and application (including the owner's response to inspection report and Safety Review recommendations) of the dam safety management program and documentation for the dam including:
 - SOPs
 - DOMMs
 - Emergency Action Plan
 - Data Book
 - Design Report/Safety Review
 - Surveillance and inspection program and records.
- (This assessment should take into account applicable development permit conditions for the dam and the requirements outlined in this guideline.)

6.5.5 Regulatory audits

- Purpose:** Independently, NR&M in its role as Regulator may audit dam safety management programs for referable dams in Queensland. These audits will generally examine compliance with development permit conditions dealing with dam safety and the outcomes of inspections and Safety Reviews. Such audits assist dam owners to compare their practices with industry standards.
- Undertaken by:** NR&M
- Reporting:** The report may indicate:
- deficiencies in the dam safety management program and its documentation
 - non-compliance with development permit conditions
 - proposed actions by NR&M and the dam owner
 - comments on the efficiency and the effectiveness of the dam safety management program.
- Discussion:** Generally the audit will be carried out on dams at random. Dams with a questionable management performance record are more likely to be audited. The outcome of these audits will assist NR&M to assess the effectiveness of their regulation program throughout the state.

7 Safety Reviews

7.1 Introduction

A safety review is a procedure for systematically assessing the safety of a dam after its original construction. It is a fresh engineering assessment of the integrity of all elements of a dam. It usually incorporates a:

- current failure impact assessment
- detailed review of structural, hydraulic, hydrologic and geotechnical design aspects
- review of historical operational performance
- review of surveillance reports
- comprehensive inspection of the dam
- comparison of the standards used for building and upgrading the dam against current design standards.

7.2 Steps involved in a Safety Review

The steps involved in a safety review include:

- Collect background information on the dam. This includes all relevant historical investigation, design, construction, remedial, operation and maintenance, monitoring and inspection data.
- Compare the performance of the dam with the standard set by the original design engineers (if known) and the relevant standards and guidelines existing at the time of the review. The review must include a prediction or assessment of the theoretical performance of the dam against current standards and guidelines.
- Where design aspects are based on assumptions or are incomplete, the Safety Review should include basic investigations and detailed analysis to substantiate the design.
- In the case of incomplete documentation, further investigations may be required, particularly in the case of an initial safety review. Where insufficient plans or data exist of critical elements, additional investigation activities should be undertaken to resolve uncertainties. Typical investigation activities include:
 - survey to establish lines and dimensions
 - testing of materials in the dam and its foundation
 - geological drilling and mapping
 - calculation of revised flood estimates
 - updating of earthquake forces.

Particular attention should be given to changes in land use that may have occurred since construction of the dam which may affect design and operation criteria. This includes such activities as mining, urbanisation or clearing of the catchment area both upstream and downstream of the dam.

The design assumptions and standards used should be reviewed and compared with current best practice, eg

- the foundation integrity (bearing, seepage) applied should be reviewed and compared with current best practice
- the spillway adequacy should be reviewed and compared with current accepted engineering standards, ie ANCOLD–Guidelines on Selection of Acceptable Flood Capacity for Dams
- the embankment and outlet structure should be reviewed and checked as to whether it can withstand appropriate loadings (including seismic) in accordance with current engineering practice.

Conclusions should be developed regarding the adequacy of the main elements of the dam (ie foundations, main wall, spillway, outlet works, associated equipment and monitoring system).

Comments should be made regarding adequacy of the dam safety surveillance and inspection program and operation and maintenance procedures. Such comments and conclusions should reflect prevailing knowledge in hydrology, hydraulics, soil mechanics, geology, structural analysis and design criteria relating to dams.

Further guidance in the issue to be addressed when undertaking a Safety Review can be obtained from Appendix 3 - Checklist of Dam Technology Issues.

The level of sophistication of Safety Reviews varies depending on the complexity of the dam. For example, a Safety Review for a large gated structure requires a greater range and depth of studies than for a small grassed bywash earth dam. In addition, Safety Reviews are not necessarily completed when the Safety Review Report is finalised. Subsequent investigations recommended in the Report are often required and may take years to finalise.

7.3 Frequency of Safety Review

The frequency of dam safety reviews is generally based on the age of the dam and the appropriateness of the technology used on that dam. Safety reviews are generally conducted on a maximum twenty-year cycle but may also be initiated in response to issues such as:

- an absence of design and construction documentation
- a regulatory requirement
- detection of abnormal behaviour
- changes in acceptable design and construction standards
- proposals to raise or modify a dam
- changes in Standing Operating Procedures.

7.4 Safety Review personnel

the Safety Review of a dam can be quite complex and personnel engaged in safety reviews should be experienced in dam technology. Where necessary, the services of suitably experienced geologists, hydrologists and other specialists should be utilised. Consideration should also be given to independent review by engineers other than those who carried out the original design of the dam.

7.5 Safety Review Reports

A Safety Review Report should be produced to document the safety review and should include:

- a statement on the safety of the dam indicating whether or not the dam is in a satisfactory condition and capable of meeting current design criteria
- report on comprehensive inspection
- parameters adapted and assumptions made (and their bases) for review analyses)
- methods of review analyses and results (numerical and physical)
- identification of any deficiencies in the dam including criticality ratings for these deficiencies⁶
- recommendations for remedial work, emergency action and/or further studies which should be undertaken and timings for these.

⁶ A deficiency may be insufficient knowledge about a particular aspect of a dam.

Whilst dam owners may engage consultant engineers to carry out the Safety Review and prepare the report, the recommendations contained in a Safety Review Report will be considered as originating from the dam owner. The dam owner will be responsible for implementing the recommendations. Comprehensive inspections and ultimately audits undertaken by the Regulator, will evaluate the dam owners response to Safety Review Reports.

When preparing a Safety Review Report the reviewer should consult the checklist of dam technology issues included as Appendix 3—Checklist of Dam Technology Issues.

8 Deficiencies, Incidents, Failures and Remedial Action

8.1 Introduction

There are a number of situations that may require remedial action at a dam. These situations can vary from a minor deficiency in the dam, to a major incident or even dam failure.

A deficiency threatens the safety of a dam and may be detected by surveillance inspections and evaluations or dam safety reviews. Deficiencies include:

- inappropriate or deficient design or construction
- changes to design criteria
- changes in the failure impact rating of the dam (for example an increase from a category 1 failure rating to a category 2 failure impact rating)
- time based deterioration or breakdown of material;
- maintenance related problems
- deficiencies in the dam safety management program
- inappropriate operating techniques
- inadequate surveillance procedures
- damage to dam (eg landslides, erosion, earthquake etc).

An incident is an event, which could deteriorate to a very serious situation or endanger the dam.

Examples of incidents include:

- rapid change in seepage
- overtopping of earth embankment
- excessive beaching
- excessive embankment erosion
- spillway or bywash erosion or blockage
- excessive cracking or displacement in concrete dams and spillways
- sliding, rotation or settlement of the dam
- malfunction of gates or crest bags.

The failure of a referable dam means the physical collapse of all or part of the dam or the uncontrolled release of any of its contents. Causes of failure include:

- overtopping of embankment dams
- collapse or erosion of spillways
- internal erosion or piping through earth embankments or abutments
- failure of release conduits
- overturning of concrete dams
- deterioration of maintenance deficiencies.

8.2 The need for remedial action

Remedial action is required in response to a deficiency, incident or dam failure. The type of remedial action required and its urgency is determined by the nature of the event.

Remedial action may include:

- preventative measures to stop situations worsening;
- short term actions such as activation of Emergency Action Plans (including evacuations), installation and operation of warning systems, modification of operating procedures including lowering of reservoir levels by controlled release and increased surveillance;
- long term actions such as structural changes to a dam;
- changes to operating procedures;
- decommissioning of a dam.

In life threatening situations, remedial actions may involve short-term actions including the removal of persons at risk, modification to operations, controlled release of storage, increased surveillance and provision of alarm systems.

8.3 Remedial action review

There may be a number of remedial actions which can be undertaken in response to an incident, deficiency or failure. A Remedial Action Review should be undertaken which methodically evaluates the various options.

The Remedial Action Review should include:

- determination of the risk of failure of the dam
- preparation of a failure impact assessment to determine the current population at risk and a consequence assessment to determine other consequences such as economic and environmental damage
- development of possible solutions
- quantitative risk analysis
- estimation of the benefits and implementation costs of each solution
- justification for the adoption of the preferred remedial action.

8.4 Communication of incidents and failures

All dam incidents and failures, either actual or suspected, should be documented. If the dam owner is not already aware of the incidents and failures, such information should be conveyed by the dam operator (or consultants) to the dam owner for consideration and action⁷. Dam owners should ensure that permanent records of such events are kept in the dam safety inspection and evaluation reports.

⁷ Information on dam deficiencies is provided to the dam owner as a part of periodic and comprehensive inspections.

9 Emergency Action Planning

9.1 Introduction

An Emergency Action Plan (EAP) is a formal plan that:

- identifies emergency conditions which could endanger the integrity of the dam and which require immediate action;
- prescribes procedures which should be followed by the dam owner and operating personnel in the event of an emergency;
- provides timely warning to appropriate emergency management agencies for their implementation of protection measures for downstream communities.

The standards used for design, construction, operation, maintenance and inspection of dams are intended to minimise the risk of dam failure. However, as unusual circumstances could result in dam failure, dam owners need to identify conditions which could lead to failure situations and which may require dam safety emergency planning.

Emergency planning takes place at two levels:

- to prescribe activities at the dam - known as the Emergency Action Plan which is prepared and operated by the dam owner, and
- to prescribe activities below or beyond the dam - known as the Counter Disaster Plan, which is prepared and operated by the appropriate local Disaster District Co-ordination Committee (DDCC) with significant input from the dam owner.

An EAP should indicate who is responsible for undertaking particular actions under emergency circumstances and must be tailored to the conditions at each dam.

9.2 Dam owner's role

A dam owner should:

- develop and maintain an EAP
- in all emergencies, respond in accordance with the EAP
- determine the area of potential inundation or other impact from dam failure
- establish and maintain a communication system for the timely notification of impending and actual emergencies
- provide the Disaster District Co-ordination Committee (DDCC) with details of emergency response actions at the dam (eg, flood releases) and estimates of their downstream impacts
- develop a test schedule to ensure the EAP is functional and staff are familiar with the EAP.

9.3 Process for developing an EAP

When developing an EAP, the following steps should be taken by, or on behalf of, the dam owner:

- determine and identify those conditions that could forewarn of an emergency and specify the actions to be taken and by whom under what circumstances
- in consultation with the District Disaster Coordinator (DDC) for the impacted area (or the Disaster District Manager from the Department of Emergency Services), identify all jurisdictions, agencies and individuals who should be involved in the EAP (for example, local governments, the Queensland Police Service and downstream residents)
- identify response actions to be taken in response to potential emergencies

- identify any necessary resources, special tools, equipment, keys and indicate where they can be located if required in an emergency
- list and prioritise all persons and entities (including contact details) involved in the notification process and the roles and responsibilities assigned to them (eg a flow chart may be used)
- identify primary and secondary communication systems, both internal (between persons at the dam) and external (between dam personnel and outside entities)
- develop a draft of the EAP
- hold meetings with all parties (including emergency management agencies) included in the notification list, to review the draft EAP
- make any revisions, obtain the necessary plan approval and disseminate the EAP to those who have responsibilities under the EAP
- test and revise the EAP at regular intervals.

9.4 Issues To Be Considered In Emergency Action Plans

An Emergency Action Plan (EAP) needs to be easily identified. Consequently, it is recommended that the EAP is contained in a hard covered A4 sized folder, colour coded red.

The issues to be included in an EAP should be as follows.

1. Distribution control sheet (which is page 1)

It is important that the current EAP is issued to a number of parties including:

- Dam Operator
- Specific dam personnel with roles in the EAP
- Chief executive NR&M
- Local counter disaster groups (eg Disaster District Co-ordination Committee (DDCC) and local Government Counter Disaster Committee (LGCDC))
- Local governments which may be affected by the emergency.

Details of these parties should be listed on the distribution control sheet.

2. Title Page/Cover Sheet

3. Table of Contents

4. Notification listing or flowchart

This listing or flow chart should clearly summarise the following:

- Who is responsible for notifying each dam owner representative(s) and/or emergency management official(s) and others (eg residents located immediately downstream of a dam)?
- What is the prioritised order in which individuals are to be notified?
- Who is to be notified?

The listing or flowchart should include current individual names, position titles, office and home telephone numbers, alternative contacts and means of communication. Where applicable, radio frequencies and call signs should be detailed.

The number of persons to be notified by each responsible individual on the flowchart should be governed by what other responsibilities the person has been assigned. It is usually recommended that any one individual not be responsible for contacting more than three or four other parties.

The following parties should be considered for inclusion in the notification listing or flowchart:

- dam owner
- local emergency management officials (DDCC and LGCDC) and other organisations
- appropriate state emergency management agencies
- residents and property owners located immediately downstream of the dam within the boundary of potential inundation where available warning time is very limited
- local governments which may be affected
- operators of other dams or water-retention facilities which may be affected



- managers and operators of recreation facilities which may be affected
- Bureau of Meteorology.

The decisions as to who needs to be contacted will depend on the scale and timing of the potential impacts.

5. Roles and Responsibilities

The responsibilities of the following parties should be specified:

- dam owner
- dam operator
- other dam personnel with a role to play in the EAP (including standby officers where appropriate).

Specific roles, which should be addressed in terms of responsibilities, include:

- notification of local counter disaster agencies (such as DDCC and LGCDC) and dissemination of information to the media and public
- notification of evacuation (eg in the case of a resident located just downstream of the dam the dam owner may need to notify that person directly)
- on-site monitoring of the situation at the dam and keeping parties informed of developing conditions at the dam from time to time
- other actions (eg opening of gates etc where appropriate)
- follow-up evaluation after the emergency (including an Emergency Event Report).

6. Area map

This map should show access routes to the storage during fair and adverse weather conditions, identifying travel times and distances.

7. Drawing of the Storage Catchment Area

8. Emergency Events and action list

Typical emergency or potential problem identification includes but is not limited to:

Problem	General characteristics	When and what to check
Overtopping imminent	Storage full and water level rising - check water levels	During periods of excessive rainfall
Wave erosion	Beaching or notching of the upstream face of embankments by waves generated over long periods of strong wind	During or after periods of strong wind - inspect upstream face of embankment
Toe erosion	Erosion of embankment toe by spillway discharge or diversion flows	During and after large rainfalls - inspect embankment toe



Problem	General characteristics	When and what to check
Gullying	No armouring or vegetation cover on embankment batters or poor drainage	During and after large rainfalls inspect embankment batters for damage to armouring or vegetation cover
Loss of storage contents	Excessive loss from the storage and/or occasionally increased seepage or increased groundwater levels near the storage	During routine monitoring - look for environmental changes such as vegetation damage, salt scalds, etc
Seepage erosion or piping	Progressive internal erosion of the embankment or foundation to form an open conduit or pipe	During routine inspection or after unaccountable increases in seepage flows, look for an emission point
New springs, seeps or boggy areas	Evidence of internal changes in seepage control (could be initial signs of piping failure)	During routine inspection, look for “evergreen” spots, boggy ground or pools of water
Rapid increases or cloudy appearance of seepage	Seepage flow through the storage embankment is cloudy and increasing (piping failure has started)	After detection of cloudy water at seepage monitoring points - look for the source of cloudy water
Increase in gallery seepage	Increase in the normal rate of gallery seepage	After detection - check for differential movement or cracking in concrete components
Foundation failure	Sliding, rotation or settlement of part or entire dam	During routine inspection or immediately after earthquakes - inspect for evidence of foundation movement or displacement immediately adjacent to dam
Slide in downstream slope	Slide in the downstream face	During routine inspection - look for cracks or scarps near the crest and bulges at the toe
Flow slide	Collapse and flow of soil around the storage periphery	During routine inspection and especially with sedimentary/ colluvial soils - look for material displacement around the storage rim



Problem	General characteristics	When and what to check
Landslide	Mass movement of soil or rock from slopes and valley walls around the storage	During routine inspection - look for material displacement
Movement or cracking in structural concrete work	Failure of mechanical components such as pipes, gates etc	During routine inspection or when mechanical problems such as a burst pipe or a jammed gate occur - look for any movement or cracking of the structural concrete work to determine the cause
Failure of appurtenant structures or operating equipment	Loss of ability to supply water or discharge floods safely	After detecting an operational anomaly - identify and investigate the cause
Abnormal instrument readings (if installed)	A sudden change in the values of instrument readings	On detection - check for equipment malfunction and investigate the cause
Algal blooms	Blue green opaque nature of near surface and shallow water	During routine inspections particularly in the summer months - look for rapid colour change of the storage to a blue green opaque nature
Chemical spills	Dead fish and other aquatic life in storage, or a strange odour or colouration	On detection - identify and investigate the cause

In the event of such problems occurring it may be appropriate for more detailed inspections by properly qualified dams engineers. If the problems are likely to cause failure of the dam and loss of storage, the Emergency Action plan should be activated.

9. Dam Failure Inundation Map

- Dam failure inundation maps should be developed at a scale sufficient to be used for identifying downstream-inhabited areas within the area subject to possible danger.
- Inundated areas should be clearly identified.
- It may be appropriate to supplement the inundation on the maps with water surface profiles showing the elevation before failure, the peak water surface elevation after failure, and the location of structures at critical locations.
- A narrative description of the areas affected by the dam break can be included to clarify unusual conditions.
- The best available topographic map should be used. The expected inundation following the assumed failure should be delineated on the map.

- The accuracy and limitation of the information supplied on the inundation maps and how best to use the maps should be described.
- Inundation maps should be updated periodically to reflect changes in downstream areas.
- Include any other pertinent information as a result of coordination with the appropriate emergency management authorities.

10. Any other charts, rating tables, considered by the dam owner as necessary

Other charts and rating tables may include charts developed in the hydrological analysis for the dam or during spillway design.

9.5 Emergency Event Report

Following an emergency, an Emergency Event Report should be completed which contains:

- a description of the event
- instrumentation readings (where appropriate)
- description of any observed damage
- photographs
- the EAP
- details of communication which took place during the emergency
- comment on the adequacy of the EAP
- any recommendations or suggested changes to the EAP.

Dam owners have the responsibility for implementing the recommendations contained in the Emergency Event Report. Comprehensive inspections and ultimately audits undertaken by the Regulator, will evaluate the dam owners response to Emergency Event Reports.

9.6 Counter Disaster Plan

The Department of Emergency Services controls counter disaster coordination and planning in Queensland. If an emergency occurs with a dam which will constitute a disaster, the State Emergency Service will be in charge of the community response including the evacuation of residents. Counter Disaster Plans should be linked to the EAPs prepared for each dam. Dam owners should co-operate with the Disaster District Agencies (DDCC and LGCDC) and the community when preparing Counter Disaster Plans.

For further information on Counter Disaster Plans, refer to Guide 7 of Emergency Management Planning for Floods Affected by Dams published by Emergency Management Australia.

9.7 Testing and Reviewing

To ensure EAPs are kept up to date and effective, they need to be maintained by:

- Testing

EAPs should be tested periodically by conducting a drill simulating emergency conditions (exercises). Such tests can be either field or desk top exercises and are used to refresh and train

those likely to be involved if an event occurs.

Operational staff at dams should participate in exercises annually. Larger scale exercises involving coordination between the Counter Disaster Agencies and other authorities should be conducted at least every five years.

- Updating the EAP

A periodic review of the overall plan should be conducted to assess its workability and efficiency (ie timeliness), and to plan for the improvement of weak areas. For example, telephone contact details should be reviewed and updated at least on an annual basis.

The EAP should be reviewed for adequacy at least every five years as part of the comprehensive 5 yearly inspection.

Once the EAP has been revised, the updated version (or the affected pages) should be distributed to all involved parties. The distribution of copies of the EAP and the notification flowchart (if issued separately) must be controlled and documented to ensure simultaneous updating of all copies. Updates should be made promptly. In addition, it is recommended that the entire EAP is reprinted and distributed to all parties at least every 5 years.

10 Decommissioning

10.1 Introduction

When a dam is no longer needed, the dam owner may:

- arrange for the transfer of ownership and associated responsibilities to another party
- decommission the dam.

10.2 Decommissioning

A decommissioned dam is a dam where parts of the structure are removed or otherwise modified to make it incapable of storing water, either temporarily or permanently.

The extent of modification required for the safe decommissioning of a dam should be assessed by an experienced dams engineer and may include:

- effective removal of part of the main wall
- permanent enlargement or opening of the outlet works
- lowering of the spillway crest
- removal of spillway, control gates or stopboards
- excavation of a diversion channel through an abutment.

10.3 Dam Safety Decommissioning Plan

When decommissioning a dam, owners should prepare a dam safety decommissioning plan, which outlines the proposed action to be taken to decommission the dam. The dam safety decommissioning plan should:

- include a time sequence of studies and works associated with the decommissioning
- address all dam safety issues associated with the decommissioning including:
 - show impacts of sudden loss of remaining embankments or other dam sections for a range of flood events in compliance with the Guidelines for Failure Impact Assessments of Water Dams
 - provision for safe release of stored water
 - assessment of altered hydraulic character of spillways and streams
 - provision to minimise impact on downstream residents
 - provision for consultation with downstream residents and landholders.

In addition to dam safety issues there are numerous environmental, economic and social issues to be considered when decommissioning a dam. The owner should determine the requirements of the Environment Protection Agency (EPA) when planning the decommissioning of any dam.

Appendix 1

Abbreviations and Definitions

Abbreviations

ANCOLD	Australian National Committee on Large Dams
AFC	Acceptable Flood Capacity
DDC	Disaster District Co-ordinator
DDDC	Disaster District Co-ordination Committee
DOC	Designer's Operating Criteria
DOMM	Detailed Operating and Maintenance Manual
EAP	Emergency Action Plan
FSL	Full Supply Level
IFF	Imminent Failure Flood
LGCDC	Local Government Counter Disaster Committee
NR&M	Department of Natural Resources and Mines
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
RPEQ	Registered Professional Engineer (Queensland)
SOP	Standing Operating Procedures

Definitions

Abutment: That part of the valley side against which the dam is constructed.

Annual exceedance probability: The probability of a specified event being exceeded in any year.

Appurtenant Works: All ancillary structures of a dam including, but are not limited to, spillways, inlet and outlet works, tunnels, pipelines, penstocks, power stations and diversions.

Catchment: The land surface area, which drains into a dam or to a specific point.

Category 1 failure impact rating: A category of referable dam under *Water Act 2000*. The population at risk has been determined as between 2 and 100 persons inclusive.

Category 2 failure impact rating: A category of referable dam under *Water Act 2000*. The population at risk has been determined as greater than 100 persons.

Chief Executive: Chief executive of the Government Department (Qld) responsible for administering the dam safety provisions of the *Water Act 2000*. At the time of writing this was NR&M.

Collapse: The physical deformation of a structure to the point where it no longer fulfils its intended function.

Controlled Document: A document subject to managerial control over its contents, distribution and storage.

Dam:

- (a) works that include a barrier, whether permanent or temporary, that does or could or would impound, divert or control water and
- (b) the storage area created by the works. The term includes an embankment or other structure that controls the flow of water and is incidental to works mentioned in (a).

The term does not include the following -

- A rainwater tank
- A water tank constructed of steel or concrete or a combination of steel or concrete
- A water tank constructed of fibreglass, plastic or similar material

Dams Engineer: An engineer who is suitably qualified and experienced and who is recognised by the engineering profession as experienced in the engineering of dams.

Decommissioned Dam: A dam that has been taken out of service and which has been rendered safe in the long term.

Designers Operating Criteria (DOC): Comprehensive operating criteria, which stress the designers, intended use and operation of equipment and structures in the interest of safe, proper, and efficient use of the facilities.

Emergency: An emergency in terms of dam operation is any condition, which develops unexpectedly, endangers the integrity of the dam and requires immediate action.

Emergency Action Plan (EAP): A continually updated set of instructions and maps to deal with emergency situations or unusual occurrences at dam.

Failure (Dam):

- the physical collapse of all or part of the dam or
- the uncontrolled release of any of its contents.

Flood Control Dam: A dam which temporarily stores or controls flood runoff and includes dams used to form flood retarding basins.

Foundation: The undisturbed material on which the dam structure is placed.

Freeboard: The vertical distance between a stated water level and the lowest level of the non overflow section of the dam.

Full Supply Level (FSL): Means the level of the water surface when the water storage is at maximum operating level when not affected by flood.

Height of Dam: Means the measurement of the difference in level between the natural bed of the watercourse at the downstream toe of the dam or, if the dam is not across a watercourse, between the lowest elevation of the outside limit of the dam and the top of the dam.

Imminent Failure Flood (IFF): The flood event which when routed through the reservoir just threatens failure of the dam. The reservoir is assumed to be initially at maximum normal operating level.

Incident: An event which could deteriorate to a very serious situation or endanger the dam.

Inspection (Dam): A careful and critical examination of all physical aspects of a dam.

Inspector: A technical person suitably trained to undertake dam safety inspections

Maintenance: The routine work required to maintain existing works and systems (civil, hydraulic, mechanical and electrical and computer hardware/software) in a safe and functional condition.

Monitoring: The collection and review of data to assess the performance and behavioural trends of a dam and appurtenant structures.

Operator: The person, organisation, or legal entity which is responsible for the control, operation and maintenance of the dam and/or reservoir and the appurtenant works.

Outlet works: The combination of intake structure, screen, conduits, tunnels and valves that control discharge.

Owner: The owner of land on which the dam is constructed or proposed to be constructed.

Probable Maximum Flood (PMF): The flood resulting from PMP and, where applicable, snowmelt, coupled with the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions.

Probable Maximum Precipitation (PMP): The theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin.

Referable Dam: A dam is a referable dam if:

- a failure impact assessment is required to be carried out for the dam and
- the assessment states the dam has a category 1 or 2 failure impact rating and the chief executive accepts the assessment.

Registered Professional Engineer (RPEQ): A registered professional engineer, a professional engineering company or a registered professional engineering unit as defined under the Professional Engineers Act 1988 (Qld).

Remedial Work: Any work required to rectify a deficiency to an adequate safety standard.

Reservoir: An artificial lake, pond or basin for storage, regulation and control of water, silt, debris or other liquid or liquid carried material.

Reservoir Capacity: The total or gross storage capacity of the reservoir up to full supply level excluding flood surcharge.

Risk: The probability of an adverse event. The likelihood of a dam failure occurring with adverse consequences (“chance of failure to perform” or “chance of harm” are alternative definitions).

Safety Review: The assessment of dam safety by methodical examination of all design and surveillance records and reports, and by the investigation and analysis of matters not addressed previously or subject to new design criteria.

Spillway: A weir, conduit, tunnel or other structure designed to permit discharges from the reservoir when pondage levels rise above the full supply level.

Spillway Crest: The uppermost portion of the spillway overflow section.

Surveillance: Ongoing monitoring and review of the condition of a dam and its appurtenant structures; and the review of operation, maintenance, monitoring procedures and results in order to determine whether a hazardous trend is developing or is likely to develop.

Tailwater Level: The level of water in the discharge channel immediately downstream of the dam.

Toe of Dam: The junction of the downstream (or upstream) face of dam with the ground surface (foundation); sometimes 'Heel' is used to define the upstream toe of a concrete gravity dam.

Top of Dam: The elevation of the uppermost surface of the dam proper, not taking into account any camber allowed for settlement, kerbs, parapets, guardrails or other structures that are not a part of the main water retaining structure. This elevation may be a roadway, walkway or the non-overflow section of the dam.



Appendix 2

Further reading

Legislation and Australian Guidelines

Water Act 2000 (Qld)

Water Resources Act 1989 (Qld)

(To be repealed on commencement of relevant sections of *Water Act 2000*)

Environmental Protection Act 1994 (Qld)

Integrated Planning Act 1997 (Qld)

Department of Primary Industries (Water Resources), Queensland, “Queensland Dam Safety Management Guidelines - Dam Safety Course Version”, 1994. (Superseded by this document)

Australian National Committee on Large Dams, “Guidelines on the Environmental Management of Dams”, 2001.

Australian National Committee on Large Dams (ANCOLD), “Guidelines on the Assessment of the Consequences of Dam Failure”, 2000.

Australian National Committee on Large Dams, “Guidelines on Selection of Acceptable Flood Capacity for Dams”, 2000.

Australian National Committee on Large Dams, “Guidelines on Tailings Dam Design, Construction and Operation”, 1999.

Australian National Committee on Large Dams (ANCOLD), “Dam Safety Management Guidelines”, 1994.

Australian National Committee on Large Dams (ANCOLD), “Guidelines on Risk Assessment”, 1994.

Australian National Committee on Large Dams, “Guidelines on Strengthening and Raising Concrete Gravity Dams”, 1992.

Australian National Committee on Large Dams, “Guidelines on Design Criteria for Concrete Gravity Dams”, 1991.

Australian National Committee on Large Dams, “Guidelines on Concrete Faced Rockfill Dams”, 1991.

Australian National Committee on Large Dams, “Roller Compacted Concrete for Gravity Dams”, Guidelines Supplement, Bulletin No 75, 1991.

Australian National Committee on Large Dams, “Guidelines on Design of Dams for Earthquakes”, 1988.

Department of Natural Resources & Mines, “The Guidelines for Failure Impact Assessments for Water Dams”, 2002.

The Australian Standard for Quality Systems AS/NZS ISO 9001-3:1994.

Emergency Management Australia, “Emergency Management Planning for Floods Affected by Dams” Guide 7, 2002.

Useful Web Sites

Australian National Committee on Large Dams (ANCOLD)
<http://www.ancold.org.au>

U.S. Bureau of Reclamation, “Training Aids for Dam Safety”, July 2001.
<http://www.usbr.gov/dsis/tads.html>

Queensland Government Legislation
<http://www.legislation.qld.gov.au/legislation.htm>

US Army Corps of Engineers
<http://www.usace.army.mil/inet/usac-docs/eng-manuals/em.htm>

Books, Journal Articles and International Guidelines

American Society of Civil Engineers “The Evaluation of Dam Safety”, Proceedings of the Engineering Foundation Conference, ASCE, 1976.

American Society of Civil Engineers & U.S. Commission for Large Dams, “Foundations for Dams”, Proceedings of the Engineering Foundation Conference, 1974.

Bowen, R., “Grouting in Engineering Practice”, 1975.

Building Research Establishment, “An Engineering Guide to the Safety of Embankment Dams in the UK”, Report 1990.

Canterford, R. P., “Australian Rainfall and Runoff”, Institution of Engineers Australia, 1987.
 (This document is presently being updated)

Department of Primary Industries (Water Resources), Queensland, “Queensland Dam Safety Course Notes”, 1994.

Fell, R, MacGregor, P, Stapledon, D. “Geotechnical Engineering of Embankment Dams”, 1992

Houlsby, A.C. (1977,1978). Foundation grouting for dams ANCOLD Bulletins 47,48 and 50

ISMES (Italy), “Activities for Dams (site characterisation to safety monitoring)”, 1985.

ISMES (Italy), “Management of Information for Dam Safety”, 1985.

Jansen, R. B., “Dams and Public Safety”, U.S. Department of the Interior, Bureau of Reclamation, 1983.

Keller, W., “Geodetic Deformation Measurements on Large Dams”, Kern Pamphlet, 1987

“Safety of Dams: Flood and Earthquake Criteria”, National Academy Press, 1985.

“Safety of Small Dams”, Proceedings of the Engineering Foundation Conference, ASCE, 1974.

Sherard, J. L. et al, “Earth and Earth Rock Dams”, Wylie, 1963.

Thomas, H. H., “The Engineering of Large Dams”, Vols. 1 & 2, 1976.

U.S. Federal Coordinating Council for Science Engineering and Technology, “Federal Guidelines for Dam Safety”, FEMA No 93, June, 1979.

U.S. Bureau of Reclamation, “Downstream Hazard Classification Guidelines”, Bureau of Reclamation, December 1988.

U.S. Bureau of Reclamation, “Design of Small Dams”, U.S. Department of the Interior, Bureau of Reclamation, 1987.

U.S. Bureau of Reclamation, “Guide for preparation of Standing Operating Procedure’s for Dams and Reservoirs”, Bureau of Reclamation, 1986.

U.S. Bureau of Reclamation, ‘Safety Evaluation of Existing Dams’, U.S. Department of the Interior, Bureau of Reclamation, 1983.

U.S. Bureau of Reclamation, ‘Concrete Manual’, U.S. Department of the Interior, Bureau of Reclamation, 1981.

U.S. Bureau of Reclamation, ‘Earth Manual’, U.S. Department of the Interior, Bureau of Reclamation 1980.

U.S. Bureau of Reclamation, ‘Design of Arch Dams’, U.S. Department of the Interior, Bureau of Reclamation, 1977.

U.S. Bureau of Reclamation, ‘Design of Gravity Dams’, U.S. Department of the Interior, Bureau of Reclamation, 1976.

U.S. Committee on Large Dams, “Dam Safety Practices and Concerns in the U.S.A.”,

U. S. Federal Emergency Management Agency, “National Dam Safety Program - A Progress Report”, FEMA, No 103, 1986.

U. S. Federal Emergency Management Agency, “Dam Safety: An Owners Guidance Manual”, FEMA, No 145, 1987.

U.S. National Research Council, “Safety of Existing Dams - Evaluation and Improvement”, National Academy Press, 1983.

U.S. National Research Council, “Safety of Dams - Flood and Earthquake Criteria”, National Academy Press, 1985.

The Australian National Committee on Large Dams produces a “Bulletin” as a periodical with 2 or 3 editions being published each year. These bulletins present papers on all aspects of Australian dam design, construction and ongoing operation and management of dam safety. Further details are available from the ANCOLD website (<http://www.ancold.org.au>)

United States Bureau of Reclamation - Training Aids for Dam Safety (July 2001).

Dam safety inspection training modules⁸:

- Preparing to Conduct a Dam Safety Inspection.
- Documenting and Reporting Findings from a Dam Safety Inspection.
- Inspection of Embankment Dams.
- Inspection of Concrete and Masonry Dams.
- Inspection of the Foundation, Abutments, and Reservoir Rim.
- Inspection of Spillways and Outlet Works.
- Inspection and Testing of Gates, Valves, and Other Mechanical Systems.
- Instrumentation for Embankment and Concrete Dams.
- Identification of Material Deficiencies.
- Evaluation of Facility Emergency Preparedness.

Dam safety awareness, organization, and implementation modules: ⁹

- Dam Safety Awareness
- How to Organize a Dam Safety Program.
- How to Organize an Operation and Maintenance Program.
- How to Develop and Implement an Emergency Action Plan.
- Identification of Visual Dam Safety Deficiencies.

Data review, investigation and analysis, and remedial action for dam safety modules: ¹⁰

- The Dam Safety Process.
- Evaluation of Hydrologic Adequacy.
- Evaluation of Hydraulic Adequacy.
- Evaluation of Concrete Dam Stability.
- Evaluation of Embankment Dam Stability and Deformation.
- Evaluation of Seepage Conditions¹¹.

International Commission on Large Dams (ICOLD), Publish Bulletins and Transactions on a range of aspects of dam design, construction and ongoing operation and management of dam safety.

In Australia these are available through :-

- the ANCOLD Publications Officer. (In January 2002 the position was held by Mr Len McDonald [len@damsafety.nsw.gov.au].)
- or through the ANCOLD web site <http://www.ancold.org.au>

A list of the ICOLD publications available at 1 January 2002 follows:-

- No. 15 Frost Resistance of Concrete (1960)
- No. 18 Guide and Recommendations on Aggregates for Concrete for Large Dams (1965)
- No. 20 Surface-active Admixtures for Concrete for Large Dams (1968)
- No. 22 Guide and Recommendations on Pozzolans and Slags for use in Concrete for Large Dams (1972)

⁸ These modules are for engineers with little or no inspection experience and technicians with some familiarity with dams.

⁹ These training modules are primarily for dam owners and operators.

¹⁰ These modules are for dam safety program managers, dam owners and operators, and experienced engineers.

¹¹ Available from United States Bureau of Reclamation, Engineering and Research, D-3000, P.O. Box 25007, DFC, Denver, Colorado 80225-0007.

- No. 24 Accelerating and Retarding Admixtures (1973)
- No. 25 Extensibility of Concrete for Large Dams (1976)
- No. 29 Report from the Committee on Risks to Third Parties from Large Dams (1977)
- No.30a Finite Element Methods in Analysis and Design of Dams (2nd Edition, 1978)
- No.32a Bituminous Concrete Facings for Earth and Rockfill Dams (1977-82)
- No. 33 Compendium of Dam Symbols (1979)
- No. 34 ICOLD Guide for the International System of Units (IS)
- No.36a Cements for Concrete for Large Dams
- No. 37 Dam Projects and Environmental Success (1981)
- No. 38 Use of Thin Membranes on Fill Dams (1981)
- No. 39 Upstream Facing Interface with Foundations and Abutments (1st Supplement to Bulletin 32a)
- No.40a Fibre Reinforced Concrete (1988)
- No. 42 Bituminous Cores for Earth and Rockfill Dams (1982)
- No. 44a Bibliography - Mine and Industrial Tailings Dams and Dumps (1982, 1989)
- No. 46 Seismicity and Dam Design (1983)
- No. 47 Quality Control of Concrete (1983)
- No. 48a River Control During Dam Construction (Reprinted 1986)
- No. 49a Operation of Hydraulic Structures of Dams (Reprinted 1986)
- No. 50 Dams and the Environment. Notes on Regional Influences (1985)
- No. 51 Filling Materials for Watertight Cut-Off Walls (1985)
- No. 52 Earthquake Analysis Procedure for Dams- State of the Art (1986)
- No. 53 Static Analysis of Embankment Dams (1986)
- No. 54 Soil-Cement for Embankment Dams (1986)
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Appendix 3 - Checklist of Dam Technology Issues

Issues that should be considered when preparing a Design Report or a Safety Review Report

1. General

- Report on any specific investigations and analyses carried out.
- Report on design methods, standards and loads adopted and the design data gathered and developed (ie plans, reports of investigations).
- Report on the proposed and actual construction methods (including results of testing).
- Report on operational and maintenance intentions used in developing the design or necessitated by the constraints of the design.
- Describe the expected performance and condition of the structure.
- Describe the instrumentation and monitoring requirements for the dam.

2. Drawings

- Plan of the dam and appurtenant works drawn on a contour plan of the site.
- Arrangements, elevations and sections showing details of the structures, the proposed foundation levels and sub-surface geological features.

3. Summary of Principal Data

- Type of dam.
- Type of foundation cut-off (if any).
- Type of spillway.
- Height of dam (as defined in the *Water Act 2000*).
- Length of (as applicable) embankment(s) or non-overflow structure(s).
- Spillway crest(s).
 - Type, number and dimensions of spillway and any crest or sluice gates.
- Elevations of (as applicable):
 - original stream bed or lowest natural surface at toe
 - base of cut-off
 - spillway crest(s)
 - top of dam
 - full supply level
 - top of flood control storage (if any)
 - maximum flood level.
- Volumes of (as applicable):
 - excavation for foundations, cut-off and spillway
 - fill in each embankment zone and total
 - concrete in spillway, if separate
 - concrete in dam wall and appurtenance.
- Reservoir storage capacity:
 - to full supply level
 - in flood control storage
 - in surcharge storage.
- Reservoir surface area at full supply level.
- Catchment area.

- For the maximum design flood:
 - estimated recurrence interval
 - peak inflow rate
 - peak spillway discharge.
- For outlet works:
 - number and dimensions of outlet pipes and conduits
 - number, sizes and types of guard and regulating valves and gates
 - discharge capacity of each outlet with reservoir at full supply level.
- List of reports prepared by any person or organisation in the course of investigation and design.

4. Hydrological and Hydraulic Data and Analyses

- Failure impact assessment (including dam break analysis) and consequence assessment.
- Topographic map of the catchment or description of the terrain including elevations.
- Area of the catchment and of each sub-area controlled by other storages or lakes.
- Summary of stream flow, flood flow or rainfall records on which the hydrological analyses are based.
- Adequacy of spillway and means of assessment.
- Tables or curves of reservoir area and storage capacity versus water surface level.
- Summaries, as applicable, of hydrological analyses leading to the determination of flood frequencies, probable maximum flood, reservoir capacity, outlet capacity, spillway capacity and freeboard above maximum flood level.
- Recurrence interval of maximum flood adopted for the design of spillway and outlets, as applicable.
- Particulars of proposed reservoir operation including operation of outlets and spillway crest gates during floods.
- Tailwater rating curve(s) for spillways and outlets.
- Hydraulic data including formulae and co-efficients used in determining capacity of spillways and outlets.
- Discharge rating curves for spillways and outlets.
- Summary of assumptions and methods adopted for the design of energy dissipaters for spillways and outlets.
- Results of any physical or numerical hydraulic model studies.
- Fetch of reservoir and estimated wave height and run-up.

5. Foundation conditions and treatment

- Map and description of the general geology of the dam site and reservoir area showing major faults and identifying any other potentially hazardous features requiring special consideration.
- Report on any underground mine workings in the vicinity of the dam or reservoir and any provisions considered necessary to accommodate these workings.
- Records of foundation exploration holes, pits, excavations and other sub-surface investigations indicating:
 - nature and depth of material on which the dam, spillway, outlets and other appurtenant works are proposed to be founded
 - summaries of results of laboratory and in-situ tests for determining the engineering properties of the foundation materials indicating the number of tests, sampling locations and extreme as well as average values.
- Nature and extent of any proposed foundation treatments such as:
 - cut-off through pervious strata
 - provisions for drainage
 - curtain, blanket or consolidation grouting;
 - measures to consolidate, decrease permeability or otherwise modify the properties of the foundation or remedy defects.

6. Properties of construction materials

- For earthfill, filter materials, pervious materials, transition materials and rockfill:
 - approximate locations of the borrow areas and quarries and estimated volumes of reserves of each material
 - numbers of exploration holes, pits and excavations in each proposed borrow area and quarry
 - summaries of results of laboratory tests for determining the engineering properties of each type of material, and of results of geological examinations and tests on rock materials, indicating the number of test samples and extreme as well as average values.
- For concrete aggregates, if not obtained from sources of materials previously described:
 - approximate locations of proposed sources and estimated volumes of reserves of aggregates
 - number of exploration holes, pits and excavations in each proposed source
 - summaries of results of laboratory tests for determining the engineering properties of each type of material, and of results of geological examination and tests on rock materials, indicating the number of test samples and extreme as well as average values.

7. Embankment Design and Stability Analyses

- Details of each design case considered.
- Summaries of the properties of the material in each zone of the embankment and the foundation adopted for the stability analyses including density and shear strength parameters both as placed and saturated as appropriate and the justification for the adopted properties.
- Basis for the estimates of the pore pressures in the impervious zones adopted for each design case examined.
- Particulars of the methods of stability analyses used, formulae used in the analyses or references in technical literature, and the upstream and downstream water levels used in each design case.
- Minimum values of the factor of safety obtained for each design case and the locations of the critical slip surface for each case drawn on a cross-section of the embankment or results of any other method of assessment of the stability of the embankment.
- References in technical literature to design rules if used to determine dimensions of a small embankment without analyses.

8. Stress and Stability Analysis of Concrete Structures & other structural components

- Details of each design case considered.
- Summaries of the properties of concrete and foundation materials adopted for the analyses.
- Assumptions as to loads, including combinations of loads due to water, dead weight, uplift, earthquake, silt or other solids and temperature change when appropriate.
- Limiting stresses.
- Methods of analysis.
- Results of any structural model studies.
- Results of analyses including safety factors and stresses in the structure and foundation or the results of any other method of assessment of the stability of the structure.

9. Instrumentation

- Layout and description of embedded instruments and other devices installed to observe the behaviour of the works including, as applicable, pore pressures and uplift, leakage, embankment settlements, foundation deformations, alignment, deflections, stresses, strains, temperatures, contraction joint openings, seismic and mechanical vibrations.
- Pore pressure and uplift values assumed for the design of the associated structures at instrument locations
- Recommended for frequency of observations/readings

10. Construction specifications

- Clauses dealing with:
 - foundation treatment and grouting
 - sources of construction materials
 - methods of treatment and placement of materials
 - acceptability criteria.
- Construction schedule and sequence of construction operations, if specified.
- Stream diversion plan with respect to safety during construction.

Appendix 4 - Checklist Of Details For Consideration When Undertaking A Surveillance Evaluation¹⁶

1. General Interpretation

All new data should be thoroughly examined in context with existing data.

Situation “Normal”

Generally the latest set of observations can be quickly scanned as numbers in a table or points on a plot and be seen to be as expected. In simple cases such as settlement or horizontal deflection of fill or gravity dams the reading should be within a millimetre or two of expectation, for a well-planned observation schedule.

For high thin arch dams, reservoir water level and seasonal temperature variations can justify statistical regression checks, and the observation should be within a few millimetres of a well-organised prediction from regression.

Leakage and piezometric data, when notionally cleared of local runoff effects, should generally follow any significant reservoir head changes. Seasonal opening and closing of joints or cracks in concrete dams can be reflected in gallery or toe drain flows, but after allowing for such influences, there should be negligible long term change.

Anomalies - Real or Not?

Sometimes an isolated instrument reading, or a survey observation, will indicate some severe distress or a strain, deformation or pore pressure which, if valid, would represent a real threat to the dam.

Every effort should be made to urgently assess such a situation, with repeat readings, repair of blown fuses, or extra instruments, targets or reference pillar checks.

If the dam has not failed and the adjacent parts are not indicated as behaving abnormally, that instrument reading or survey observation must be taken as anomalous, however carefully it purports to have been checked “correct”.

Typical Assessment of “Overall Picture”

In foundations with piezometers upstream and downstream of grout and drainage curtains, and flow measurement of drains or drainage adits, it is possible to develop a good picture of the water table.

Ideally the piezometers will continue to indicate a roughly linear head drop along the seepage path. Rises and falls can be expected to follow corresponding reservoir level changes.

If tightening of foundation joints by creep causes a slow reduction in the long-term mean leakage flow, the head pattern described above should still apply.

¹⁶ Taken from ANCOLD Dam Safety Management Guidelines (1994)



If pressures build up downstream of the drainage curtain in dry weather, consideration of some extra drainage drilling is indicated.

Emergency Action “Triggering”

The surveillance engineer should be familiar with the designs, recent performance and possible failure mechanisms of all dams for which the engineer has surveillance responsibility.

Immediate personal access should be available to senior management in a perceived Dam Safety emergency. Senior management should not usurp the authority of the Dams Safety Engineer unless they are appropriately qualified and experienced.

Staff at the dam should be sufficiently trained to recognise an emergency and have the authority to trigger emergency action in the event of a disruption in communication.

Dam owners, particularly in relation to initiating, testing or upgrading Emergency Action Plans should maintain close regular liaison with those responsible for emergency services.

2. Factors For Consideration

The evaluation of a dam’s performance usually requires a close inspection of the dam and its appurtenances, examination of water pressures and seepage records and the various movements relative to the abutments or of differential movement within the dam. These data are then compared with design assumptions, predictions and historical behaviour patterns to fully evaluate the existing situation.

Seepage

Seepage through, around or under a dam is expected. The quantity and nature of seepage, the seepage paths, and the velocity of the seepage waters are issues to be considered when analysing the dams’ structural behaviour.

The quantity and nature of seepage is important for several reasons:

- **Leaching:**
seepage may dissolve some of the chemical constituents of the concrete, rock or soil. Leaching may provide an enlarged seepage path resulting in increasing seepage. Dams founded on limestone are subject to this problem. Evaluation of the composition of the seepage water (eg turbidity, dissolved salt content) can provide a further insight into dam behaviour.
- **Weakening:**
seepage water may completely saturate soils and rock, and cause excessive uplift (pore pressures) as well as softening and weakening of soil and rock.
- **Loss of Storage:**
excessive leakage may, in extreme cases, compromise the storage capability of the reservoir.
- **Indication of Behaviour:**
increases in seepage quantity with time may indicate the onset of internal erosion, and decreases may indicate infilling of seepage paths, with build up of internal pressures in dams and their foundations.

The location of a seepage path is of concern because:

- **Piping:**
if seepage is confined to a few discrete paths and the velocity becomes sufficiently high to move soil particles, progressive erosion may occur resulting in a “piping” failure.
- **Leaching:**
seepage waters may result in concentrated dissolution.
- **Drainage:**
if discrete seepage paths are present and are not intercepted by drains, then drains should be installed. Seepage (or pore) pressures if above design values may compromise the stability of a dam.

Movements

Some movement of all or part of a dam can be expected eg seasonal movements, changes in water level. Movements may be in the vertical plane, the axial plane (along the dam’s axis), and the upstream-downstream plane, or rotational. It is common for more than one direction and mode of movement to be present in a dam.

Vertical movements occur as a result of consolidation of the foundations or the embankment. Such settlement is typically greater along the crest of the dam than along the heel or toe and is also usually greater near the centre of the dam than near the abutments. Such settlement can result in cracking. Minor upward vertical movement (heave) can also occur at the toe of an embankment dam due to fill creep or excess uplift pressures.

Vertical movement of the centre of a fill dam with respect to the abutments is generally associated with horizontal movement toward the centre of the dam. This axial movement results in tension, which can involve cracking of the core or face membrane.

Upstream-downstream movements are usually in the downstream direction and are due to hydrostatic forces acting on the upstream face of the dam. These movements can be horizontal or rotational. Upstream movements are usually of a rotational-type and may occur during “rapid drawdown”. These rotational movements may be a deep-seated or a relatively shallow configuration. The slides may extend into the foundation, intersect at the dam’s heel or toe, or may be entirely contained within the dam. The general cause of such movements is deficient shearing resistance along the often saturated failure surface associated with high uplift pressures and reduced effective stresses.

3. Typical Periods for Evaluation

During the life of a dam, from initial planning, through construction, reservoir filling, and operation, an evaluation may be necessary as follows:

Preconstruction

Evaluation of pre-construction conditions using various instruments can be valuable. During the initial planning and design stages several important considerations affecting dam safety should be investigated. They include:

- **Normal ground-water levels:**
the existing ground-water level in the abutments, dam area, reservoir rim, and downstream of the dam and its seasonal variation should be determined.
- **Quality of the ground-water:**
ground-water mineral composition can be compared with later seepage water mineral composition

- to aid in determining if dissolution is occurring.
- Seepage at abutments:
seepage due to natural ground-water at abutments prior to construction will affect the design of the dam and later evaluation of the dam's performance.
- Landslide scars/faults:
old landslide scars and faults in the vicinity of the dam indicate the potential for additional sliding during reservoir construction and operation.
- Permeability of existing materials:
for the foundation, abutments, and reservoir floor, treatments such as grouting cut-off walls and upstream blankets can reduce the effect of excessively permeable materials.
- Foundation consolidation:
knowing the characteristics of foundation materials allows anticipated settlement of the dam to be estimated.
- Fill and foundation shear strength:
the shear strengths of the relevant materials are needed to determine the stability of the dam.
- Seismic:
the seismic risk at the dam site is used to design the dam to resist loading up to the Maximum Credible Earthquake. Preparations should also be made to assess the existence of reservoir-induced seismicity.
- Hydrologic:
catchment conditions, flood potential and the likelihood of changing conditions affecting future flood magnitude are important in determining spillway capacity.

During Construction

Installation and observation of instrumentation begins during construction. Visual observation is also vital during this period.

- Instrument installation:
many instruments are installed during dam construction. These include piezometers, pressure cells, strain gauges, settlement and movement measuring devices and thermometers. It is absolutely essential that proper care be taken during their installation otherwise no information of value will be obtained from them. Incorrect installation techniques produce information detrimental to interpretation. Instruments must be tested as they are installed. Continuous supervision by specialists with authority to require repair or replacement is vital in the rough construction environment.
- Settlement:
consolidation of foundation and embankment materials result in settlement of the surface of the dam as it is constructed. Settlement measuring instrumentation (such as hydrostatic manometers and cross arms), installed during construction, record such settlement.
- Observation of excavations:
during construction excavations for foundation and core trenches, should remove undesirable materials. Visual observations by experienced personnel during this phase are extremely valuable and should be carefully recorded. Based on these observations, there may be need for instruments to be relocated or added or for design changes. This information can be important in diagnosing subsequent anomalous behaviour.
- Increasing Pore Pressures:
rapid construction of embankments, at high moisture contents, may cause excessive pore pressures, which would result in instability if not allowed to dissipate. Records of such pore pressures can be of long-term significance.
- Slide movements:
slide movements due to high pore pressure building up during construction may be noted either

visually or by instrumentation.

- Temperature:
excessive temperatures from cement hydration in concrete dams may cause subsequent thermal cracking if not controlled.
- Permeability:
filter permeability should be checked as placement can compact a filter more than specified.

During First Reservoir Filling

The first filling of a reservoir is normally a critical event for a dam. At that time, the first true analysis of the behaviour of a dam with reservoir loading can be made. Instrumentation readings and visual observations are conducted very frequently during this period.

- Seepage:
as the water level in the reservoir rises, it is especially important to watch both the dam and abutments for increases in seepage quantities, changes in seepage clarity, new seepage locations and the functioning of drains.
- Pore pressure:
at this time frequent readings should be taken to monitor pore pressure changes and patterns.
- Dam movements:
the increasing load from the reservoir water will cause movements of the dam, particularly in the downstream direction. These require close monitoring, ideally including correlation with movement controlling factors.

During Normal Operations

Dam owners generally aim to have trouble free operation of a dam for many years. The water level in many reservoirs fluctuates each year resulting in seepage quantity and pore pressure fluctuations on a regular, somewhat predictable basis. It is therefore important to establish a regular instrumentation monitoring schedule and a regular visual inspection of the facility and to summarise the findings in regular surveillance reports on the dam. Any significant unusual changes noted should be an immediate cause for further investigation.

During Rapid Drawdown

Occasionally, the reservoir level is lowered rather quickly for some reason. The term “rapid” depends on the type of material in the dam and abutments. In some relatively permeable materials, “rapid” may mean hours or days, while in low permeability materials, a “rapid drawdown” might cover a period of weeks. During drawdown the external reservoir water pressure is removed but the internal pore pressures in the dam and abutments remain, to dissipate more slowly in impermeable materials. This creates a condition where slides may occur in the upstream face of an embankment, the abutments, or anywhere along the reservoir rim. Surface movements and pore pressures in the upstream shoulders require special monitoring at this time.

4. Interpretation Of Data

Data Presentation

The use of graphical presentation of instrumentation data should be undertaken for the evaluation of dams. Graphical presentation by computers is simple and rapid and reduces the chance of plotting errors and enables ancillary computations and data variation checks to be performed.

Data presentation, when properly done, is of very significant value, but incorrect data plotting may cause

errors in interpretation. The characteristics of incorrect plotting include:

- **Improper scale:**
proper and consistent scales must be used. Movements should not normally be shown larger than full-scale (1:1).
- **Excessive data:**
in general, each plot should contain only two variables: (eg water level and time). There may, however, be a large amount of data points on a single instrument or even a number of instruments. The number of instruments shown on a single sheet of plotting is a matter of common sense. Plot lines should not repeatedly cross each other and distinctly different line symbols should be used for each plot.
- **Coloured lines:**
distinguishing plots by colour should be avoided due to the use of black and white photocopying (eg when “quoting” plots in subsequent communications).

Detection of Errors

Data errors can usually be detected either in the field at the time of reading or in the office during processing or reviewing. Often, it has been found that if the instrument reader knows what the previous reading on an instrument was, they can re-check the current reading if it differs significantly. (The risk that the reader will report a reading close to the previous one without actually making an observation, or even where a different reading is actually obtained, has to be considered.)

Normal and Abnormal Conditions

Application of the terms “normal” and “abnormal” depends on the particular characteristics of a dam in question. The behaviour of pressures, strains, movements, and seepage, should be compared to the behaviour anticipated during the design of the dam and any preconstruction data gathered from the dam site. It is important for designers to state acceptable “ranges” in design reports and operating instructions. For dams with limited design data, historical behaviour patterns should be developed.

Correlation of Inspection/Monitoring Data

The recommendation for major remedial works on a dam should not depend on uncorroborated evidence. Ideally any visible anomaly should be confirmed by anomalies recorded on associated instruments.

It is important to compare measured aspects of a dam’s behaviour over identical date ranges. Since observations cannot always be made concurrently, response factors, such as regression coefficients, should be used to determine the most probable values on the chosen comparison date, for movements, which could not be observed on the date.

Reservoir water level, ambient temperature, and age since construction should be included amongst the controlling variables in these studies. In comparing the designer’s predictions and the prototype’s performance, regression can be an important tool in separating the effects of temperature, water load and creep, so that each may be compared in turn.

In general, those responsible for interpreting monitoring results should endeavour to make all possible logical linkages throughout the range of dam data obtained from observations and inspections and be vigilant in the detection of errors and false alarms. Familiarity with the reliability of installations and observers is a great advantage in making a judgement as to whether an “alarm” is false or real as a result of a genuine excessive change in the value of the entity being monitored. In this regard close liaison between operators and surveillance personnel is critical.

Appendix 5

Checklist of Advice Concerning Dam Safety Inspections and the Preparation of Reports

This detailed advice applies to periodic and special inspections for physical integrity in the dam and to comprehensive inspections which assess the overall safety management of the dam. This checklist:

- defines the information about the structure that needs to be gathered during the inspection
- gives examples of the defects and problems that may be encountered
- requires the formulation of recommendations on remediation and repair strategies
- specifies the standard of report presentation that is acceptable to NR&M.

This advice is intended to define a minimum standard of report. It would be expected that engineers experienced in the management and performance of dams would provide a dam owner with comment and insight into the issues that are influencing the safety of a dam and advice on the management of the dam as an asset.

While most of the common causes of dam failure have been included in here, the list is not inclusive. Each dam is different and may present its own unique problems. Anyone who inspects dams should be aware of a wide range of potential problems and look for all potential modes of failure.

Where a dam contains novel or particularly complex features the inspection and report should reflect additional emphasis on these aspects.

Part A - Periodic Inspections

Periodic Inspections focus on the physical defects.

Personnel

For safety reasons it is advisable to have two or more personnel on each inspection. This applies particularly to isolated areas and to inspections where access to confined spaces is necessary.

Equipment

The following items may be useful

- checklist field book and pencils
- recording device (eg dictaphone)
- cameras (still and video)
- hand held levels
- probe
- safety gear: waders, harnesses, hard hats, safety boots, breathing apparatus, flame safety lamp and anything else to comply with safety regulations
- tape measures

- torch (“mine safe” for unventilated conduits, tunnels or adits)
- shovel
- geological hammer
- binoculars
- first aid kit
- stakes and flagging tape.

Recording Inspection Observations

Inspections require the accurate location, recording and photographing of questionable areas. The objective is to permit observation and comparison of the state of a dam through time. It is necessary to record:

- extent of such areas (ie length, volume, width and depth or height)
- a brief description of any anomalous condition eg:
 - quantity/quality of drain outflows, seepage and its source(s)
 - location, type and extent of deteriorated concrete
 - location, length, displacement and depth of cracks
 - extent of moist, wet or saturated areas
 - changes in conditions.

Areas For Inspection

Monitoring

A surveillance evaluation should be integrated into a periodic inspection. The surveillance evaluation report should:

- assess the available pressure, movement and seepage monitoring data by analysis of the impact (if any) of all monitoring results
- assess the seepage from the storage (A plan should be provided showing position, quantity, and quality of seepage.)
- report on the recent movement survey for the dam
- report on the foundation and embankment pressures being experienced by the dam (A plan showing the position and purpose of the individual piezometers should be provided).

An assessment should be made of the appropriateness of seepage, movement and pressure monitoring being carried out at the dam.

Operation

The report should include a review of the way in which the dam has been operating since the last periodic inspection and how it is intended to operate until the next periodic inspection is carried out. The report should comment on the impacts of the operation on dam safety including rainfall records, release records, record of flows in the spillway and maintenance and repairs carried out.

It is appropriate to report on the compliance with Standard Operating Procedures (SOP). It is also desirable to assess the SOP relative to best practice and the Queensland Dam Safety Management Guidelines 2002.

Requirements for specific elements of dams are outlined in Part E.

The following areas may also have to be considered in an inspection;

- a test operation of all equipment
- evaluation of all surveillance data
- major function checks and maintenance inspections. For example:
 - flip bucket watering
 - conduit dewatering
 - diver inspection of intake work
 - conduit video inspection
- the foundations, abutments, and reservoir rim should all be inspected regularly
- an inspection should be made far enough downstream to ensure that there are no problems that will affect the safety of the dam
- the reservoir surface and shoreline should also be regularly inspected to identify possible problems. whirlpools can indicate submerged outlets (Large landslides coming into the reservoir could cause waves overtopping the dam or water quality problems, suspect areas should be quantitatively monitored.)
- upstream development and other catchment characteristics, which might influence reservoir water or silt inflows, should be noted in major inspection reports to anticipate possible problems or modifications in the dam
- downstream development in flood plains should also be regularly assessed.

Part B - Special Inspections

A Special Inspection is recommended in the following cases regardless of the regular inspection schedule:

- whenever a concerning specific defect is observed in the dam
- during and immediately after the first reservoir filling or augmentation
- during and after a rapid draw down
- before a predicted major rainfall, or filling
- during (if possible) and after heavy flooding (or severe windstorm)
- following an earthquake, sabotage or overtopping; immediately and then regularly for several months to detect any delayed effects.

When carrying out a Special Inspection a dam owner should follow the steps listed for Periodic Inspections.

Part C - Comprehensive Inspections

Comprehensive Inspection focuses on the dam safety management program and documentation for the dam. It is an assessment of the appropriateness, the effectiveness and application (including the owner's response to recommendations) of the dam safety management program and documentation for the dam including:

- SOPs
- DOMMs
- EAP
- Data Book
- Design Report/Safety Review
- Surveillance and inspection program and records.

This assessment should take into account the development permit conditions for the dam.

Personnel

An experienced dams engineer who is a RPEQ should carry out Comprehensive Inspections. In assessing and reporting on these aspects of the dam the inspecting engineer needs to assess the current dam safety management program and documentation for the dam against that required firstly, in the development permit conditions and generally in the Queensland Dam Safety Management Guidelines 2002.

Operation

It is appropriate to report on the compliance with SOPs. It is also desirable to assess the SOP relative to best practice and the requirements of the Queensland Dam Safety Management Guidelines 2002

Inspection

Comprehensive Inspections should incorporate a review of the Periodic Inspection program and periodic inspection records for the dam as well as evaluating the dam owner's response to the conclusions and recommendations from inspection reports.

Emergency Preparedness

Comprehensive Inspections should incorporate an assessment of the emergency preparedness of the owners and operators of the dam. The owners EAPs and documentation should be assessed relative to the requirements of the Queensland Dam Safety Management Guidelines 2002.

Part D - Preparation of a Periodic, Special And Comprehensive Inspection Report

General

The aim of the periodic, special and comprehensive inspection reports is to document the findings of each inspection and to detail the required actions to be taken by the owner as a result of the inspection. These reports should be presented in a precise and readable form and be signed by the inspector.

Detailed data that is used to assess aspects of the dam should be attached as appendices and not included in the body of the reports. Captioned and dated photographs should be used extensively in the reports.

Information On The Dam

The report should include the following background information on the storage:

- ownership details including any change of owner
- details of the development permit conditions for the dam
- a brief description of the dam including:
 - location (latitude and longitude)
 - nearest town
 - principal dimensions and design water levels
 - construction type
 - current water levels
 - history, including inspection history.
- a thorough and critical review of:
 - Data Book

- SOPs
- EAPs
- operation and maintenance plans and log books for the dam
- Safety Review status for the dam.

Documenting The Inspection

The report should address the preparation for the inspection in the following areas:

- outline of the preparation for the inspection
- the preparation of checklists
- data gathering
- special provisions (eg drainage of stilling basins or aerial inspection)
- review of previous inspection, including identification of action items
- review of operation and design information.
- composition of the inspection team including:
 - details of the inspecting engineer or consultant including the RPEQ No. as appropriate (RPEQ No. compulsory for comprehensive inspections)
 - details of owner's representative
 - details of operations staff involved in the inspection
- the photographic record of the inspection. All photographs should be dated and annotated to reflect the features recorded

Conclusions And Recommendations

Each inspection report should include an overall assessment of the state of the dam and recommend action to remedy defects or ensure continued appropriate management practices. These should include:

- comments on the implementation of recommendations from previous reports
- conclusions on the safety of the dam
- recommendations on additional evaluation, investigation or testing
- recommendations on rehabilitation, repair and operational modifications relating to issues that were noted during the inspection
- a summary sheet outlining the recommended action, the responsible person and the appropriate time frame
- the dam owner should sign the report and endorse the recommendations.

If observed defects are considered serious, advice from a suitably qualified and experienced engineer should be sought. Depending on the significance of the potential consequences, the advice should be documented in the report.

Circulation

Copies of the periodic inspection report should be circulated to the following:

- the dam owner
- the individual responsible for operation of the dam.

Copies of the comprehensive inspection report should also be circulated in accordance with the development permit conditions for the dam.

Sample Contents Page

- General
- Conclusions and Recommendations
- Information on the dam
- Inspection
- Monitoring
- Review of Data Book, SOPs, DOMMs & EAP *for comprehensive inspections
- Embankment (If Needed)
- Spillway
- Outlet Works (If Needed)
- Concrete (If Needed)
- Weir
- Captioned and Dated Photographs

Part E - Requirements for specific elements of dams for Periodic, Special And Comprehensive Inspections

This section outlines defects observed in each of the following elements of dams.

1. Earth embankments
2. Spillways and bywashes
3. Discharge control structures and outlet works
4. Concrete dams
5. Weirs

Owners should address the requirements for each element of their dam.

1. Requirements for earth embankments

There are several types of dam construction that are included in the earth embankment category. They include:

- homogeneous rolled earth fill dams
- homogeneous rolled earth fill dams with toe drains
- zoned rolled earth fill dams
- diaphragm rockfill dams
- central core rockfill dams.

These dams all include an impermeable zone of clay fill or concrete and a supporting rock or earthfill zone to provide strength. Filter zones provide internal drainage of the structure.

These dams can fail by:

- internal erosion of embankment material by seepage and transport of embankment material through sinkhole cracks, animal burrows, compaction flaws in embankment, compaction flaws in conduit surrounds, flaws in the abutments (known as a piping failure)
- bulk removal of material and loss of height and section through slumping, beaching, tree blow over, and gully and sheet erosion
- overtopping.

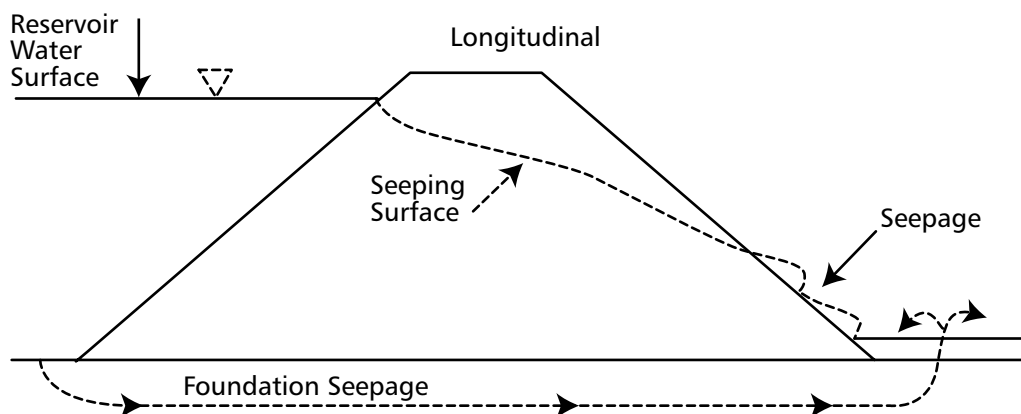
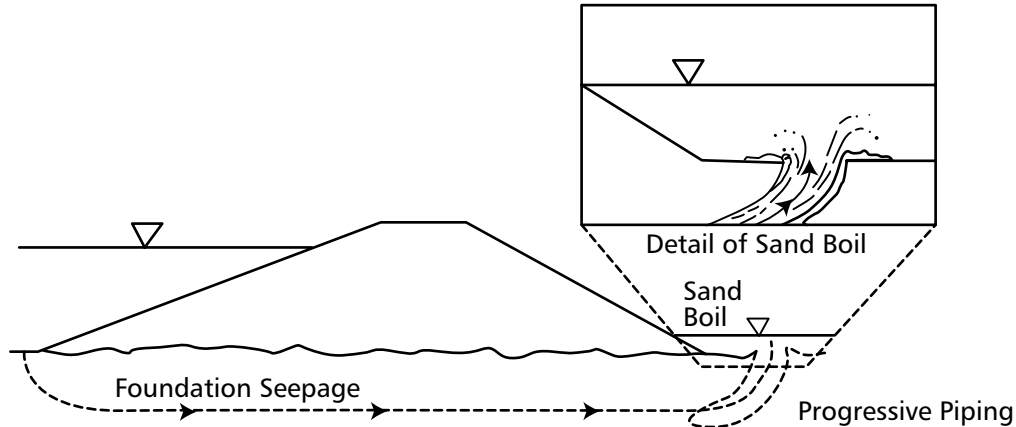
The report should document the inspection by including comments on the condition of the dam embankment with regard to

- erosion
- vegetative growth
- seepage
- slump formation
- beaching
- deterioration of rip rap
- cracking.

Following are some illustrations of deficiencies to look for when inspecting embankment dams.

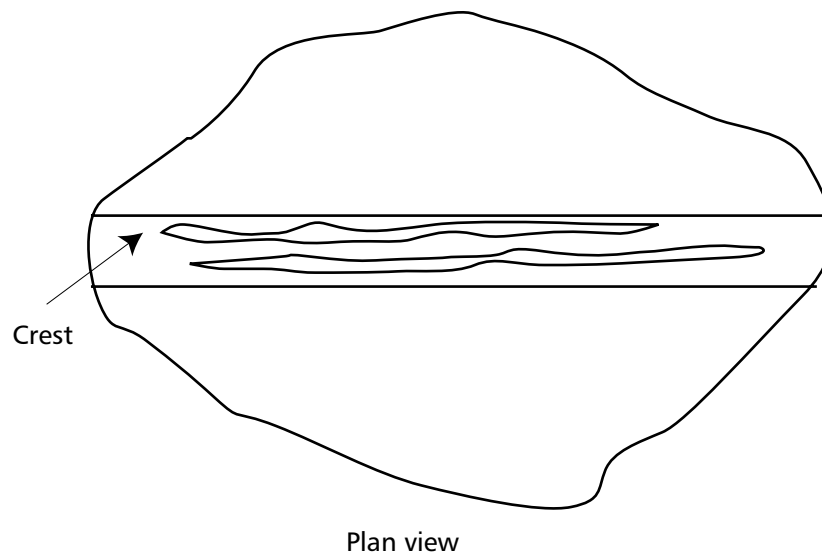
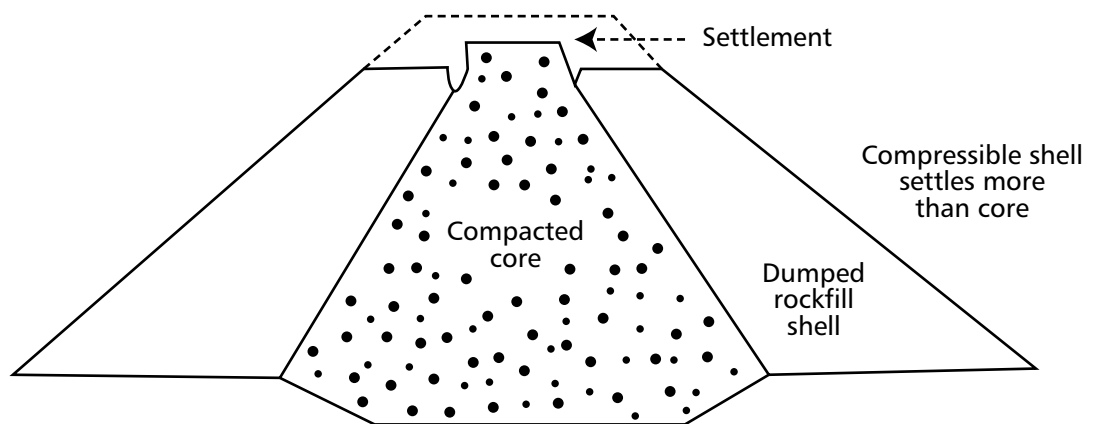
Seepage

- A water flow or sand boil on the lower portion of the downstream slope or toe area, especially at the groins.
- Leakage around conveyance structures such as outlet works, spillway conduits, or penstocks.
- Blocked toe drains and relief wells.
- An increase in the amount of water being released from toe drains and relief wells. (Remember to take into account changes in the reservoir level, or the effects of rainfall on the downstream face and abutments).
- Wet areas or area where the vegetation appears greener or more lush on the embankment slope or toe area.
- Turbidity or cloudiness of the seepage.



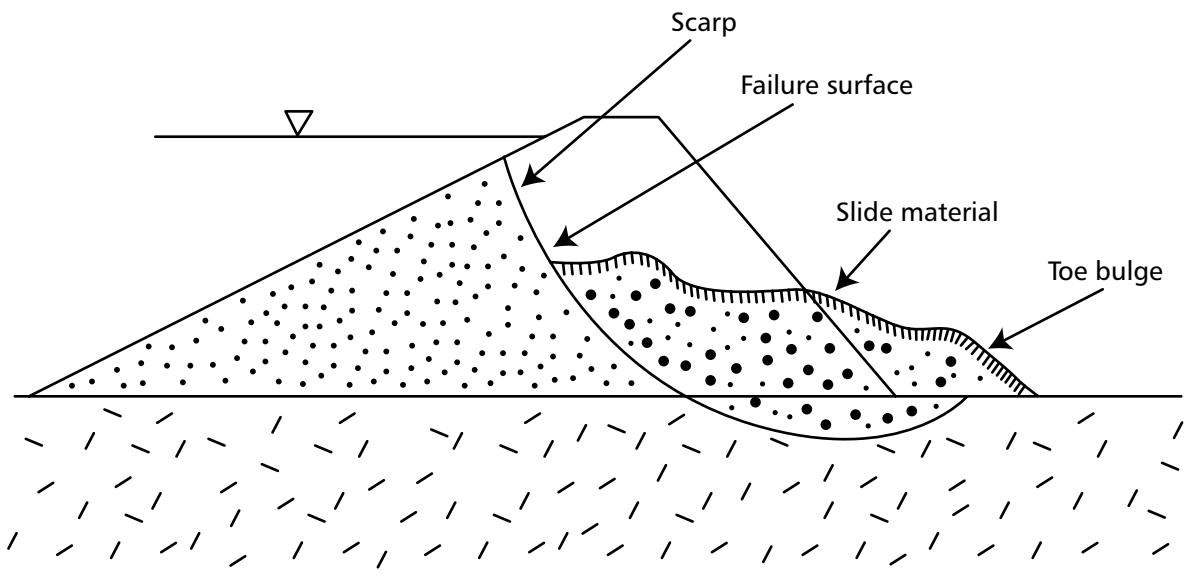
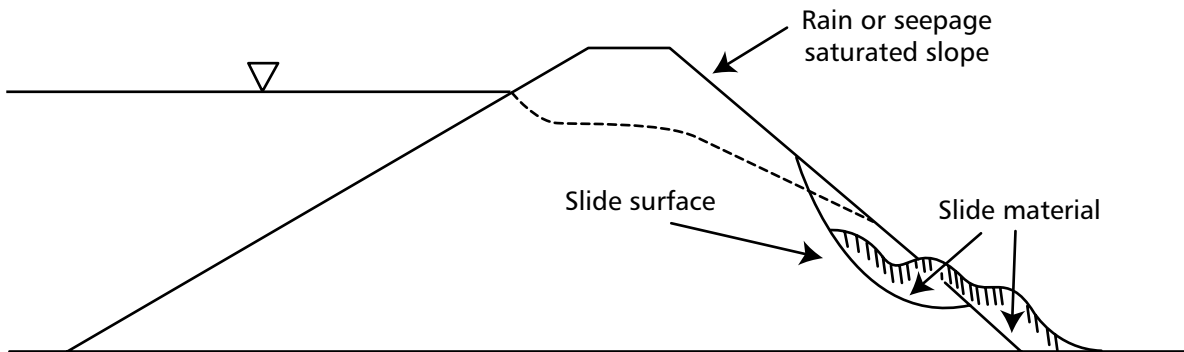
Cracking

- Desiccation Cracking: A random honeycomb pattern of cracks usually found on the crest and the downstream slope.
- Transverse Cracking: Cracks that are perpendicular to the length of the dam usually found on the crest.
- Longitudinal Cracking: Cracks that are parallel to the length of the dam. Longitudinal cracks may be associated with stability problems in the slopes.



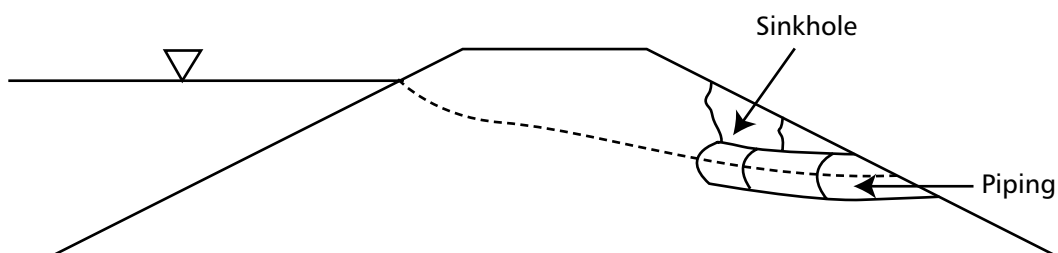
Instability

- Slides on the upstream and downstream slopes.
- Bulging, especially at the toe of the dam.
- Misalignments in the crest and embankment slopes found by sighting along fixed points.



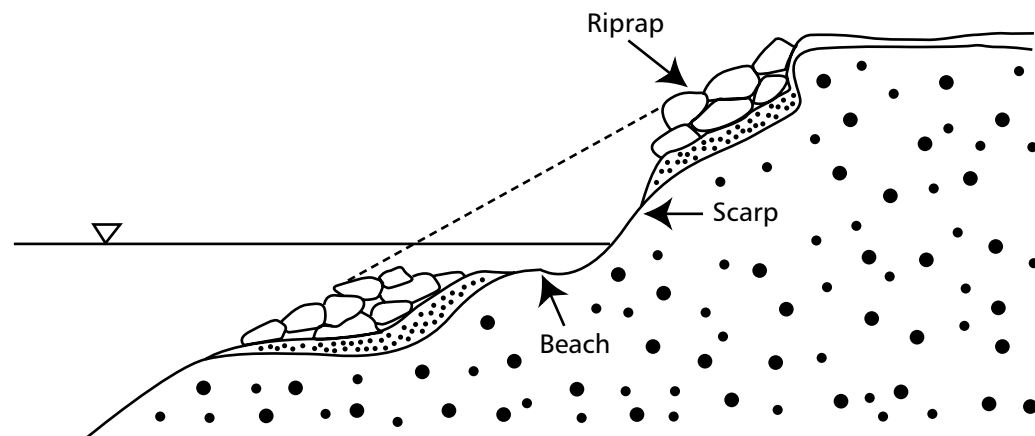
Depressions

- Sinkholes found by checking and probing each depression. Remember, sinkholes have steep, bucket-like sides while minor depressions have gently sloping, bowl-like sides. These are initiated by settlement or migration of materials in the embankment.



Maintenance Concerns

- Inadequate Slope Protection: Check for bald areas or areas where the protection is sparse or damaged.
- Surface Runoff Erosion: Check for gullies or other signs of erosion. Make sure to check the low points along the upstream and downstream shoulders and groins since surface runoff can collect in these areas.
- Inappropriate Vegetative Growth: Check for excessive and deep-rooted vegetative growth, especially trees.
- Debris: Check for debris on and around the dam, especially debris that could clog or choke outlet-works or spillway inlets.
- “Animal Burrows”: Check for damage caused by burrowing animals.



2. Requirements for spillways and bywashes

Spillways are designed to withstand high flows that have the capacity to overtop and erode embankments and to undermine concrete and rockfill structures.

Spillways that are not able to adequately contain the extreme flows through the dam contribute to failure of the dam by overtopping.

Spillways can fail by erosion of the structure from downstream, and by erosion that results from failing to contain the flows within the spillway section and by erosion of support for any structural elements through weaknesses.

Spillway flow needs to be directed back to the stream safely. Poorly directed flows through the spillway can erode the toe of the dam embankment and initiate failure.

Spillways and bywashes should be inspected immediately after spill events to monitor any damage and to determine erosion patterns. Comments on damage sustained after spill events should be included in the surveillance report.

The surveillance report should include an assessment of, and recommendations on the dam spillway or bywash with regard to:

- erosion of the downstream slope
- slumps in sidewalls
- potential for blockages caused by fencing, debris build up, or vegetative growth
- profusion and integrity of grass cover to the downstream slope

- blockages in the underdrainage of concrete spillways.

A recommendation for any remedial works to ensure the spillway and bywash is capable of fulfilling its function.

3. Requirements for discharge control structures and outlet works

Dams with inadequate and failed outlet pipes experience loss of serviceability by emptying or by being unable to release as required. Leaking from the outlet conduit is a common source of internal erosion failure. Deterioration and failure of the outlet structure, collapse or deterioration of the outlet pipework or valves or failure of associated control systems could cause the loss of outlet capability.

Discharge conduit

The discharge conduit should be inspected internally if possible (proper regard for workplace health and safety requirements is essential). If access to the conduit is not possible, video inspection should be carried out. The following aspects of the conduit should be assessed and reported on:

- sources of leakage should be photographed, marked on a plan and the flow rate estimated
- misalignment should be measured, and marked on a plan
- deterioration of pipe and joint material should be photographed
- fouling of the intake structure
- extent of corrosion.

Valves

All valves should be exercised at each inspection and an assessment made on the condition, the ease of operation, maintenance history and ease of access. The report should contain comments on the appropriateness of labelling of valves.

The full range of gate settings should be checked. The person performing the inspection should slowly open the valve, checking for noise and vibration. Certain valve settings may result in greater turbulence. There is a need to also listen for noise like gravel in the system. This indicates cavitation is occurring, and these gate settings should be avoided.

Structures

All structure associated with the dam should be assessed for serviceability. Intake structures may need to be inspected by divers for fouling and deterioration. Valve pits and boxes inspected for concrete deterioration and settlement. Intake structure steelwork inspected for corrosion and misalignment and damage. Baulks and gates exercised and inspected for corrosion and damage. Outlet structures inspected for concrete deterioration corrosion and misalignment and damage.

Dams incorporating mechanical or fabridam gate structures should be reported on by an appropriately experienced mechanical engineer.

Electrical, mechanical and control systems

Mechanical equipment including spillway gates, sluice gates, valves, stoplogs, pumps, flash boards, relief wells, emergency power sources, siphons, and electrical equipment should be operated at least once a year and preferably more often. Testing should cover the full operating range under actual operating conditions. Each operating device should be permanently marked for easy identification, and all



operating equipment should be kept accessible. All controls should be checked for proper security to prevent vandalism. All operating instructions should be checked for clarity and maintained in a secure, but readily accessible location.

All control systems associated with operation of the dam should be reported on by an appropriately experienced electrical engineer. The report should include assessment of the operation of all functions of the control system through the full range of responses and alarms. The report should incorporate an assessment of the condition and the maintenance and operation history of the system and of the existence and appropriateness of the operation plan for the controlled system. The report should make recommendations on the future maintenance requirements.

4. Requirements for concrete dams

Possible causes of concrete dam failure include:

- overturning or sliding due to erosion of the foundation or abutments during overtopping resulting from inadequate freeboard
- abutment or foundation failure due to overstressing
- structural failure of concrete unable to sustain imposed loads.

When inspecting the crest and the faces of concrete dams and weirs any of the following defects should be noted, documented and photographed and an assessment made of any changes in their severity since last inspection:

- seepage and leakage
- cracking concrete deterioration
- disintegration
- spalling
- efflorescence
- drummy concrete
- popouts
- pitting
- scaling
- surface defects
- displacement
- misalignment
- differential movement in cracks
- conditions of joints.

When inspecting the areas upstream and downstream of a concrete dam and weirs any of the following defects should be noted, documented and photographed and an assessment made of any changes in their severity since last inspection:

- cracking, bulges and slides
- sinkholes
- wet areas
- lush vegetation
- erosion of the abutment areas following spills.

5. Requirements for weirs

Weirs are designed to withstand overtopping by all river flows. As a consequence, weirs need to not only be stable and safe against the hydraulic forces applied and to retain water but must also be able to retain integrity in an erosive environment.



Whilst a regular time based inspection regime is appropriate, it is more important to inspect and document the deficiencies and remedial requirements after each river flow event.

Common causes of failure of weirs include:

- excessive and progressive downstream erosion, both from within the stream and through lateral erosion of the banks
- erosion of inadequately protected abutments
- hydraulic removal of fines and other support material from downstream protection (gabions and aprons) resulting in erosion of the apron protection
- deterioration of the cutoff and subsequent loss of containment
- additional aspects specific to concrete, rockfill or steel structures.

Inspection reports should comment on:

- details of any testing of flow control structure
- adequacy of flow control structure
- Mechanical / electrical equipment
- disruption to the downstream banks - as an indication of erosion
- water levels in the downstream pond - as an indication of seepage
- deepening of the downstream pond as a result of erosion
- erosion of abutment protection
- corrosion or other deterioration of the sheetpile or other cutoff material
- cracks and open construction joints in the downstream apron - as an indicator of hydraulic removal of fines.

Inspection reports for weirs should document the:

- magnitude of each river flow event since last report
- comment on the relative upstream and downstream water levels
- any repairs and maintenance resulting from each flow event
- comments on the operation of mechanical equipment (eg gates, bags) during flow events.

Notes

Notes





Queensland
Government
Natural Resources
and Mines

DEPARTMENT OF NATURAL RESOURCES AND MINES

QUEENSLAND DAM SAFETY MANAGEMENT GUIDELINES

This version approved February 2002

Guidelines on Acceptable Flood Capacity for Dams

February 2007

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1 Purpose, scope and structure of the guidelines

Dams play a vital role in our lives. They meet demand for drinking, irrigation and industrial water supply; they control floods, increase dry-weather flows in rivers and creeks and give opportunities for various recreational activities. But besides being a valuable resource, dams can also be a source of risk to downstream communities with dam failure potentially resulting in unacceptable damage to property and loss of life. One of the main causes of dam failure is the overtopping of dams because of inadequate flood carrying capacity.

S.491 (4A) of the *Water Act 2000* empowers the chief executive of the Department of Natural Resources and Water (NRW) to issue guidelines for applying safety conditions to referable dams. This document is a guideline issued by a duly authorised delegate of the chief executive pursuant to s.491 (4A). Dam safety conditions in relation to flood adequacy will be applied to referable dams in accordance with these guidelines.

The aim of these guidelines is to present the Queensland Government's flood adequacy policy against which all referable dams in Queensland will be assessed and to alert the dam owners to their wider responsibilities and liabilities in ensuring the safety of their dams.

The general principle is that a dam whose failure would cause excessive damage or the loss of many lives should be designed to a proportionally higher standard than a dam whose failure would result in less damage or fewer lives lost.

These guidelines relate to the flood safety of water dams, and more specifically, to the selection of an Acceptable Flood Capacity (AFC) and adequate spillway provisions for all proposed and existing referable dams in Queensland¹.

These guidelines detail the:

- available methods for determining the required flood discharge capacity for referable dams
- procedures to be followed when applying these methods
- reporting requirements when reporting the results of these investigations to the chief executive of NRW
- timeframe for any necessary dam safety upgrades.

These guidelines present three methods for assessing AFC for referable dams:

- Small dams standard
- Fall-back option
- Risk assessment procedure (incorporating ALARP).

The *Small dams* standard is a method, which allows the owners of small earth dams to quickly assess spillway adequacy. It is essentially a simplified "Fall-back" method, which relates the Acceptable Flood Capacity directly to the population at risk.

The *Fall-back* option is intended for larger dams where the cost of undertaking a full risk assessment is not warranted when weighed against the potential benefits.

¹ Under the *Water Act 2000*, referable dams are those assessed using NRW's *Guidelines for Failure Impact Assessment of Water Dams (NRM, 2002b)* as having a population at risk of 2 or more in the event of any potential failure of the dam.

In terms of safety, the traditional engineering approach has always been to specify the required flood discharge capacity for the dam at the design stage based on the relevant hydrological data and flood estimating and flood routing procedures. Hydrologic safety was considered separately from other risks, which resulted in identification of inadequate spillway capacity as a major cause of dam failure.

More recent risk based approaches, such as that put forward by ANCOLD (ANCOLD 2003), indicate that hydrological safety should be assessed within the total load context in order to identify the priority of dam safety inadequacies and dam failure scenarios. Dam failure scenarios may include (but are not limited to) piping at dam headwaters elevated by flood, spillway malfunction or severe scour at lesser floods than extreme.

The risk assessment procedure is based on the ANCOLD risk assessment process and is consistent with the framework of the national standard AS/NZS 4360:2004 Risk Management. It is a comprehensive tool intended to enable the dam owner to evaluate the deficiencies and available risk reduction options. This type of assessment should be adopted for major dams. The risk assessment procedure provides the owner with a review of the adequacy of the dam under all load conditions and failure scenarios, not just flood loadings. It also has the capability to more realistically assess the Acceptable Flood Capacity of gated spillway operations and the likelihood of premature failure due to causes such as spillway erosion.

Dam owners should note that, while these Guidelines set minimum requirements to protect the interests of the community, it is the responsibility of the owner to ensure the safety of dams, including their investigations, design, construction, operation, safety review and remediation.

Dam owners should realize that many of the rainfall estimates from years past are well below current estimates. In many cases the design floods may change over time as the techniques for determining extreme rainfalls are progressively refined and more detailed flood studies are undertaken for each dam.

It is the dam owners prerogative to adopt a higher safety standard where the owner considers that this is necessary from a business risk perspective.

Dam owners should also note that these guidelines set out the normal requirements of the chief executive of NRW. Where dam owners believe that a departure from these normal requirements is warranted, they should submit proposals for the chief executive's consideration with reasons in support of the proposed departure.

2 Requirements of the *Water Act 2000*

The *Water Act 2000* (the Act) provides the regulatory framework for dam safety of water dams in Queensland. Under s.491 of the Act the chief executive has the power to impose safety conditions on constructed referable dams, regardless of whether or not the dam owner already has a development permit for the dam. The chief executive also has the power under s.492 to change those safety conditions. Safety conditions imposed or changed by the chief executive are taken to be part of a development permit approving the construction of the dam.

The Act also refers to the guidelines, which may be issued and used by the chief executive in the process of applying safety conditions to a referable dam. These guidelines are such guidelines and they apply to all referable dams in Queensland including all referable gully dams, hillside storages and ring tanks.

The *Queensland Dam Safety Management Guidelines* (NR&M 2002a) and the *Guidelines for Failure Impact Assessment of Water Dams* (NR&M 2002b) have already been issued by NRW and should be read in conjunction with these guidelines. In applying these guidelines, it should be noted, that they are intended to form the basis for safe practices and to provide a consistent approach in the assessment of the safety of referable dams in Queensland.

References to other guidelines issued by NRW are to be taken as a reference to any updated version of those guidelines where the context permits.

3 Methodology to determine Acceptable Flood Capacity

3.1 General

All referable dams are required to have sufficient flood discharge capacity to pass the following:

- (a) the Acceptable Flood Capacity without failure of the dam²
- (b) a Spillway Design Flood without any damage to the dam

Where the selected Spillway Design Flood discharge is less than the Acceptable Flood Capacity, the potential impacts of floods in excess of the Spillway Design Flood up to the magnitude of the Acceptable Flood Capacity shall be identified, quantified and documented in the written Acceptable Flood Capacity Assessment report (Appendix A). Such potential impacts shall include detailed assessments of:

- (a) how the magnitude of the adopted spillway design flood was determined and why it is considered acceptable
- (b) the probability of the floods greater than the spillway design flood occurring and the potential there is for damage and loss of life caused by such floods
- (c) the consequences of flows in excess of the spillway design flood and the impact of the higher flow velocities and greater water depths on various parts of the dam structure
- (d) the potential damage to the dam caused by these flows and how the energy from these flows is dissipated

When assessing the flood discharge capacity of existing dams, the existing flood discharge capacity shall be taken as the flood discharge capacity that can be discharged without failure of the dam in its current arrangement.

These *Guidelines on Acceptable Flood Capacity for Dams* are based on a range of ANCOLD and other guidelines as listed below:

- *Selection of Acceptable Flood Capacity for Dams* (ANCOLD, 2000a),
- *Assessment of the Consequences of Dam Failure* (ANCOLD, 2000b)
- *Risk Assessment* (ANCOLD, 2003)
- *Guide to Flood Estimation* (AR&R 1999, Nathan, R. J. and Weinmann, P.E).

As most of the processes from the relevant ANCOLD and AR&R 1999 guidelines are not repeated here, it is important that the above documents are read in conjunction with these guidelines. In particular, where issues are not specifically addressed in these NRW Guidelines on Acceptable Flood Capacity, the relevant sections of the referenced ANCOLD guidelines apply.

The combined inflows into the storage from all sources should be taken into account when assessing the required spillway capacity. This combined inflow should include all natural inflows as well as inflows from water harvesting and from diversion channels.

The combined discharge capacity of all spillways can be taken into account when assessing a dam's flood discharge capacity. However, unless it can be clearly demonstrated that outlet works or hydropower stations can be reliably operated during flood events, the discharge capacity of these structures is to be ignored when assessing discharge capacity during floods.

² Under the *Water Act 2000*, failure of a referable dam is defined as:

- (a) the physical collapse of all or part of the dam; or
- (b) the uncontrolled release of any of its contents.

When requested, a written Acceptable Flood Capacity Assessment Report must be prepared by a Registered Professional Engineer of Queensland (RPEQ) for the current dam arrangement and submitted to NRW. Appendix A outlines the requirements for the Acceptable Flood Capacity Assessment Report.

Dam owners should ensure that their dam can safely pass floods up to the Acceptable Flood Capacity. Also the following characteristics or features for the spillway and outlet works where appropriate should be demonstrated:

- (a) adequate resistance to erosion and cavitation
- (b) adequate wall height to retain the flows
- (c) adequate energy dissipation to prevent undermining or other erosion
- (d) adequate resistance to uplift and other hydraulic forces on the spillway during the passage of floods
- (e) capability to pass floating debris as required to ensure the unimpeded operation of the spillway
- (f) adequate safety from landslides and scour
- (g) adequate capacity to avoid restriction of the discharge capacity from debris build-up in the spillway approach channel and outlet channels.

In addition, where appropriate, the dam owner should ensure:

- (h) Spillway gates and other control devices will operate with sufficient flood discharge capacity under all design conditions.
- (i) Spillway gates, outlet works and other discharge control devices operate reliably. The reliability of discharge control operating mechanisms (including power supply, control and communication) should be commensurate with the hazard category involved and the time available during major floods to repair them or operate them by other means should problems occur. The reliability should be reflected in the determination of discharge capacity available to pass the Acceptable Flood Capacity.
- (j) Unless a case for a contrary view is adequately made, where fuse plugs or fuse gates are relied upon to pass the Acceptable Flood Capacity, they should be appropriately designed, constructed and maintained in order to fulfil their required function in accordance with the following:
 - Initial triggering of the fuse element is not to occur for floods having greater probability than 0.2 per cent AEP
 - Failure of successive fuse plugs or fuse gates is to be progressive, predictable and designed to minimise the impact on downstream Population at Risk (PAR);
 - The potential downstream impacts of fuse plug or fuse gate triggering at representative locations of PAR are to be identified and documented as part of the Acceptable Flood Capacity report (detailed in Appendix A).

Unless varied by the above, the design of fuse plugs is to comply with the provisions of US Department of the Interior (USBR 1987), *Guidelines for Using Fuse-plug Embankments in Auxiliary Spillways*.

- (k) Where stoplogs or flashboards are the primary discharge control mechanism, they are designed to:
 - be removed under conditions which overtop the stoplogs or flashboards, or

- be removed prior to the onset of any flood, or
- reliably fail under the flood loadings.

The spillway discharge capacity adopted for the Acceptable Flood Capacity Assessment Report should reflect the option adopted.

- (l) all components are designed to withstand the appropriate earthquake loadings³
- (m) assured access to all necessary locations on the dam for necessary operations during a flood event.
- (n) a discharge capacity that will not be compromised by the failure of any structure across the spillway, its approach channel or its outlet channel.

More details on each of the three assessment methods are provided below.

3.2 Small dams standard

This assessment method may be used for any referable dam in Queensland having:

- a zoned or relatively homogeneous earthen embankment less than 12 metres high
- a PAR of 15 or less
- uncontrolled spillways⁴
- depths of flooding of PAR of less than three metres and the product of the depth of flooding and the average flow velocity is less than 4.6 m²/sec.

It is expected that such levels of flooding are unlikely to occur for dams less than 12 metres high unless the discharge is severely concentrated in downstream channels or where the PAR is located in very close proximity to the dam.

This method is also not to be used for dams relying on spillways controlled by gates or other mechanical discharge control structures to pass the Acceptable Flood Capacity. For dams outside the parameters described above, only the fall-back option or the risk assessment procedure should be used.

The following steps are to be applied in the small dams standard assessment process:

1. Determine the maximum incremental PAR for any potential dam failure condition by following the procedures outlined in the *Guidelines for Failure Impact Assessment of Water Dams* (NR&M, 2002b) for a range of flood failure conditions up to the 1:20 000 Annual Exceedance Probability (AEP) flood event.

Note: If the incremental PAR is greater than 15 for any of the flood failure conditions, this ‘small dams standard’ cannot be used to determine the AFC and one of the other methods must be used.

2. Determine the AEP of the required Acceptable Flood Capacity rainfall event by applying the maximum PAR to the graph presented in Figure 1:

$$AEP = \left(\frac{1}{PAR} \right) \times 10^{-3}$$

³ Until a Queensland guideline is developed on earthquake loadings for referable dams, the *ANCOLD “Guidelines for Design of Dams for Earthquake”*, August 1998 (ANCOLD 1998) should be applied.

⁴ In this context, an ‘uncontrolled spillway’ is one which does not rely on flow through spillway gates or other mechanical discharge control structures to pass the Acceptable Flood Capacity.

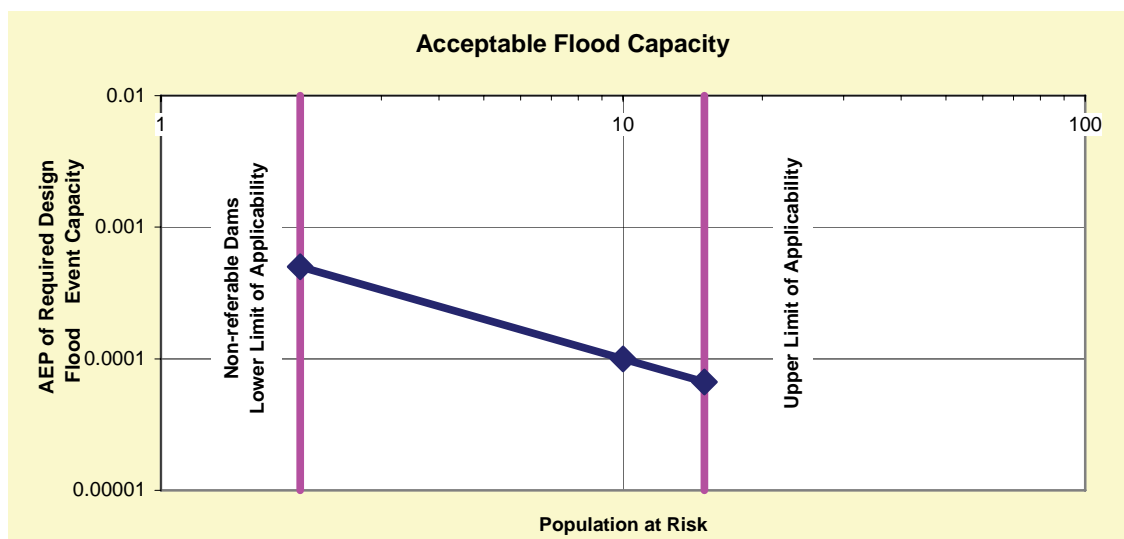


Figure 1 Acceptable flood capacity standard for small dams

3. Determine the storage inflow hydrograph for the critical duration storm event commensurate with the AEP of the design flood event rainfall as determined in Figure 1 (Refer Section 3.5);
4. Route this flood through the dam.

Note that it is to be assumed that the dam storage is initially at Full Supply Level (FSL) at the start of the flood event.

The required Acceptable Flood Capacity (AFC) for the dam is the discharge capacity required to pass the critical duration storm event without causing failure of the dam.

Note that this option does not take into account:

- (a) Any differentiation between new and existing dams;
- (b) Financial, business, social or environmental damages that might occur as a result of any potential failure;
- (c) The ALARP principle.

This small dams standard is a simplified version of the fall-back option assessment process and as such, should be less costly to undertake than either of the alternative methods. However, small dam owners must be aware that they could benefit by carrying out one of the other more detailed assessment methods by perhaps demonstrating that a lower flood discharge capacity is appropriate for their dam.

3.3 Fall-back option

Except as modified in these guidelines, the following documents should be adopted and used for this method:

- ANCOLD *Guidelines on Selection of Acceptable Flood Capacity for Dams* (ANCOLD 2000a);
- ANCOLD *Guidelines on Assessment of the Consequences of Dam Failure* (ANCOLD 2000b); and
- NRW *Guidelines for Failure Impact Assessment of Water Dams* (NRM, 2002b).

The following steps are to be applied to the fall-back option assessment process:

1. Conduct an assessment of the potential consequences of dam failure associated with the passage of a range of design floods through the storage using the consequence criteria contained in the *ANCOLD Guidelines on Assessment of the Consequences of Dam Failure* (ANCOLD, 2000b) and the following qualifications:
 - The dam is to be assumed to be initially at Full Supply Level at the start of the flood event;
 - Breach dimensions, timing and PAR are to be determined in accordance with the *NRW Guidelines for Failure Impact Assessment of Water Dams* (NR&M, 2002b).
2. Determine the Hazard Category rating for the dam for each case in accordance with Table 1:

Incremental Population at Risk (PAR)	Severity of Damage and Loss			
	Negligible	Minor	Medium	Major
$2 \leq \text{PAR} \leq 10$	Low Notes 1	Significant Note 5	Significant Note 5	High C Note 6
$10 < \text{PAR} \leq 100$	Note 1	Significant Notes 2 and 5	High C Note 6	High B Note 6
$100 < \text{PAR} \leq 1000$		Note 2	High A Note 6	High A Note 6
$\text{PAR} > 1000$			Note 3	Extreme Note 6

Table 1: Hazard Category for Referable Dams

(Please Note: Table 1 is a modified version of Table 3 Hazard Categories in the, Guidelines on Assessment of the Consequences of Dam failure (ANCOLD, 2000b.)

Note 1: It is unlikely that the severity of damage and loss will be “Negligible where one or more houses are damaged.

Note 2: Minor damage and loss would be unlikely when PAR exceeds 10.

Note 3: Medium damage and loss would be unlikely when the PAR exceeds 1000.

Note 4: Not used.

Note 5: Change to High C where there is the potential for one or more lives being lost.

Note 6: See section 2.7 and 1.6 in the Guidelines on Assessment of the Consequences of Dam failure (ANCOLD, 2000b) for an explanation of the range of High Hazard Categories.

3. Identify the required range of the Annual Exceedence Probability (AEP) flood for the dam in accordance with Table 2 [based on Table 8.1 in the *Guidelines on Selection of Acceptable Flood Capacity for Dams* (ANCOLD, 2000a)]:

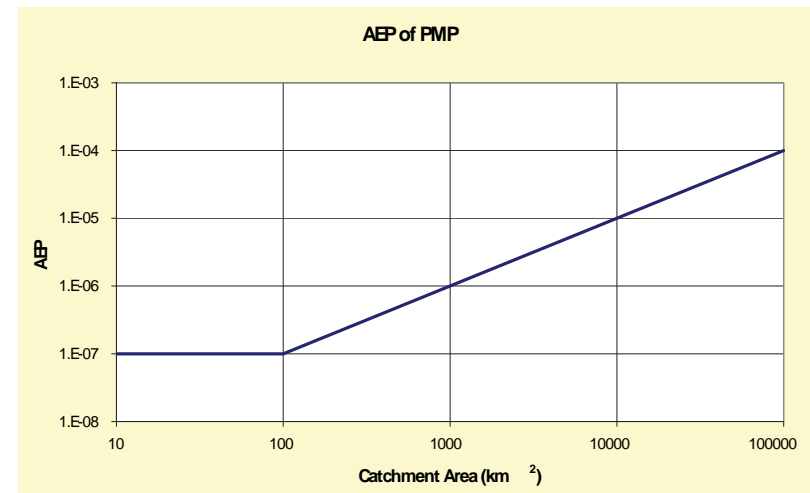
Incremental Population at Risk (PAR)	Severity of Damage and Loss							
	Negligible		Minor		Medium		Major	
2 PAR 10		5.0x10 ⁻⁴		5.0x10 ⁻⁴		1.0x10 ⁻⁴		1.0x10 ⁻⁵
	Low		Signi cant		Signi cant		High C	
10 < PAR 100		5.0x10 ⁻⁴		1.0x10 ⁻⁴		1.0x10 ⁻⁴		C
		5.0x10 ⁻⁴		1.0x10 ⁻⁴		1.0x10 ⁻⁴		1.0x10 ⁻⁵
100 < PAR 1000			Signi cant		High C		High B	
		1.0x10 ⁻⁴		1.0x10 ⁻⁴	C		C B	B
100 < PAR 1000					A		A	A
					High A		High A	
PAR > 1000					A		A	A
							PMF	PMF
							Extreme	
							PMF	PMF

Where

- A= PMP Design Flood
- B= PMP Design Flood or 10⁻⁶, whichever is the smaller flood event
- C= PMP Design Flood or 10⁻⁵ whichever is the smaller flood event

Note that the probability of the PMP Design Flood is a function of the catchment area.

Table 2: Required range of Acceptable Flood Capacities for different hazard categories



4. Interpolate (using the procedure defined in Appendix C) within the nominated range to determine the required Annual Exceedence Probability (AEP) for the spillway design flood for each failure case.
5. Determine the required AEP of the “critical duration design flood event rainfall” by selecting the flood event having the lowest AEP in Step 4.
6. Determine the storage inflow hydrograph for the critical duration design flood event commensurate with the AEP of the design flood event rainfall (Refer Section 3.5).

Note that it is to be assumed that the dam reservoir is initially at Full Supply Level at the start of the flood event.

The required Acceptable Flood Capacity (AFC) is the discharge capacity required to pass the critical duration storm event without causing failure of the dam.

Note: The owner of the dam should be aware that the fall-back method may result in a higher design requirement and consequent higher cost of the upgrade required to bring it up to the required standard than the alternative risk assessment procedure (incorporating ALARP).

3.4 Risk assessment procedure

Except as modified in these guidelines, the Acceptable Flood Capacity Assessment based on the risk assessment procedure should be carried out in accordance the following guidelines:

- *ANCOLD Guidelines on Selection of Acceptable Flood Capacity for Dams* (ANCOLD, 2000a)
- *ANCOLD Guidelines on Assessment of the Consequences of Dam failure* (ANCOLD, 2000b)
- *NRW Guidelines for Failure Impact Assessment of Water Dams* (NR&M 2002b) (for the dam breach sizes and timings and the estimation of Population at Risk);
- *ANCOLD Guidelines on Risk Assessment* (ANCOLD, 2003) (with particular attention to the quantitative studies at advanced or very advanced levels).

A design life of no less than 150 years following the completion of any necessary dam safety upgrades is to be adopted when assessing the risk of failure over the life of the dam. Note that the probability of exceedence of an event over the design life is **not** simply the AEP times the life of the dam. It is calculated using the formula:

$$\text{Probability over design life} = 1 - (1 - \text{AEP})^{\text{design life}}$$

The following steps are to be applied to the Risk Assessment Procedure:

1. Conduct a comprehensive, quantitative risk assessment study of the dam for all loads and consequences in accordance with the *ANCOLD Guidelines on Risk Assessment*, (ANCOLD 2003), and *Guidelines on Selection of Acceptable Flood Capacity for Dams*, (ANCOLD, 2000a). Details on the probability of flood events causing dam failure, based on the probability of the event over the life of dam and expected loss of life during these events must be reported in the Acceptable Flood Capacity assessment report. The following general qualifications apply:
 - As the potential for loss of life increases, the greater degree of rigour and thoroughness will be expected in the risk assessment.

- Dam is to be initially at Full Supply Level at the start of any flood events.⁵
- Breach dimensions and timing are determined in accordance with *Guidelines for Failure Impact Assessment of Water Dams* (NR&M, 2002b)
- Total PAR is estimated using the procedures contained in the *NRW Guidelines for Failure Impact Assessment of Water Dams* (NR&M, 2002b) or *ANCOLD, Guidelines on Assessment of the Consequences of Dam Failure* (ANCOLD, 2000b);
- *Graham's Method* (Graham, 1999) is to be used for estimating loss of life (LOL) due to dam break flood events. Unless it can be clearly demonstrated that warnings will be reliably issued and disseminated around the impacted community at least 12 hours prior to the anticipated impact of dam failure, it is to be assumed that no warning is available to the Population at Risk for dam failure events⁶.
- Note that *Graham's Method* for estimating Loss of Life (LOL) during a dam break event is based on the total population at risk rather than the incremental population at risk produced by the *Guidelines for Failure Impact Assessment of Water Dams* (NR&M, 2002b). It is also significant that the 'flood severity' also tends to be greater with dam break. Unless it can be clearly demonstrated that fewer people will be exposed to any dam break flood discharge, the total PAR is to be used in assessments of potential loss of life due to the failure event. Thus the estimated incremental loss of life due to failure should be taken as:

$$\begin{array}{l} \text{Incremental LOL} \\ \text{due to failure event} \end{array} = \begin{array}{l} (\text{LOL for flood event with dam failure}) \text{ less} \\ (\text{LOL for same event without dam failure}) \end{array}$$

- Note that the LOL for flood events without dam failure is not covered by *Graham's Method* but is typically in the range 0.001xPAR to 0.0001xPAR. This means that the Incremental LOL can, in most circumstances, be taken as the total LOL due to dam break.
2. Use the risk assessment study data on the annual probabilities of dam failure and estimated LOL to determine whether the risk profile is within ANCOLD's recommended 'limits of tolerability'. These minimum limits of tolerability are reproduced below from the section on 'Life safety risks' in the *ANCOLD Guidelines on Risk Assessment* (ANCOLD, 2003):-
- *for existing dams, an individual risk to the person or group, which is most at risk, that is higher than 10⁻⁴ per annum is unacceptable, except in exceptional circumstances*
 - *for new dams or major augmentations of existing dams, an individual risk to the person or group, which is most at risk, that is higher than 10⁻⁵ per annum is unacceptable, except in exceptional circumstances*
 - *for existing dams, a societal risk that is higher than the limit curve, shown on Fig. 7.4 [of ANCOLD, Guidelines on Risk Assessment] is unacceptable, except in exceptional circumstances*
 - *for new dams or major augmentations of existing dams, a societal risk that is higher than the limit curve, shown on Fig. 7.5 [of ANCOLD, Guidelines on Risk Assessment], is unacceptable, except in exceptional circumstances.*

⁵ It is recognised that this restriction is conservative. However, anecdotal evidence suggests that there is a higher likelihood of large rainfall events occurring towards the end of a 'wet' wet season. The assumption of the dam initially at Full Supply Level is to apply unless dam owners can clearly demonstrate, to the satisfaction of the chief executive, that an alternative approach is appropriate.

⁶ In making the case for a shorter warning time, the dam owner will need to demonstrate that a reliable warning will be able to be given under all reasonable circumstances that can be effectively and efficiently disseminated to the affected PAR and that suitable arrangements are in place to ensure that this will not reduce in effectiveness with the passage of time.

3. If the risk profile for the existing dam is above the limits of tolerability:
 - (a) determine the storage inflow hydrograph for the critical duration design flood event commensurate with the AEP of the design flood event rainfall which just satisfies the limits of risk tolerability assuming the dam is in its current arrangement (Refer Section 3.5). As the Risk Assessment Procedure involves integration of all hazards including flood events, the risk analyst must be aware of the failure modes when evaluating the flood AEP, particularly where failure modes not directly associated with spillway flood discharge capacity are significant contributors to the risk i.e. piping;
 - (b) formulate risk reduction options that would bring the risk profile down to the limit of tolerability.
4. Assess compliance with the ALARP principle by formulating additional risk reduction options that would bring the risk profile further below the limit of tolerability and undertaking a cost-benefit analysis for the upgrade options required to reduce the risk profile below the limits of tolerability based on:
 - incremental project costs and benefits to reduce the risk profile beyond the limits of tolerability. (Only include those costs considered necessary and sufficient to implement the measures to further reduce risk)
 - the cost-benefit methodology detailed in Appendix B;
 - a Value of a Statistical Life (VOSL) of \$5 million (in 2004 dollars)⁷.

The options considered should be sufficient to clearly demonstrate that the ALARP criteria have been satisfied. In this context ALARP is considered to be satisfied whenever the incremental cost of undertaking a spillway upgrade project to reduce the risk below the specified limits of tolerability exceeds the benefits.

5. The spillway flood discharge capacity required to satisfy the limits of tolerability including ALARP is to be considered the Acceptable Flood Capacity (AFC).
Note that in some circumstances where the flood risk is only a relatively minor part of the overall risk profile for the dam, other dam safety remedial works may be required to reduce the risk profile below the limits of tolerability.
6. Determine the relative proportion (as a percentage) of the inflow flood determined in Step 5 above that can be passed by the existing dam.

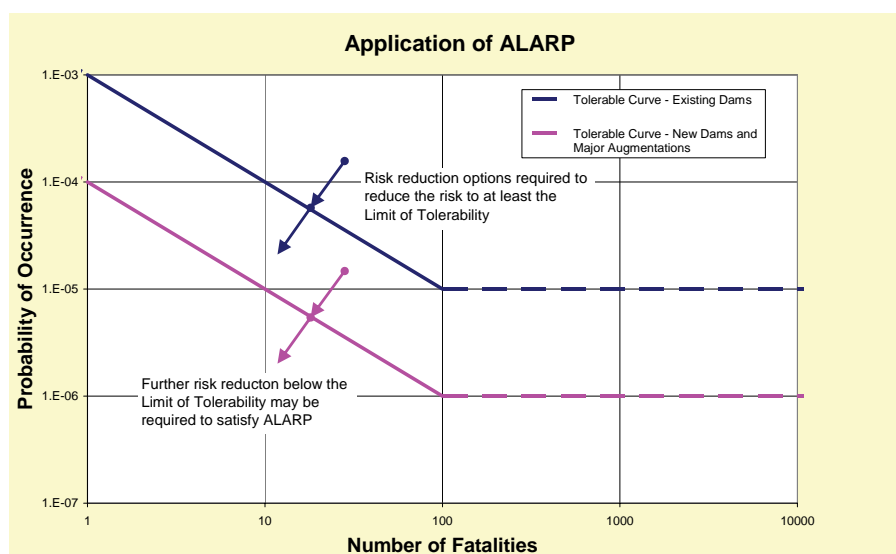


Figure 2 Application of ALARP to bring societal risk profile below Limit of Tolerability

⁷ Note: Because of differences in the methodologies, the VOSL is not directly comparable with the ANCOLD Cost to Save a Statistical Life (CSSL)

3.5 Estimation of the critical duration storm event

The following process is generic for deriving the critical storm duration hydrograph and is to be used for estimating the critical duration inflow flood hydrographs for a given Annual Exceedence Probability (AEP) for all Acceptable Flood Capacity (AFC) assessment options.

- (a) Determine the rainfall for a range of storm durations at the given AEP appropriate for the dam catchment and dam configuration. The required rainfall shall be estimated by applying, as appropriate:
 - *CRC Forge method* (refer to the NR&M report *Extreme Rainfall Estimation Project (Hargraves, 2004)* for assessing probabilities for “rare” flood events (Note: flood probabilities are to be based on the probabilities of the causative rainfall events) and
 - Appropriate methodology for assessing Probable Maximum Precipitation (PMP), in accordance with:
 - the Bureau of Meteorology (BoM) Bulletin 53 *The Estimation of Probable Maximum Precipitation in Australia: Generalised Short Duration Method* (GSDM, BoM, 2003a), or
 - the BoM *Revision of the Generalised Tropical Storm method for Estimating Probable Maximum Precipitation* (GTSMR, BoM 2003b).
 - The provisions of *Australian Rainfall and Run-off* (AR&R 1999) shall be used for interpolating rainfall magnitudes between the CRC Forge rainfalls and the PMPs.
- (b) The runoff from this rainfall is to be converted into inflow flood hydrographs using a non-linear run-off routing model (such as RORB, WBNM, RAFTS etc). Where reasonable calibration data is available, the model should be calibrated but with calibrations biased towards larger flows. Where reasonable calibration data is not available, the regional parameters approach presented in the Institution of *Engineers Australia, Book VI—Estimation of Large to Extreme Floods* (Nathan & Weinmann, 1999) should be applied.

All catchments are to be assumed in a saturated condition prior to the start of the storm event causing the rainfall. Unless the case for different loss models is appropriately made, an “*initial loss-continuing loss*” model is to be applied. Unless an effective case can be made to use other loss parameters, the initial loss/continuing loss parameters recommended in *Book VI of Australian Rainfall and Run-off – Volume 1* (AR&R 1999) are to be used.

When assessing the inflow hydrographs of flow into the dam reservoir during a flood event, all inflows into the storage should be considered. This should include any inflows from water harvesting pumps or run-off from catchments diverted into the storage. This will produce inflow hydrographs into the dam reservoir of the type shown in Figure 3.

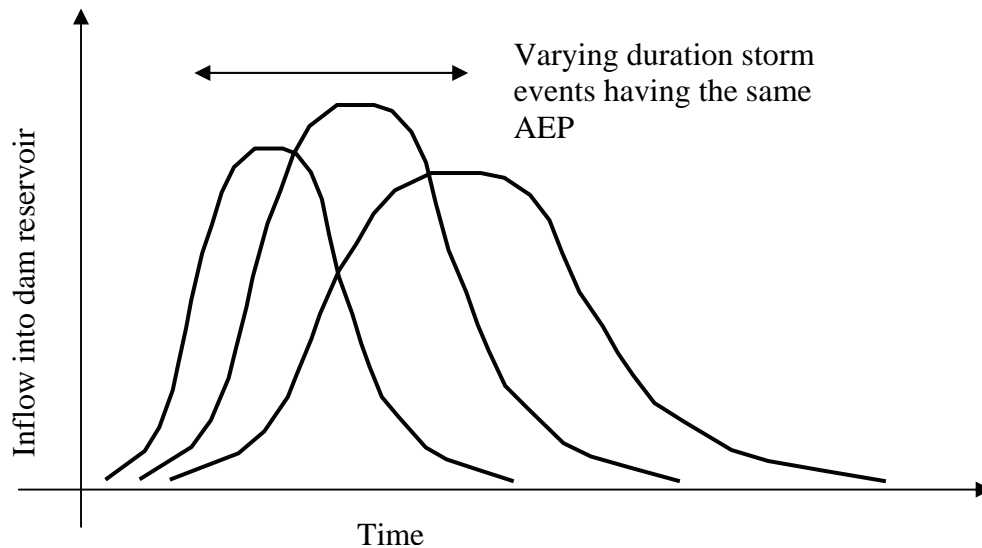


Figure 3 - Effect of storm durations on flood magnitude

- (c) Route this run-off through the reservoir storage to determine the resultant maximum reservoir headwater and corresponding outflow from the dam storage for each flood event. Estimates of outflows during floods are to be based on the following assumptions:
- The reservoir is to be at Full Supply Level at the start of the flood event or sequence of flood events.
 - Where the dam wall is designed to accommodate discharge over the non-overflow sections (e.g. as in some mass concrete dams), the analysis can take this discharge into account. However, if they are not designed to accommodate discharge (e.g. earth dam embankments), it is to be assumed that the existing spillway walls extend vertically upward to the height required to pass the discharge.
 - When assessing the outflow for spillways controlled by spillway gates or other mechanical discharge control devices, the assumed reservoir operations are to be based on normal flood operational procedures for the dam together with:
 - i. for assessments using the Fall-back option, the failure of at least 16 per cent of gates or other discharge devices (rounded up to the nearest whole number of gates) from the start of the event
 - ii. for assessments using the Risk Assessment procedure the person doing the assessment should assess the probability of gate failure using the best available information.
- (d) The result of steps (a) to (c) will be a series of ‘Reservoir Level versus Time’ curves as shown in Figure 4.
- (e) Select the flood event producing the maximum reservoir level as the critical duration flood event for the dam.

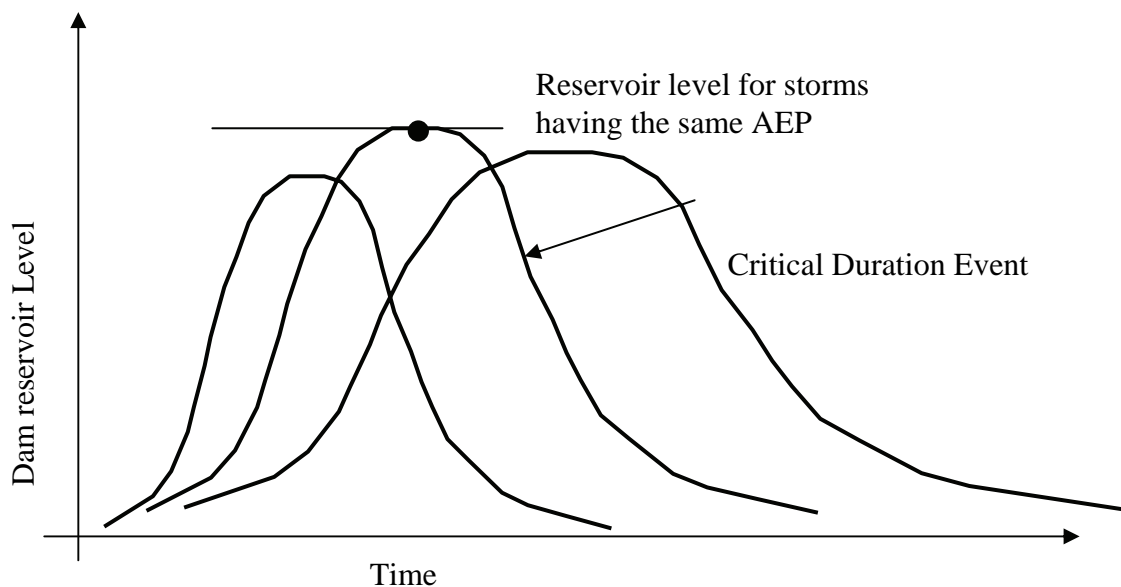


Figure 4 Selection of Critical Duration Flood Event

3.6 Freeboard

Freeboard should be provided above maximum flood levels for wind set-up and wave run-up. It should be noted that freeboard can be a significant component of any Acceptable Flood Capacity Assessment with considerations of the need for freeboard provisions being more critical for embankment dams, as such dams are generally more susceptible to breaching and failure by overtopping.

The magnitude of any necessary freeboard will vary for each dam and will depend on issues such as the :

- effective resistance to dam structure to waves and overtopping
- magnitude and direction of winds and the effective fetch for winds generated waves
- depth of the storage
- likely duration of headwater levels near the crest of the dam and the likely coincidence of these high flood levels with strong winds
- potential settlement of the crest of embankment dams.

The magnitude of wind set-up and wave run-up should be estimated using appropriate Australian wind data and the processes outlined in US Department of the Interior, Bureau of Reclamation, *Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams* (USBR 1981).

For proposed dams, it may be prudent to consider conservative freeboard provisions in view of:

- developments in meteorology and estimates of extreme rainfalls
- developments in hydrologic methodology and estimated floods
- the potential for future developments downstream requiring additional flood discharge capacity
- the generally low incremental cost of providing additional flood discharge capacity at the time of initial construction.

Concrete dams can sometimes tolerate the increased loading associated with some overtopping, and as such, may not require positive freeboard. Additionally, in some cases, concrete dams can accept a negative freeboard, which is some degree of overtopping. Items that need to be considered when assessing the required freeboard on concrete dams include the impact of the maximum reservoir headwater levels on the dam structure and the potential for scour of the toe of the dam or the abutments, which could affect stability.

For embankment dams, freeboard provision can alternatively be considered as an integral part of the risk assessment procedure.

Consideration may be given to minimal freeboard on submission of a well-supported risk analysis and having regard to:

- consideration of correlation between adverse winds and peak level in the reservoir due to the flood
- the duration and resistance to potential overtopping due to wind set-up and wave run-up and high headwater levels.

Provisions proposed for freeboard and the associated Acceptable Flood Capacity and relevant AEP shall be indicated in written Acceptable Flood Capacity Assessment reports produced in accordance with Appendix A.

4 Upgrade schedules

The required Acceptable Flood Capacity for a particular referable dam is the capacity required to safely discharge the Acceptable Flood Capacity as determined through risk assessment or other methods outlined in these guidelines and dam safety conditions and approved by the regulator. This capacity will be different for each dam and will depend on the individual circumstances of each dam. Dam owners should note that the required flood discharge capacity may change with time as changes to land use occur downstream of the dam.

All new referable dams will be required to provide a total discharge capacity equal to the Acceptable Flood Capacity from the time they become operational or start to permanently store water.

Owners of existing referable dams, which cannot safely discharge the Acceptable Flood Capacity, will be required to upgrade the spillway capacity of their dams. The timing of any necessary upgrade works for the dam is dependent on the proportion of the Acceptable Flood Capacity able to be safely passed by the existing dam. The timing will have to at least satisfy the schedule presented in Table 3.

The procedure to be adopted for determining the proportion of the Acceptable Flood Capacity able to be passed by the existing spillway(s) is as follows:

- (a) The discharge values of the critical duration storm event inflow hydrograph are scaled by a factor 'k' to produce a 'trial' flood event such that

$$Q_{\text{trial}} = k Q_{\text{cdse}}$$

where Q_{trial} = The discharge ordinate of the trial flood event

Q_{cdse} = Inflow ordinate of the critical duration storm event producing the Acceptable Flood Capacity discharge

k = the proportion of the Acceptable Flood Capacity

The 'time base' for the trial inflow hydrograph remains unaltered.

- (b) The resultant flood is then routed through the storage to determine the maximum headwater level in the reservoir.
- (c) Steps (a) and (b) are repeated with new estimates of 'k' until
 - i. for cases where the Acceptable Flood Capacity is determined by the Small Dam Standard or the 'Fall-back option: Where the maximum headwater level in the storage just reaches the dam crest or some other level below the dam crest at which failure of the dam would be likely⁸.
 - ii. for cases where the Acceptable Flood Capacity is determined by the Risk Assessment Procedure: Where the risk profile just satisfies the limits of tolerability and the ALARP criteria.

This proportion of the Acceptable Flood Capacity is taken to be the discharge capacity of the existing dam.

⁸ Unless a dam embankment is specifically designed to be overtopped safely, the level at which failure is to be considered 'likely' is to be no higher than the level of the embankment crest. If defects are known to be present in embankment dams which could cause failure when the water level is below the level of the embankment crest, this lower level is to be taken as the 'maximum headwater level'. For dams assessed as being capable of being safely overtopped, this level of overtopping can be taken into account when determining 'maximum headwater level'. When considering the combined impact of wind set-up and waves on top of high reservoir levels due to flooding, the Annual Exceedence Probability of the overall event is to be the combined probability of the flood causing the headwater levels and the probability of the wind event generating the set-up and the waves. Wind set-up and wave heights are to be determined using appropriate Australian wind data and the processes contained in US Department of the Interior, Bureau of Reclamation, *Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams* (USBR, 1981).

Note that although consideration of the current consequences would be sufficient for this assessment, it is strongly recommended that likely future downstream developments be taken into account in assessing AFC.

The programming of any necessary dam safety upgrade works is to take into account, factors such as the time necessary to complete the work and the time of year available to undertake the work so as to minimise any additional risk to those living downstream.

Dam owners may choose to stage spillway upgrades to meet these timeframes, or to undertake all required works to meet 100 per cent of the required spillway capacity in one stage.

Tranche	Required minimum flood discharge capacity	Date by which the required minimum flood capacity is to be in place for existing dams
1	25% of AFC or 1:500 AEP flood event (whichever is the bigger flood)	These dams must be upgraded as soon as possible ¹
2	50% of AFC or 1:2000 AEP flood event (whichever is the bigger flood)	1 October 2015 ^{2,3}
3	75% of AFC	1 October 2025 ^{2,3}
4	100% of AFC	1 October 2035 ^{2,3}

Table 3: Schedule for Dam Safety Upgrades

Notes to Table

1. As a guide, it is expected that up to about five years may be required to complete a flood discharge capacity upgrade for dams greater than 10 meters in height, and two years will be required to complete a spillway upgrade for smaller dams. However, each case will be considered on its own merits.
2. In each case the required discharge capacity will need to be reassessed just prior to the undertaking of final spillway upgrade works to ensure that the required Acceptable Flood Capacity has not changed and that the planned spillway capacity is still consistent with the specified upgrade program.
3. The timing of the tranches 2, 3 and 4 will be confirmed once the Acceptable Flood Capacity, and related, assessments have been completed for all or most of the known referable dams. This is anticipated to occur by 1 July 2008.

5 Glossary

Please note: This is a selected glossary only. Please refer to the Glossary in the various ANCOLD Guidelines for a more comprehensive definition of all terms.

AEP - Annual Exceedance Probability – The probability that a particular flood value will be exceeded in any one year.

AFC - Acceptable Flood Capacity - The overall flood discharge capacity required of a dam determined in accordance with these guidelines including freeboard as relevant, which is required to pass the critical duration storm event without causing failure of the dam.

ALARP – As Low As Reasonably Practicable principle, which states that risks, lower than the limit of tolerability, are tolerable only if risk reduction is impracticable or if its cost is grossly disproportionate (depending on the level of risk) to the improvement gained.

ANCOLD - Australian National Committee on Large Dams

AR&R 99 – In the context of this paper it refers to ‘Australian Rainfall and Runoff, A guide to Flood Estimation, Book VI, Estimation of Large to Extreme Floods’, 1999.

BoM – Commonwealth Bureau of Meteorology

CRCForge – Co-operative Research Centre Focussed Rainfall Growth Estimation – A regional frequency analysis technique used to derive estimates of large to rare rainfall (see Section 3.5).

Critical Duration Design Flood Event – The design flood event having a duration which causes the maximum discharge from a dam for a given Annual Exceedance Probability.

DCF - Dam Crest Flood – the flood event which, when routed through the storage with the storage initially at Full Supply Level, results in still water in the storage, excluding wind and wave effects which:

- for an embankment dam, is the lowest point of the embankment crest,
- for a concrete dam, is the level of the non-overflow section of the dam, excluding handrails and parapets if they do not store water against them;
- for a concrete faced rockfill dam, is the lowest point of the crest structure or a point on a wave wall if it is designed to take the corresponding water load.

Dam Break Flood – The flood event occurring as a consequence of dam failure.

Dam failure is the physical collapse of all or part of a dam or the uncontrolled release of any of its contents.

Design Life – The useful life for which a structure is designed.

EAP – Emergency Action Plan (prepared and implemented in accordance with requirements of *Queensland Dam Safety Management Guidelines* (NR&M, 2002a))

Failure Mode – A way that failure can occur, described by a means by which element or component failures must occur to cause loss of the sub-system or system function.

Fall-back option – is the assessment methodology described in Section 3.2 of these guidelines.

Fatality rate - is the appropriate fatality rate in Graham’s loss of life formula (Graham, 1999).

FIA - Failure Impact Assessment undertaken and certified in accordance with the requirements of the Water Act 2000 and NR&M’s *Guidelines for Failure Impact Assessment of Water Dams* (NR&M 2002b).

Flood Discharge Capacity – The capacity to discharge floods (in m³/sec)

Freeboard – The vertical distance between a stated water level and the top of the non-overflow section of a dam. The part of the freeboard that relates to the flood surcharge is sometimes referred to as the “wet freeboard”, and that above the flood surcharge, due to wind and other effects, is sometimes referred to as the “dry freeboard”.

FSL – Full Supply Level – The level of the water surface when the water storage is at maximum operating level, when not affected by flood.

Fuse plugs (and fuse gates) – Discharge elements designed to fail in a controlled fashion once a design event has been triggered (see Section 3.1).

Graham’s Method – A method for estimating the loss of life due to dam failure (refer to Section 3.4)

Height (of dam) – means the measurement of the difference in level between the natural bed of the watercourse at the downstream toe of the dam or, if the dam is not across a watercourse, between the lowest elevation of the outside limit of the dam and the top of the dam.

Hydrograph - A graphical representation of a time-discharge curve of the unsteady flow of water.

Hazard Category – The potential incremental losses and damages directly attributable to the failure of the dam.

Incremental PAR – refer to PAR.

Limits of Tolerability – A risk that society can tolerate so as to secure certain net benefits (refer to Section 3.4)

LOL - Loss of Life - means the estimated loss of life in the event of a dam failure.

NRW – The Queensland Department of Natural Resources & Water (previously known as the Department of Natural Resources & Mines or NR&M or the Department of Natural Resources, Mines and Water or NRMW).

Outlet Works – A combination of structures and equipment required for the safe operation and control of water released from a reservoir to serve various purposes, e.g. regulate stream flow and quality; provide irrigation, municipal, and/or industrial water.

PAR - Population at Risk – means the number of persons, calculated under the guidelines referred to in s.482 (I) (b) [of the Water Act 2000], whose safety will be at risk if the dam, or the proposed dam after its construction, fails. Unless otherwise indicated, PAR is the ‘incremental PAR’ due to the failure event i.e. the difference in the PAR for the same event with dam failure relative to the event without dam failure. When ‘Total PAR’ is referred to, this is the total PAR inundated both due to the natural flood event and the natural flood levels aggravated by the failure event.

PMP Design Flood – The flood resulting from the PMP using AEP neutral assumptions of catchment conditions.

PMF - Probable Maximum Flood – The flood resulting from PMP, and where applicable snow melt, coupled with the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions.

PMP - Probable Maximum Precipitation – The theoretical greatest depth of precipitation for a given duration that is physically possible over a particular catchment area, based on generalised methods.

Probability of Occurrence – The probability that the risk (event) will occur.

Referable Dam – A dam, or a proposed dam for which:

- (a) a failure impact assessment is required to be carried out [under the Water Act 2000]; and
- (b) the assessment states the dam has, or the proposed dam after its construction will have, a category 1 or category 2 failure impact rating; and
- (c) the chief executive has, under section 487 [of the Water Act 2000], accepted the assessment.

The following are not referable dams:

- (a) a dam containing, or a proposed dam that after its construction will contain, hazardous waste.
- (b) a weir, unless the weir has a variable flow control structure on the crest of the weir.

The following are not dams and cannot therefore be referable dams:

- (a) a rainwater tank;
- (b) a water tank constructed of steel or concrete or a combination of steel and concrete;
- (c) a water tank constructed of fibreglass, plastic or similar material.

Ring tank – A dam that has a catchment area that is less than 3 times its maximum surface area at full supply level.

Risk Assessment Procedure – is the assessment methodology described in Section 3.4 of these guidelines.

Risk Profile - The aggregated relationship between the consequences resulting from a range of adverse events and their probability of occurrence (see Section 3.4).

RPEQ – A Registered Professional Engineer of Queensland as defined under the Queensland Professional Engineers Act 2002.

Small Dams Standard – is the assessment methodology described in Section 3.2 of these guidelines.

Societal Discount Rate – The discount rate used in determining the net present value (refer to Appendix B)

Societal Risk – The risk of widespread or large scale detriment and multiple loss of life from the realisation of a defined hazard. Refer also to the definition in *ANCOLD Guidelines on Risk Assessment* (ANCOLD, 2003)

Spillway – A weir, channel, conduit, tunnel, gate or other structure, designed to permit discharges from the reservoir when pondage levels rise above FSL; can include secondary, auxiliary, emergency spillways or fuse plugs.

Spillway Design Flood – The flood event which can be routed through the dam (with appropriate allowance for freeboard due to wind and wave effects) without any damage to individual sections of the dam.

Sunny Day Failure - means a dam failure which is not significantly affected by a natural flood occurring at the same time.

VOSL - Value of Statistical Life

Weir - A barrier constructed across a watercourse below the banks of the watercourse that hinders or obstructs the flow of water in the watercourse.

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Appendix A - Summary of Written Acceptable Flood Capacity Assessment Requirements

Summary of Written Acceptable Flood Capacity Assessment Requirements

The Acceptable Flood Capacity Assessment must be certified by a registered professional engineer as accurate and reasonable. The following information must be included in a written Acceptable Flood Capacity Assessment report:

Executive Summary/Introduction

A general description of the dam and the result of the Acceptable Flood Capacity Assessment including:

- Name of dam;
- Location of dam (i.e. longitude and latitude);
- Real property description of the land on which the dam structure is located
- Photographs of the existing dam or dam site
- Name of the owner of dam (i.e. name of individual or company).
- Dam owner contact details (i.e. postal address, street address, phone number, facsimile, email);
- Status of dam (i.e. existing or proposed dam or proposed work);
- Date dam construction completed to current arrangement;
- Development permit and water licence details (if any);
- Date last failure impact assessment accepted by the chief executive;
- The maximum population at risk;
- The failure impact assessment category for the dam;
- Type of dam (i.e. homogenous earthfill dam, zoned earth and rockfill dam, concrete dam or other);
- Height and storage capacity of the dam;
- Dam capacity to Full Supply Level (in megalitres);
- Spillway description (Type & Dimensions);
- Spillway discharge rating curves and any applicable operational rules (for gated operations) used in determining the AFC;
- Existing Flood Discharge Capacity for the dam at the dam crest level or a level with the design freeboard;
- AEP of the Existing Flood Discharge Capacity
- Acceptable Flood Capacity (AFC) for the dam;
- Spillway Design Flood and, if it is less than the AFC, details as to how it was assessed and the impacts of floods in excess of the Spillway Design Flood;
- Identified current flood discharge capacity as a percentage of AFC.

Data and methodology used

The Acceptable Flood Capacity Assessment shall include a summary of the data on which the assessment is based and the details of the methodology used (small dams standard/ fallback option /risk assessment) including, but not limited to the following:

Risk assessment	Small Dams Standard/Fallback Option
<ul style="list-style-type: none"> • Description of methodology for determining design rainfalls and results; • Description of methodology for determining spillway capacity floods and the results of routing the floods through the storage; • Description of methodology for assessing consequences of failure • Basis of the risk assessment process, methodology, parameter values and uncertainties including documentation as to: <ul style="list-style-type: none"> ○ Demonstrate the appropriateness of the assessment; ○ How the risks were identified and assessed; ○ What systems are applied to ensure the risks are properly controlled? 	<ul style="list-style-type: none"> • Description of methodology for determining design rainfalls and consequent flood magnitudes; • Details of the operating procedures adopted in determining the AFC; • Details of consequences of dam failure for Sunny Day and Flood failure conditions • PAR for each failure case considered; • Interpolations.

Details of the review of the appropriateness and accuracy of the data (including the details of dam break analyses for “Fallback Option”) must be also included in the assessment.

Note that although consideration of the current consequences would be sufficient for this assessment, it is strongly recommended that all likely future downstream developments be taken into account in assessing AFC.

Assessment

Details of the assessment including, but not limited to the following:

Existing Dams	Proposed dams
<ul style="list-style-type: none"> • Dam Crest Flood (DCF) for the existing arrangement, with the assigned Annual Exceedance Probability (AEP), to ANCOLD <i>Guidelines on Selection of Acceptable Flood Capacity for Dams</i>, Appendix 1. • For dams with hazard category of <i>Extreme</i> or <i>High A</i>, PMF, based on Book VI, ARR (Nathan & Weinmann, 1999) procedures, with FSL the pre-flood reservoir condition, and including information on the assigned values for all influencing parameters such as temporal and spatial patterns and losses. • For dams with hazard category of <i>High B</i> or <i>High C</i>, ‘PMP Design flood’ based on Book VI procedures with the reservoir at FSL at the start of the flood event or sequence of flood events. • The assessed hazard category, and potential consequences, noting any changes to potential consequences since the previous review report-both total and incremental consequences are to be reported including the potential for loss of life. • Assessment of the allowance for freeboard with reasons • Note of any changes to dam management, operating rules, conditions and surveillance procedures since the previous review report. • Information on EAPs in place. • Identified hydrologic deficiencies including assessment against Guideline criteria • Estimated risks of failure and assessment of their tolerability. • Capacity to accommodate future climate change (i.e. what is in reserve?) 	<ul style="list-style-type: none"> • Assessed hazard category and consequences – total and incremental - are to be reported including the potential for loss of life. • Hydrologic assessment against deterministic criteria. (needs further definition) • DCF and PMF and/or PMP Design flood, as for review of existing dams, and appropriate. • Proposals for freeboard provisions with reasons for the nominated freeboard. • Proposals, including assessed risks, for flood management during construction • Proposed dam management operating rules, conditions and surveillance procedures. • Provisions, if any, for future climate change.

Risk reduction proposals for existing dams (following the completion of an assessment for the dam)

Risk reduction measures only need to be considered as part of the risk assessment process when considering whether ALARP has been satisfied.

- Risk reduction options considered and comparative assessments against existing arrangement.
- Proposed DCF, PMF and/or PMP Design Flood, with assigned AEP, as appropriate for each of the options considered.
- Assessed hazard category and potential dam failure consequences, after implementation of risk reduction measures.
- Details of any structural measures to be relied on for risk reduction including changes to spillways or dam embankments etc.
- Details of any proposed non-structural measures to be relied on for risk reduction including changes to dam management, operating rules and flood warning systems, conditions and surveillance procedures.
- Proposed freeboard provisions and basis for these for each of the options considered.
- Proposals, including assessed risks, for flood management and construction management during construction.
- Interim EAPs, both during planning and during construction.

Registered Professional Engineer details.

The Acceptable Flood Capacity Assessment is to incorporate a certification from a Registered Professional Engineer (RPEQ). This certification shall include:

- Name of the certifying RPEQ.
- Registration number.
- Contact details (including postal address, street address, telephone number, facsimile, email as appropriate).
- A statement that this AFC assessment is reasonable and accurate and has been done in accordance with the NRW Guidelines on Acceptable Flood Capacity for Dams;
- Signature of RPEQ.
- Date.

Appendix B - Methodology for Demonstrating Compliance with ALARP.

Methodology for demonstrating compliance with ALARP.

The **ALARP principle** requires that risks should be ‘as low as reasonably practicable’. The methodology for demonstrating risks are ALARP is to be applied to all assessments where the “risk assessment procedure” is used for determining Acceptable Flood Capacity.

This requirement is to reduce risks to life to the point where further risk reduction is impracticable or requires action that is grossly disproportionate in time, cost, trouble and effort to the reduction in risk achieved. This principle forms the balance between equity and efficiency, with the balance deliberately skewed in favour of equity.

To decide whether risks are ALARP, it is necessary to consider the possibilities for further risk reduction beyond the limits of tolerability and their relative ease or difficulty (the sacrifice) of implementing them and to balance these against the benefits of implementing them. To demonstrate this, for the purposes of these guidelines, it is necessary to formulate risk reduction options and to prepare concepts and realistic cost estimates to undertake the risk reduction measures.

Each case will depend on the circumstances of the dam under consideration, but further risk reduction measures considered should not only include major modifications to the dam structure but should also include modifications or additions of individual pieces of equipment and/or components of individual structures where such measures are likely to have a significant impact on the overall risk of dam failure. In assessing the costs of these further risk reduction measures, only the incremental costs associated with risk reductions beyond the limit of tolerability should be considered⁹.

By undertaking the activities detailed in these guidelines and incorporating the outcomes in their decision recommendations, the analysts can assist the decision-maker, who has to make the final judgement that risks are ALARP.

A particular owner’s ability or inability to afford a risk reduction measure – that is, the owner’s financial circumstances - is not a consideration in deciding whether life safety risks are ALARP.

The methodology outlined below presents a cost-benefit framework for determining whether the ALARP upgrade improvements are required. This methodology assumes that a number of engineering calculations have already been performed to determine the probability of a flood event or other hazard (e.g. seismic, wind, piping) causing dam failure based on the probability of the event over the life of the dam and the expected loss of life during the event. The answers to these calculations are then applied to the methodology presented below.

A range of potential ALARP spillway capacity upgrades (including any necessary structural upgrades to accommodate additional headwaters and flows) should be considered in the assessment. The levels of these upgrades must then be used to develop a cost benefit curve for the spillway upgrade options, so that the point at which costs equal benefits can be identified. This optimal ALARP upgrade standard should then be compared with and plotted on the same graph as the limit of tolerability to demonstrate the upgrade point with which dam owners are required to comply.

The methodology requires the probable loss of life due to dam failure¹⁰ and probable property damage over the life of the dam due to dam failure to be determined, for both the project that just satisfies the tolerable risk criteria without consideration of ALARP¹¹ and a range of further potential ALARP spillway upgrades.

The probability of loss of life due to dam failure over the dam’s life is calculated by examining the

⁹ Where the overall dam upgrade project is to proceed as one overall project, the project costs associated with an ALARP component of the project should only include that proportion of the overall establishment costs associated with the upgrade of the works beyond the ‘tolerable limit’.

¹⁰ Note that probability of expected loss of life due to dam failure over the life of the dam may also be expressed as the probability of death and dam failure occurring at the same time.

¹¹ The minimum tolerable spillway standard prior to the consideration of ALARP is the spillway capacity which just allows the risk profile to meet the limit of tolerability criteria.

population at risk, the fatality rate¹² and the probability of dam failure during a flood event (or the flood event plus a proportional increase in discharge capacity equal to the level of ALARP upgrade being examined) over the nominated design life of the dam¹³ for the particular catchment. The probability of expected loss of property due to dam failure over the dam's life is calculated by examining the property at risk, the expected damage during a flood event and the probability of dam failure during that flood event (or the flood event plus a proportional increase in discharge capacity equal to the level of ALARP upgrade being examined).

The first calculation in the methodology should be applied to the dam arrangement that just satisfies the tolerable risk criteria without consideration of ALARP, as follows:

$$E(\text{LOL}_{\text{dam life}}) = [\sum (F_i \times \text{PAR}_i)] \times P(\text{FE})$$

which simplifies to:

$$E(\text{LOL}_{\text{dam life}}) = E(\text{LOL}) \times P(\text{FE})$$

Where:

$E(\text{LOL}_{\text{dam life}})$ = total expected LOL over the life of the dam.

$E(\text{LOL})$ = expected total LOL during a failure event;

F_i = fatality rate for each separate community, (i), in the particular catchment (This rate should be calculated for each community as some communities may be subject to different levels of flood severity and different flood vulnerabilities);

PAR_i = total PAR in each separate community during the failure event corresponding to the fatality rate F_i in the particular catchment;

$P(\text{FE})$ = probability of dam failure during a flood, seismic or other event over the life of the dam;

The calculation is also applied separately to the proposed ALARP upgrade standard. That is:

$$E(\text{LOL}_{\text{dam life}})^* = [\sum (F_i^* \times \text{PAR}_i^*)] \times P(\text{FE})^*$$

which simplifies to:

$$E(\text{LOL}_{\text{dam life}})^* = E(\text{LOL})^* \times P(\text{FE})^*$$

Where:

$E(\text{LOL}_{\text{dam life}})^*$ = total expected LOL over the life of the ALARP upgraded dam.

$E(\text{LOL})^*$ = expected total LOL during a failure event at the ALARP upgraded dam;

F_i^* = fatality rate at ALARP upgraded dam for each separate community, (i), in the particular catchment (note that this is necessary as some individual communities comprising the PAR may be subject to different levels of flood severity and different flood vulnerabilities);

PAR_i^* = total PAR in each separate community during the failure event corresponding to the fatality rate F_i^* in the particular catchment;

$P(\text{FE})^*$ = probability of dam failure due to a nominated flood, seismic or other event greater than the minimum tolerable spillway standard over the life of the ALARP enhanced dam;

Once the expected loss of life is determined based on a dam complying with the tolerable risk level and the various levels of ALARP upgrade, the incremental reduction in the probability of loss of life from dam failure as a result of the ALARP upgrade being performed may be calculated. This requires the difference in the total expected loss of life calculated in the first step to be calculated, as follows:

$$E(\text{LOL}_{\text{dam life}})_{\text{Incremental}} = E(\text{LOL}_{\text{dam life}}) - E(\text{LOL}_{\text{dam life}})^*$$

Where:

$E(\text{LOL}_{\text{dam life}})_{\text{Incremental}}$ = incremental reduction in total expected LOL over the life of the dam due to the ALARP upgrade being performed

¹² The 'fatality rate' is the appropriate fatality rate in Graham's loss of life formula (Graham, 1999) assuming 'no warning time' unless a strong case to the contrary is made.

¹³ To be taken as 150 years from the completion of the spillway upgrade.

Similarly, the expected property damage can be considered by determining the incremental flood damage due to the failure of the dam during an event and the changes to the operations and maintenance costs due to the upgrade.

$$E(\text{Damages}_{\text{dam life}})_{\text{Incremental}} = E(\text{Damages}_{\text{dam life}}) - E(\text{Damages}_{\text{dam life}})^*$$

Where:

$E(\text{Damages}_{\text{dam life}})_{\text{Incremental}}$ = Incremental damages due to the dam failure event

$E(\text{Damages}_{\text{dam life}})$ = the expected total damages resulting from the event without dam failure

$E(\text{Damages}_{\text{dam life}})^*$ = the expected total damages resulting from the event with dam failure

The expected damages are to be based on the NRW *Guidance on the Assessment of Tangible Flood Damages* (NR&M 2002c).

This incremental reduction in the estimated loss of life over the life of the dam, attributable to the ALARP upgrade being performed is then used to determine the expected total benefit ($E(TB_t)$) resulting from the ALARP upgrade. This is done by multiplying the VOSL by the incremental reduction in the estimated over the life of the dam due to the ALARP upgrade being performed, as shown below.

$$E(TB_t) = E(\text{LOL}_{\text{dam life}})_{\text{Incremental}} \times \text{VOSL}$$

It is presumed that the expected total benefit will be achieved in the year the upgrade is completed (ie, time = t). This is the case as the reduction in the probability of dam failure as a result of an increase in the level of AEP flood event that the upgraded dam can endure, will occur in the year that the upgrade work is completed. This benefit is not accrued in prior or subsequent years, as the timing of the total benefit is taken to align with the reduction in risk and the completion of work.

A societal discount rate of 6%, as noted in Queensland Treasury Guidelines (Qld Treasury, 2000 and Qld Treasury 1997) is to be adopted when determining the net present value of cash flows. The expected total cost of the upgrade should also be ascertained in current year dollars using the same societal discount rate. This will necessarily require the dam owner to consider the timing of cash flows associated with the upgrade and apply a similar 6% discount rate. The discounting calculations are presented below.

$$E(TB_0) = E(B_t) / (1+r)^t$$

and

$$E(TC_0) = [E(C_t) / (1+r)^t] + [E(C_{t-1}) / (1+r)^{t-1}] + [E(C_{t-2}) / (1+r)^{t-2}] + \dots + [E(C_{t-n}) / (1+r)^{t-n}]$$

Where:

r = societal discount rate

t = the time period in which the benefit will be received and the costs will be incurred

$E(TB_0)$ = expected total benefit in current year dollars

$E(TC_0)$ = expected total cost in current year dollars

These expected total benefits and costs may then be compared to establish if the ALARP upgrade is likely to produce total benefits in excess of total costs (ie, a cost benefit ratio of less than unity). If the net benefit is positive then the project should go ahead. The cost- benefit decision calculation is presented below:

$$\text{If: } \begin{aligned} E(TC_0) / E(TB_0) &\leq 1 \rightarrow \text{ALARP spillway upgrade required} \\ E(TC_0) / E(TB_0) &> 1 \rightarrow \text{ALARP spillway upgrade not required} \end{aligned}$$

This calculation illustrates that where the analysis produces a cost to benefit ratio of less than or equal to one (ie, benefits at least match the costs), then the ALARP upgrade would be required. An example of how this methodology should be applied appears in the example presented below.

Through this process, the cost benefit curve can be plotted so that the appropriate level of dam upgrade may be identified.

From a social economic perspective, the appropriate level of upgrade beyond the limit of tolerability would be where the marginal benefits of the total spillway upgrade equal the marginal costs of the total spillway upgrade. This is the point at which total net benefits are maximised. This point may be determined by graphing the cost benefit curve, of total expected benefits against the relative increase in flood discharge capacity based on the calculations performed for the range of ALARP spillway upgrades.

When relying on 'risk assessment', dam owners are required to undertake upgrades at least to the 'tolerable risk' line. The extent to which the spillway needs to be further upgraded depends on whether the point at which the total benefits equal the total costs lies beyond the limit of tolerability or not.

ALARP upgrade options to be considered

There are a wide range of potential upgrade options to be considered as part of the upgrade process to reduce the risks below the tolerable risk level. Such options that might be considered include (but may not be limited to):

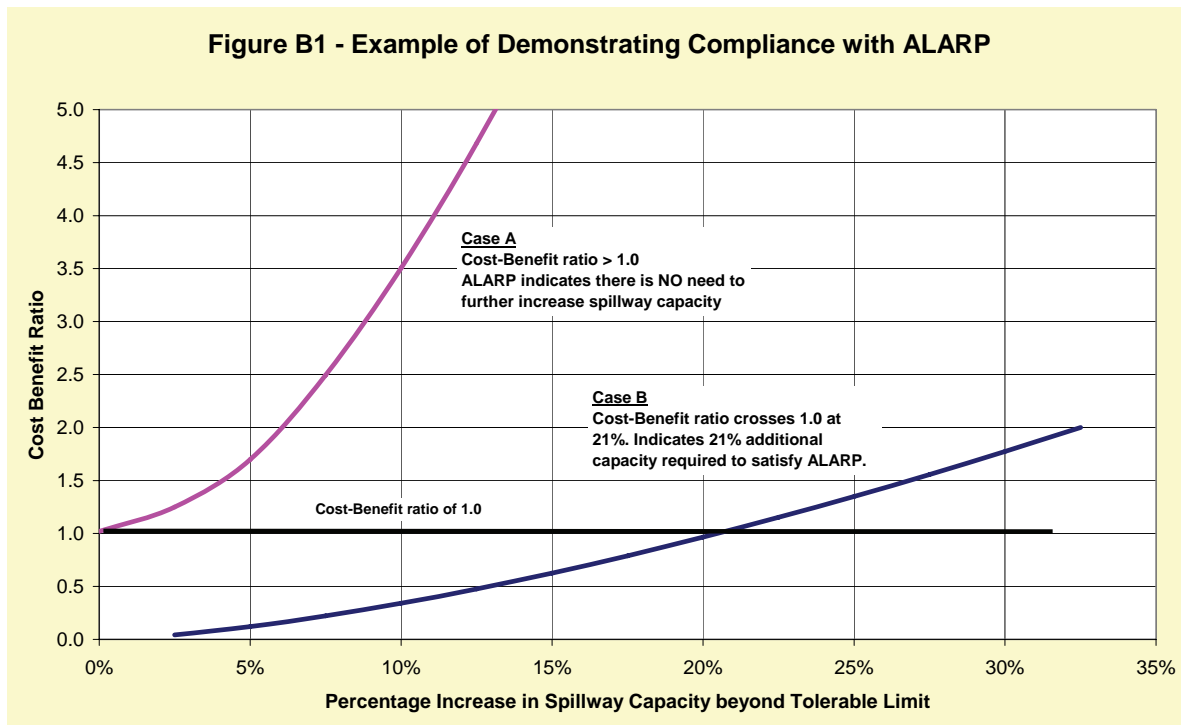
- Widening or deepening an existing spillway
- The addition of spillway gates or some other flow control structure
- Modifying the operating systems/rules for the structure so that risk of failure is reduced
- Structural modifications to the dam to enable it to safely pass overtopping flows
- Additions/modifications to dam embankments and foundations to reduce the risk of failure
- The addition of additional spillways such as higher level auxiliary spillways or fuse plug spillways
- Raising or modifying non-overflow dam sections to reduce the risk of failure
- Diversion of some of the catchment around the dam
- A combination of any or all of the above.

The required accuracy of the necessary estimates for these options will be dependent on the sensitivity of the outcome. The accuracy need not be high where the result is clear-cut one way or the other.

The actual ALARP upgrade options to be considered in each particular case will be dependent on the circumstances at each individual dam and advice may need to be sought from an RPEQ experienced in dam engineering. Non-structural options can only be considered if it can be clearly demonstrated that such options can be relied on in the long term and are under some degree of control by the dam owner.

Example

An example of the ALARP methodology is provided below to illustrate the practical application of calculating the life benefits achieved by upgrading the size/capacity of a spillway by 10% beyond the limit of tolerability standard. The assumptions made below are presumed to have been provided through engineering studies and calculations



Assumptions:

$P(FE) = 0.04878$ (= probability of a 1 in 3000 year AEP event occurring over a 150 year life of the dam)

$P(FE)^* = 0.02107$ (= probability of a 1 in 7045 year AEP event [equivalent to a 10% increase in spillway capacity] occurring over a 150 year life of a dam)

$F = 0.15$ (for medium severity flooding where houses would be damaged during flood events)

$PAR = 10$ (obtained from Failure Impact Assessment studies)

$VOSL = \$5m$ AUD (2004 dollars)¹⁴

$r = 6\%$

$t = 5$ (ie, upgrade will be completed in year 5)

$E(TC) = \$250,000$ (ie, expected total cost of ALARP upgrade over five years as follows:
year 1: 5%; year 2: 5%; year 3: 15%; year 4: 35%; year 5: 40%)

Probability of death given dam failure

Under tolerable safety standard

$$E(LOL_{dam\ life}) = [(F_i \times PAR_i) + (F_k \times PAR_k) + (F_m \times PAR_m)] \times P(FE)$$

$$= [0.15 \times 10] \times 0.04878 = 0.07317$$

After ALARP spillway improvement

$$E(LOL_{dam\ life})^* = [(F_i^* \times PAR_i) + (F_k^* \times PAR_k) + (F_m^* \times PAR_m)] \times P(FE)^*$$

$$= [0.15 \times 10] \times 0.02107 = 0.03160$$

¹⁴ Assumed based on a figure within the strong to very strong ANCOLD justification range for risks just above the broadly acceptable risk.

Incremental reduction in probability of death given dam failure

$$\begin{aligned} \text{Incremental } E(\text{LOL}_{\text{dam life}}) &= E(\text{LOL}_{\text{dam life}}) - E(\text{LOL}_{\text{dam life}})^* \\ &= 0.07317 - 0.03160 = 0.04157 \end{aligned}$$

Expected Benefit of ALARP spillway upgrade

In year 5:

$$\begin{aligned} E(B_t) &= \text{Incremental } E(\text{LOL}_{\text{dam life}}) \times \text{VOSL} \\ E(B_5) &= 0.04157 \times \$5,000,000 = \$207,850 \end{aligned}$$

At time zero:

$$E(B_0) = E(B_t) / (1+r)^t = \$207,850 / 1.06^5 = \$155,990$$

Expected indexed Cost of ALARP spillway upgrade at time zero

$$\begin{aligned} E(C_0) &= [E(C_t) / (1+r)^t] + [E(C_{t-1}) / (1+r)^{t-1}] + [E(C_{t-2}) / (1+r)^{t-2}] + \dots + [E(C_{t-n}) / (1+r)^{t-n}] \\ &= \$100,000 / 1.06^5 + \$87,500 / 1.06^4 + \$37,500 / 1.06^3 + \$12,500 / 1.06^2 + \$12,500 / 1.06 \\ &= \$198,500 \end{aligned}$$

Cost-Benefit Analysis

$$E(C_0) / E(B_0) = \$198,500 / \$155,900 = 1.27$$

In this example, for this potential project, as the costs of undertaking the additional upgrade outweigh the benefits, the dam owner would not be required to increase the minimum safety of the spillway by 10% above the tolerable limit to sustain a larger AEP flood event. Had the benefits outweighed the costs however, the upgrade would have been required.

Such cost-benefit assessments should be undertaken for a range of upgrades beyond the limit of tolerability, so that the optimal level of ALARP upgrade could be identified. If this was done and a cost-benefit curve of the type shown in the Figure B1 for 'Project Type A' might result.

To achieve compliance with the minimum safety standard, dam owners are required to undertake upgrades until the optimal upgrade point is reached (being the point at which benefits equal costs). Thus, for the Project Type A example, where no point is below a Cost-Benefit ratio of 1.0, no further upgrade would be required to satisfy ALARP. However, if a cost-benefit curve like 'Project Type B' resulted, a additional 21% upgrade would be required in order to satisfy ALARP.

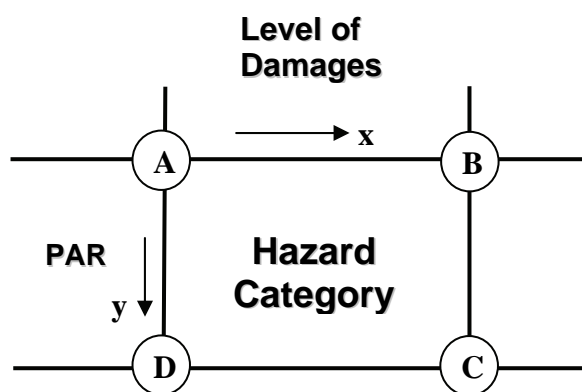
Appendix C - Methodology for Interpolating Required AEP within a particular Hazard Category using Fallback Procedure

Methodology for Interpolating Required AEP within a particular Hazard Category using Fallback Procedure

The following methodology can be applied for interpolating the required AEP of the Acceptable Flood Capacity within a specific Hazard Category for the Fallback procedure.

The following interpolation procedure is to be applied within any ‘Severity of Damage and Loss’ and ‘Population at Risk’ cell of Table 2:

- (a) Once the consequences of failure (level of damage) and the PAR have been assessed using the provisions of Section 3.3, determine the appropriate Hazard Category and determine the Annual Exceedence Probabilities (AEPs) to be applied at each of the points A, B, C and D using the AEPs set out in Table 2. (Note the points A, B, C and D are not to be confused with the hazard category in Table 2)



- (b) Determine the ‘x’ and ‘y’ coordinates for the most critical failure case.
 x = the relative severity of damage and loss relative to the boundaries of the damage scale
 y = the log of the PAR

Where ‘x’ and ‘y’ are calculated as follows:

$$x = [\log_{10}(\text{Damage}) - \log_{10}(\text{Damage @ A})] / [\log_{10}(\text{Damage @ B}) - \log_{10}(\text{Damage @ A})]$$

$$y = \log_{10}(\text{PAR}/10)$$

Where the values of damages at A/D and B/C have been interpolated from the ranges of damages contained in ANCOLD 2000b for:

1. Estimated Costs
2. Service and Business relating to the Dam
3. Social
4. Natural Environment

With the lowest AEP selected corresponding to the worst combination of ‘x’ and ‘y’ values being adopted.

Note for ‘Major’ levels of damage, the maximum value of the ‘x’ coordinate shall be taken to correspond to twice the level of damages at the boundary between ‘medium’ and ‘major’.

- (c) Using the following relationship, determine for each combination of ‘PAR’ and ‘Level of Damages’ the required AEP of the design flood and select the smallest AEP as the required AEP of the AFC.

$$\text{Log(AEP)} = \alpha_1 + \alpha_2 x + \alpha_3 y + \alpha_4 xy$$

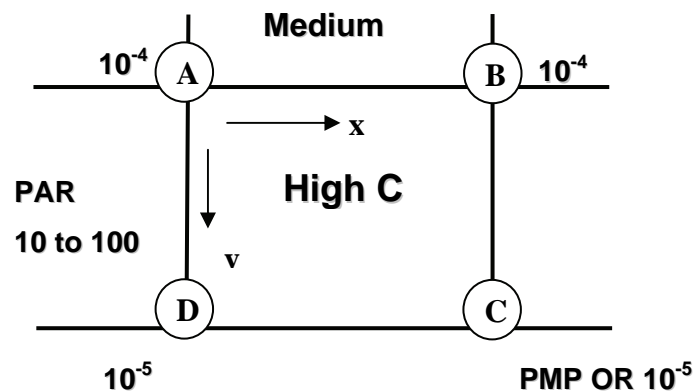
Where

- α_1 = the log (AEP) of the design flood at point A
- α_2 = the log (AEP) of design flood at point B – α_1
- α_3 = the log (AEP) of design flood at point D – α_1
- α_4 = the log (AEP) of design flood at point C – $\alpha_1 - \alpha_2 - \alpha_3$

By way of example for the case of

- a PAR of 29 and serious damage or destruction of 10 houses producing a ‘Medium’ level of residential damages¹⁵.
- A catchment area of less than 100km²

Because the catchment area is less than 100 km², Table 2 indicates the notional AEP of the Probable Maximum Precipitation is 1.0x10⁻⁷ and the Hazard Category is ‘High C’.



Point ‘A’ corresponds to a PAR of 10 and, from Appendix D of ANCOLD *Guidelines on Assessment of Consequences of Dam Failure* (ANCOLD, 2000b), a level of damages equivalent to the destruction of four houses.

Point ‘B’ corresponds to a PAR of 10 and a level of damages equivalent to the destruction of forty-nine houses.

Point ‘C’ corresponds to a PAR of 100 and a level of damages equivalent to the destruction of forty-nine houses.

Point ‘D’ corresponds to a PAR of 100 and a level of damages equivalent to the destruction of four houses.

From Table 2 of this Guideline, the AEP of the AFC at point ‘A’ and ‘B’ is 1.0x10⁻⁴ and the AEP of the AFC at points ‘C’ and ‘D’ is the probability of the PMP or 1.0x10⁻⁵ (whichever is greater) i.e 1.0x10⁻⁵.

Thus ...

- At point A $y = \log(10) = 1, x = 0, \text{ required AEP} = 1.0 \times 10^{-4}$
- At point B $y = \log(10) = 1, x = 1, \text{ required AEP} = 1.0 \times 10^{-4}$
- At point C $y = \log(100) = 2, x = 1, \text{ required AEP} = 1.0 \times 10^{-5}$
- At point D $y = \log(100) = 2, x = 0, \text{ required AEP} = 1.0 \times 10^{-5}$

At the point of interest $x = (\log 10 - \log 4) / (\log 49 - \log 4) = 0.366$

$$y = \log_{10}(29/10) = 0.4624$$

$$\alpha_1 = \log_{10}(1.0 \times 10^{-4}) = -4$$

¹⁵ Under the ANCOLD Guidelines on the Assessment of Consequences of Dam failure (ANCOLD 2000b) a ‘Medium’ level of residential damages corresponds to ‘Destroy 4 to 49 houses or damage to a number’.

$$\alpha_2 = \log_{10}(1.0 \times 10^{-4}) - \alpha_1 = -4 - (-4) = 0$$

$$\alpha_3 = \log_{10}(1.0 \times 10^{-4}) - \alpha_1 = -5 - (-4) = -1$$

$$\alpha_4 = \log_{10}(1.0 \times 10^{-5}) - \alpha_1 - \alpha_2 - \alpha_3 = -5 - (-4) - (-1) - 0 = 0$$

Which gives a required AEP of the Acceptable Flood Capacity of

$$\begin{aligned} \text{Log(AEP)} &= \alpha_1 + \alpha_2 x + \alpha_3 y + \alpha_4 xy \\ &= -4 + 0 * x - 1 y + 0 * x y \\ &= -4 - 1 * 0.4624 = -4.4624 \end{aligned}$$

Therefore the required AEP is $1 \times 10^{-4.4624} = 3.45 \times 10^{-5}$

Department of Environment and Resource Management
DIRECTOR-GENERAL BRIEFING NOTE

Approved	Not Approved	Noted
Further information required		
A/DC	[Redacted]	
Dated	30/9/11	

TO: A/Director-General

SUBJECT: Approval of Flood Mitigation Manual – Manual of Operational Procedures for Flood Mitigation as Wivenhoe Dam and Somerset Dam.

TIMEFRAME/REQUESTED BY

- This brief was initiated by the department.
- A decision is urgently required by **4pm 30 September 2011** to comply with a recommendation in the Interim Report of the Queensland Floods Commission of Inquiry.

RECOMMENDATION

It is recommended that the A/Director-General:

- by Gazette notice, **approve** the attached (**Attachment A**) Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 8, September 2011 (the Manual) under section 371 of the *Water Supply (Safety and Reliability) Act 2008*.
- **tick the approval box and sign** the Reviewed Flood Mitigation Manual Assessment and Decision Form as decision maker (**Attachment B**)
- **note** that if the Manual is approved, an urgent Extraordinary Government Gazette Notice (gazette notice) will be published. The gazette notice will function as the approval of the Manual under the *Water Supply (Safety and Reliability) Act 2008*.
- **note** that the department’s Executive Officer, Inquiry Recommendations Implementation Group is working to have the gazette notice published by 1 October 2011 and that the last available time to order the notice is 4.45pm on 30 September 2011.

BACKGROUND

- The Queensland Bulk Water Supply Authority trading as Seqwater (Seqwater) owns and operates Wivenhoe and Somerset Dams.
- Flood operations at Wivenhoe Somerset Dams are controlled by a Flood Mitigation Manual. The current Flood Mitigation Manual for Wivenhoe and Somerset Dams was approved by an authorised delegate of the chief executive under section 371 of the *Water Supply (Safety and Reliability) Act 2008* on 7 November 2009.
- The Queensland Floods Commission of Inquiry (“Commission”) was established on 17 January 2011. The Commission completed its first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties. The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011.
- The Director-General is authorised to approve the Manual by Gazette Notice pursuant to section 371 of the *Water Supply (Safety and Reliability) Act 2008*. The relevant section of the legislation is extracted and attached (**Attachment C**). It is important to note that the approval is effected by publication of a gazette notice and the date of approval will be the date of the gazette notice not the date this briefing note is approved. A draft gazette notice is attached (**Attachment D**)

Author Name: Peter Allen Position: Project Director, Dam Safety Tel No: [Redacted] Date: 29 September 2011		Recommended: Name: Bob Reilly [Redacted] Position: General Manager, Office of the Water Supply Regulator Tel N: [Redacted] Date: 30 September 2011
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- The authority to approve Flood Mitigation Manuals under the above section has also been properly delegated pursuant to the *Water Supply (Chief Executive) Delegation (No. 1) 2011* to:
 - General Manager, Office of the Water Supply Regulator
 - Director, Water Industry Asset Management & Standards, Office of the Water Supply Regulator
 - Project Director, Dam Safety, Office of the Water Supply Regulator (Position No 76025966)
 - Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator.
- However, because compliance with the Interim Report recommendations of the Commission is a whole of government commitment it is appropriate that the Director-General approve the Manual.

CURRENT ISSUES

- Recommendation 2.8 of the Commission's Interim Report stated that Seqwater should:
 - conduct an interim review of the Wivenhoe manual
 - have the draft manual assessed by independent expert peer reviewers
 - consider the expert peer reviews
 - submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.
- A letter dated 29 September 2011 from Seqwater submitting the Manual for approval is attached (**Attachment E**).
- That letter also enclosed Explanatory Notes to the Manual (**Attachment F**).
- That letter also enclosed a letter from Seqwater's independent peer reviewer, [REDACTED] (**Attachment G**) stating that he is satisfied with the Manual.
- The Commission released draft findings for comment to particular interested parties, which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals. The Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the Flood Mitigation Manuals however it was considered prudent that this issue be addressed. The General Manager, OWSR wrote to Seqwater requesting that a delegation power be inserted into the Flood Mitigation Manuals for Wivenhoe and Somerset Dams. (CTS14552/11 **Attachment H** - This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services). A delegation power has been inserted into the Manual at section 1.9.
- A Principal Lawyer, Legal Services (Floods Commission of Inquiry Liaison) has reviewed the Manual and prepared a Legal Advice that has been reviewed by a Deputy Crown Solicitor at Crown Law. The Legal Advice including a copy of the letter from Crown Law dated 29 September 2011 is attached (**Attachment I** - This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services).
- The Project Director, Dam Safety has, as assessment officer, assessed the Manual under policy and procedure DS5.3 (**Attachment J**) and recommended that the decision maker approve the Manual (**Attachment B**).
- A longer term review of the Flood Mitigation Manual for Wivenhoe and Somerset Dams is being undertaken by Seqwater in consultation with the department in accordance with recommendations 2.10, 2.11, 2.12, and 2.13 of the Commission's Interim Report.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- There are no resource/implementation implications for DERM.

Author Name: Peter Allen Position: Project Director, Dam Safety Tel No: [REDACTED] Date: 29 September 2011			Recommended: Name: Bob Reilly Position: General Manager, Office of the Water Supply Regulator Tel No: [REDACTED] Date: 30 September 2011
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PROPOSED ACTIONS

- If the Manual is approved the Executive Officer, Inquiry Recommendations Implementation Group will arrange for an Extraordinary Government Gazette Notice to be published on an urgent basis.
- The department will continue to work with Seqwater on the interim review of the North Pine Flood Mitigation Manual with a view to having it approved as early as possible and by 14 October 2011 at the latest.
- The department will continue to work with Seqwater on the longer term review of both Flood Mitigation Manuals.

ACTING DIRECTOR-GENERAL'S COMMENTS

ATTACHMENTS

- Attachment A: Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (the Manual), Revision 8, September 2011 for approval.
- Attachment B: Reviewed Flood Mitigation Manual Assessment and Decision Form for signing
- Attachment C: Extract section 371 of the *Water Supply (Safety and Reliability) Act 2008*.
- Attachment D: Draft gazette notice.
- Attachment E: Letter dated 29 September 2001 from Seqwater submitting Manual for approval.
- Attachment F: Explanatory Notes to the Manual prepared by Seqwater.
- Attachment G: Letter dated 29 September 2001 from Len MacDonald, Seqwater's independent peer reviewer.
- Attachment H: CTS14552/11.
- Attachment I: Legal Advice.
- Attachment J: DS 5.3 Processing a flood mitigation manual for a dam following review.

Author Name: Peter Allen Position: Project Director, Dam Safety Tel No [REDACTED] Date: 29 September 2011			Recommended: Name: Bob Reilly Position: General Manager, Office of the Water Supply Regulator Tel No [REDACTED] Date: 30 September 2011
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PROPOSED ACTIONS

- If the Manual is approved by the Executive Order, Input, Recommendation, Implementation Group will emerge for an extraordinary Government Affairs Office to be published on an regular basis.
- The department will continue to work with Congress on the status review of the North Line Flood Mitigation Manual with a view to having it approved as early as possible and by the October 2011 at the latest.
- The department will continue to work with Congress on a regular term review of both Flood Mitigation Manuals.

ACTING DIRECTOR-GENERAL'S COMMENTS

- The Manual is approved by the Executive Order, Input, Recommendation, Implementation Group will emerge for an extraordinary Government Affairs Office to be published on an regular basis.
- The department will continue to work with Congress on the status review of the North Line Flood Mitigation Manual with a view to having it approved as early as possible and by the October 2011 at the latest.
- The department will continue to work with Congress on a regular term review of both Flood Mitigation Manuals.

<p>Approved by Date Signature</p>			<p>Approved by Date Signature</p>
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REVIEWED FLOOD MITIGATION MANUAL ASSESSMENT AND DECISION FORM

General Information

Name of dam	Somerset/Wivenhoe Dams
Reference number/s (from Referable Dam Register)	Somerset (#354), Wivenhoe (#377)
Dam owner contact details	Queensland Bulk Water Supply Authority (trading as Seqwater)
Date reviewed flood mitigation manual received by DERM	29 September 2011
Date approval for existing flood mitigation manual expires	22 January 2015
DERM file details	DAM/130/000(0377)/ CBD/024089 and CBD/024093
Supporting information received from the dam owner	Letter detailing what was contained in the submission Explanatory Notes produced by Seqwater detailing how the Queensland Flood Commission of Inquiry recommendations have been addressed. Letter from [REDACTED] who acted as an independent peer reviewer on the behalf of Seqwater.
Name / position of assessment officer	Peter Allen, Project Director Dam Safety
Name / position of decision maker	[REDACTED] A/Director-General
Due date for completion of review	Recommendation 2.8 of the Queensland Floods Commission of Inquiry Interim Report recommended that the Interim Review of the Wivenhoe Manual be approved before 1 October 2011

REVIEWED FLOOD MITIGATION MANUAL CHECKLIST

	Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
Amendments since previous manual			
1.	Does the manual or accompanying correspondence provide a summary of changes and why they are necessary?	3	Seqwater have provided a summary document which indicates the changes made in order to satisfy the recommendations made in the Queensland Floods Commission of Inquiry (QFCOI) Interim Report dated 1 August 2011. They have not provided a detailed list of all changes.
Consultation			
2.	Are any stakeholders adversely affected by the changes? If so, has the dam owner consulted with relevant stakeholders?	3	The Manual has been reviewed as a result of a recommendation of the Queensland Floods Commission of Inquiry. The changes [redacted] for PA
3.	Have concerns/issues been raised by stakeholders? If so, have the concerns been addressed in the manual?	3	Because of the time frames involved, no external consultation has been undertaken. However, all the relevant recommendations made by the Commission of Inquiry for the Interim Review of the Manual have been addressed.
Direction of operations			
4.	Does the manual include the following		
	<ul style="list-style-type: none"> Operational arrangements to unambiguously define flood release operations for the dam during flood events 	5	Yes. This has been one area where significant changes have been made to more clearly define the current practices. It has been the subject of an independent peer reviewer [redacted] - formerly Chair of the NSW Dam Safety Committee) and an extensive legal review by Seqwater legal representatives and DERM legal officers.
	<ul style="list-style-type: none"> Designation and responsibilities of those responsible for Flood Operations including qualifications and experience. 	5	Yes. Arrangements are identical those of the previous Manual (Revision 7). There have been minor editorial changes.
5.	Does the manual cover training for relevant personnel	5	Yes. As per Revision 7. However, a briefing note is to be sent to the A/Director General recommending that he sign a letter to Seqwater detailing the 'chief executives training requirements for the period 1 October 2011 to 30 September 2012.
6.	Does the manual detail the follow reporting requirements		
	<ul style="list-style-type: none"> Training 	5	Yes. Refer to Section 2.8 of Revision 8. See also comment for Item 5.

Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
• Flood preparedness	5	Refer to Section 2.3 of Revision 8.
• Flood event reporting	5	Refer to Section 2.13 of Revision 8. The details of what is required in the post-event flood reporting have been detailed.
Flood Mitigation Objectives		
7. Does the manual cover the following objectives and assign priorities to each objective:-		
• Structural safety of dam/s	5	Refer to Section 3.2 of Revision 8. Details are provided of the maximum tolerable flood levels for both dams and the effect of closely spaced large floods.
• Protection of urbanised areas from inundation	5	Refer to Section 3.3 of Revision 8. Reference to "non-damaging flows" of 4000 m ³ /sec has been removed in accordance with Recommendation 2.9.
• Minimise disruption to downstream rural communities (if applicable)	5	Refer to Section 3.4 of Revision 8. The details of the strategies are contained in Section 4.
• Minimise impact on flora and fauna	5	Refer to Section 3.6 of Revision 8. This section also refers to 'bank slumping'.
Flood monitoring and forecasting		
8. Does the manual detail the provision of real time flood data to BOM for the issuing of flood warnings and any necessary flood modelling?	4	Described in Section 2.12. The issue of the weight given to forecasts has been addressed by detailing the current practice. There has been no major review of the release strategies. This is to be addressed as part of the Longer Term Review.
9. Have details of the operation of the overall operating system been included	5	The selection of release strategies is detailed in Section 4. It is a more detailed description than that provided in Revision 7. Flowcharts are provided to detail the selection of particular strategies and what is considered within each strategy. The wording has been fairly extensively review and found to be better defined than in Revision 7.
10. Does the manual detail an appropriate flood monitoring and forecasting system?	4	Details of where the individual ALERT stations or the mechanics of the software are not provided. However, it is a well established system and there is sufficient details/requirements built into the Manual to require adequate maintenance and future development of the system.

	Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
Communications			
11.	<p>Does the manual cover communications with the following:</p> <ul style="list-style-type: none"> Stakeholder agencies (e.g. Bureau of Meteorology, DERM, relevant councils affected by the dam) Operational staff employed by the dam owner Public 	<p>4</p> <p>4</p> <p>3</p>	<p>List of stakeholders is detailed in 2.12. Details of who is to be given warnings etc. is detailed in the Emergency Action Plan.</p> <p>List of types of communication included in Section 2.11.</p> <p>During flood events there is no provision for communicating with the public. This is handled in the Emergency Action Plan for each dam.</p>
Review			
12.	Does the manual allow for variation to the document when technical and physical conditions relating to the dam change.	5	<p>Section 4.5 provides for the use of 'Reasonable Discretion' in the event that a Senior Flood Operations Engineer considers it necessary.</p> <p>Section 1.6 provides for non-temporary variations to the manual.</p> <p>These should be adequate for the purpose.</p>
13.	<p>If no other changes are required (as per No. 12 above) does the manual include details of the mandatory review that is required within the time frame set by the chief executive?</p> <p>Note: the manual should include details such as</p> <ul style="list-style-type: none"> how detailed the review should be things to be considered during the review. <p>A review may or may not result in a change to the manual.</p>	N/A	See Item 12. It does not cover the ability of the chief executive to request particular changes to the Manual ... but that is contained in the Water Supply Act and does not need duplication.
Operation during flood events			
14.	Does the manual include details of:		
	<ul style="list-style-type: none"> infrastructure for flood releases (this may include diagrammatic representations) 	5	Good overall description in Sections 5.2 and 6.1.

Issue		Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
	<ul style="list-style-type: none"> details of structures to be considered during flood operations 	4	Details of the bridges to be considered in flood operations are provided in Figure 5.3.2 and Appendix J. Mention of 'non-damaging' flows has been removed with now only a reference to 4000 m ³ /sec in Brisbane being a target flow in Brisbane. This corresponds to the flow at which significant damage starts to occur in Brisbane.
	<ul style="list-style-type: none"> Discharge rating information for gates, spillways and auxiliary spillways 	5	Full details provided in Appendices. An equation for the discharge through a triggered fuse plug has been provided in Appendix E in accordance with statements made on Page 42 of the QFCol Interim Report.
	<ul style="list-style-type: none"> Initial flood control action 	4	Contains details of who is responsible for mobilisation and when a flood event is declared and when it is completed.
	<ul style="list-style-type: none"> Flood operation strategies 	5	Detailed in Sections 5, 6 and 7. While the overall strategies have remained essentially unchanged, they have undergone extensive review for consistency, presentation and to comply with Recommendation 2.10.
	<ul style="list-style-type: none"> Gate closing strategies 	5	Detailed in Sections 5.4 and 6.3.
	<ul style="list-style-type: none"> Gate operation sequences 	5	Detailed in Sections 5.5 and 6.4.
Emergency flood operations			
15.	Does the manual include the provision for and information on emergency flood operations	5	Emergency flood operations are to proceed in accordance with Section 7. These provisions are the same as those in Revision 7.
16.	Are flood operations consistent with the Emergency Action Plan (EAP)?	5	The EAP details the notifications required to other parties. The way the dam is operated is in accordance with this Manual.
Other Issues			
17.	Does this manual raise any other issues not covered in the above checklist?	5	No.
Queensland Floods Commission of Inquiry			
18.	Does this manual comply with the outcomes of the Queensland Floods Commission of Inquiry?	5	However, it does comply with the relevant recommendations made in the QFCol Interim Report. It has had an extensive legal review and a review of all the technical aspects to ensure consistency and compliance with the Recommendations.

Comment on the results of the detailed assessment of the reviewed manual. In particular comment on the overall extent and significance of any non-compliance with the issues in the checklist or any failures to address the above issues adequately or in sufficient detail

All aspects of the Manual have undergone an extensive review. It has undergone a peer review process by [REDACTED] (the former Chairman of the New South Wales Dam Safety Committee) and his comments have been incorporated into the Manual. There have been a lot of editorial changes to reflect current arrangements and the QFCoI recommendations.

Detail legal advice received on their review of the legal aspects of the flood mitigation manual (if it was deemed appropriate to seek legal advice).

[REDACTED] (Principal Lawyer, Legal Services) has been reviewing the Manual from a DERM legal perspective and interacting with the Seqwater legal representatives. She has indicated that Revision 8 now satisfies DERM requirements from a legal perspective.

Recommendation and decision

Assessment officer's recommendation to decision maker



Approve the reviewed flood mitigation manual

Reasons for recommendation to approve the reviewed manual

Revision 8 of the Flood Mitigation Manual for Wivenhoe and Somerset Dams has undergone the Interim Review recommended by the Queensland Floods Commission of Inquiry in their Interim Report of 1 August 2011.

Revision 8 has been extensively reviewed from a technical and a legal perspective and now satisfies all the relevant recommendations made by the Commission of Inquiry. The Seqwater appointed independent peer reviewer is 'satisfied with the manual'.

It is recommended that it be approved for a period of five years until 1 October 2016. It is expected that it will ultimately be superseded by the next revision once the longer term review recommended by the Commission of Inquiry is completed.

Evidence for the findings

Note: Documents, information, Acts, standards and guidelines that were considered in the course of carrying out this assessment and making this recommendation. List all contacts with the dam owner, information given to the dam owner and information received or used in making the recommendation.

- *Water Supply (Safety and Reliability) Act 2008*
- Work practice DS 5.3 Assessing a flood mitigation manual for a dam following review (WIR/2011/4884 in the policy register)
- DERM files **DAM/130/000(0377)/ CBD/024089 and CBD/024093 (Keeper files)**
- Interim Report of Queensland Floods Commission of Inquiry (QFCoI), 1 August 2011.
- Revision 7 of Manual of operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, November 2009.
- Revision 8 of Manual of operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, September 2011.

- Peer Review Letter by Independent Peer Reviewer [REDACTED] provided by Seqwater

Findings on material facts

Note: That is, the results of the flood mitigation manual checklist.

- Under section 373 of the Act the owner of the dam reviewed and updated the existing approved flood mitigation manual for Wivenhoe and Somerset dams and submitted it to the department for approval on 29 September 2011.
- The QFCoI recommended an interim review of the Manual with a view to having it ready for the 2011/2012 wet season.
- Revision 8 of the Manual satisfies all the recommendations made by the QFCoI.
- There has been extensive review of the release strategies for each dam with the aim of clarifying the existing procedures and ensuring consistency across the Manual.
- The next stage for the review of the Manual is the 'Longer Term Review' in accordance with recommendations 2.10 to 2.13 of the QFCoI Interim Report. This has already begun but may not be completed for a couple of years.

Reasons for the recommendation

Note: These are the reasons for the conclusion, in this part you assess the evidence and say how it was applied; you give a logical explanation for the recommendation.

- Revision 8 satisfies all the recommendations made by the Queensland Floods Commission of Inquiry in their Interim Report published on 1 August 2011.
- The current use of rainfall forecasts has been more completely defined. (A more thorough review of the application of rainfall forecasts and the way in which they are used will be part of the 'Longer Term' Review.)
- Revision 8 has been extensively reviewed by DERM Legal Officers. This has ensured a consistency of language throughout the Manual for significant terms including 'predicted'. [REDACTED] for PA
- The existing flood release strategies have been clarified with Flowcharts introduced to define the transitions to W2 and W3 from strategy W1.
- The drawdown rules have been defined in more detail.
- There is no mention of the term 'non-damaging flows' or other similar terms defining the relative consequences of a discharge.
- There is clarification that strategy W3 does not deliberately permit all the flood engineers to release water which would create a flow at Moggill of over 4000 m³/sec although it is recognised that flows greater than this magnitude could occur if unforecast rain subsequently occurs downstream of Wivenhoe Dam. [REDACTED] for PA.
- The mechanical capability of the Wivenhoe gate opening mechanism is defined in Appendix G.
- Section 8.6 of Revision 7 has been revised and the term 'generally' has been removed. It is now contained in Section 5.5 for Revision 8.

Certification and signature of assessment officer

I have complied with the procedure for processing a flood mitigation manual for a dam following review. When making this recommendation, I have taken the material described above, the requirements of the *Water Supply (Safety and Reliability) Act 2008*, relevant guidelines, the matters outlined in the procedure for processing a flood mitigation manual for a dam following review and departmental training I have received, into account when making this recommendation.

Signature of assessment officer [Redacted]

Position of assessment officer Project Director Dam Safety

Date recommendation made 30 September 2011

Decision maker's decision (tick appropriate box/es and delete those not needed)

Authority to make decision

~~<<insert instrument of delegation>>~~ Water Supply (Safety & Reliability) Act 2008

~~Seek further advice~~

~~Person/s advice is to be sought from~~ N/A

~~<<insert source of further advice - could be legal advice or advice from an Advisory Council etc>>~~

Approve the reviewed flood mitigation manual

Approval timeframe (not more than 5 years)

~~<<insert date approval expires (not more than 5 years)>>~~ 5 years

~~Further investigations by the assessment officer are required before a final decision is made~~

~~Issues to be further investigated by the assessment officer~~

N/A

~~<<list details of issues>>~~

~~Time frame for completion of investigations~~

~~<<insert timeframe>>~~

~~Not approve the reviewed flood mitigation manual~~

~~Reasons to not approve the reviewed manual~~

N/A

~~<<insert reasons for not approving the manual>>~~

Require additional information about the reviewed flood mitigation manual

Details of additional information required

<<insert details of additional information required>>

N/A

Time frame for the information to be provided to the chief executive

<<insert timeframe>>

Certification and signature of decision maker

I have complied with the procedure for processing a flood mitigation manual for a dam following review when making this decision. I have taken the assessment officer's recommendation and the documents and information described above into account when making this decision.

Signature of decision maker



Date of decision

20. 9. 11

PLEASE ENSURE ALL BLUE WRITING AND << >> SIGNS HAVE BEEN DELETED PRIOR TO PRINTING THIS DOCUMENT

PLEASE PRINT NAME AND ADDRESS OF THE PATIENT IN FULL

DATE OF BIRTH (MONTH, DAY, YEAR)

PHYSICIAN'S NAME AND ADDRESS

A/4

I have examined the patient and the results of the examination are as follows: (Please describe the condition and the treatment given. If the patient is under the care of another physician, please state the name of that physician.)

[Redacted Signature]

Signature of Doctor

[Redacted Date]

Date of Exam

PLEASE ENSURE ALL BLUE PRINTING HAS BEEN DELETED PRIOR TO PRINTING THIS DOCUMENT

[s 370]

Part 2 **Flood mitigation**

370 **Owners of particular dams must prepare flood mitigation manual**

- (1) A regulation may nominate an owner of a dam as an owner who must prepare a manual (a *flood mitigation manual*) of operational procedures for flood mitigation for the dam.
- (2) The regulation must nominate the day by which the owner must comply with section 371(1).

371 **Approving flood mitigation manual**

- (1) The owner of a dam must give the chief executive a copy of the flood mitigation manual for the dam for the chief executive's approval.
- (2) The chief executive may, by gazette notice, approve the manual.
- (3) The approval must be for a period of not more than 5 years.
- (4) The chief executive may get advice from an advisory council before approving the manual.

372 **Amending flood mitigation manual**

- (1) The chief executive may require the owner of a dam, by notice, to amend the flood mitigation manual for the dam.
- (2) The owner must comply with the requirement.
- (3) If the owner complies with the requirement, the chief executive must, by gazette notice, approve the manual as amended.
- (4) The approval of the manual as amended must be for—
 - (a) the balance of the period of the approval for the manual before the amendment; or

Water Supply (Safety and Reliability) Act 2008

**APPROVAL OF FLOOD MITIGATION MANUAL NOTICE
(No 00) 2011**

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 00) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on [number] October 2011 approved the Manual of Operational Procedures for Flood Mitigation for Wivenhoe Dam and Somerset Dam, Revision 8 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on
2. Not required to be laid before the Legislative Assembly.
3. The administering agency is the Department of Environment and Resource Management.

MISC APPROVAL OF FLOOD MITIGATION MANUAL

DRAFT

DOCUMENT RECEIVED BY DERM	
File No.	
File Location.....	
29 SEP 2011 5:40pm	
Action By	
Registered Y/N	
Doc. Code	

29 September 2011

Mr Bob Reilly
General Manager
Office of the Water Supply Regulator
GPO Box 2454
BRISBANE QLD 4000

Dear Mr Reilly,

Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (*the Wivenhoe Manual*)

As you know, in the Interim Report of the Queensland Floods Commission of Inquiry, the Commission recommended that Seqwater conduct an interim review of the Wivenhoe Manual (see recommendations 2.8 and 2.9).

I confirm that the interim review, addressing the matters referred to in the Commission's recommendation 2.9, has been completed. Seqwater has worked closely with Department officers in carrying out the review.

Enclosed are two copies of Revision 8 of the Wivenhoe Manual for your approval under section 371 of the *Water Supply (Safety and Reliability) Act 2008 (the Act)*.

To assist in your consideration of the Wivenhoe Manual, I enclose the following additional documents:

1. Explanatory Notes prepared by Seqwater, which describe the changes made from Revision 7; and
2. Letter from [REDACTED] the independent expert reviewer, to Seqwater's solicitors confirming his approval of Revision 8. It was a recommendation of the Commission that expert peer review of the Wivenhoe Manual occur prior to the submission of it.

Seqwater requests that you approve the Wivenhoe Manual, by gazette notice, for a period of 5 years, in accordance with the Act.

If you require any further information, please contact Mr. Jim Pruss, Executive General Manager – Water Delivery.

Yours sincerely



Peter Borrows
Chief Executive Officer

Enclosed

**INTERIM REVIEW OF THE MANUAL OF OPERATIONAL PROCEDURES FOR
FLOOD MITIGATION AT WIVENHOE DAM AND SOMERSET DAM
SEPTEMBER 2011 (REVISION 8)
EXPLANATORY NOTES**

INTRODUCTION

On Monday 17 January 2011, Queensland Premier Anna Bligh established an independent Commission of Inquiry to examine the unprecedented flood disasters associated with the 2010/11 wet season that impacted 70 per cent of the State. The Commission of Inquiry delivered an Interim Report on 1 August 2011 covering matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season.

In relation to the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam ("the Manual"), the Interim Report recommended that Seqwater should:

1. Conduct an interim review of the Manual.
2. Have the draft manual assessed by independent expert peer reviewers.
3. Consider the expert peer reviews.
4. Submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.

The Interim Report also recommended that the following matters being given particular attention during the interim review:

- Definition of what 'best forecast rainfall' means.
- Prescription about how forecast rainfall information is to be used by the flood engineers.
- Definition of 'predicted lake level' and the use of consistent language throughout the Manual about predicted lake levels.
- Clarification of options for transition to strategies W2 or W3 from strategy W1.
- Clarification of the rules for drawdowns of the dams following flood events.
- Removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill.
- Clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s.
- Precise definition of the maximum mechanical capability of the gate opening mechanism.
- Clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Whilst Seqwater's view has been and remains that Version 7 of the Manual did not contain any material uncertainty or ambiguity in respect of these matters, the Commission's recommendations have been implemented. This document explains how this has occurred.

MANAGEMENT OF THE INTERIM REVIEW OF THE MANUAL

Undertaking a complete review of the Manual within six weeks as required by the Commission of Inquiry was a challenging task that required boundaries to be placed on extent of the investigations that could be undertaken, and on the consultation processes associated with the review. Primarily this is because there needs to be certainty that any changes made to the Manual do not worsen downstream flooding or risk the safety of the Wivenhoe Dam and Somerset Dam ("the Dams"). Generally, six weeks would be considered insufficient if a full study with extensive consultation were to be undertaken.

Further, the challenge of completing the interim review within such a short period of time was made more difficult by reason of the following factors that impacted on the resources available to undertake the review:

- Key staff associated with the review continued to have substantial ongoing commitments to the Commission of Inquiry and were required to provide extensive statements on a range of multiple matters not associated with the operation of the Dams, while the review was in progress.
- A similar interim review of the Manual of Operational Procedures for Flood Mitigation at North Pine Dam was undertaken in parallel. This was also a requirement of the Commission of Inquiry.
- Extensive routine preparations continued for the 2011/12 wet season. In particular annual training of Dam Operators and new Flood Operations Engineers and Officers was undertaken. This training traditionally occurs in August and September, just prior to the commencement of the defined flood season on 1 October.
- The relocation of the Flood Operations Centres to new premises and the need to ensure that systems and models are sufficiently robust has required significant Seqwater resources, including the Flood Engineers and Officers.
- Key staff associated with the review are involved in progressing around 30 other recommendations made by the Commission of Inquiry in the Interim Report.

In view of the above factors and the unprecedented short time period given to complete the review, the following boundaries were placed on the interim review:

- The review would focus on addressing the priority matters recommended for examination by the Commission of Inquiry.
- Independent expert review would be limited to an individual rather than a panel review.

- The focus would be on defining and clarifying existing strategies rather than changing them. As changes to existing objectives and strategies will directly and significantly impact on urban communities living downstream of the Dams, it is appropriate for such changes to be endorsed by the Steering Committee that has recently been formed to oversee the longer term Manual review. This Committee contains representatives from each of the Councils representing these communities. Further, the Commission recommended that no change in strategy occur prior to the longer term review of the Manual.
- It was not feasible for public consultation to be undertaken during the six week review.

COMMISSION OF INQUIRY PRIORITY MATTERS

The following is an explanation as to each of the Commission of Inquiry priority matters and how they have been addressed in the interim review of the Manual.

1. **Definition of what 'best forecast rainfall' means and prescription about how forecast rainfall information is to be used by the flood engineers.**

In Version 7 of the Manual, the term 'best forecast rainfall' caused confusion for some readers. The Bureau of Meteorology (BoM) provide a broad range of both quantitative and qualitative forecast rainfall products that can be used to predict catchment run-off. At any single point in time during a flood event, it is not possible to predict which product will provide the 'best forecast rainfall' information. However, it is well known by those who use the Manual that the 24-hour Quantitative Precipitation Forecasts ("QPFs") issued by BoM are the primary forecast tool as they are issued by BoM to provide specific rainfall information in relation to the Dams' catchments.

As a result, the term 'best forecast rainfall' has been removed from the Manual and appropriate references made to the QPFs.

Further, commentary has been included within the Manual (see Sections 4.2 and 4.3) which explain how the QPFs should be used in selecting a strategy and how wider forecast information should be used in determining a release rate when acting in a particular strategy. This commentary confirms the long standing practice of the Flood Engineers. It also accords with:

- BoM's present advice which is that rainfall forecast information issued by the BoM is generally too unreliable to be used as a basis for predicting definitive future Lake Levels and river flows and making releases from the Dams. This was evident in the January 2011 Flood Event where, in hindsight, it is clear that reliance on rainfall forecasting information provided by the BoM during the event would have caused much worse flooding in Brisbane. This is a clear illustration of the dangers of relying too heavily on rainfall forecasts. The weight placed

upon forecasts in flood event decision making must always be a matter for the professional engineering judgment of the Flood Engineer.

- The Commission's finding that *"it is not possible to articulate a method by which it would be possible to predict lake level with any precision or confidently change strategies on the basis of rainfall forecasts. The existing science suggests that such forecasts lack the reliability which would be necessary before they could be incorporated into such a process"*.

Ongoing investigations into the reliability of forecasts and discussions between Seqwater and the BoM will continue. Certainly, as advancements in rainfall forecasting technology occur, these advancements will be incorporated in flood event decision making, as has occurred for a number of years.

2. Definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels.

To ensure consistent language throughout the Manual, the Glossary of updated Manual contains a definition of the terms "predicted", "Lake Level" and "Actual Lake Level".

In relation to "predicted", the definition is as follows:

"predicted" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2;

Therefore, when predicting lake level during a flood event, the Flood Engineer is now required to refer to Section 4.2.

The text in Section 4.2 reflects the long standing practice of the Flood Engineers.

It should also be noted that the QPF adopted at a particular point in time may be reduced or discounted to take into account the rainfall recorded since the QPF was issued, or it may not at the discretion of the Duty Flood Operations Engineers(s). Seqwater will ensure that any organisation or person that is provided with potential floodwater release predictions, or related information, based on the QPF forecasts is made aware, in writing, of the manner in which the QPF forecast has been used to derive these predictions. Further, use of the QPF forecasts will be considered as part of the long-term review of the manual.

3. Clarification of options for transition to strategies W2 or W3 from strategy W1.

Four detailed flowcharts have been developed to clarify the options for transition from Strategy W1 to Strategies W2 or W3. As explained to the Commission of Inquiry, these transition options have always been very clearly understood by the Flood

Engineers, but the flowcharts should enable persons with limited knowledge of Brisbane Basin hydrology to develop a basic understanding of transition options.

4. Clarification of the rules for drawdowns of the dams following flood events.

The rules previously used for drawdowns (always referred to in the Manual as 'drain downs') of the Dams following flood events have been clarified by the insertion of additional explanatory text. The new text inserted for both Dams is contained in Sections 5.4 and 6.3.

5. Removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill.

Removal of the term 'non-damaging flows' (and similar terms) from the Manual to describe flows below 4000 m³/s at Moggill has no impact on flood event decision making or the strategies used during flood events to operate the dams. This change has however been made as recommended by the Commission of Inquiry.

6. Clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s.

No person associated with previous Manuals has ever understood that Strategy W3 allows deliberate releases of water from Wivenhoe Dam that would create a flow at Moggill of over 4000 m³/s. Such an approach would be equivalent to deliberate flooding of the habitable floors of urban dwellings, which has never been a consideration under Strategy W3 which has the primary objective of protecting urban areas from inundation. All four Flood Engineers who operated the Dams during the January 2011 Flood Event, as well as the approver of the previous Manual has provided this evidence to the Commission of Inquiry.

Further, Seqwater's view is that Version 7 of the Manual did not contain any uncertainty on this topic.

However, to address the Commission requirement and further clarify that Strategy W3 does not allow deliberate releases of water from Wivenhoe Dam that would create a flow at Moggill of over 4000 m³/s, further text has been included:

- Within the description of Strategy W3 itself;

- Within Section 3.3; and
- In the paragraph below the Strategy Selection Flowchart in Section 5.3.

7. Precise definition of the maximum mechanical capability of the gate opening mechanism.

It is well understood by all persons associated with flood operations at Wivenhoe Dam that the Radial Gates can be fully opened in 35 minutes or at a rate of one metre every two minutes.

Accordingly maximum mechanical capability is not a constraint when undertaking Radial Gate operations during flood events under any circumstances. However, to satisfy the Commission's requirement, the maximum mechanical opening capability of the Radial Gates has been added to Appendix G and the second paragraph which previously appeared on page 32 of Version 7 of the Manual (which may have been the source of the Commission's concern) has been removed.

8. Clarification of how part 8.6 should be followed in Strategy W4, including clarifying the use of the word 'generally'.

When operating under Strategy W4, the range of available release rates at any point in time will be infinitely large as it is a function of the temporal and spatial distribution of the rainfall that will fall in the 14,000km² Brisbane River Basin. Accordingly it is not possible to make strict rules covering all circumstances when operating under Strategy W4 because exceptions can always be imagined and will therefore always be possible. The use of the word 'generally' in previous versions of the Manual was in recognition of these factors and also to recognise that release rates within such a critical Strategy must be a matter for the professional engineering judgment of the Flood Engineers, to be exercised in real time flood operations.

However, to satisfy this requirement and provide further clarification, further guidance has now been included within the description of Strategy W4.

VARIATIONS TO FULL SUPPLY LEVEL

In Revision 8 of the Manual, the focus was on clarifying existing strategies to enable persons with limited knowledge of Brisbane Basin hydrology to develop a basic understanding of how the Dams are operated during Flood Events. No changes to current operating practices were made as part of the revision.

The only substantial change made was to modify the Manual to allow the maximum urban protection flood mitigation benefit to be obtained from temporary reductions in the Full Supply Level ("FSL") of Wivenhoe Dam, should they occur. In this regard, the Commission

recommended, assuming a seasonal forecast of a particular quality was provided by BoM, that there should be a temporary reduction in the full supply level of Wivenhoe Dam to 75% for the 2011/2012 wet season, "*with a concomitant adjustment to the trigger levels for the strategies in the Wivenhoe Manual*". This recommendation required further changes to be made to the Manual during the interim review. These changes require further review and will be examined in extensive detail by the Steering Committee that has recently been formed to oversee the longer term Manual review.

A summary of the changes made to Revision 8 of the Manual related to this issue are as follows:

- Strategies W1, W2 and W3 have been related to a FSL rather than a defined physical level.
- The available flood storage volume associated with Strategy W1 has not been altered.
- The available flood storage volume associated with Strategies W2 and W3 has been increased in relation to the altered FSL, to maximise urban protection.
- The available flood storage volume associated with Strategy W4 has not been altered.
- If it is certain that a Flood Event will occur it has been made allowable to commence releases prior to FSL being reached, provided it is judged likely that the overall impacts of the Flood Event will be reduced.
- The definition of FSL in the Manual Glossary has been changed to allow for any temporary reductions in FSL which may be made by the relevant Minister.

Overall, these combined changes will allow the maximum urban protection flood mitigation benefit to be obtained from temporary reductions in the FSL of Wivenhoe Dam, should they occur.

Partner, Allens Arthur Robinson
PO Box 7082, Riverside Centre
BRISBANE QLD 4001

NSW 2145
29 September 2011

Dear [REDACTED]

Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam – Review and Comment

By letter dated 22 August 2011 you invited me to review and comment on Revision 8 of the subject manual. That offer was accepted and an agreement was executed.

Several iterations of the manual have been reviewed by me and matters raised have been the subject of discussion.

The revised manual (Seqwater, 2011, *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam*, Revision 8, Controlled Copy No 1, September) has been prepared on the basis that the objectives and strategies of the previous manual (Revision 7) will be preserved at this stage – see the last sentence of sub-section 2.5.7 of Queensland Floods Commission of Inquiry, 2011, *Interim Report*, August.

My review has concentrated on these aspects:

1. Ensuring that matters raised by the Floods Commission have been addressed – refer to sub-section 2.5.7 and recommendations 2.8 and 2.9, as well as sub-sections 2.8.1 and 2.8.3 of the Interim Report;
2. Ensuring so far as is reasonably practicable that the manual is free of uncertainty and ambiguity;
3. Ensuring that, so far as is reasonably practicable, any changes to the provisions of the Revision 7 manual do not adversely impact on the objectives set out in section 3.1 of the manual. Given the indefinitely large number of rainfall patterns which could occur over the Brisbane River catchment in flood events it is difficult to be certain that this aim has been met for all possible flood scenarios;
4. Ensuring so far as is reasonably practicable that compliance with the manual is feasible;
5. Ensuring that consistent language is used throughout the manual; and
6. Ensuring that language is accurate; that is, that the words of the manual convey the intended meaning.

My review did not include these matters:

1. A review of the flood hydrology and dam engineering studies which underpin the manual strategies that aim to protect the safety of the dam;
2. A verification check of data and of values derived by engineering calculations in the manual. Data and values have only been challenged where inconsistency was noted.

In accordance with my role as understood above, I am now satisfied with the manual.

Yours sincerely,

[REDACTED]

[REDACTED] BE, MEngSc, FIEAust, CPEng, LGE
Dam Safety and Risk Consultant

Phone: [REDACTED]

Fax: 02 [REDACTED]

Mobile: [REDACTED]

E-mail: [REDACTED]

Department of Environment and Resource Management
A/DIRECTOR-GENERAL BRIEFING NOTE

Approved	Not Approved	Noted
Further information required		
DC	[Redacted]	
Dated	31/8/2011	

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TO: Director-General

SUBJECT: Queensland Floods Commission of Inquiry – Amendment of Flood Mitigation Manuals – Provision for Delegation of Chief Executive’s Powers

TIMEFRAME/REQUESTED BY

- [Redacted]
- [Redacted]

RECOMMENDATION

[Redacted]

BACKGROUND

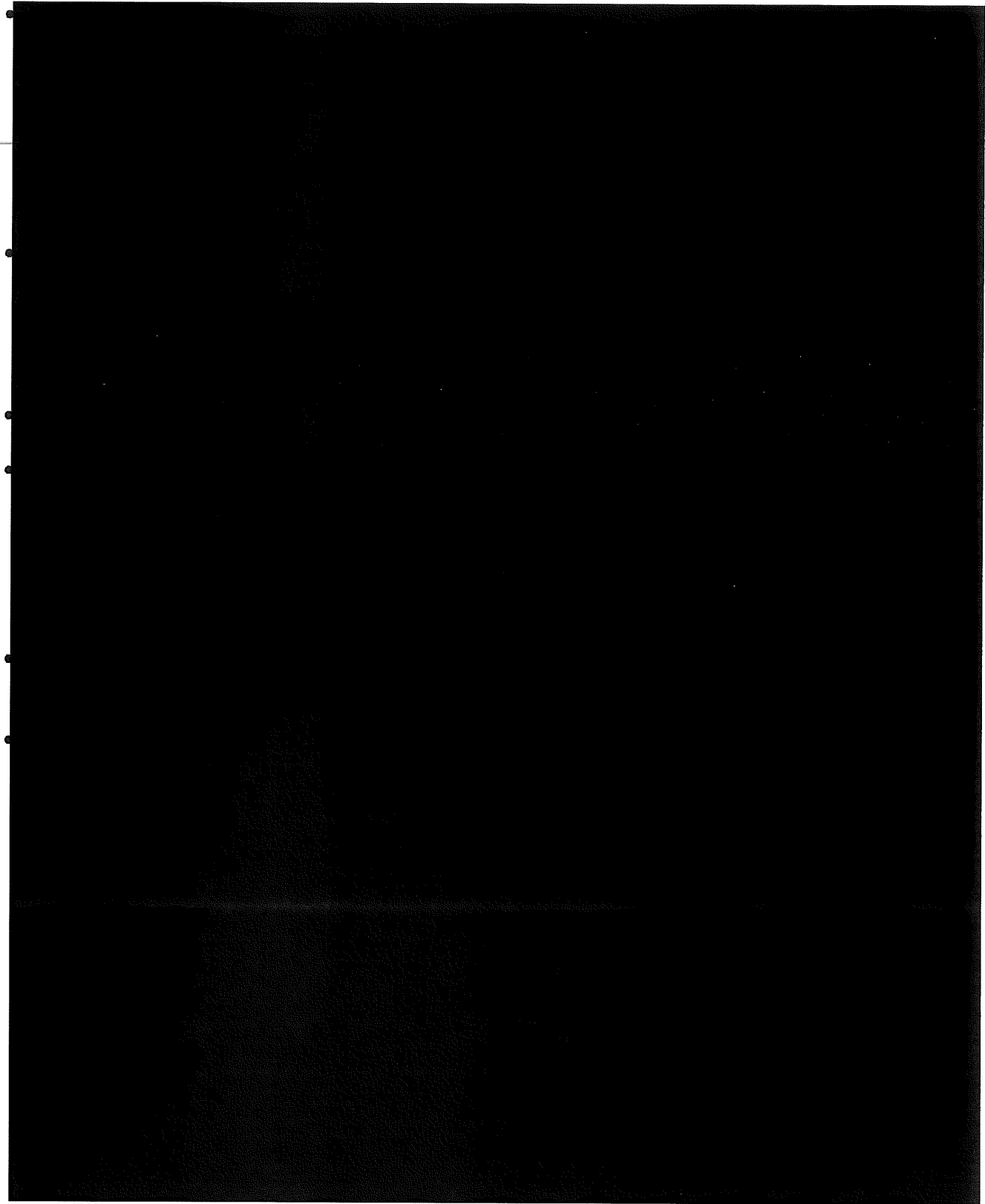
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Rec'd - ODG
29 AUG 2011

Author Name: Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [Redacted] Date: 18 August 2011	Cleared by Name: Position: A/Director, Legal Services Tel No: 323 [Redacted]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [Redacted]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [Redacted] Date: [Redacted]
	Name: Paul Walsh Position: A/Director, Legislative Development Services Tel No: 3330 [Redacted]	Name: Position: Assistant Director- General, Corporate Services Tel No: 3224 [Redacted]	26.8.11

126/8/11

CURRENT ISSUES



Author Name: Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [REDACTED] Date: 18 August 2011	Cleared by Name: Position: A/Director, Legal Services Tel No: 323 [REDACTED]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [REDACTED]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [REDACTED] Date:
	Name: Position: A/Director, Legislative Development Services Tel No: 3330 [REDACTED]	Name: Position: Assistant Director- General, Corporate Services Tel No: 3224 [REDACTED]	



RESOURCE/IMPLEMENTATION IMPLICATIONS

- [Redacted]

PROPOSED ACTION

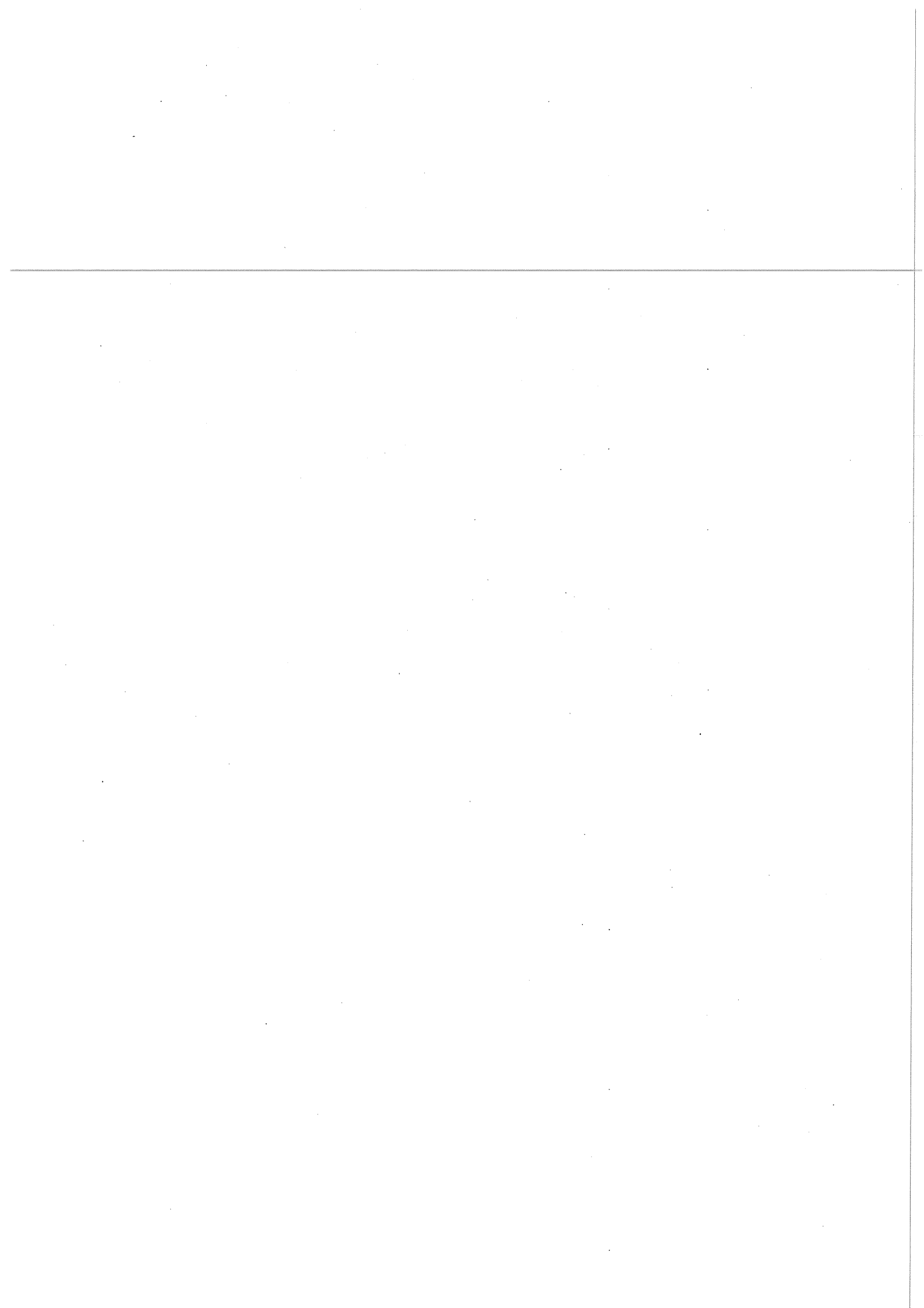
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A/DIRECTOR-GENERAL'S COMMENTS

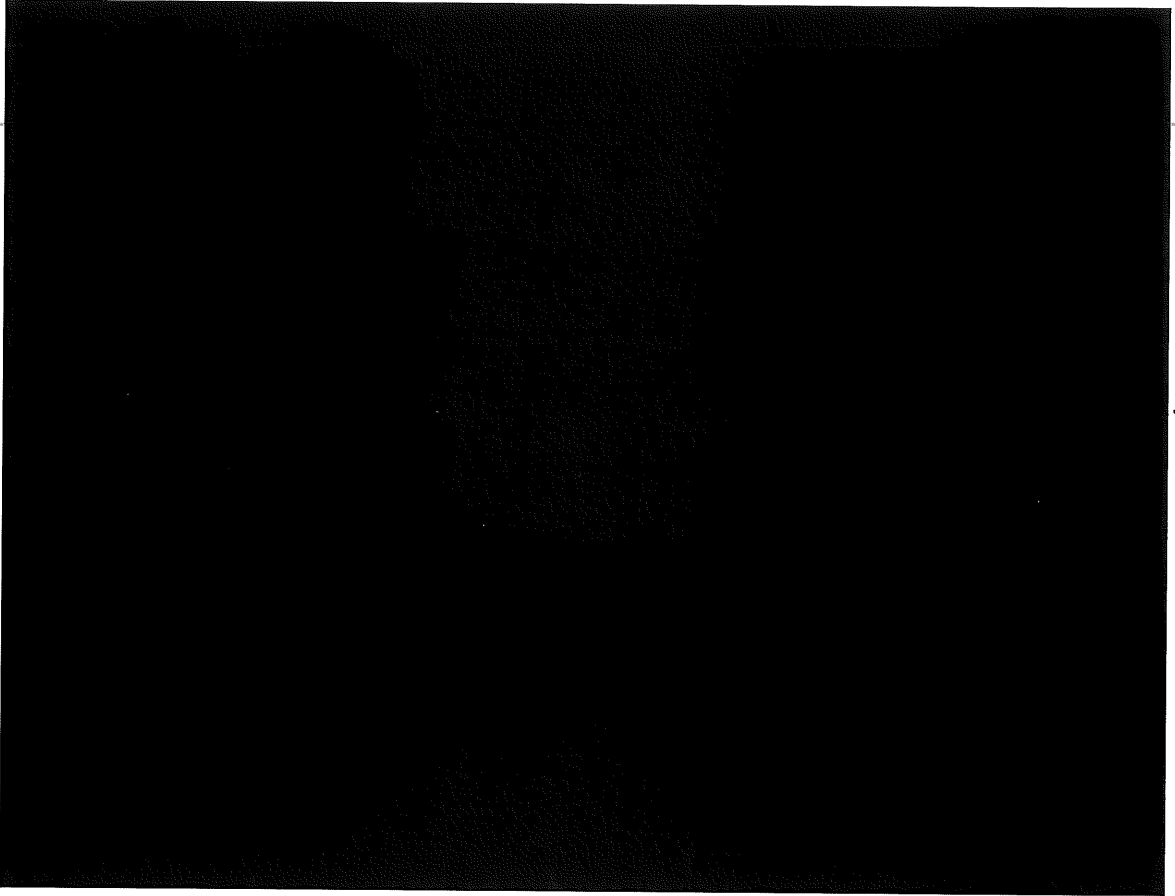
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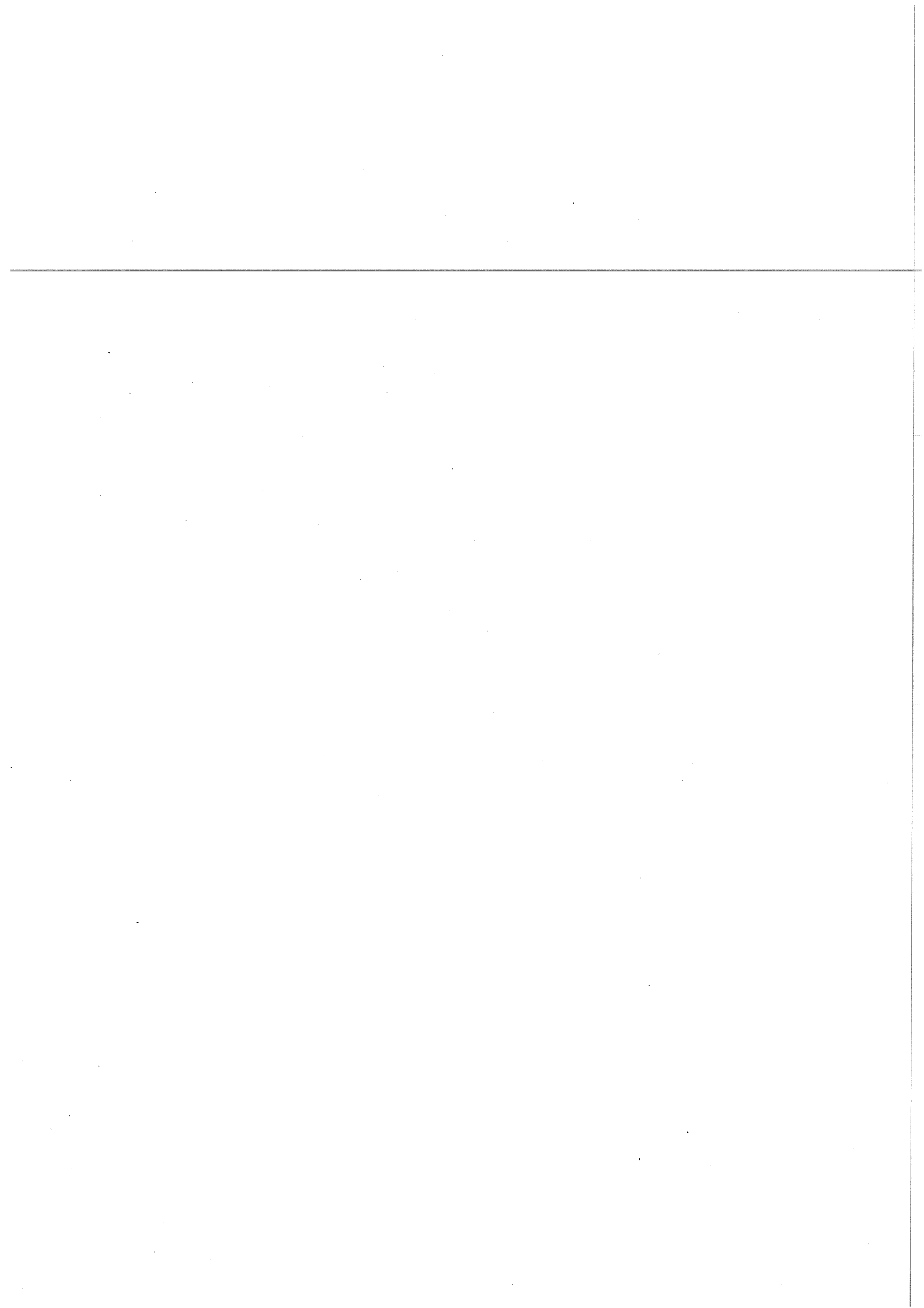
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Author Name: [Redacted] Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [Redacted] Date: 18 August 2011	Cleared by Name: [Redacted] Position: A/Director, Legal Services Tel No: 323 [Redacted]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [Redacted]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [Redacted] Date: [Redacted]
	Name: [Redacted] Position: A/Director, Legislative Development Services Tel No: 3330 [Redacted]	Name: Danielle Anderson Position: Assistant Director- General, Corporate Services Tel No: 3224 [Redacted]	



Attachment 1





Legal Advice

Your ref: FMM Legal Review

Our ref: LEG [REDACTED]

Author: [REDACTED]

Phone: 3330 [REDACTED]

Fax: 3224 2432

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Date: 29 September 2011

To: Terry Wall, A/Director-General

Through: [REDACTED] Director, Legal Services

[REDACTED], A/Director, Legislative Development Services (Floods Commission of Inquiry Liaison)

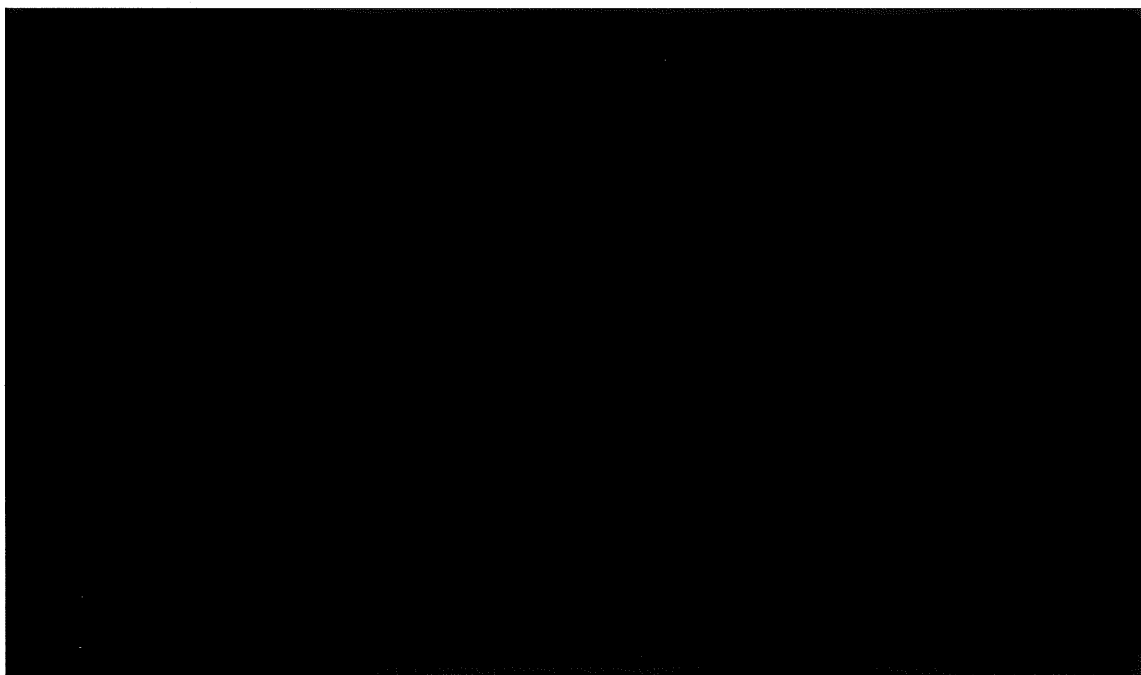
[REDACTED] Principal Policy Officer, Inquiry Recommendations Implementation Group (Floods Commission of Inquiry Liaison)

Bob Reilly, General Manger, Office of the Water Supply Regulator

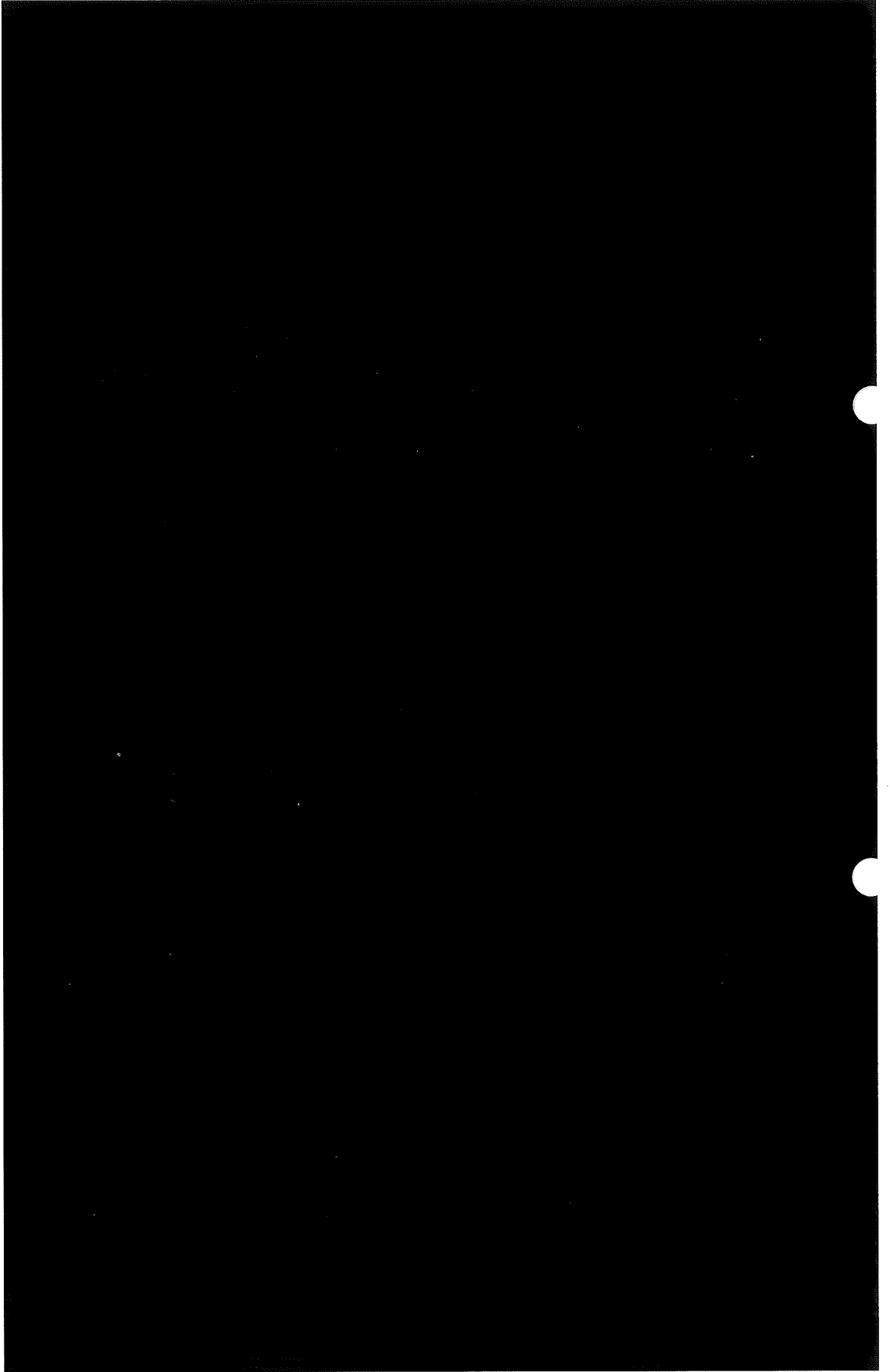
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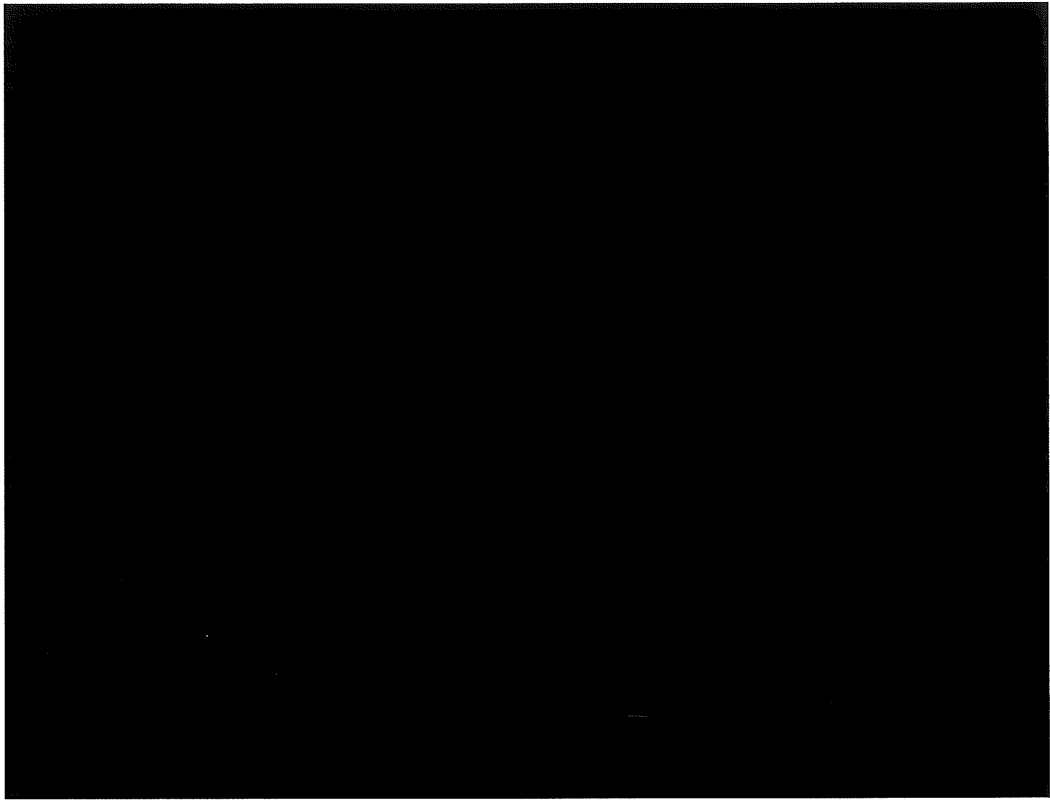
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1. Background



2. Process

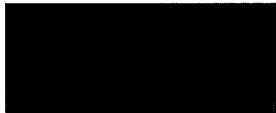
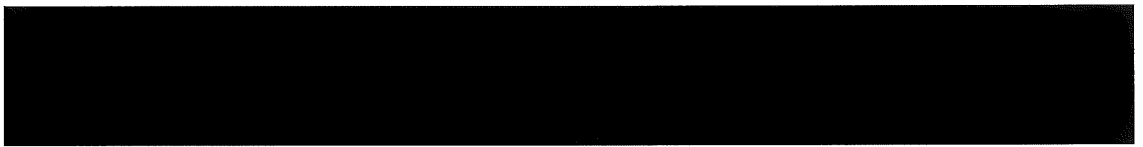




3. Advice - Wivenhoe/Somerset FMM



4. Compliance with recommendations from the Interim Report



Principal Lawyer & Team Co-Leader - Floods Liaison Inquiry Response
Floods Commission of Inquiry Liaison
Legal Services / Governance & Strategy
Corporate Services
Department of Environment and Resource Management

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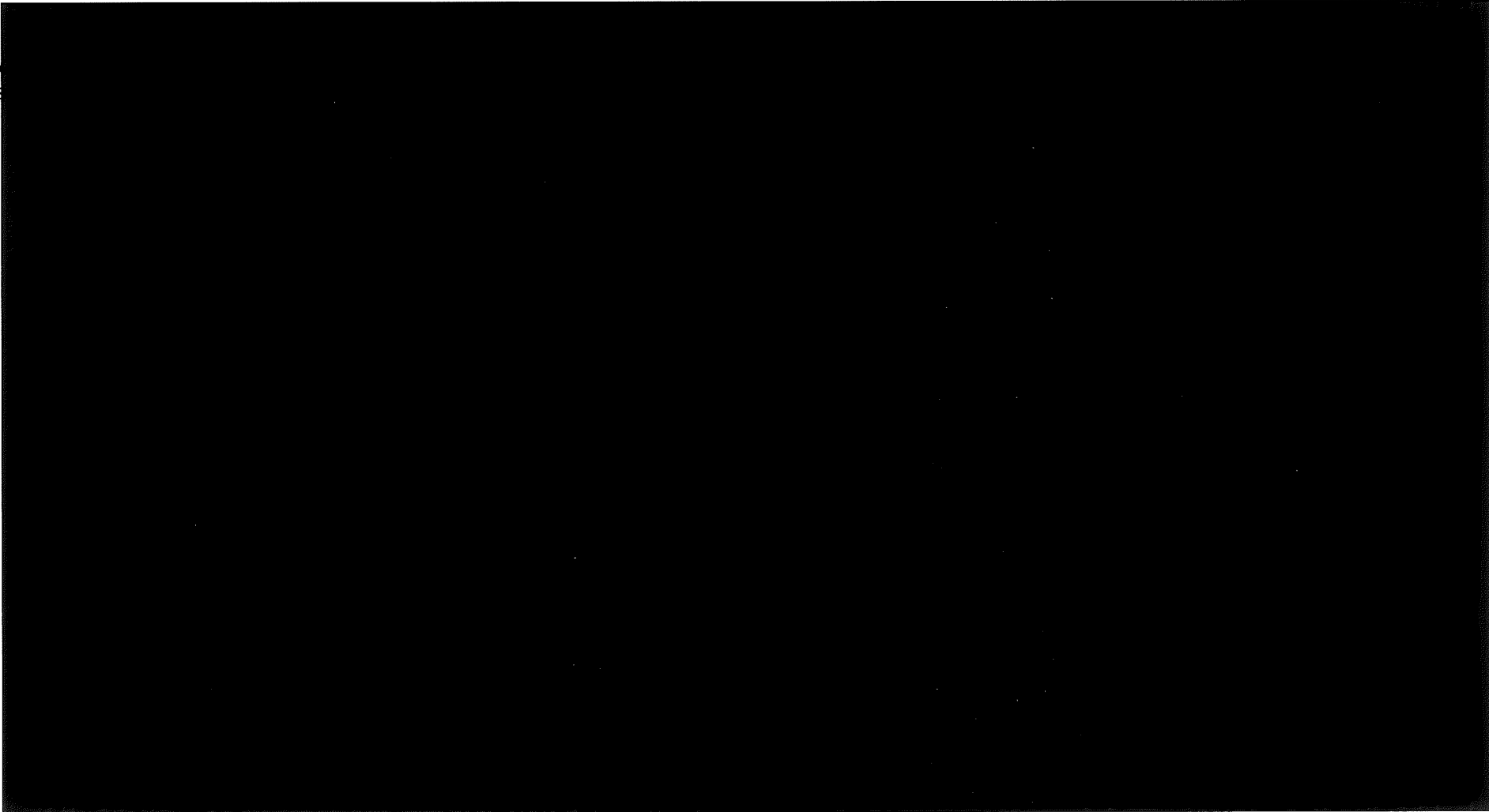
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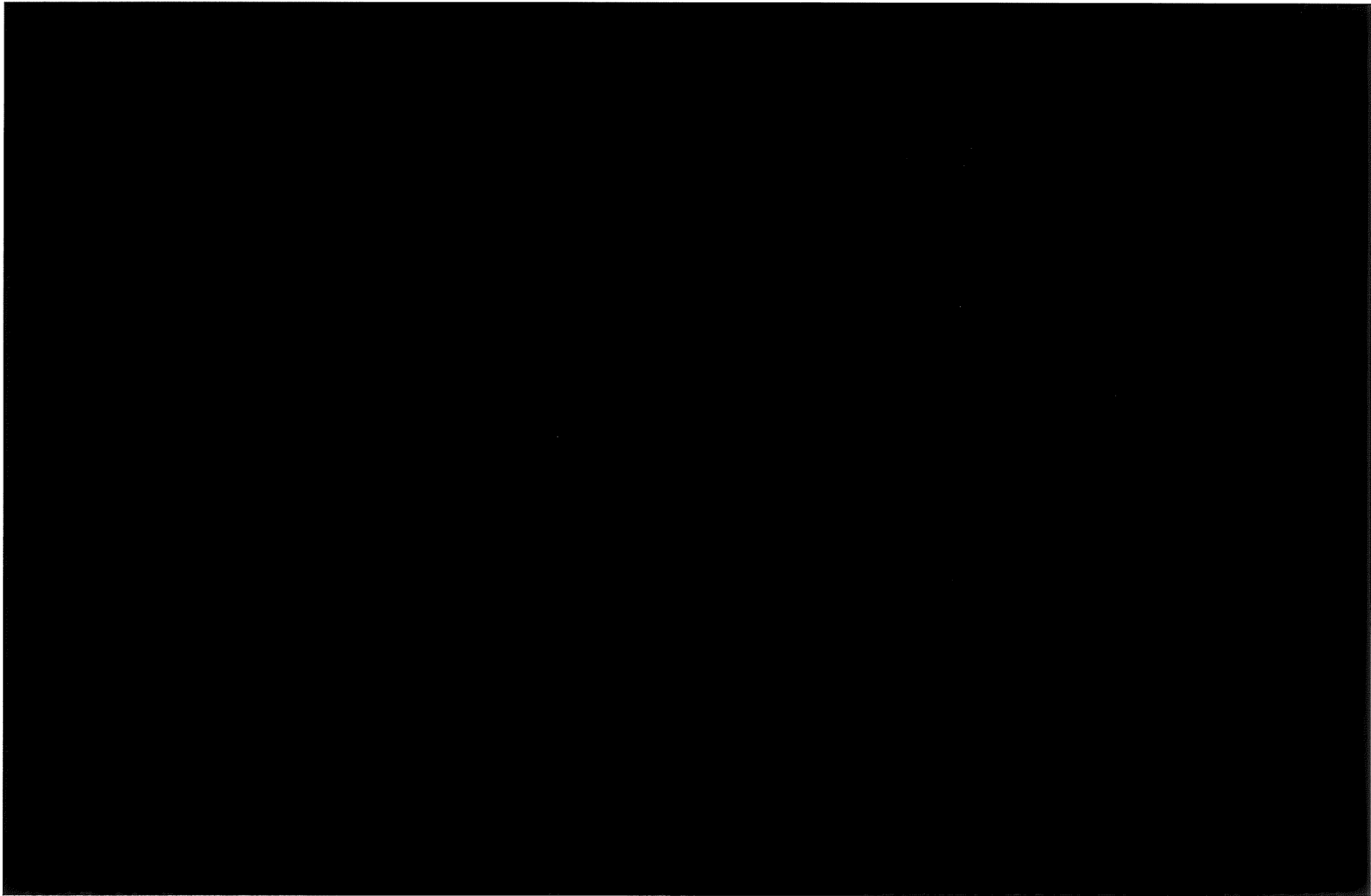
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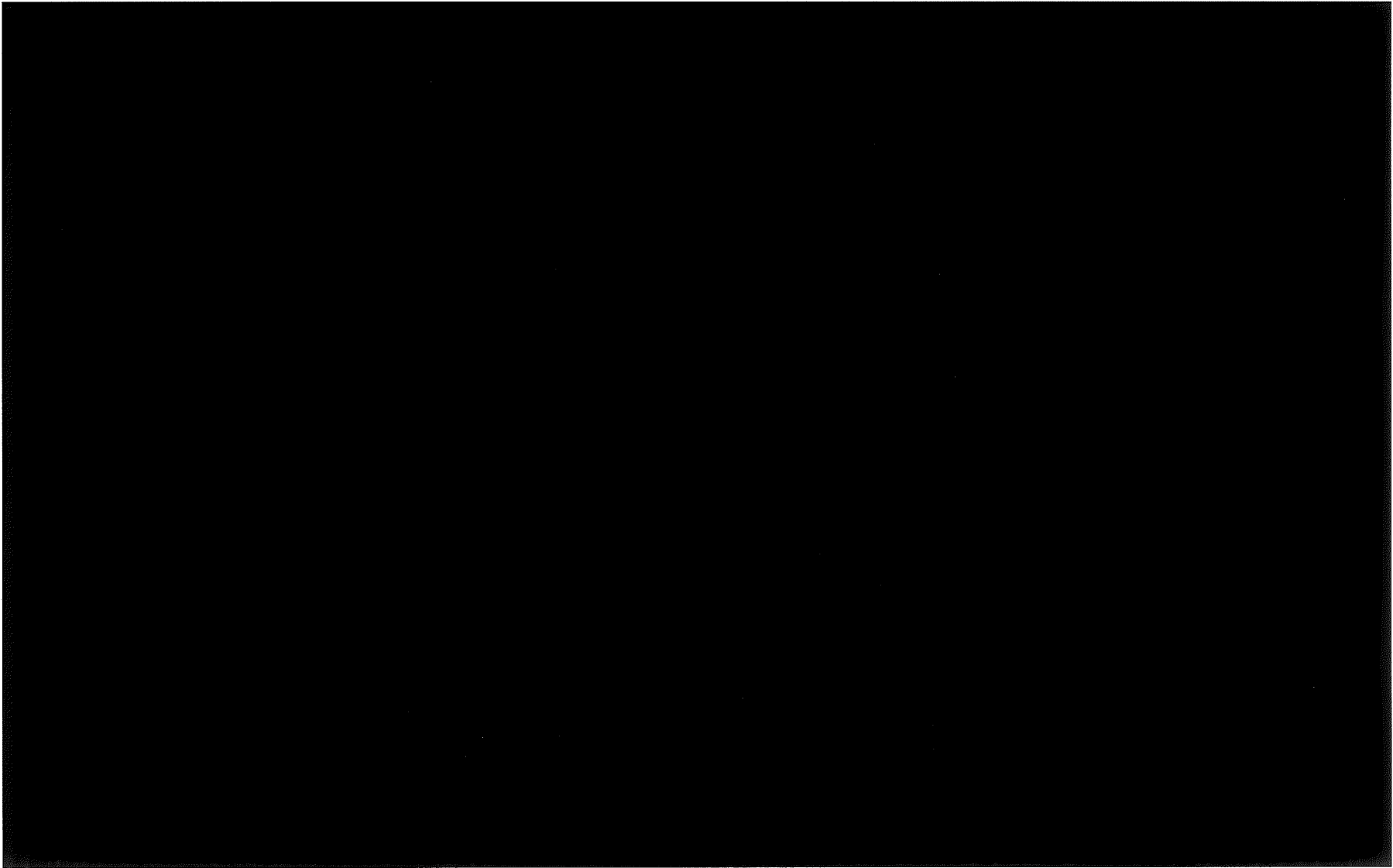
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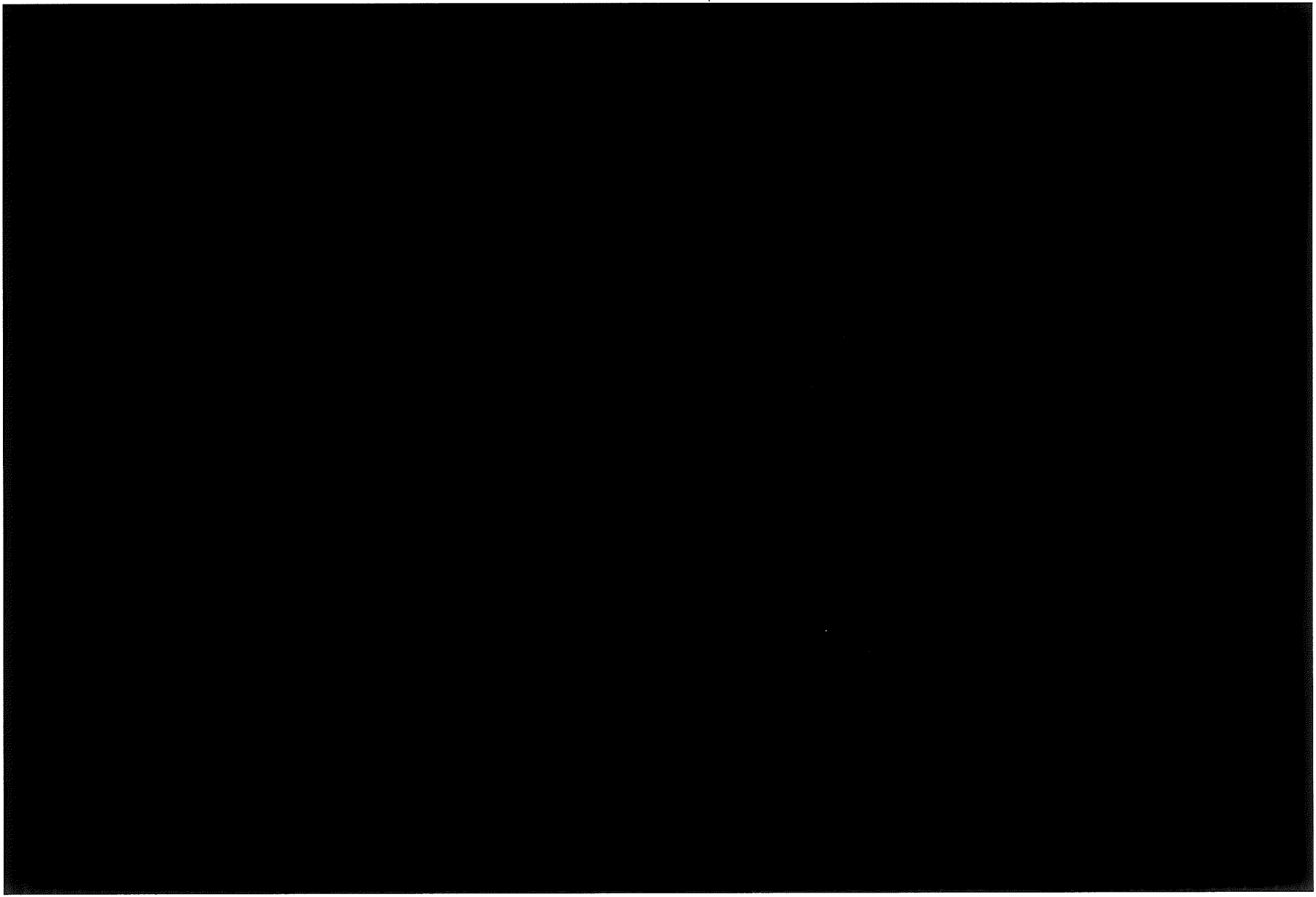
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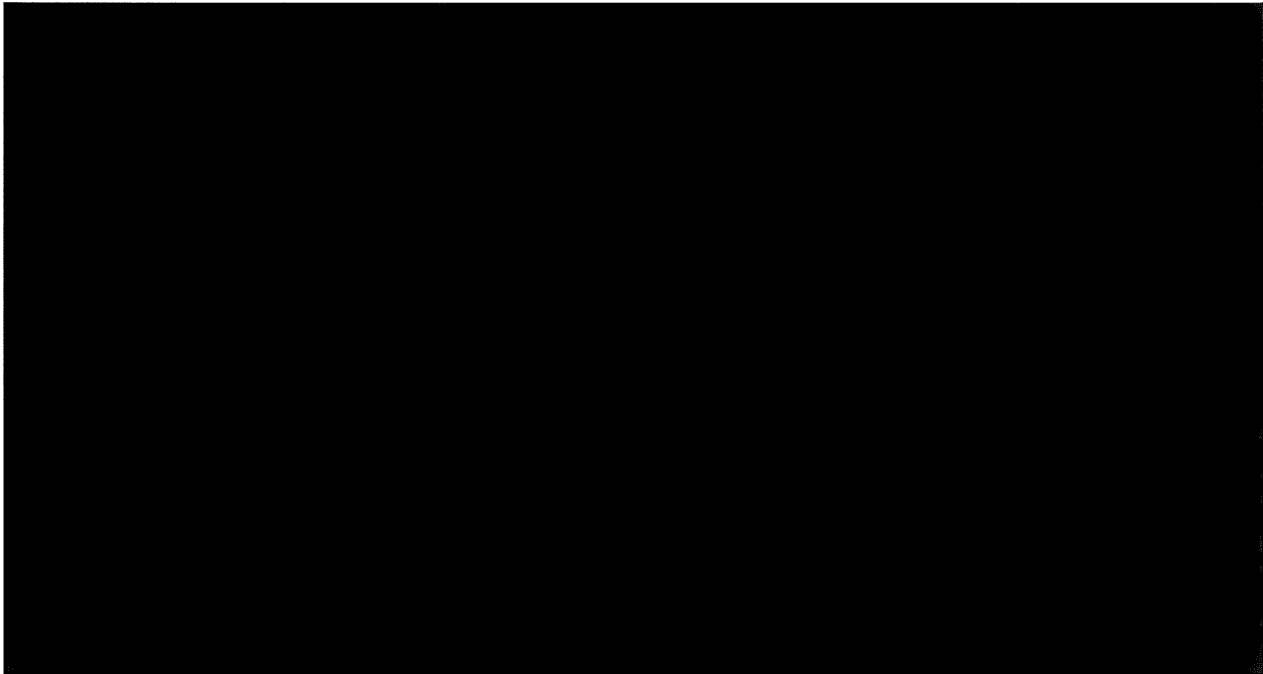
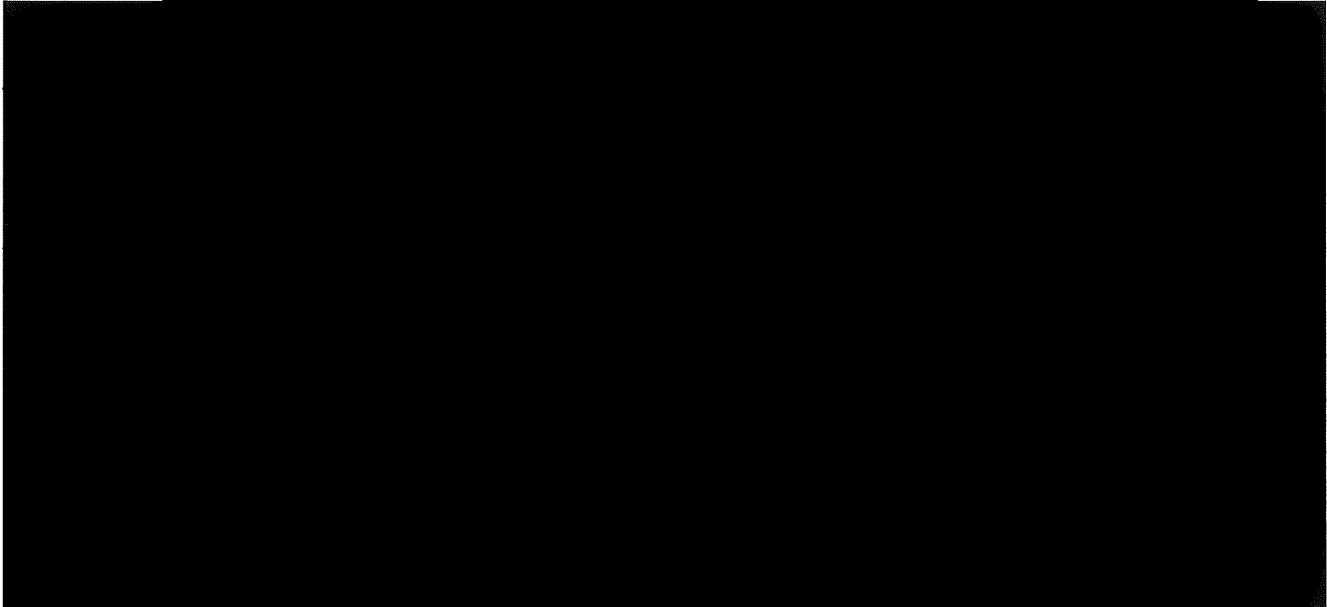
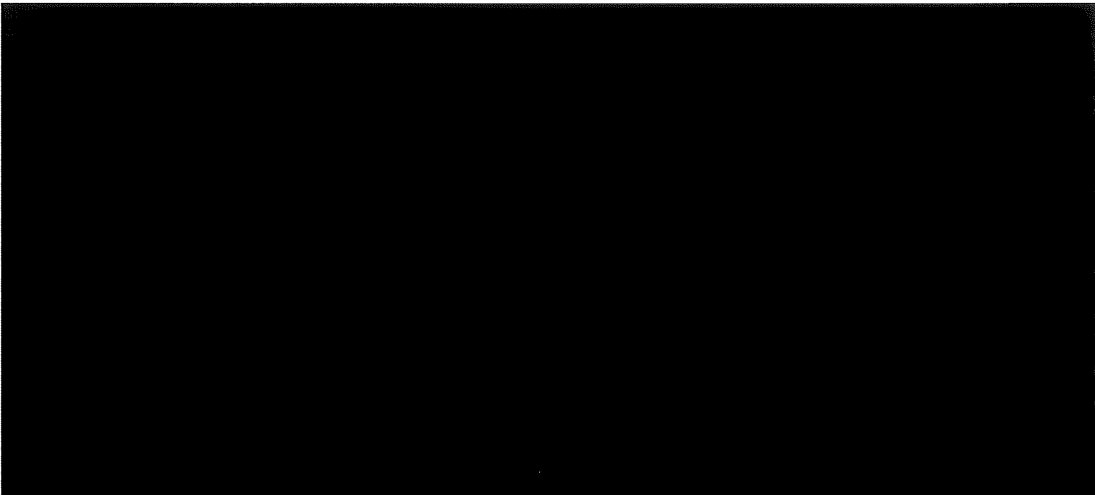




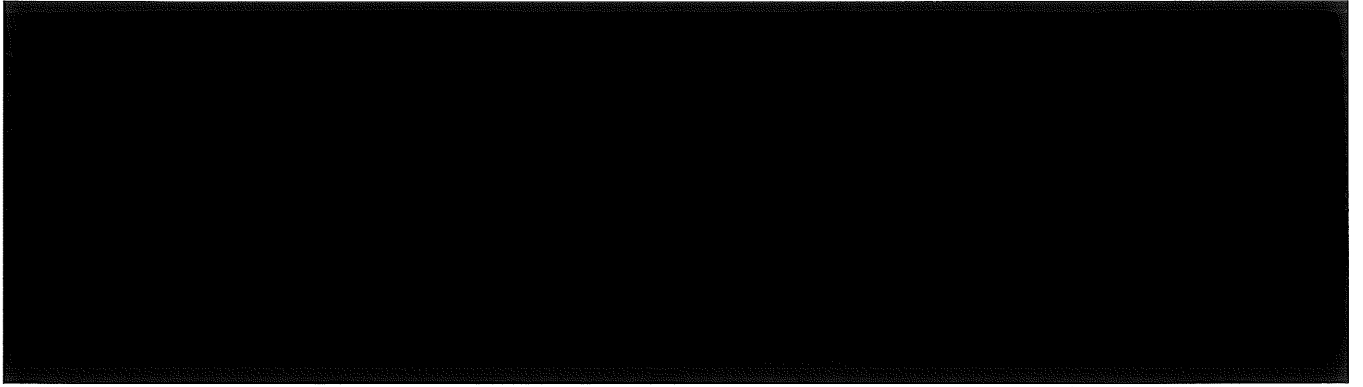


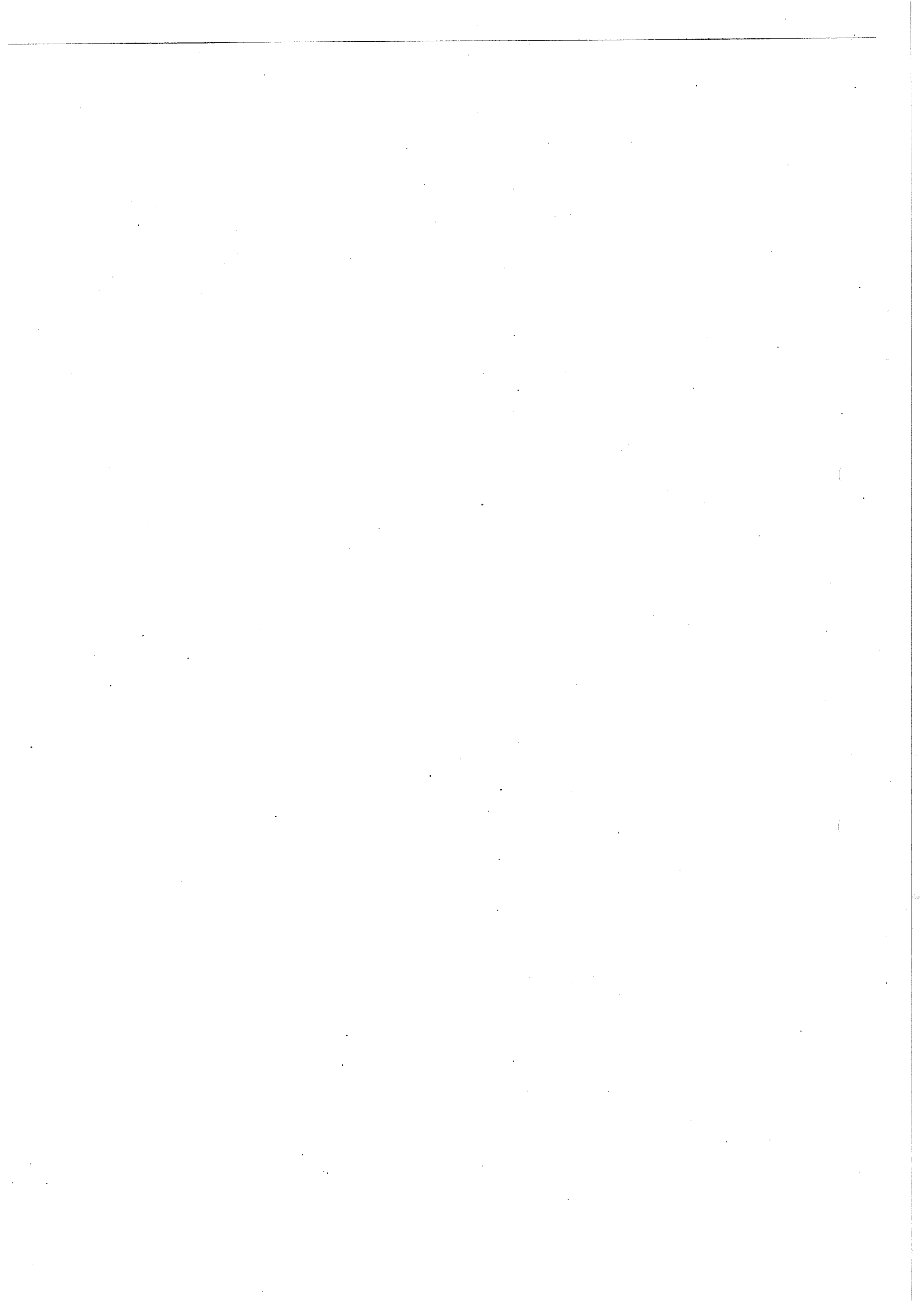


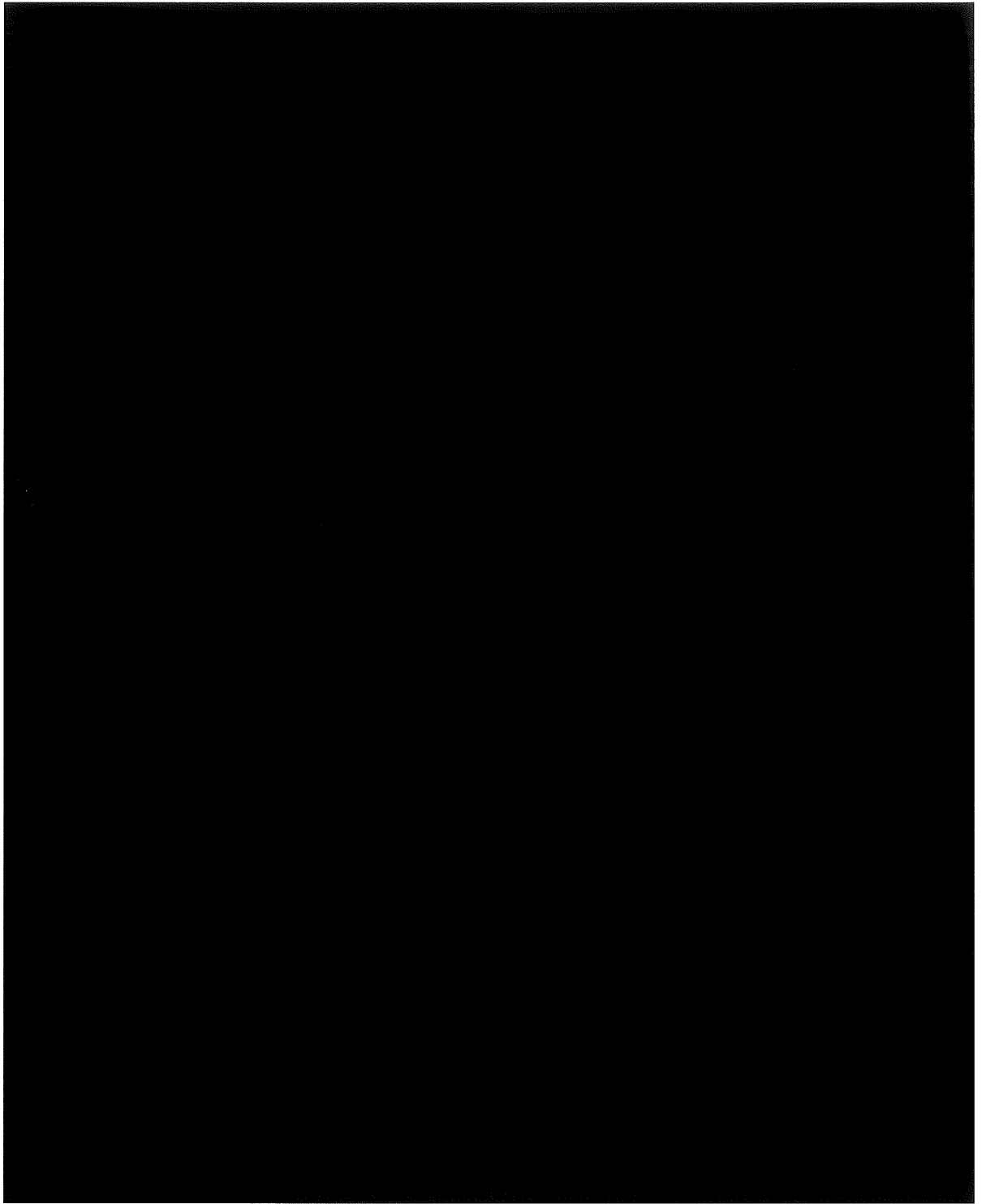
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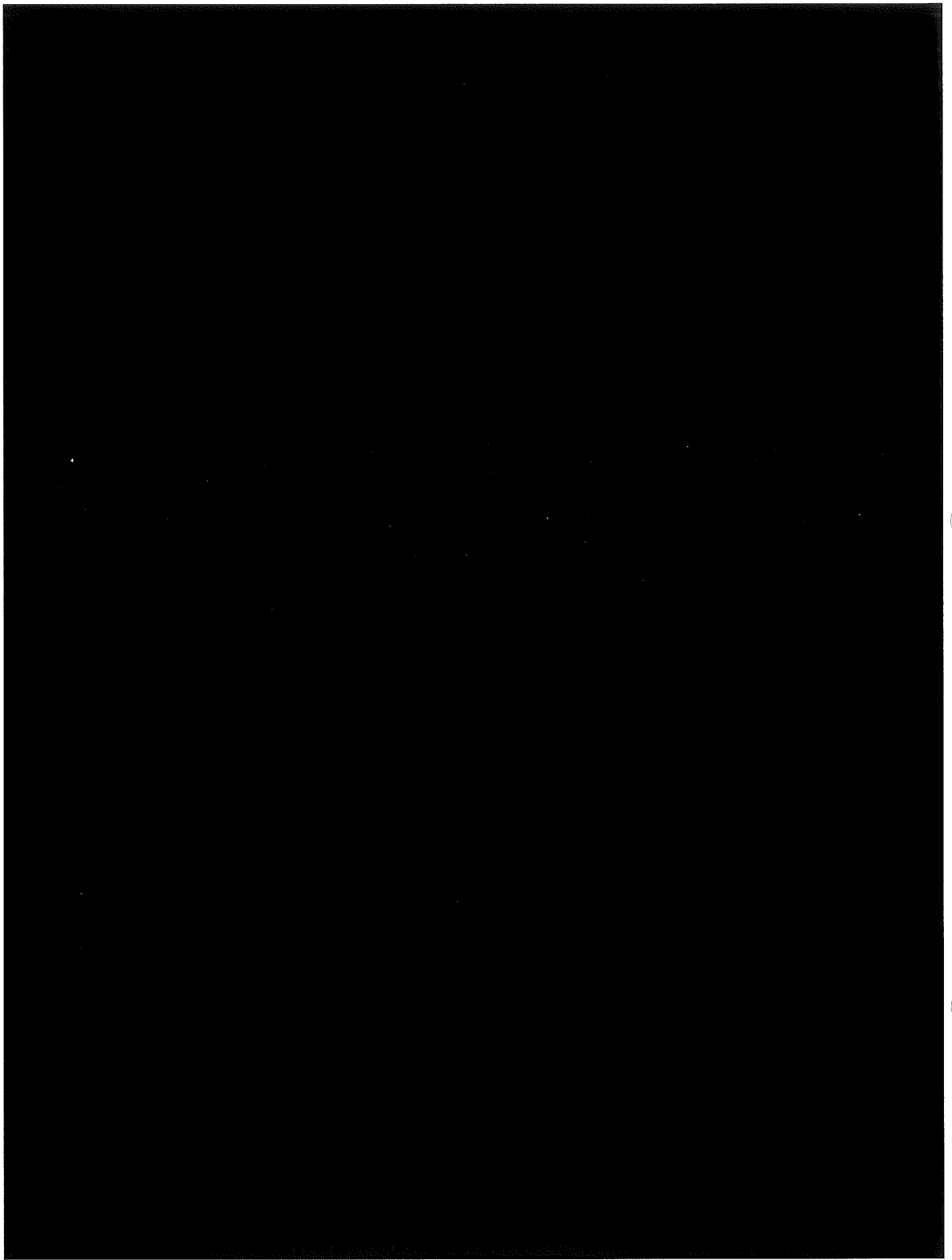


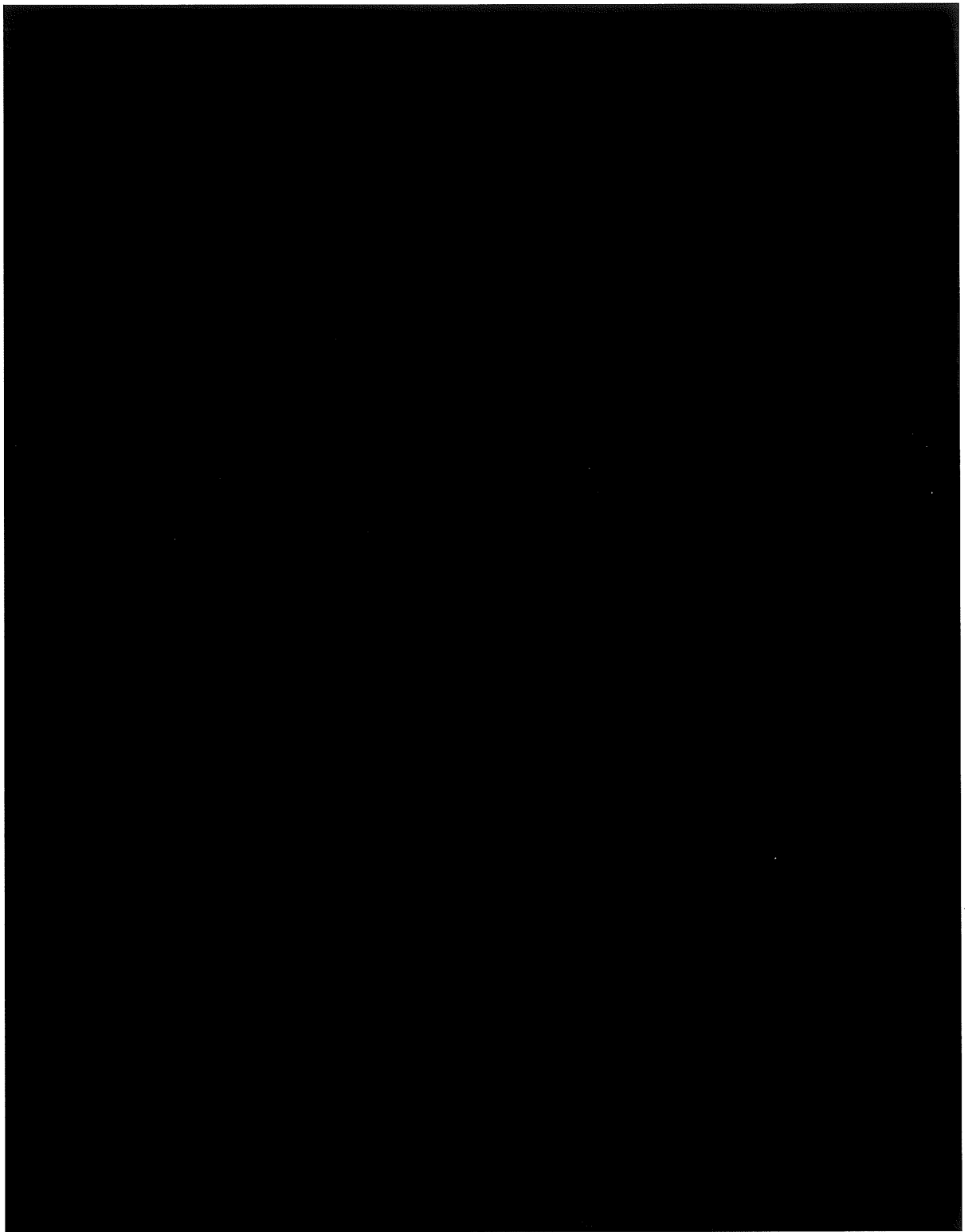


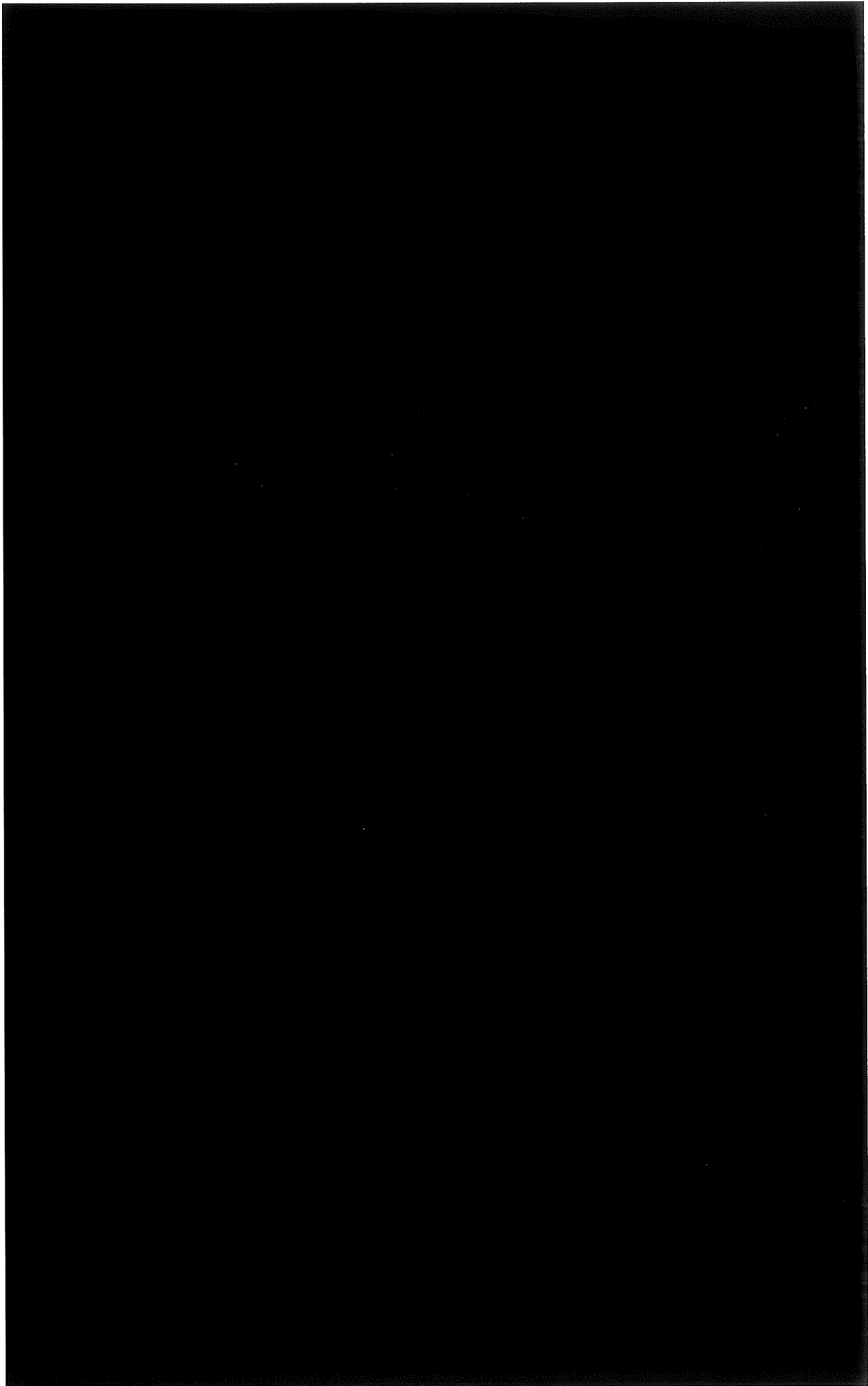


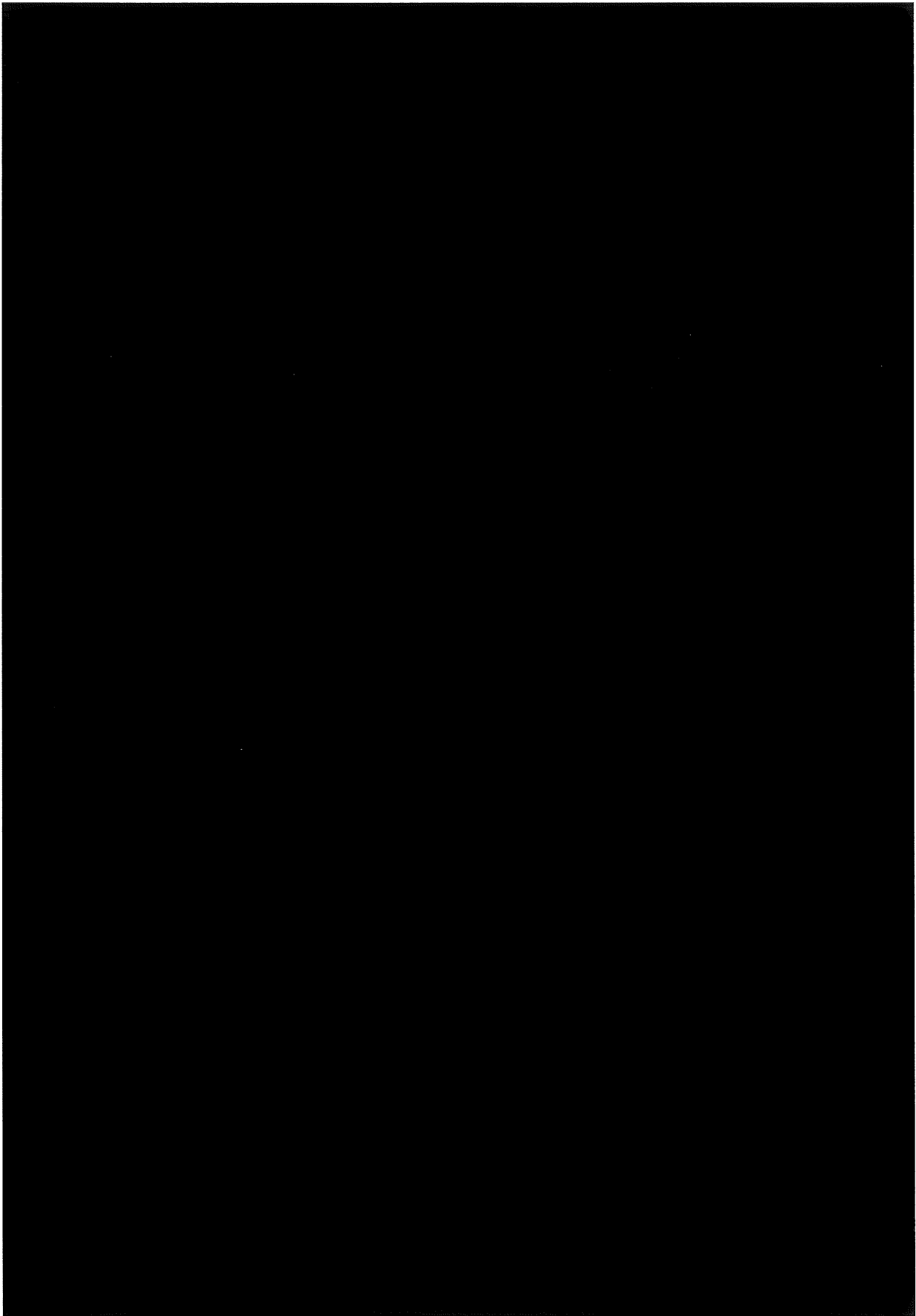


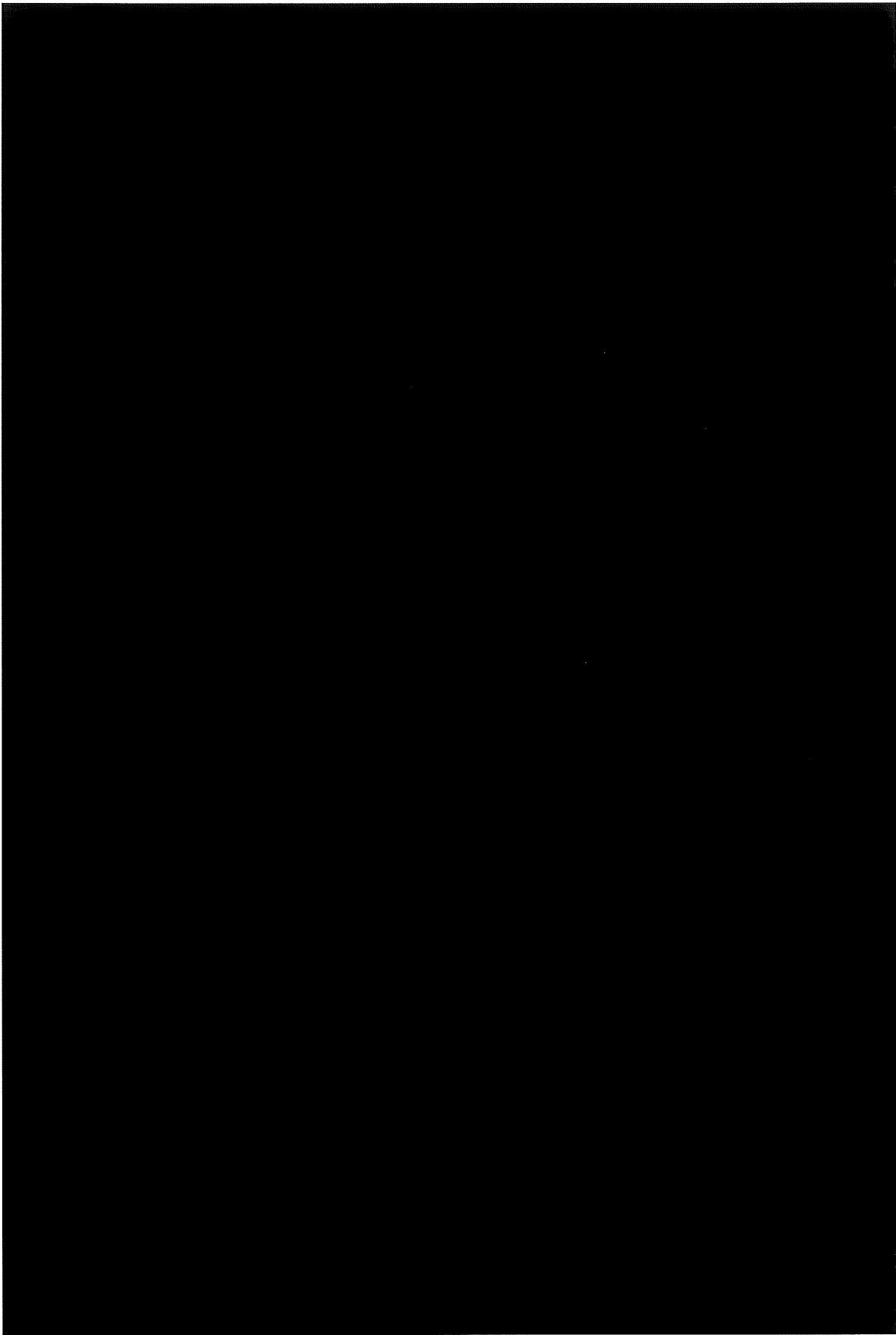


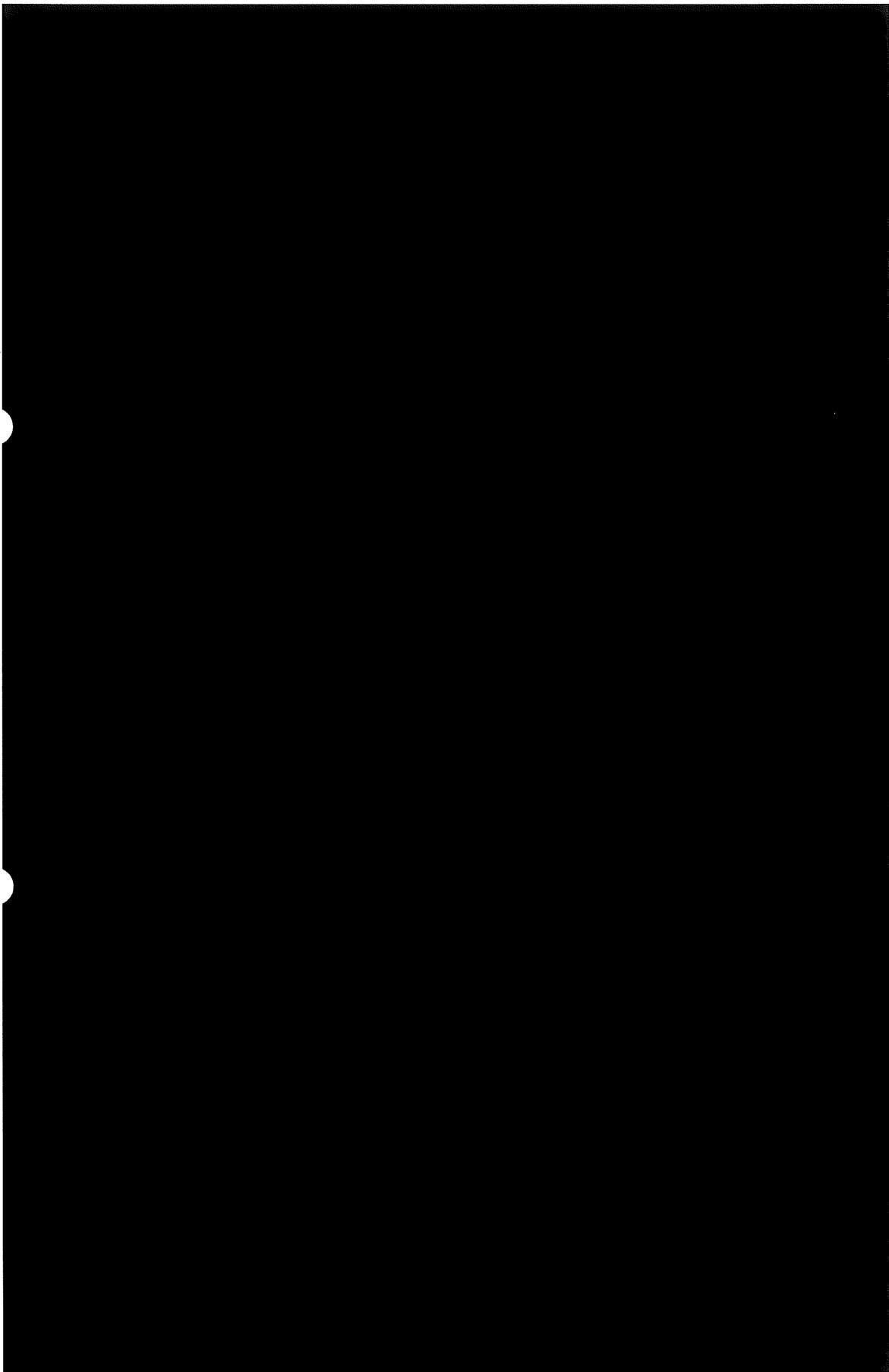




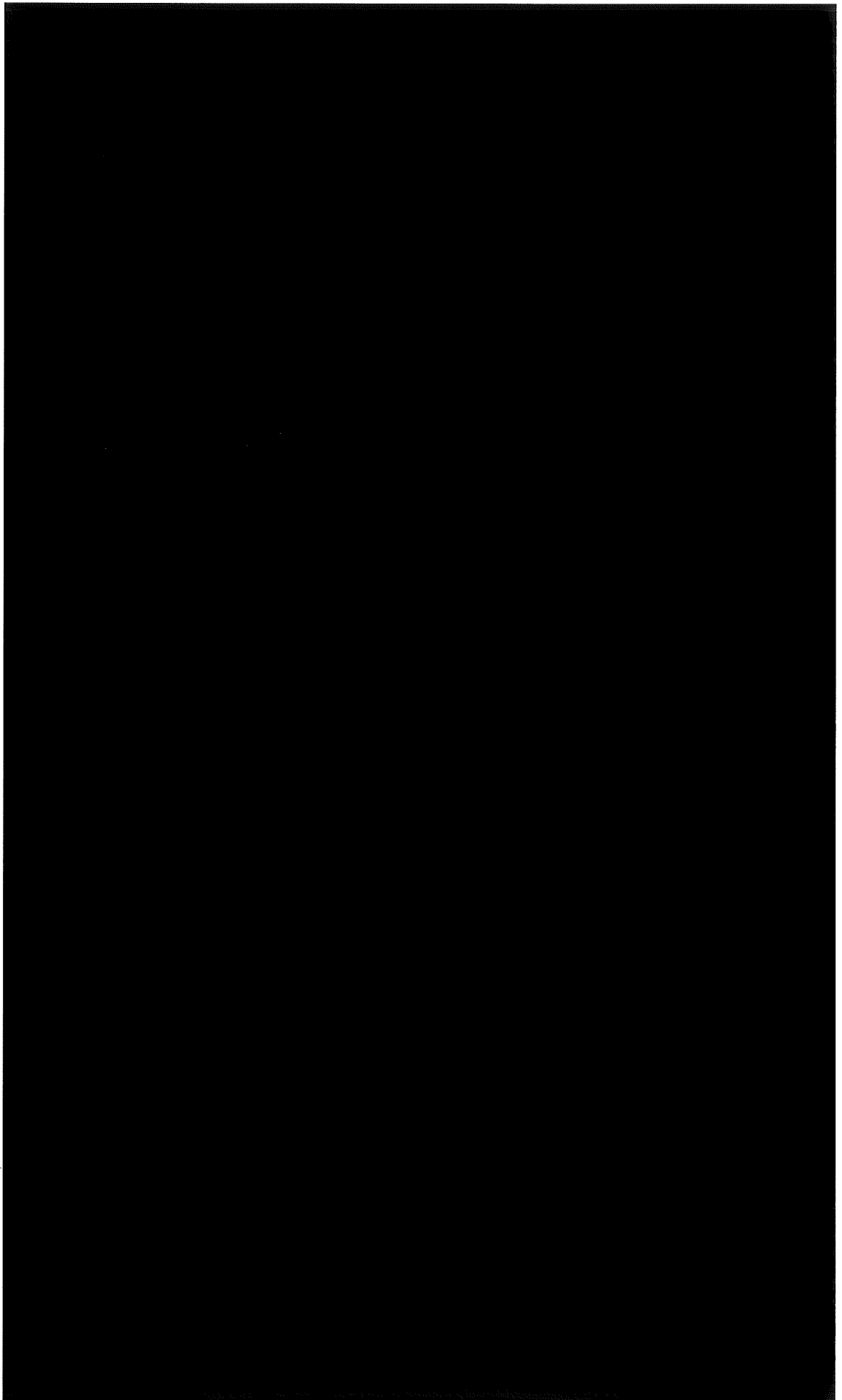




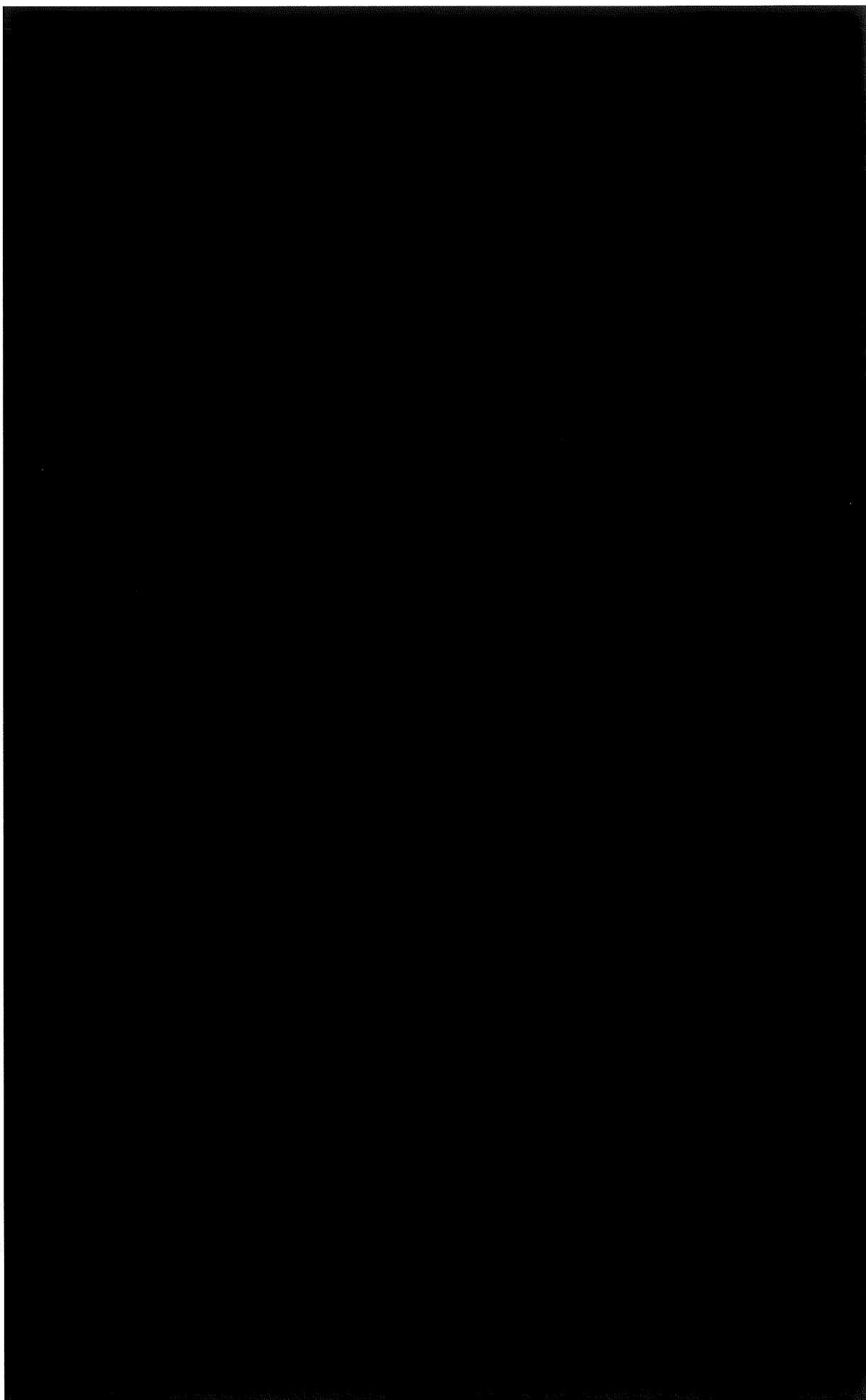




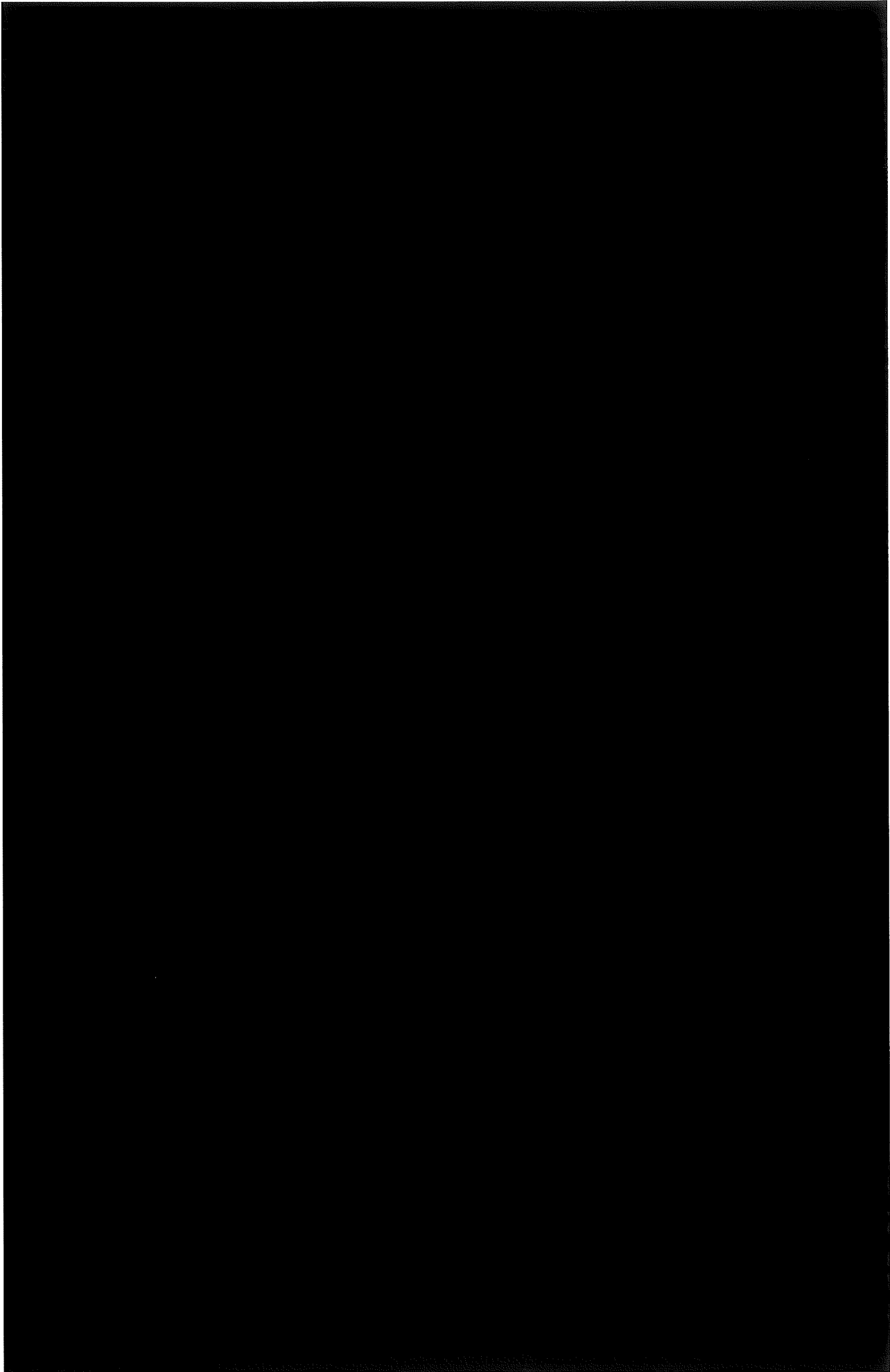


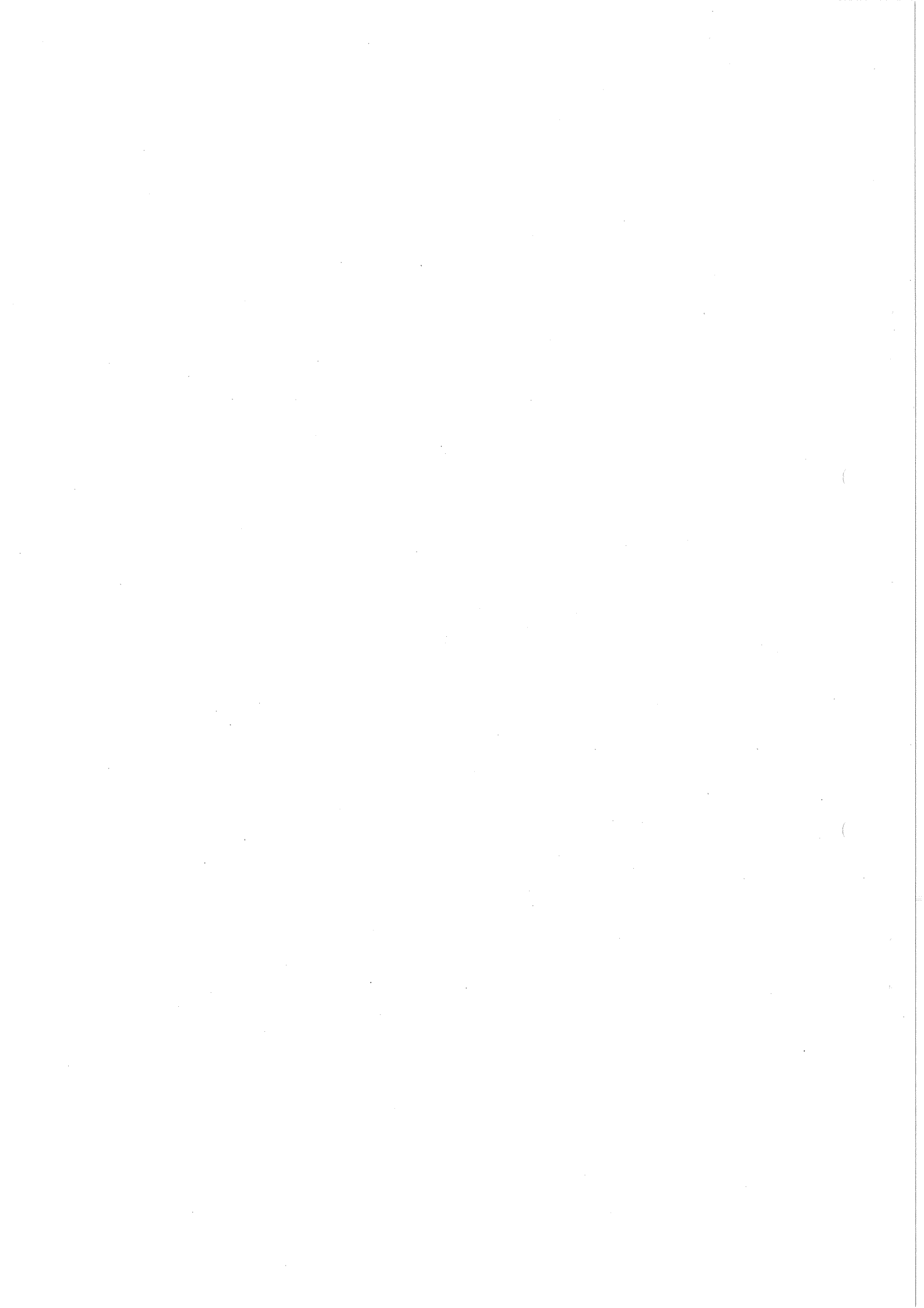












**Flood Mitigation Manual Legal Advice
Enclosures - Document Summary**

Item	Date	Comment Type
1	19 September 2011	Legal Review Comments
2	23 September 2011	Legal Review Comments
3	25 September 2011	Legal Review Comments
4	28 September 2011	Legal Review Comments
5	28 September 2011	Technical Comments
6	29 September 2011	Legal Review Comments and Technical Comments



1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011.

The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")).

The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified).

At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] ("Seqwater's lawyer"), a Partner at Allens Arthur Robinson the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyer by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with [REDACTED] (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I will be meeting with John Tibaldi from Seqwater and [REDACTED], a Partner at Allens Arthur Robinson on Wednesday 21 September 2011 at the Flood Operations Centre to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

3.1 General

For clarity and ease of reference, it would be better if each paragraph was numbered according to chapter and section (currently 2.9 is the only part with numbered paragraphs) and if the dot points were converted to (a), (b), (c) etc., however this is not a substantive issue.

In the flowcharts, approximately three quarters of the sentences contain punctuation at the end and the other quarter does not. Whichever option is chosen, consistency is recommended. Also, in the flowcharts the words "No" and "Yes" are variously and inconsistently black and red (I recommend black for yes and red for no).

Throughout the whole document there are various references to water levels and lake levels. I recommend only using the term "*lake level*". I further recommend stating that if a lake level does not specify "predicted" or "actual" that it could be taken to be either using professional engineering judgement and to check those references.

3.2 Title page, revisions table and table of contents

The "Date" column of the revisions table contains "*November 2009*". This should read, "*November 2009 (approved by gazette notice 22 January 2010)*" as this will correctly show the date that Revision 7 commenced. It is currently alright for Revision 8 to have "*September 2011*" because this is the latest draft of the FMM.

I have been advised by Seqwater's lawyer that the FMMs are yet to have final formatting and reference checking performed, so I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

3.3 Glossary

In the definition of Chief Executive "*Director General*" needs an en dash replacing the space to become "*Director-General*".

The FMM has the following definition of Full Supply Level (FSL).

"FSL" or "Full Supply Level" means:

(a) *the level of the water surface when Wivenhoe Dam or Somerset Dam (as the case may be) is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP; or*

(b) *such other lower level in Wivenhoe Dam as shall apply pursuant to the Water Act 2000 (Qld),*

but in any case not exceeding EL 67.0 metres for Wivenhoe Dam and EL 99.0 for Somerset Dam;

Currently the Moreton ROP specifies the FSL of Wivenhoe as EL 67.0m AHD and the FSL of Somerset as EL 99.0 AHD.

Seqwater's lawyer agreed to add the double underlined part on Friday 16 September 2011 to correct an obvious error (otherwise the maximum FSL for Somerset Dam would be EL 67.0m AHD).

Seqwater's lawyer was to come back to Paul Walsh regarding wording for the underlined part as Paul is not satisfied with the current wording as apparently it does not correctly reflect either:

- current legislative arrangements; or
- proposed legislative arrangements.

The following are words which could be used:

"FSL" or "Full Supply Level" means:

- (a) the level of the water surface when Wivenhoe Dam or Somerset Dam (as the case may be) is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP; or
- (b) such other level in Wivenhoe Dam or Somerset Dam as shall apply as an interim supply security level pursuant to an approved interim program or revised interim program under the Moreton ROP; but in any case not exceeding EL 67.0 metres for Wivenhoe Dam and EL 99.0 for Somerset Dam;

The Glossary should contain the following definitions:

- **"lake level"** means the water surface elevation of a Dam.
- **"actual lake level"** means the lake level at the manual headwater gauge, with reasonable adjustments to a figure judged very likely.
- **"dam crest flood"** or **"DCF"** means the Flood Event which would result in the headwater level in the Dam reaching the Dam crest.
- **"PMPDF"** means Probable Maximum Precipitation Design Flood;

3.4 Chapter 1

In the first paragraph "(the Dams)" can be removed because the Glossary already defines the term.

These words should be removed from section 1.3 "Seqwater must communicate with Agencies during Flood Events in accordance with Section 2.12." because Seqwater's lawyer has advised me that section 2.12 is about data provision, not communications.

Seqwater's lawyer has agreed to remove the following words from section 1.5 "In the circumstances set out in the Act, Seqwater and its directors, employees and agents are protected from liability when complying with the operational procedures in this Manual.". The inclusion or removal of these words does not affect Seqwater's indemnity under section 374 of the *Water Supply (Safety and Reliability) Act 2008* so it was adjudged to alleviate confusion by removing them altogether.

3.5 Chapter 2

In the second paragraph of section 2.10, I recommend replacing the words "actual level" with "actual lake level".

Comments from Peter Allen are as follows.

In section 2.2 insert a new bullet point in an appropriate location within the other bullet points:
A log of the performance of the FFS is maintained.

In section 2.6 insert a new bullet point to be the first bullet point:

- *An appropriate engineering qualification*

In section 2.8:

remove "in accordance with such program as is required by the Chief Executive."
and replace with "Such training shall incorporate the requirements of the Chief Executive."

In the section 2.9 title remove "data collection network and".

In section 2.10 at the end of the second paragraph change "FSLs" to "FSL(s)".

3.6 Chapters 3 and 4

Comments from Peter Allen and/or Bob Reilly are as follows.

In section 3.4 replace "reducing" with "limiting".

In section 3.5 replace "the primary" with "a major".

In section 4.3 first bullet point replace "will" with "can".

3.7 Chapter 5

The first box of the first flowchart states:

"Is it judged unlikely that the Wivenhoe Dam lake level will exceed the FSL?"

While "judged likely", "judges it likely" and "judged very likely" are all defined terms in the Glossary, "judged unlikely" is not defined. So while the meaning could be inferred, it would be preferable to change the wording to: "Is it judged likely that the Wivenhoe Dam lake level will not exceed the FSL?"

In the map of the crossings, Colleges Crossing has an asterisk but there is no corresponding explanation. I assume it is the same as the explanation in Appendix J, "* affected by tidal flows", however the asterisk should be removed if practicable.

In the Strategy W1 Flowchart, Colleges Crossing is used with a possessive apostrophe. This is contrary to accepted place name guidelines and inconsistent with the map. The two uses of "College's Crossing" should be replaced with "Colleges Crossing".

Page 36 - A table like this needs to be placed before the W3 flowchart (similar to W1 and W2):

LOCATION	TARGET MAXIMUM FLOW IN THE BRISBANE RIVER
Moggill	• 4,000m ³ /s.

Comments from Peter Allen and/or Bob Reilly are as follows.

Section 5.3.

Third paragraph second sentence remove the words ", prior to the event peak".

In the copy provided words are missing at the top of the first flowchart.

In the flowchart, insert the words "(close all bridges as in Strategy W1 flowchart)" underneath the words "Go to Strategy W2 Flowchart".

Page 29 first paragraph, first sentence insert the words "up to that time" after the second use of Wivenhoe Dam.

In the notes to Strategy W1, insert "Downstream" before "bridge locations and submergences flows are shown below".

In the Strategy W1 flowchart when should Fernvale Bridge be closed? Seqwater also needs to confirm whether closing Fernvale Bridge is the responsibility of DTMR or Somerset Regional Council.

In the Strategy W2 table, the first OR should be capitalised. Also, the fourth decision box from the flowchart should be appropriately reproduced.

Page 34 middle paragraph insert at end, "after taking into account the likely duration and size of the flood event".

Page 36 - In the Strategy W3 table, the first OR should be capitalised.

Page 39 – First paragraph remove “that could be imagined”.

Page 39 – Second bold heading insert “peak” between “Predicted” and “Lake Level”.

Page 39 – Last paragraph insert “or lesser” after the word “greater”.

Section 5.4.

First sentence change “In general, drain down of the Dams commences when the water levels in the Dams are falling and it is judged likely that the levels will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.” to “In general, drain down of Wivenhoe Dam commences when the lake level in Wivenhoe Dam is falling and it is judged likely that the lake level will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.”

First dot point insert “in both Dams” after “FSL”.

3.8 Chapter 6

the first paragraph of Chapter 6, “both dams” should become “both Dams”.

The first box of the first spreadsheet states:

“Is it judged unlikely that the Somerset Dam lake level will exceed the FSL?”

The second box of the first spreadsheet states:

“Is it judged unlikely that the Wivenhoe Dam lake level will exceed the FSL?”

While “judged likely”, “judges it likely” and “judged very likely” are all defined terms in the Glossary, “judged unlikely” is not defined. So while the meaning could be inferred, it would be preferable to change the wordings to:

“Is it judged likely that the Somerset Dam lake level will not exceed the FSL?”

“Is it judged likely that the Wivenhoe Dam lake level will not exceed the FSL?”

In the notes to Strategy S2, “both dams” should become “both Dams”.

In section 6.3 the second sentence of the second bullet point of the third paragraph states: “The list of bridges impacted by Somerset Dam is contained in Appendix K.” From the appendices provided, this needs to be changed to “Appendix J”.

Comments from Peter Allen and/or Bob Reilly as follows:

In 6.3 first paragraph remove “In general, drain down of the Dams commences when the water levels in the Dams are falling, the flow in the Brisbane River at Moggill is reducing and the rainfall forecasts provided by the BoM indicate that no significant runoff producing rainfall is expected in the Brisbane River basin for at least 48 hours.” and replace with “In general, drain down of Somerset Dam commences when the lake level in Somerset Dam is falling.”

In 6.3 second paragraph, first sentence insert at the end “such closures should aim to ensure the actual lake levels in the Dams follow the Wivenhoe/Somerset Operating Target Line.

In 6.3 first bullet point insert “in both Dams” after “Floodwaters stored above the FSL”.

In 6.4 second paragraph after heading “Regulator Valve Considerations” delete the word “operated” and replace with “open”.

3.9 Chapter 7

Peter Allen has advised that he is not happy with the loss of communications procedures and wants them back as they were in Revision 7.

Peter also has a question to ask regarding LCS2.

Peter Allen would also like the following dot point inserted in 7.3:

- "Via the Dam Supervisor at the other Dam or via the Dam Supervisor at North Pine Dam,"

3.10 Wivenhoe/Somerset FMM Appendices

I have checked that any references to an appendix in the FMM is to the correct appendix and found one error (see paragraph 3.8 above regarding section 6.3), however I have not perused the appendices in detail.

Comments from Peter Allen and/or Bob Reilly are as follows.

The appendix which is titled "**Flood Forecasting System (FFS)**" should have "**APPENDIX L**" at the top.

In Appendix J, isn't closing Fernvale Bridge the responsibility of DTMR not Somerset Regional Council?

4. Comments – North Pine FMM

4.1 General

For clarity and ease of reference, it would be better if each paragraph was numbered according to chapter and section (currently 2.9 is the only part with numbered paragraphs) and if the dot points were converted to (a), (b), (c) etc., however this is not a substantive issue.

Throughout the whole document there are various references to water levels and lake levels. I recommend only using the term "*lake level*". I further recommend stating that if a lake level does not specify "predicted" or "actual" that it could be taken to be either using professional engineering judgement and to check those references.

I have attempted to point out where the Wivenhoe/Somerset FMM differs from the North Pine FMM. Generally this is for a good reason specific to nature of each of the three dams and the facts and circumstances surrounding operations.

4.2 Title page, revisions table and table of contents

The "*Date*" column of the revisions table contains "*August 2010*". This should read, "*August 2010 (approved by gazette notice 17 December 2010)*" as this will correctly show the date that Revision 7 commenced. It is currently alright for Revision 8 to have "*September 2011*" because this is the latest draft of the FMM.

I have been advised by Seqwater's lawyer that the FMMs are yet to have final formatting and reference checking performed, so I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

4.3 Glossary

In the definition of Chief Executive "*Director General*" needs an en dash replacing the space to become "*Director-General*".

DCF definition should be changed to "**dam crest flood**" or "**DCF**" means the Flood Event which would result in the headwater level in the Dam just reaching the Dam crest.

The FMM has the following definition of Full Supply Level (FSL).

"FSL" or "Full Supply Level" means the level of the water surface when North Pine Dam is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP;

Currently the Moreton ROP specifies the FSL of North Pine Dam as EL 39.6m AHD.

Bob Reilly would like the following words added (underlined) to be consistent with the Wivenhoe/Somerset FMM

“FSL” or “Full Supply Level” means the level of the water surface when North Pine Dam is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP but in any case not exceeding EL 39.6 metres;

I am advised by Seqwater’s lawyer that it is not possible to have a flexible FSL at North Pine Dam because the strategy tables are all set to the current FSL. It would take approximately four months to re-calculate the tables. Peter Allen agrees with this. So if there was a temporary reduction in FSL before the start of the wet season, the dam would simply be allowed to fill to the current permanent FSL and then procedures would commence in accordance with the Manual. Therefore the definition of FSL in the North Pine FMM cannot mirror the definition in the Wivenhoe/Somerset FMM.

I note there is no definition of or “Power Station” or “Wivenhoe/Somerset Operating Target Line” as there is in the Wivenhoe/Somerset FMM, however this is alright as these terms are not used in the North Pine FMM.

Also the Wivenhoe/Somerset FMM defines the term “Dams” while the North Pine FMM defines the term “Dam” but that is obviously alright as the FMMs cover two and one dam/s respectively.

The Glossary should contain the following definitions:

- **“judged very likely”** means an event or circumstance being, in the professional engineering judgment of the Duty Flood Operations Engineer, certain or near certain to occur given the likely consequences associated with any decision which depends upon the judgment;
- **“lake level”** means the water surface elevation of the Dam.
- **“actual lake level”** means the lake level at the manual headwater gauge, with reasonable adjustments to a figure judged very likely.

4.4 Chapter 1

These words should be removed from section 1.3 “Seqwater must communicate with Agencies during Flood Events in accordance with Section 2.12.” because Seqwater’s lawyer has advised me that section 2.12 is about data provision, not communications.

Seqwater’s lawyer has agreed to remove the following words from section 1.5 “In the circumstances set out in *Act*, Seqwater and its directors, employees and agents are protected from liability when complying with the operational procedures in this Manual.”. The inclusion or removal of these words does not affect Seqwater’s indemnity under section 374 of the *Water Supply (Safety and Reliability) Act 2008* so it was adjudged to alleviate confusion by removing them altogether.

4.5 Chapter 2

Obviously there are differences in section 2.2 of the Wivenhoe/Somerset FMM and the North Pine FMM caused by two dams and one dam, respectively, being operated. Also as North Pine does not have anything like the Strategy W4 in the Wivenhoe/Somerset FMM there is no requirement to inform the CEO and Chief Executive.

In the second paragraph, I recommend replacing the words “actual level” with “actual lake level”.

Comments from Peter Allen are as follows.

In section 2.2 insert a new bullet point in an appropriate location within the other bullet points:

- *A log of the performance of the FFS is maintained.*

In section 2.6 insert a new bullet point to be the first bullet point:

- *An appropriate engineering qualification*

In section 2.8:

remove "*in accordance with such program as is required by the Chief Executive.*" and replace with "*Such training shall incorporate the requirements of the Chief Executive.*"

In the section 2.9 title remove "*data collection network and*".

4.6 Chapters 3

In section 3.4 add the words "*However, it is permissible for the Dam to be drained below FSL before final gate closure where it is judged likely that continued base flow will return the lake level to near FSL following gate closure.*" at the end.

Obviously there are differences in section 2.2 of the Wivenhoe/Somerset FMM and the North Pine FMM caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

Comments from Peter Allen and/or Bob Reilly are as follows.

In section 3.4 replace "*a primary*" with "*a major*".

4.7 Chapter 4

Chapter 4 of the North Pine FMM is equivalent to Chapters 4, 5 and 6 of the Wivenhoe/Somerset FMM. There are obvious differences caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

Sections 4.10 (Lifting Radial Gates Clear of the Flow) and 4.11 (Lowering Radial Gates that have been lifted Clear of the Flow) of the North Pine FMM do not closely resemble those equivalent parts of section 5.5 of the Wivenhoe/Somerset FMM. Peter Allen has advised, however, that there is no need to change the wording.

Peter Allen potentially disagrees with John Tibaldi in this area and they need to confer until a resolution is reached.

Comments from Bob Reilly are as follows.

Section 4.4, 2nd paragraph, last line delete "*as close as practical to the FSL.*" and replace with "*near FSL*".

Section 4.6 last dot point on p.18, 2nd line change "*reduced*" to "*reduce*".

4.8 Chapter 5

Chapter 5 of the North Pine FMM is equivalent to Chapter 7 of the Wivenhoe/Somerset FMM. There are obvious differences caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

In section 5.3 the following bullet points should be inserted (to be consistent with the Wivenhoe/Somerset FMM):

- "*Via other Seqwater personnel using the contact details contained in the Emergency Action Plans for the Dam;*"
- "*Via the Dam Supervisor at Wivenhoe Dam or via the Dam Supervisor at Somerset Dam;*"

The North Pine FMM contains

"• *Ensure the Dam is at FSL at the end of the Flood Event.*"

This should read (change underlined) "*at near FSL*".

4.9 North Pine FMM Appendices

I have checked that any references to an appendix in the FMM is to the correct appendix, however I have not perused the appendices in detail. I have also not been provided with a copy of appendix G, but I assume it is the same as appendix L in the Wivenhoe/Somerset FMM.

Comments from Peter Allen and/or Bob Reilly are as follows.

Appendix A – should DTMR be included?

Appendix B – please include a column with the 2011 Flood Heights.

Appendix C – could Peter Allen have the revised version of this ASAP please. This is very important and he needs it by 12pm Tuesday 20 September 2011 at the latest.

Appendix E – could this include a statement about hydrological studies currently being carried out?

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	• definition of what 'best forecast rainfall' means	Y – although suggest a minor clarification point	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding. I note that the phrase "forecast rainfall" is still included in the draft FMM for example at 4.3 " <i>Forecast rainfall products provided by the BoM including weather radar, qualitative and quantitative rainfall forecast products, and weather warnings</i> ". I would prefer that this still be more closely defined, otherwise "forecast rainfall" could, on one (torturous but still technically possible) argument, include
The following matters require particular attention during the interim review of the Wivenhoe			

manual:

- prescription about how forecast rainfall information is to be used by the flood engineers

Y – although suggest a minor clarification point

long term climate change predictions (which really should not be included, given the purposes of the FMM are really dam safety and flood mitigation, and the FMM is not about water security).

Seqwater's lawyer advised me that section 4.2 in the draft FMM states "*When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which have been derived from the FFS based on forecast rainfall are:*

- *If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.*
- *If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.*

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

My comments from the above section about the words "forecast rainfall" (which are used multiple times in section 4.2 of the draft FMM) apply.

- definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Maybe

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking appears to confirm this. However I have found

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

approximately 50 places in the draft FMM where lake level is used without either actual/predicted and sometimes it appears to be within context but sometimes there is potential for confusion (for example in Chapter 6 "As Somerset Dam is the upstream dam, decisions on flood releases from Somerset Dam must take into account the Wivenhoe Dam lake level").

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed.

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "non-damaging flows" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "maximum mechanical capability" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical

- clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Maybe

perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms that "*generally*" is not used in most of section 5.3 however it is used in the last sentence of the third paragraph of "*Strategy W4A – No Fuse Plug Initiation Expected*" as "*In these circumstances the discharge should generally remain at less than 4000m³/s prior to the lake level reaching EL 74.0 metres unless a larger outflow is judged very likely to result in reduced urban flooding downstream of the Dam.*". While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "

Review Comments 23 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified).

At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 – August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyer by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with Paul Walsh (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED] a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. Paul Walsh and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by October 2011. Seqwater's lawyers provided the revised draft to DERM early on Thursday 22 September 2011. DERM is aiming to provide comments back by early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM and by Saturday 24 September 2011 on the North Pine FMM. I understand that the drafts have concurrently been sent to the independent peer reviewer.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

3.1 General

Appendix L was not provided with the appendices and should be provided. Seqwater has previously provided a version of Appendix L which I have presumed has not changed much.

3.2 Title page, revisions table and table of contents

The title page should have a date stamp as agreed. Bob Reilly particularly wants this. So the date stamp for this version would be 22 September 2011.

A general check for all the terms in the glossary should be performed to check that they are capitalised where appropriate.

In the table of contents, in 3.5 "lake level" should become "Lake Level". I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

Throughout the manual, second level bullet points have simply been indented. Peter Allen requires a clearer hierarchy to be shown and I suggest replacing second level bullet points with dashes. For example in section 1.1 this:

- the fact that flood forecasting involves estimation and judgment as there are limitations on being able to (amongst other things):
 - accurately estimate flood run-off within the Brisbane River basin;
 - obtain accurate forecasts of rainfall during Flood Events; and
- the limitations on being able to:
 - identify all potential flood hazards and their likelihood; and
 - remove or reduce community vulnerability to flood hazards.
 -

would become this:

- the fact that flood forecasting involves estimation and judgment as there are limitations on being able to (amongst other things):
 - accurately estimate flood run-off within the Brisbane River basin;
 - obtain accurate forecasts of rainfall during Flood Events; and
- the limitations on being able to:
 - identify all potential flood hazards and their likelihood; and
 - remove or reduce community vulnerability to flood hazards.

This needs to be rectified in:

- page 9, section 1.1
- page 14, section 2.6
- page 15, section 2.9 (2 instances)
- page 16 section 2.10 "1." and "2" should be changed to dot points.
- page 24, section 4.3
- page 50, Notes section

3.3 Glossary

Change:

"Actual Lake Level" means the Lake Level at the staff headwater gauge with reasonable adjustments (where possible made by an engineer) to take into account prevailing conditions;

Change

“**Lake Level**” (or where used in a flowchart, **lake level**) means the water surface elevation in a dam;”

Insert:

“**Network**” means a network of rainfall and water level Gauging Stations which provides data in near real time and enables continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.

Insert:

“**Probable Maximum Flood**” or **PMF** means the flood resulting from the theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin and, where applicable, snowmelt, coupled with the worst flood-producing catchment conditions that can realistically be expected in the prevailing meteorological conditions.

3.4 Chapter 1

Section 1.1 Paragraph 3 change:

“The strategies set out in Chapters 4, 5 and 6 are intended to guide decision making in seeking to achieve those objectives.”

Section 1.5 heading change (at Bob Reilly's request):

“~~Legal Authority and Statutory Protection~~”

3.5 Chapter 2

Section 2.9 change:

- The FFS is described in Appendix L.
- ~~Seqwater must maintain the Network as part of the FFS a network of rainfall and water level Gauging Stations which provide data in near real time and enable continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.~~
- Seqwater must maintain the FFS and have it available for use by the Duty Flood Operations Engineers during Flood Events.
- Seqwater must improve the practical operation of the FFS by:
 - Implementing improvements identified during Flood Event reviews;
 - Improving model calibration as improved data becomes available;
 - Updating software in line with industry standards; and
 - Improving the coverage and reliability of the data collection network in conjunction with Agencies and the BoM.
- Seqwater must maintain a record of the performance of the data collection Nnetwork (being part of the FFS), including revised field calibrations and changes to the number, type and locations of rainfall and stream height gauges.
- Seqwater must also maintain a record of the performance of the FFS and is to rectify any identified faults as soon as practical.
- Seqwater must ensure that all available data and documentation from each Flood Event is collected and catalogued for future use.
- Seqwater must ensure that any information it collects that is relevant to the calibration of its field stations is provided to the BoM and relevant Agencies.
- Seqwater must provide a report to the Chief Executive by 30 September each year on the state of the FFS and the state of the Nnetwork referred to in Section 2.9.1, as part of the Statement of Preparedness provided to the Chief Executive under Section 2.3. The report must assess (as appropriate) the following in terms of hardware, software and personnel:
 - ~~adequacy of the FFS and the Nnetwork referred to in Section 2.9.1;~~
 - reliability of the FFS over the previous period;

- reliability of the FFS under prolonged flood conditions;
- accuracy of forecasting flood flows and heights; and
- the overall state of preparedness of the FFS.

3.6 Chapters 3 and 4

Section 3.2 change:

Stability calculations have indicated that Somerset Dam can safely withstand being overtopped to a Lake Level of at least EL 109.7 metres, provided all crest gates are fully open.

Section 3.2 change

Extreme Floods and Closely Spaced Large Floods

As indicated in the previous section, techniques for estimating extreme floods show that Flood Events are possible which would overtop both Dams. ~~In the case of Wivenhoe Dam~~ Such an overtopping could result in the destruction of ~~Wivenhoe the Dams~~. Such events however require several days of extremely intense rainfall to produce the necessary runoff.

Section 3.4

~~Generally,~~ this consideration is secondary to considerations associated with limiting bridge inundation.

Section 3.5 change (at Bob Reilly's request):

As the Dams are ~~the primary~~ major urban water supply for South East Queensland, it is important that all opportunities to fill the Dams are taken.

Section 3.6 change:

~~Generally,~~ gate closure sequences should aim to mimic the natural flood recession that would have occurred had the Dams not been constructed.

Section 4.3 change:

This is because the BoM has advised that rainfall forecast information issued by the BoM is ~~generally too~~ unreliable to be used as a basis for predicting definitive future Lake Levels and river flows and making releases from the Dams.

3.7 Chapter 5

Page 24 Section 5.1 change "level" to "Lake Level"

Page Section 5.2 change:

~~Dam Crest Flood~~

Page 26 Section 5.3 insert "or" at the second last bullet point.

Page 27 change (at Peter Allen's request)

The magnitude of the release from Wivenhoe Dam at any point in time should not exceed the predicted maximum inflow into Wivenhoe Dam up to that time during the Flood Event unless it is judged very likely by the Duty Flood Operations Engineer that there is a need to exceed the predicted maximum inflow up to that time to minimise downstream flood impacts. The most likely circumstances for this course of action would be associated with a flood originating primarily from downstream of Wivenhoe Dam.

Page 37 change

There are no restrictions on gate opening increments or gate operating frequency once the Lake Level exceeds EL 74.0 metres, as ensuring the structural safety of the ~~Dams~~ dam is the primary concern when these Lake Levels are experienced.

Page 37 (Peter Allen noted) there is a superfluous parenthesis under the title "Strategy W2 Flowchart".

Strategy W2 Flowchart the word "Flowchart" is in red not black (but do not change it if this will hold up approval of the manual).

Strategy W3 Flowchart second decision box change (at Peter Allen's request):

Is the predicted peak flow at Moggil excluding Wivenhoe Dam releases judged likely to exceed 2000 m³/s and can the predicted Wivenhoe Dam lake level remain below EL 74.0 metres if the flow at Moggil is maintained at less than this value 2000 m³/s?

Page 37/38 change (at Ron Guppy's request)

Overall, when operating Wivenhoe Dam under Strategy W4, the Duty Flood Operations Engineer must select a Radial Gate release rate that ensures the structural safety the Dams. While there may be significant adverse impacts arising from flooding downstream of the Dams, the impacts will be considerably worse if either or both of the Dams fail during a Flood Event. While it is well understood that the impacts of urban flooding below Wivenhoe Dam can be devastating to rural and urban communities, the impacts associated with the failure of Wivenhoe Dam during a Flood Event would be far worse than any natural flood. Therefore when operating under Strategy W4, it is never permissible for the Duty Flood Operations Engineer to select a Radial Gate release rate that retains flood water in the Dams in a manner that risks the structural safety of the Dams.

Page 38 (at Peter Allen's request):

Change 4000m³/s to 4000m³/s so superscript font is used.

Page 38 (at Peter Allen's request):

However in some circumstances, the timing of a greater peak release may reduce urban flooding, as the final urban flooding outcome also depends on the timing of natural inflows into the Brisbane River that are occurring downstream of the Dam.

Page 39 in second row, second column of table change:

~~the Wivenhoe Dam~~

Page 41 section 5.4 first bullet point change:

The FSL in ~~both the~~ Dams

Floodwaters stored above the FSL in ~~both the~~ Dams should generally in most circumstances be emptied within seven days after the flood peak has passed through the Dams. However, provided a favourable weather outlook is available, this requirement can be relaxed for the volume of water stored between the FSL and a level 0.5 metres above the FSL.

Section 5.4 change:

- The stranding of fish downstream of the Dams should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 41 section 5.5 change:

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of the dam Wivenhoe Dam is at risk;
- The radial gates are at risk of being overtopped; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 45 Section 5.7 change:

Under these circumstances, the uncontrolled flow passing through the eroded fuse plug embankments may be greater than the flow from ~~the Wivenhoe Dam~~ required to minimise downstream rural and urban impacts.

3.8 Chapter 6

Page 48 section 6.2 change (at Ron Guppy's request):

The intent of Strategy S1 is to maximise the combined benefits of the flood storage capabilities of the Dams to minimise disruption to rural life ~~downstream of Wivenhoe Dam.~~

Page 48 Section 6.2 change:

The actions when operating Somerset Dam under Strategy S1 are:

- The regulator valves and sluice gates are generally in most circumstances kept closed; and
- The crest gates are raised before the Somerset Dam Lake Level exceeds EL 100.45 metres.

Page 49 section 6.2 four changes:

The regulator valves and sluice gates are used to release water from the ~~Somerset~~ Dam with the aim of moving towards the Wivenhoe/Somerset Operating Target Line. Ideally, at the peak of a Flood Event, the Dams' Lake Levels should plot on or very close to the Wivenhoe/Somerset Operating Target Line. However, this may not be possible to achieve in practice. Prior to the peak of the Flood Event, it is also desirable (although may not be possible) for the Dams' Lake Levels to generally plot on or very close to the Wivenhoe/Somerset Operating Target Line. This will prevent the need for rapid sluice gate operations as the peak of the Flood Event approaches.

Page 52 section 6.3 change

~~In general, drain down of the Dams commences when the Lake Levels in the Dams are falling, the flow in the Brisbane River at Moggill is reducing and the rainfall forecasts provided by the BoM indicate that no significant runoff producing rainfall is expected in the Brisbane River basin for at least 48 hours. Drain down of the Dams commences when the total volume of flood water stored in the combined flood storage compartments of the Dams begins to fall and it is judged likely that the total volume of flood water stored will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.~~

Once drain down commences, sluice gate closure, in usual circumstances, occurs in the reverse order to sluice gate opening. ~~In usual circumstances~~ Generally, the final sluice gate closure occurs well before the Somerset Dam Lake Level falls to the FSL, as the regulator valves are normally used for final drain down. The final closure of the last open sluice gate or regulator valve should be timed to allow the Lake Level to return to near the FSL.

The following factors must be considered when determining gate closure sequences at Somerset Dam during the drain down phase:

- Floodwaters stored above the FSL in both Dams should in most circumstances generally be emptied within seven days after the flood peak has passed through the Dams. However, provided a favourable weather outlook is available, this requirement can be relaxed for the volume of water stored between the designated FSL and a level 0.5 metres above the designated FSL.

Section 6.3 change:

- The stranding of fish downstream of the Ddams should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 52 section 6.3 add as last bullet point:

- The objectives in Section 3.6 should be considered.

Page 52 section 6.4 change

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of either or both of the Dams the dam is at risk;
- The radial gates are at risk of being overtopped; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 53 in table change "dam level" to "Lake Level"

Page 53 section 6.4 change:

Regulator valves are to be kept fully closed when the tail water level below Somerset Dam is above the invert of the valves (EL 68.60 metres). Operating the valves under these circumstances can damage the valves. This requirement can be ignored if the structural safety of the Somerset Dam is at risk.

Page 53 section 6.4 change

If one or more of the regulator valves, sluice gates or crest gates are inoperable during the course of the Flood Event, the openings of the working valves and gates are to be adjusted to provide the required discharge from the Somerset Dam.

3.9 Chapter 7

Page 54 section 7.1 insert and/or at the end of the second last bullet point.

Section 7.2 change:

dDam eCrest fFlood

Section 7.3.1 in the table (page 55/56/57) change "Storage Level" to "Lake Level" in three instances.

Page 57 change:

The table above shows individual sequence steps against a target storageLake Llevel. The minimum time intervals between each step in the radial gate opening sequence are shown in the table below. Falling behind or being in front of the target gate openings is permissible when the storageLake Llevel is less than EL 74.0 metres, but not allowed when the storageLake Llevel is greater than EL 74.0 metres. When the storageLake Llevel is below EL 74.0 metres, the operating intervals shown in the table below must be followed and can be only be reduced to protect the structural safety of the Wivenhoe Ddam.

Page 57 change

In these circumstances, gates are preferably generally operated in the order of 3, 2, 4, 1, and 5 moving through the sequence shown in the table.

Page 58 section 7.3.2 change

In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log; and
- Remain in the general vicinity of the dam while on duty.

There are two separate procedures that can be followed at Somerset Dam if communications with the Flood Operations Centre are lost. The choice of the appropriate procedure to follow depends on the Somerset Dam Lake Level. The two procedures are:

- **Procedure LCS1** – The Somerset Dam Lake Level is below EL 100.45 metres; or
- **Procedure LCS2** – The Somerset Dam Lake Level is above EL 100.45 metres.

The following actions are applicable to each procedure:

- Unless communications with Wivenhoe Dam are available, the Wivenhoe Dam Lake Level is to be assumed as the level shown on gauge boards located downstream of Somerset Dam;
- The crest gates are to be kept fully raised to allow uncontrolled discharge;
- The regulator valves are to be closed and are in nearly all circumstances generally kept closed if the tail

water level exceeds EL 68.60 metres. The only exception to this is if the regulator valves are used to prevent overtopping of the Somerset Dam; and

- The sluice gates are operated as either fully opened or fully closed. The order of operation for opening the sluice gates is LMKNJQIP. Sluices are to be closed in reverse order of opening. Any inoperable sluices are to be dropped from the opening or closing sequences.

3.10 Wivenhoe/Somerset FMM Appendices

Appendix A (at Bob Reilly's request) insert an extra row:

AGENCY	RESPONSIBLE PERSON	LOCATION
DTMR	tba	tba

Appendix B

In the table change "Storage Level" to "Lake Level" in two instances.

In the text change "Storage Level" to "Lake Level" in four instances.

In the text change "headwater level" to "Lake Level" in two instances.

Appendix E

In the first table change "Storage Level" to "Lake Level" in two instances.

Notes after first table change (at Bob Reilly's request):

1. The information in this table is based on a FSL of EL 67.0 metres
2. This is the maximum discharge of an individual spillway bay or regulator. Total discharge is calculated by adding the contributions of each gate or regulator.
3. The temporary storage is assumed to be the storage above normal Full Supply Level of EL 67.0 metres.
4. The first fuse plug is designed to trigger at EL 75.7 metres. Above this level, fuse plug flows from the fuse plug tables need to be added to give the total outflow

In the second table change "Water EL (m AHD)" to "Lake Level (EL)" in two instances.

Change header in tables(at Peter Allen's/Ron Guppy's) and notes:

FUSE PLUG DETAILS

Fuse Plug	Type	Width (L)	Crest Level	Fuse Plug Pilot Channel Invert Level	Storage Level corresponding to Fuse Plug Pilot Channel Invert Level ¹
		m	m AHD	m AHD	m AHD

- 1 Storage Lake Level is as per that measured at the Headwater Staff Gauge. Initiation of Fuse Plug is expected to occur when the Lake Water Level exceeds the Lake Level at Fuse Plug Pilot Channel by 0.10 - 0.15 m.
- 2 Includes 0.03m of drawdown from the Fuse Plug Pilot Channel Invert to the Lake Water Level.
- 3 Includes 0.08m of drawdown from the Fuse Plug Pilot Channel Invert to the Lake Water Level.

Discharge for each fuse plug may be approximated using the following equation:

$$Q_{\text{Fuse Plug}} = 2.1 * L * (\text{Storage Lake Level} - 67.0)^{1.5}$$

Where L = width of fuse plug bay in metres.

FUSE PLUG RATINGS

Storage Lake Level	Fuse Plug Discharge			
	Left Bay	Central Bay	Right Bay	Total
m AHD	m ³ /s	m ³ /s	m ³ /s	m ³ /s

In the graph axis label change "Water Level" to "Lake Level".

Appendix G

Page 1 Change:

The main purpose of gating the spillway is to exercise maximum possible control over the flow in the Brisbane River insofar as river flows in excess of 4,000 m³/s at Moggill cause significant damage to urban areas downstream although lower flows will still cause damage. The radial gates also allow the routing of much larger floods with substantial flood mitigation being achieved.

Page 2 in table change "Reservoir Level" to "Lake Level".

Page 3 at the bottom change "Dam" to "dam".

Appendix J

In table change header

BRIDGE NAME	ROAD	DECK ELEVATION m AHD	LOCAL AUTHORITY <u>AREA</u>
-------------	------	----------------------------	-----------------------------

Appendix K

Change "Probable Maximum Precipitation Design Flood" to "PMPDF" in four instances.

Appendix L

A copy should be provided.

4. Comments – North Pine FMM

To be provided 24 September 2011

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "**Lake Level**" (or where used in a flowchart, "**lake level**") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "

Review Comments 25 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified). At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyers by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with Paul Walsh (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED] a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. Paul Walsh and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011. Seqwater's lawyers provided the revised draft FMMs to DERM early on Thursday 22 September 2011. I provided DERM comments back early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM. I provided DERM comments back late on Saturday 24 September 2011 on the North Pine FMM. I understand that Seqwater plan to engage a professional document editor to review the FMMs for typographic errors and internal inconsistencies. I understand that the drafts have concurrently been sent to the independent peer reviewer.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly and/or Ron Guppy
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

Provided 23 September 2011. Additional comments as follows.

Page 14 section 2.3 turn the last bullet point back into a paragraph (to be consistent with the North Pine FMM and to flow logically).

Page 55 section 7.3.1 change:

"In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log;
- Remain in the general vicinity of the Wivenhoe Dam while on duty; and
- Ensure Wivenhoe Dam is near FSL at the end of the Flood Event.

(to be consistent with the North Pine FMM **unless** there is a technical reason that the return to FSL has been excluded).

Page 58 section 7.3.2 change

"In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log;
- Remain in the general vicinity of the Somerset Dam while on duty; and
- Ensure Somerset Dam is near FSL at the end of the Flood Event.

(to be consistent with the North Pine FMM **unless** there is a technical reason that the return to FSL has been excluded).

4. Comments – North Pine FMM

4.1 General

Appendix G was not provided with the appendices and should be provided. I have presumed it is very similar to Appendix L of the Wivenhoe Somerset FMM. Seqwater's lawyers provided Appendix L on 24 September 2011 and I provided legal / proofreading comments back the same day with a note that I had asked DERM's engineers for technical comment.

Throughout the document, "Radial Gates" is used. This is not a defined term so it should be "radial gates" in many instances. The Wivenhoe/Somerset FMM uses "radial gates".

4.2 Title page, revisions table and table of contents

The title page should have a date stamp as agreed. Bob Reilly particularly wants this. So the date stamp for this version would be 22 September 2011.

A general check for all the terms in the glossary should be performed to check that they are capitalised where appropriate.

Throughout the manual, second level bullet points have simply been indented. Peter Allen requires a clearer hierarchy to be shown and I suggest replacing second level bullet points with dashes.

This needs to be rectified in:

- page 2, Glossary definition of Flood Officers, "1." and "2" should be changed to dot points
- page 4, section 1.1; "1." and "2" should be changed to dot points and the dot points should be changed to dashes
- page 10, section 2.6, numbers e.g. "1." and "2" should be changed to dot points and the dot points should be changed to dashes
- page 12, section 2.9 (2 instances)
- page 18, section 4.4.

4.3 Glossary

Change:

"Actual Lake Level" means the Lake Level at the staff headwater gauge with reasonable adjustments where possible made by an engineer to take into account prevailing conditions;

I note in regard to the definition of Full Supply Level that Bill McCredie was to consult with Michael Ilott of Seqwater's lawyers to establish if there was a particular reason that the North Pine FMM FSL could not mirror the Wivenhoe/Somerset FMM definition. DERM has reserved its position in this regard.

Insert:

"Network" means a network of rainfall and water level Gauging Stations which provides data in near real time and enables continuous monitoring of rainfall and stream water levels within the Dam's catchments. Key Gauging Station locations are identified in Appendix B for reference purposes.

Insert:

"Probable Maximum Flood" or "PMF" means the flood resulting from PMP and, where applicable, snowmelt, coupled with the worst flood-producing catchment conditions that can realistically be expected in the prevailing meteorological conditions.

Insert:

"Probable Maximum Precipitation" or "PMP" means the theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin.

Also change PMF and insert PMP in W&S FMM to be consistent across the FMMs

4.4 Chapter 1

Section 1.5 heading change (at Bob Reilly's request):

~~"Legal Authority and Statutory Protection"~~

4.5 Chapter 2

Section 2.2 move the twelfth bullet point to become the tenth bullet point (consistent with the W&S FMM) and change it to:

"The Dam's Radial Gates and the Regulators are kept in good working order at all times and are not to be removed from service for maintenance or any other reason without the specific permission of the a Senior Flood Operations Engineer.

Section 2.5 change:

"When rostered on duty during a Flood Event, the responsibilities of the Flood Operations Engineer are as

follows:

- ~~D~~irect the operation of the Dam during a Flood Event in accordance with the overall strategy determined by a Senior Flood Operations Engineer; and
- ~~F~~ollow any direction from the Senior Flood Operations Engineer in relation to applying reasonable discretion in managing a Flood Event as described in Section 4.5

~~[remove actual bullet]~~ A Flood Operations Engineer is to follow this Manual in managing Flood Events and is not to apply reasonable discretion unless directed by a Senior Flood Operations Engineer or the Chief Executive."

Section 2.9 change:

"The FFS is described in Appendix G.

- Seqwater must maintain the Network as part of the FFS ~~a network of rainfall and water level Gauging Stations which provide data in near real time and enable continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.~~
- Seqwater must maintain the FFS and have it available for use by the Duty Flood Operations Engineers during Flood Events.
- Seqwater must improve the practical operation of the FFS by:
 - Implementing improvements identified during Flood Event reviews;
 - Improving model calibration as improved data becomes available;
 - Updating software in line with industry standards; and
 - Improving the coverage and reliability of the data collection network in conjunction with Agencies and the BoM.
- Seqwater must maintain a record of the performance of the data collection Nnetwork (being part of the FFS), including revised field calibrations and changes to the number, type and locations of rainfall and stream height gauges.
- Seqwater must also maintain a record of the performance of the FFS and is to rectify any identified faults as soon as practical.
- Seqwater must ensure that all available data and documentation from each Flood Event is collected and catalogued for future use.
- Seqwater must ensure that any information it collects that is relevant to the calibration of its field stations is provided to the BoM and relevant Agencies.
- Seqwater must provide a report to the Chief Executive by 30 September each year on the state of the FFS and the state of the rainfall and water level gauging nNetwork referred to above, as part of the Statement of Preparedness provided to the Chief Executive under Section 2.3. The report must assess (as appropriate) the following in terms of hardware, software and personnel:
 - adequacy of the FFS and the rainfall and water level gauging nNetwork referred to above;
 - reliability of the FFS over the previous period;
 - reliability of the FFS under prolonged flood conditions;
 - accuracy of forecasting flood flows and heights; and
 - the overall state of preparedness of the FFS.

Section 2.10 change "lake level" to "Lake Level" in three instances and "actual lake level" to "Actual Lake Level" in one instance.

Section 2.11 uncapitalise the bullet point parts (consistent with the W&S FMM).

Section 2.12 change:

"details of Aactual Lake Levels and predicted !Lake !Levels at the Dam".

4.6 Chapter 3

Page 15, Section 3.2 change:

"Embankment sections on the other hand are likely to washout rapidly if overtopped and cause failure of the Delam".

Page 15, Section 3.2 change:

"Techniques for estimating extreme floods show that Floods Events are possible which would overtop the Dam. Such events however may require a couple of several days of extremely – this is a technical point as to whether extremely gets inserted or not] intense rainfall to produce the necessary runoff." (consistent with the W&S FMM).

Also should "storms" be "rainfall systems" (consistent with the W&S FMM) or is this a purposeful technical meteorological difference?

Page 16, Section 3.4, split into two paragraphs (consistent with the W&S FMM)

Page 16, Section 3.5 insert at the start of the sentence: "Near the conclusion of a Flood Event (consistent with the W&S FMM).

4.7 Chapter 4

Page 18 second paragraph change:

As the Dam has no provision for flood mitigation, when the Dam is full ensuring the structural safety of the Dam is paramount. Accordingly, the aim is to pass any significant flood through the reservoir, while on most occasions generally ensuring that peak outflow does not exceed peak inflow, and to empty stored floodwaters as quickly as possible."

Page 19 section 4.5 for last bullet point remove actual bullet (consistent with the W&S FMM).

Page 19 Section 4.6 in second sentence and in third bullet point (two instances) change "lake level" to "Lake Level"

Page 19 Section 4.6 change:

The following factors must be considered when determining gate closure sequences:

- Floodwaters stored above the FSL should in most circumstances generally be emptied

Page 19 Section 4.6 change last bullet point:

- The stranding of fish downstream of the Dam should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 20 section 4.7 change:

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of the Dam is at risk;
- The Radial Gates are at risk of being overtopped;
- Radial Gate operations fall more than three openings behind the gate opening settings contained in Appendix C; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 21 change "lake levels" to "Lake Levels".

4.8 Chapter 5

Page 22 section 5.1 insert and/or at the end of the second last bullet point.

Page 23 section 5.3 third bullet point change "Event Log".

Page 23 section 5.3 fourth bullet point change "Remain in the general vicinity of the Ddam while on duty; and"

Page 23 section 5.3 fifth bullet point change "Ensure the Ddam is near FSL at the end of the Flood Event."

4.9 North Pine FMM Appendices

Appendix B

Add a column in the table for the 2011 flood as agreed in the meeting of 21 September 2011.

Appendix C

I am just passing on technical comments here from Peter Allen. Any questions should be directed to him.

Comments from Peter Allen:

Peter notes that the movements in the new Appendix C have been spaced out from 50mm to 100mm. Peter still believes that this will be a problem in small floods because there will be so many gate openings. He thinks that there will still be "hunting". Peter would recommend spacing it out to 400mm or making it part of the longer term review of North Pine FMM. Peter has provided his views to John Tibaldi about this. Peter is happy to discuss further with John Tibaldi. In the event that Seqwater still wish to submit the North Pine FMM with Appendix C as it currently is, Peter would like some formal assurance from Seqwater that it is confident that it will be able to operate that way.

Comments from Peter Allen:

In the first table there needs to be a zero gate setting.

Comments from Peter Allen:

Appendix C then has all gates operational but it must have one gate out (or alternatively the body of the FMM which states that one gate is out should be amended).

Appendix D

Add details of the hydraulic system currently being installed as agreed in the meeting of 21 September 2011.

Appendix E

Add details of the hydrologic investigations currently being carried out as agreed in the meeting of 21 September 2011.

Appendix G

A copy should be provided.

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "**Lake Level**" (or where used in a flowchart, "**lake level**") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "



Review Comments 28 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified). At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with Michael Ilott, a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyers by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with Paul Walsh (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED], a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. Paul Walsh and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011. Seqwater's lawyers provided the revised draft FMMs to DERM early on Thursday 22 September 2011. I provided DERM comments back early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM. I provided DERM comments back late on Saturday 24 September 2011 on the North Pine FMM. I understand that Seqwater engaged a professional document editor to review the FMMs for typographic errors and internal inconsistencies and also sent the drafts concurrently to the independent peer reviewer. Seqwater's lawyers provided the further revised draft Wivenhoe & Somerset FMM together with the draft explanatory notes early in the evening of Tuesday 27 September 2011.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly and/or Ron Guppy
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

My legal / proofreading comments are as below. I note that Peter Allen is yet to provide technical comment in this area.

Body of Manual

EITHER

Glossary change (**preferred**):

"Dams" means Wivenhoe Dam and Somerset Dam and "Dam" means either Wivenhoe Dam or Somerset Dam depending on the context used;

OR

If the "Dam" Glossary change requested above is not made then the following changes must be made but if the Glossary change is made then the following changes can be ignored:

- page 23 change "the Dam" to "Wivenhoe Dam" in paragraph 1.
- page 26 change "the Dam" to "Wivenhoe Dam" in paragraph 1.
- page 37 change seven instances of "Dam" to "Wivenhoe Dam" in paragraph 2.
- page 43 change "the Dam" to "Wivenhoe Dam" in three instances.
- page 46 change "upstream Dam" to "upstream dam" in paragraph 1.
- page 50 section 6.3 third bullet point change "each Dam" to "each of the Dams".
- Page 52 section 7.3 change "between a Dam" to "between one of the Dams" and change "at the other Dam" to "at the other one of the Dams".
- Page 52 section 7.3.1 change "the Dam" to "Wivenhoe Dam".
- Page 56 change "the Dam" to "Somerset Dam"
- Page 58 table 7.3.6 change "the Dam" to "Somerset Dam" in two instances.
- Appendix C page 64 change "Dam" to "Somerset Dam" in two instances.
- Appendix D page 68 change "elevation of Dam" to "elevation of Somerset Dam".
- Appendix G page 85 change "Dam" to "Wivenhoe Dam" in paragraph 1.
- Appendix G page 88 change "Dam" to "Wivenhoe Dam" in paragraph 2.
- 'Appendix L page 101 fourth bullet point change "Dam" to "each of the Dams" " in two instances and second tier bullet points change "Dam inflows" to "Dams' inflows".
- Ask the technical writer to perform a full check for the use of the word "Dam" in case I have missed any examples.

Section 2.6 add "and" as below :

- a total of at least five years of suitable experience and demonstrated expertise in at least two of the following areas:
 - investigation, design or construction of major dams;
 - operation and maintenance of major dams;
 - hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology; and
 - applied hydrology with particular reference to flood forecasting and/or flood forecasting systems.

Section 3.4 second paragraph change "the Dam" to "Wivenhoe Dam".

Section 4.2 Bob Reilly wants these sentences (which had not been in previous drafts) completely removed from the Manual as they are more of a general commentary than an operational procedure.

"By way of guidance, this unreliability was evident during the January 2011 Flood Event. In that event, total reliance upon rainfall forecasts would likely have caused an increase in urban flooding below Moggill, thereby highlighting the adverse consequences which can arise when significant weight is placed upon rainfall forecasts."

However, DERM has no objection to these sentences (suitably amended) being included in the Explanatory Notes.

Section 4.4 change:

Prior to a public road bridge (as listed in Appendix J) being inundated due to either releases of water from Wivenhoe Dam or water being stored above the FSL of Somerset Dam, the Duty Flood Operations Engineer should aim to ensure that the Agency responsible for the closure of the bridge is notified.

Section 5.3 Table 5.3.8 row 1 column 1 change "Somerset" to "Somerset Dam".

Section 5.5 page 43:

Change eight instances of "Radial Gate" to "radial gate".

Change two instances of "Radial gate" to "radial gate".

Section 6.2 (page 49):

- Figure 6.2.2 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.
- Notes change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in two instances.
- Notes change "storages" to "Dams".

Section 7.2 fourth bullet point (page 56) and tenth bullet point (page 57) change "the Somerset Dam" to "Somerset Dam".

Section 7.3.1 page 55 change "the Wivenhoe Dam" to "Wivenhoe Dam".

Page 56 renumber "7.2.2 Somerset Dam Emergency Procedure" to be "7.3.2 Somerset Dam Emergency Procedure".

Page 58 Table 7.3.6 row 2 column 2 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.

Page 59 Figure 7.3.1 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.

Appendices

Page 63 Appendix B clarify which dam in "Dam tail water level (Wivenhoe Lake Level)".

Page 69 Appendix D figure 5 change "Wivenhoe Dam Level" to "Wivenhoe Dam Lake Level" and change "Somerset Dam Level" to "Somerset Dam Lake Level" in the axis labels

Page 81 Appendix E figure 6 change "Water Level" to "Lake Level" in the axis label.

Pages 82 and 83 and 84 Appendix F change in one instance on each page:

* Opening required to prevent ~~R~~radial ~~G~~gate overtopping.

This is the discharge for EL 72.5m (not for all lower ~~L~~lake ~~L~~levels).

Page 85 Appendix G change this:

Therefore in operating the spillway, the principles to be observed are, in order of priority:

1. The discharge jet into the plunge pool is not to impinge on the right or left walls of the plunge pool.
2. The flow in the spillway is to be generally symmetrical.

to this:

Therefore in operating the spillway, the principles to be observed are, in descending order of priority:

- The discharge jet into the plunge pool is not to impinge on the right or left walls of the plunge pool; and
- The flow in the spillway is to be generally symmetrical.

Page 86 Appendix G change "reservoir level" to "Lake Level".

Page 87 Appendix G change "This procedure should only be used if the safety of the dam is at direct risk or to preserve the water supply stored in the Dam." to "This procedure should only be used if the safety of Wivenhoe Dam is at direct risk or to preserve the water supply stored in Wivenhoe Dam."

Page 100 Appendix K change "peak water levels" to "peak Lake Levels".

Page 101 Appendix L third bullet point change "Duty Flood Operations Engineers" to "Duty Flood Operations Engineer(s)".

Explanatory Notes

As above in relation to comment on Section 4.2 of the Manual, words to the effect of these sentences might be included:

"By way of guidance, the unreliability of QPF was evident during the January 2011 Flood Event. In that event, total reliance upon rainfall forecasts would likely have caused an increase in urban flooding below Moggill, thereby highlighting the adverse consequences which can arise when significant weight is placed upon rainfall forecasts."

I have no other legal / proofreading comments in regard to the draft Explanatory Notes.

I note that Peter Allen is yet to provide technical comment in this area.

4. Comments – North Pine FMM

Not applicable as further revised draft of the North Pine FMM yet to be provided.

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	Y	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	Y	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Wednesday 27 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "**Lake Level**" (or where used in a flowchart, "**lake level**") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe*

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "non-damaging flows" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Thursday 29 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "



28 September 2011 1.15 PM

Technical Comments (Peter Allen/ Bob Reilly / Ron Guppy)

1.

Page 2 column 3 row 8 change:

"Revision, but no substantive alteration of objectives or, strategies or operating practices."

Page 6 Table of Contents – Appendices remove the superscript "1" from Appendix E.

2.

Page 23, Section 4.2 second sentence change to:

These conditions include, amongst other things ~~(including Actual Lake Levels)~~ in the Dams, predicted Lake Levels in the Dams and predicted peak flow rates at downstream locations, including Moggill.

3.

Page 23; Section 4.2 fourth paragraph move the third and fourth sentences to explanatory notes and insert these two sentences in their place:

"By way of guidance, total reliance upon rainfall forecasts may cause an increase in urban flooding below Moggill. Adverse consequences can arise when significant weight is placed upon rainfall forecasts."

Note: I note Seqwater's position that the original sentences will not change - DERM legal is obtaining specific instructions regarding the department's position should this not be changed as suggested.

4.

Page 23, Section 4.2 fourth paragraph fifth and last sentence change to:

The Duty Flood Operations Engineer must always consider ~~these~~ potential adverse consequences when considering predictions based upon forecast rainfall.

5.

Page 43, Section 5.6, Table 5.6.1 Header Row Column 6 – the number "1" in the header should be in superscript i.e.:

Lake Level corresponding to
Fuse Plug Pilot
Channel Invert Level¹

6.

Page 53 change:

- follow the procedures set out below to determine the appropriate radial gate openings ~~settings~~; and
- ensure Wivenhoe Dam is near FSL at the end of a Flood Event.

If communications with the Flood Operations Centre are lost, appropriate radial gate openings ~~settings~~ at Wivenhoe Dam are determined by following the radial gate operating sequence as set out in the following table (Table 7.3.1).

7.

Page 55, Table 7.3.2 row 4 column 1 change > to ≥ .

8.

Page 56, paragraph 2 change:

When extreme rises in Lake Level are being experienced, Dam Operators may have difficulty in continually matching minimum gate openings ~~settings~~ to Lake Level.

9.

Page 62 and 63 Appendix B column 2 "Reservoir Capacity" either round all the figures or provide a satisfactory explanation as to why they are quoted to an extra significant digit as compared to the same column in Appendix E.

10.

Page 70 and 71 Appendix E – Heading Row columns 3, 4 and 5 the numbers "3", "2", and "2, 5" respectively need to be in superscript i.e.

Flood Capacity³

Discharge per Regulator²

Discharge per Spillway Bay^{2,5}

11.

Pages 72 to 77 Appendix E the spreadsheet needs to be reprinted, imaged and re-inserted with more room in the columns so that three digit numbers are not going down in the cell. For example, page 72 row 8 column 5 the number 113 is showing as:

11

3

when it should be showing:

113

12.

Page 78 & 79 Appendix E second header row column 1 change:

GATE OPENING

(m) (tangential opening)

Peter has also requested that for the long term review, Seqwater consider using the same gate openings in page 78 & 79 Appendix E as in the discharge rating tables (i.e. in 0.5 metre openings in both as opposed to 0.2 metre openings in one and 0.5 metre openings in the other).

13.

Page 80 Appendix E change:

$$Q_{\text{Fuse Plug}} = 2.11.98 * L * (\text{Lake Level} - 67.0)^{1.5}$$

Peter has advised in relation to this point he retrieved the design information for the fuse plugs and in section 2.4.3 of the report from the Wivenhoe Dam Alliance on "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade Q1091, September 2005" it indicates that the Coefficient of Discharge is 1.98 so that figure should be used at this time. The report indicates that the figure was sourced from the USBR Design of Small Dams which is what Peter would have used to generate a figure for the coefficient. However, this will need to be reviewed as part of the Longer Term Review as the coefficient will vary with the depth of flow over the fixed crest at EL 67.0 metres.

14.

Page 82 – Appendix F – column 1 the figures in column 1 should replicate the figures used in Table 7.3.1 and the table should be updated accordingly because the aim is to give the same total discharge. For example, Table 7.3.1 starts at 67.00 but the table in Appendix F starts at ≤72.5.

**Review Comments 29 September 2011 1.45am
Wivenhoe/Somerset FMM**

Comments – [REDACTED]

I am satisfied with the amended FMM. I have only 2 very minor changes.

Pages 32, 34, 62 change "generally" to "in most circumstances". (I am satisfied that the use of the word generally on page 87 is appropriate).

Page 105 Appendix L fourth bullet point change "Duty Flood Operations Engineers" to "Duty Flood Operations Engineer(s)".

Comments – Peter Allen

While the fuse plug discharge equation in Appendix E has been modified (co-efficient change from 2.1 to 1.98) the fuse plug discharges in the following Table have not been modified. Peter suspects the figures in the Tables have a variable coefficient included in the calculated figures (as it should be) and that they should be checked and amended if necessary.

Peter says that the replacement figures in Appendix F for Table 7.3.1 are not correct.

Peter is happy to discuss either of these points directly with Seqwater's engineers and could probably calculate the figures if necessary.

Comments – Bob Reilly

Bob's comments are in relation to the Explanatory Notes (although he realises that DERM is not approving the Explanatory Notes, only the Manual, but is concerned that it could be interpreted as an approval)

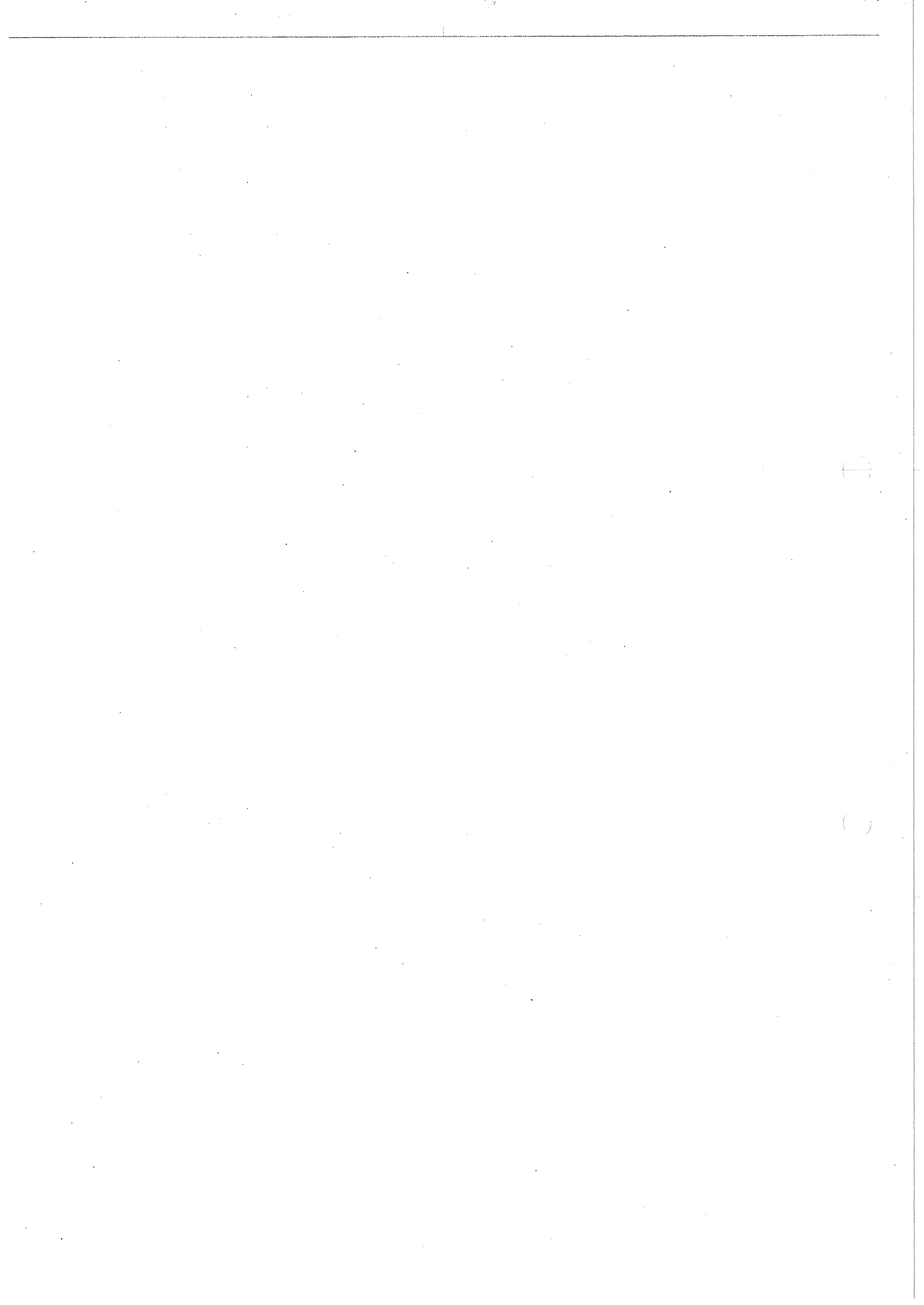
The last paragraph in point 2 in the section on Commission of Inquiry Priority Matters deals with the "scaling up" of the QPF:

It should also be noted that the QPF adopted at a particular point in time may be reduced or discounted to take into account the rainfall recorded since the QPF was issued, or it may not (that is, practically the QPF may be scaled up).

This is interpreted to mean that the Duty Flood Operations Engineer(s) will continue the practice of "scaling up" the QPF the way they did in the January 2011 flood event. Bob does not agree with this practice, and would be concerned if it applied again, given its potential to mislead other organisations/persons trying to get a sense of what could happen if the rainfall forecast eventuates.

It is noted that there is no mention in the Manual about scaling up of the QPF. DERM is not of the view that the QPF should be 'scaled up' without the advice of the BoM. It is something that will have to be addressed at length in the Longer Term Review of the Manual.

Bob is happy to discuss this point directly with Jim Pruss.



DS 5.3 Processing a flood mitigation manual for a dam following review

WIR/2011/4884 – Version 1

Endorsed 16/09/2011
by Robert Reilly, General Manager, Office of the Water Supply Regulator

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Version History

Version	Date	Comment
1	16/09/2011	Original approval

Purpose

To provide a framework for processing a reviewed flood mitigation manual for a dam submitted by the dam owner under section 373, Part 2, Chapter 4 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Rationale

All dams provide some flood mitigation benefits. However, certain dams are explicitly required to be managed so as to optimise these benefits. These dams are able to provide flood mitigation benefit through the temporary storage and later release of flood flows. As the release of such floodwaters can cause damage to property and/or the environment or potentially put lives at risk, it is essential that the dam be operated in accordance with clearly defined procedures to minimise hazard and damage to life and property while protecting the safety of the dam. A flood mitigation manual ensures that such dams make controlled releases of water for flood mitigation purposes in accordance with pre-agreed conditions. The regulatory framework within which these dams are managed for flood mitigation purposes is contained in sections 370 to 374 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Regulatory context

Section 373 of the Act requires the owner of a dam to review the flood mitigation manual for a dam before the approval for the manual expires. The dam owner must provide the chief executive with a copy of the reviewed flood mitigation manual, for approval under s. 371 of the Act.

The chief executive may also get advice from an advisory council before approving the manual.

Application

This work practice applies to a dam owner who has an existing flood mitigation manual which has been reviewed and/or updated and submitted to the chief executive for approval. The process for approval of the first flood mitigation manual for a dam is a separate work practice. Please refer to the work practice DS 5.1 Flood Mitigation Manual for a Dam.

The dam owner, can at any time, submit an amended or reviewed flood mitigation manual for approval. For continuity the reviewed and/or updated manual must be approved before the expiry of the previous manual.

Procedure

This work practice is set out below.

A flow chart for this work practice can be found in Attachment A <attachments/a-ds5-3-fmm-flowchart.pdf> .

Step 1 - Receiving a reviewed flood mitigation manual

Upon receiving the reviewed flood mitigation manual being submitted for approval, the project officer:

- Stamps the covering letter (or a copy of the front page and contents page of the manual if there was no covering letter) with the Document Received by DERM stamp
- Scans the document (or copy created above) and records details in Keeper on the file for the dam and fills in the relevant sections of the document received stamp in accordance with local office processes and departmental standards
- Updates WICD–RDR
- Prepares an acknowledgement letter to the dam owner that the reviewed flood mitigation manual has been received and is being assessed. Refer to Attachment B <attachments/b-ds5-3-fmm-ack-let.pdf> for a template for an acknowledgement letter (A template for this letter is available in G:\WIR\Dam_Safety\Templates).
- Gives all documents and the file (if required) to the decision maker.

The Director, Dam Safety (Water Supply):

- Checks and signs the letter confirming receipt of the manual. If changes are necessary to the draft letter confirming receipt of the reviewed manual, the Director, Dam Safety (Water Supply) should make the changes and return the letter to the project officer for updating prior to signing.
- Allocates an assessment officer to assess the amended manual.
- Gives the signed letter, the manual and the file to the project officer.

The project officer:

- Copies and sends the signed letter.
- Scans the signed letter and registers the letter in Keeper in accordance with local office processes and relevant departmental standards.
- Places the copy of the signed letter on the file relating to the flood mitigation manual for the dam.
- Updates WICD–RDR with appropriate information.
- Gives the manual and file to the assessment officer.

Proceed to Step 2

Step 2 - Assessment officer conducts an assessment of the reviewed flood mitigation manual

The assessment officer:

- Conducts a detailed assessment of the reviewed flood mitigation manual. Assessment officers are expected to conduct the detailed assessment having regard to the matters outlined in the guidelines and work procedures issued under the Act's provisions and other Queensland Government policy statements as advised by the chief executive of DERM (see references section of this work practice). The assessment must also include the Reviewed Flood Mitigation Manual (FMM) Assessment and Decision Form and the notes in that form (see Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf> . A template for this form is available in G:\WIR\Dam_Safety\Templates).

- Requests, if appropriate, legal review of the reviewed FMM from the Legal Services section of the department (in accordance with departmental processes).
- Completes the Reviewed FMM Assessment and Decision Form as the assessment occurs.

The purpose of the flood mitigation manual checklist (checklist) which forms part of the Reviewed FMM Assessment and Decision Form is to assist the assessment officer to determine whether the flood mitigation manual complies with the Act and the guidelines and to enable the assessment officer to make a recommendation on whether the reviewed flood mitigation manual should be approved. However, assessment officers should note that the checklist is not intended to be relied upon by assessment officers as an exact statement of the Act and the guidelines and it is essential that assessment officers regularly refer to the full text of those documents to determine the precise details of these requirements.

Discussions with dam owners and other stakeholders may be undertaken to refine the content of the manual and to ensure that the reviewed flood mitigation manual is adequate for its required purpose. See Step 3.

In completing the Reviewed FMM Assessment and Decision Form the assessment officer:

- Records on the Reviewed FMM Assessment and Decision Form whether the manual complies with the Act and the guidelines.
- Includes appropriate comments in the Reviewed FMM Assessment and Decision Form about individual items (in the comments column for the appropriate item/s). Note: if the assessment officer believes additional information or clarification of information is required proceed to Step 3 prior to completing this step.
- Completes the 'assessment officer's recommendation to decision maker' part of the Reviewed FMM Assessment and Decision Form, including all items that are relevant to the recommendation/s made.
- Gives the Reviewed FMM Assessment and Decision Form, the manual and the file to the decision maker.

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept and retained in Keeper and on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

Proceed to Step 4.

Step 3 - Request further information

In some situations the assessment officer may need to communicate with the owner of the dam, or other people, to clarify certain issues for the assessment of the reviewed flood mitigation manual (this may include editorial amendments and minor corrections to the FMM). **Accurate and written records of any communications, including verbal communications, must be kept and retained in Keeper and on the relevant departmental file.** These records should indicate who was contacted or consulted about particular issues, when this occurred and the advice that was given. It may also be appropriate for the assessment officer to make some reference to these communications in the Reviewed FMM Assessment and Decision Form itself (for example, in the comments column for the appropriate item/s in the checklist).

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

A suggested format for a letter requiring further information can be found at Attachment D <attachments/d-ds5-3-fmm-req-info.pdf> . A template for this letter is available in G:\WIR\Dam_Safety\Templates.

The letter requiring further information must:

- Be prepared on the basis of the information contained in the Reviewed FMM Assessment and Decision Form (see Step 2) and
- Be sent to the owner of the dam.

Return to Step 2 when requested information is received.

Step 4 - Decision maker makes decision about reviewed flood mitigation manual

The decision maker:

- Considers the reviewed flood mitigation manual and the recommendation made by the assessment officer.
- Decides what action should be taken in relation to the reviewed manual. The decision maker is expected to assess the appropriate action to take having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form and the notes to that form (Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf>).
- Completes the 'decision maker's decision' part of the Reviewed FMM Assessment and Decision Form.
- Gives the completed Reviewed FMM Assessment and Decision Form, the manual and the file to the assessment officer.

Depending on the situation, available options for the decision maker may be to:

- Seek further advice (this could be legal advice or advice from an advisory council)
- Not approve the manual because it does not meet the expected requirements for approval. *Go to Step 5.*
- Approve the manual – *Go to Step 6.*
- Require more information from the dam owner – *Go to Step 3.*
- Require a more detailed assessment of the FMM by the assessment officer – *Go to Step 2.*

If the decision maker decides more information is required from the dam owner, they should indicate this on the Reviewed FMM Assessment and Decision Form and return all documentation to the assessment officer who will return to Step 3.

Step 5 - Assessment officer prepares non-approval letter for the reviewed flood mitigation manual

Assessment officer receives the decision to not approve the reviewed manual from the decision maker and prepares a draft letter (including yellow file copy) advising that the reviewed flood mitigation manual doesn't meet the requirements of the Act and relevant guidelines. See Attachment E <attachments/e-ds5-3-fmm-non-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter to the decision maker who either signs the letter or requests changes to be made.

Once the decision maker has signed the letter the assessment officer sends the letter to the dam owner.

If a new flood mitigation manual is received from the dam owner in response to the letter return to Step 1.

Go to Step 7.

Step 6 - Assessment officer prepares gazette notice

Assessment officer receives the decision to approve the reviewed manual from the decision maker and prepares a draft gazette notice and completes a request to publish in the Queensland government gazette form.

- The gazette notice should state the following:
- The notice number and year
- The date and approval details for the reviewed manual
- The dates for which the reviewed manual is approved. This may be for the remainder of the approval period for the existing approved manual or for not more than five years from the date of approval of the reviewed manual.

Note: see Attachment F <attachments/f-ds5-3-fmm-gaz-notice.pdf> for a draft template of the gazette notice. A template for this document is available in G:\WIR\Dam_Safety\Templates. The request to publish in the Queensland Government Gazette form is available from Executive Council Team (ECT), Cabinet and Parliamentary Services or on insite.

Once the notice has been prepared and the form completed they must be signed off by the Director, Dam Safety (Water Supply) (or a higher position) and sent to ECT. The electronic version of the gazette notice must also be sent by email. The ECT will arrange for publication of the notice in the gazette and will advise the assessment officer by email of the publishing of the notice. Go to Step 7 when gazettal has taken place.

Step 7 - Letter sent to dam owner advising of approval of reviewed manual

The assessment officer prepares draft letter (including yellow file copy) to dam owner advising of approval of the reviewed manual and enclosing a copy of the gazette notice. See Attachment G <attachments/g-ds5-3-fmm-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter and copy of the gazette notice to the decision maker for signing.

Once the letter has been signed by the decision maker the project officer sends the letter and gazette notice to the dam owner.

Go to Step 8.

Step 8 - Assessment officer takes appropriate action with respect to RDR, the file and departmental records

The assessment officer:

- conducts a final check to ensure all relevant data has been entered into WICD–RDR.
- checks the completed Reviewed FMM Assessment and Decision Form has been signed by the assessment officer and decision maker, and that this form and all other documents created or received during the course of this work practice have been placed on the appropriate departmental file/s.
- returns the departmental file to the project officer who will check that all relevant documents have been registered in Keeper. If not, the project officer will register the documents in Keeper in accordance with local office processes and relevant departmental standards.

The processing of a flood mitigation manual for a dam following review is complete.

Responsibilities

Dam owner – under section 373 of the Act, the dam owner must, before an approval for the flood mitigation manual for a dam expires, review, and if necessary, update the flood mitigation manual and give a copy of the reviewed manual, for the dam to the chief executive for approval under s. 371.

Chief executive – section 371(2) of the Act gives the chief executive the power to approve the reviewed flood mitigation manual for a dam.

Under the Water Supply (Chief Executive) Delegation the above powers of the chief executive have been delegated to the following positions:

1. Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator
2. Project Director, Dam Safety, Office of the Water Supply Regulator (position number 76025966)
3. Director, Water Industry Asset Management and Standards, Office of the Water Supply Regulator
4. General Manager, Office of the Water Supply Regulator.

Decision makers – if the decision maker is not the Director-General, DERM he/she must ensure that he/she has, at the time of making his/her decision, a current delegation allowing him/her to make his/her decision. This is important as instruments of delegation can be revoked and replaced from time to time.

Assessment officer – is required to carry out the assessment of a reviewed flood mitigation manual, submitted to the Department under s. 373 for approval under s. 371 of the Act, having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form (Attachment C [<attachments/c-ds5-3-fmm-a-d-form.pdf>](#)) and the notes to that form. The assessment officer is expected to complete the form, as the assessment occurs, and must take into account the requirements of the guidelines, departmental policy documents and this work practice.

Project officer – performs any administrative duties as required under this work practice or by the assessment officer or decision maker or Director Dam Safety (Water Supply).

Definitions

"**the Act**" – means the Water Supply (Safety and Reliability) Act 2008

"**assessment officer**" – refer to the responsibilities section of this work practice.

"**chief executive**" – means the Director-General, Department of Environment and Resource Management

"**dam**" –

1. *Dam* means–
 - Works that include a barrier, whether permanent or temporary, that does or could impound water; and
 - The storage area created by the works.
2. The term includes an embankment or other structure that controls the flow of water and is incidental to works mentioned in paragraph (1) above.
3. The term does not include the following:
 - A rainwater tank;
 - A water tank constructed of steel or concrete or a combination of steel and concrete;
 - A water tank constructed of fibreglass, plastic or similar material.

"**decision maker**" – means the person making the decision to approve a reviewed flood mitigation manual for a dam, under this work practice. This may be the Director-General, DERM or a person who has been delegated the power to approve a flood mitigation manual.

"**DERM**" – Department of Environment and Resource Management.

"**Director, Dam Safety (Water Supply)**" – for the purposes of this work practice – means Director, Dam Safety (Water Supply) or the Project Director, Dam Safety (Position No. 76025966).

"**flood mitigation manual**" or "**manual**" or "**FMM**" – means a manual prepared under s. 370, or reviewed and updated under s. 373.

"**guidelines**" - means Guidelines for Failure Impact Assessment of Dams; Queensland Dam Safety Management Guidelines; Guidelines on Acceptable Flood Capacity for Dams; Emergency Management Planning for Floods Affected by Dams (2009) - Australian Government (Manual 23 of Australian Emergency Manual Series); Work practice DS 5.3 Processing a flood mitigation manual for a dam following review (WIR/2011/4884 in the Policy Register) and other Queensland Government policy statements as advised by the chief executive.

"**insite**" – means the internal website for use by officers of the department.

"**project officer**" – refer to the responsibilities section of this work practice.

"**RDR**" – means the Referable Dam Register of the Water Industry Compliance Database – the module within WICD that records administrative information about referable dams.

"**WICD**" – means Water Industry Compliance Database – a database that records information relating to service providers and dams.

References

The following documents should be referenced in conjunction with this work practice:-

- *Water Supply (Safety and Reliability) Act 2008*
- Water Supply (Chief Executive) Delegation (No. 1) 2011
- Work Practice DS 5.1 Flood mitigation manual for a dam (WIR/2009/3991 in policy register).
- Queensland Dam Safety Management Guidelines
- Guidelines for Acceptable Flood Capacity for Dams
- Guidelines for Failure Impact Assessment of Water Dams
- Emergency Management Planning for Floods Affected by Dams (2009) – Australian Government (Manual 23 of Australian Emergency Manual Series).

Officers involved in this work practice should also be familiar with, and comply with, requirements of the following departmental standards:

- Departmental policy RKP/2006/2907 – Recordkeeping overarching policy
- Departmental policy RKP/2006/2899 – Recordkeeping email policy
- Departmental standard IMP/2005/2253 – Procedures for using electronic mail
- Departmental standard ADM/2005/941 – Paper-based document management
- Departmental standard ADM/2002/965 – Decision making and requests for statements of reasons under the Judicial Review Act 1991
- Departmental standard ADM/2003/1402 – Information privacy.

Legislation

Water Supply (Safety and Reliability) Act 2008

Attachments

Attachment A – Flowchart <attachments/a-ds5-3-fmm-flowchart.pdf>

Attachment B – Acknowledgement letter <attachments/b-ds5-3-fmm-ack-let.pdf>

Attachment C – Assessment and decision form <attachments/c-ds5-3-fmm-a-d-form.pdf>

Attachment D – Request for information letter <attachments/d-ds5-3-fmm-req-info.pdf>

Attachment E – Non-approval amended flood mitigation manual letter
<attachments/e-ds5-3-fmm-non-app-let.pdf>

Attachment F – Gazette notice <attachments/f-ds5-3-fmm-gaz-notice.pdf>

Attachment G – Approval of amended flood mitigation manual letter <attachments/g-ds5-3-fmm-app-let.pdf>



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[No. 40

Water Supply (Safety and Reliability) Act 2008

**APPROVAL OF FLOOD MITIGATION MANUAL
NOTICE (No 01) 2011**

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 01) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on 1 October 2011 approved the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 8 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on 1 October 2011.
 2. Not required to be laid before the Legislative Assembly.
 3. The administering agency is the Department of Environment and Resource Management.
-

CTS No. 17720/11

Department of Environment and Resource Management
A/DIRECTOR-GENERAL BRIEFING NOTE

TO: A/Director-General

Approved	Not Approved	Noted
Further information required		
A/DG.	[Redacted]	
Dated	11/10/11	

SUBJECT: Approval of Flood Mitigation Manual – Manual of Operational Procedures for Flood Mitigation at North Pine Dam.

TIMEFRAME/REQUESTED BY

- This brief was initiated by the department.
- A decision is urgently required by 9am 14 October 2011 at the very latest to comply with a recommendation in the Interim Report of the Queensland Floods Commission of Inquiry and a commitment by the Minister for Finance, Natural Resources and The Arts.

RECOMMENDATION

It is recommended that the A/Director-General:

- by Gazette notice, approve the attached (Attachment A) Manual of Operational Procedures for Flood Mitigation at North Pine Dam, Revision 6, October 2011 (the Manual) under section 371 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).
- tick the approval box and sign the Reviewed Flood Mitigation Manual Assessment and Decision Form as decision maker (Attachment B) and write in the number of years of the approval (five years is recommended, but it may be any period up to five years).
- note that if the Manual is approved, an urgent Extraordinary Government Gazette Notice (gazette notice) will be published. The gazette notice will function as the approval of the Manual under the *Water Supply (Safety and Reliability) Act 2008*.
- note that the department's Executive Officer, Inquiry Recommendations Implementation Group is working to have the gazette notice published by 14 October 2011 and that the last available time to order the notice is 10am on 14 October 2011.

BACKGROUND

- The Queensland Bulk Water Supply Authority trading as Seqwater (Seqwater) owns and operates North Pine Dam.
- Flood operations at North Pine Dam are controlled by a Flood Mitigation Manual. The current Flood Mitigation Manual for North Pine Dam (Manual of Operational Procedures for Flood Mitigation at North Pine Dam, Revision 5, August 2010) was approved by an authorised delegate of the chief executive under section 371 of the *Water Supply (Safety and Reliability) Act 2008* by gazette notice on 17 December 2010.
- The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission completed its first round of public hearings on 27 May 2011. The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011.
- The Director-General is authorised to approve the Manual by Gazette Notice pursuant to section 371 of the *Water Supply (Safety and Reliability) Act 2008*. The relevant section of the legislation is extracted and attached (Attachment C). It is important to note that the approval is effected by publication of a gazette notice and the date of approval will be the date of the gazette notice not the date this briefing note is approved. A draft gazette notice is attached (Attachment D)

Author Name: Peter Allen [Redacted] Position: Project Director, Dam Safety Tel No: 3224 [Redacted] Date: 11 October 2011			Recommended: Name: Bob Reilly [Redacted] Position: General Manager, Office of the Water Supply Regulator Tel No: 3224 [Redacted] Date: 11 October 2011
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- The authority to approve Flood Mitigation Manuals under the above section has also been properly delegated pursuant to the *Water Supply (Chief Executive) Delegation (No. 1) 2011* to:
 - General Manager, Office of the Water Supply Regulator
 - Director, Water Industry Asset Management & Standards, Office of the Water Supply Regulator
 - Project Director, Dam Safety, Office of the Water Supply Regulator (Position No 76025966)
 - Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator.
- However, because compliance with the Interim Report recommendations of the Commission is a whole of government commitment it is appropriate that the Director-General approve the Manual.

CURRENT ISSUES

- Recommendation 2.25 of the Commission's Interim Report stated that Seqwater should:
 - conduct an interim review of the North Pine Dam manual
 - have the draft manual assessed by independent expert peer reviewers
 - consider the expert peer reviews
 - submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.
- The Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 8, September 2011 was approved by gazette notice on 1 October 2011, in time to meet the requirements of the Commission.
- Around this time, the Minister for Finance, Natural Resources and The Arts announced publicly and flagged to the Commission that the North Pine Dam Flood Mitigation Manual would not be ready by 1 October 2011 but that it would be ready by 14 October 2011.
- A letter dated 11 October 2011 from Seqwater submitting the Manual for approval is attached (**Attachment E**).
- That letter also enclosed Explanatory Notes to the Manual (**Attachment F**).
- That letter also enclosed a letter dated 10 October 2011 from Seqwater's independent peer reviewer, Mr Len MacDonald (**Attachment G**) stating that he is satisfied with the Manual.
- Prior to the release of the Interim Report the Commission released draft findings for comment to particular interested parties, which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals. The Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the Flood Mitigation Manuals however it was considered prudent that this issue be addressed. The General Manager, OWSR wrote to Seqwater requesting that a delegation power be inserted into the Flood Mitigation Manuals for North Pine Dam. (CTS14552/11 **Attachment H** - This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services). A delegation power has been inserted into the Manual at section 1.9.
- A Principal Lawyer, Legal Services (Floods Commission of Inquiry Liaison) has reviewed the Manual and prepared a Legal Advice that has been reviewed by a Deputy Crown Solicitor at Crown Law. The Legal Advice including a copy of the letter from Crown Law dated 29 September 2011 is attached (**Attachment I** - This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services).
- The Project Director, Dam Safety has, as assessment officer, assessed the Manual under policy and procedure DS5.3 (**Attachment J**) and recommended that the decision maker approve the Manual (**Attachment B**).

Author Name: Peter Allen Position: Project Director, Dam Safety Tel No: 3224 [REDACTED] Date: 11 October 2011			Recommended: Name: Bob Reilly Position: General Manager, Office of the Water Supply Regulator Tel No: 3224 [REDACTED] Date: 11 October 2011
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- A longer term review of the Flood Mitigation Manual for North Pine Dam is being undertaken by Seqwater in consultation with the department in accordance with recommendations 2.27 and 2.28 of the Commission's Interim Report.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- There are no resource/implementation implications for DERM.

PROPOSED ACTIONS

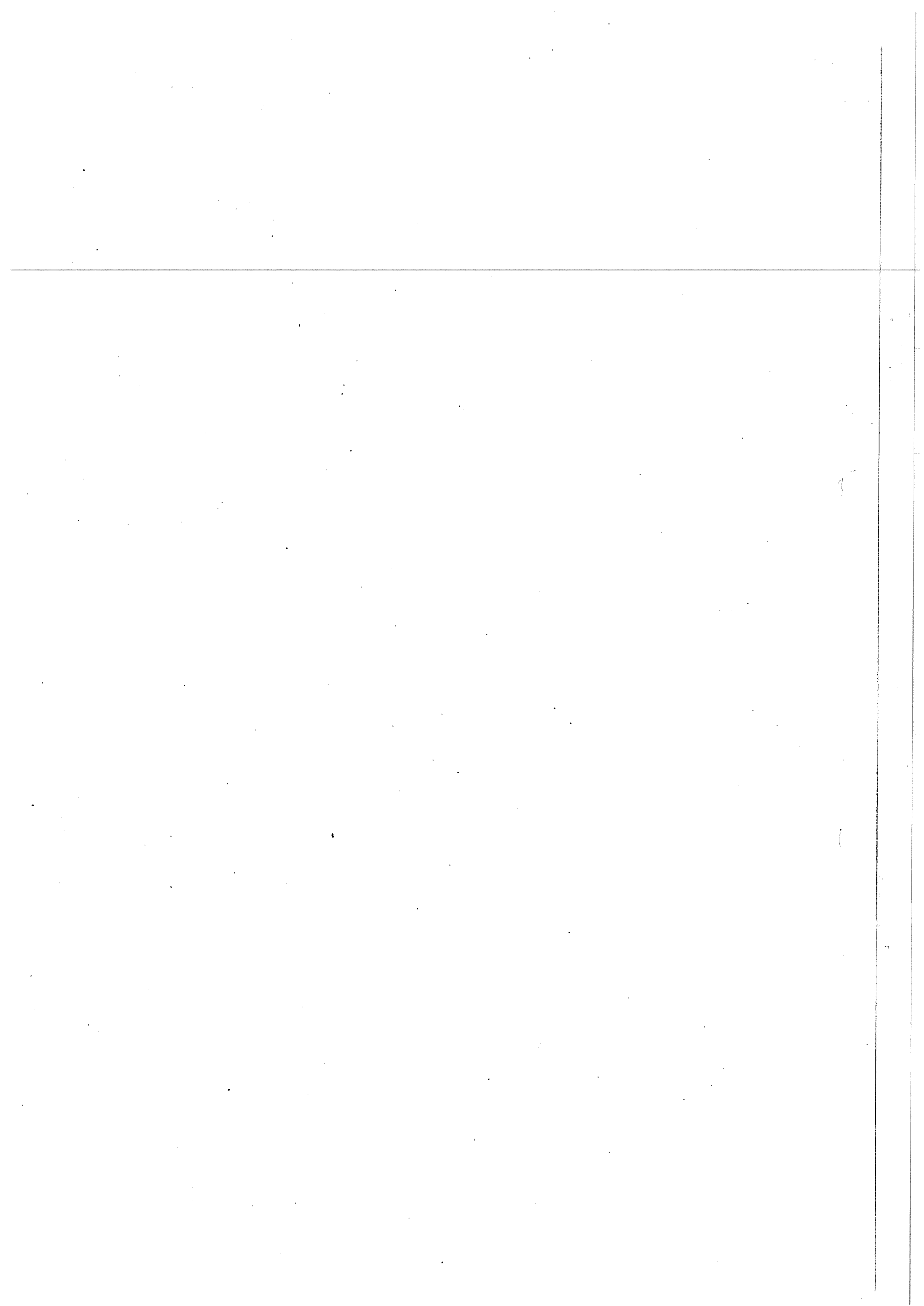
- If the Manual is approved the Executive Officer, Inquiry Recommendations Implementation Group will arrange for an Extraordinary Government Gazette Notice to be published on an urgent basis.
- The department will continue to work with Seqwater on the longer term review of the North Pine Flood Mitigation Manual and the Wivenhoe and Somerset Flood Mitigation Manual.

ACTING DIRECTOR-GENERAL'S COMMENTS

ATTACHMENTS

- Attachment A: Manual of Operational Procedures for Flood Mitigation at North Pine Dam (the Manual), Revision 6, October 2011 for approval.
- Attachment B: Reviewed Flood Mitigation Manual Assessment and Decision Form for signing
- Attachment C: Extract section 371 of the *Water Supply (Safety and Reliability) Act 2008*. ✓
- Attachment D: Draft gazette notice.
- Attachment E: Letter dated 11 October 2011 from Seqwater submitting Manual for approval. ✓
- Attachment F: Explanatory Notes to the Manual prepared by Seqwater. ✓
- Attachment G: Letter dated 10 October 2011 from Len MacDonald, Seqwater's independent peer reviewer. ✓
- Attachment H: CTS14552/11. ✓
- Attachment I: Legal Advice. ✓
- Attachment J: DS 5.3 Processing a flood mitigation manual for a dam following review.

Author Name: Peter Allen Position: Project Director, Dam Safety Tel No: 3224 [REDACTED] Date: 11 October 2011			Recommended: Name: Bob Reilly Position: General Manager, Office of the Water Supply Regulator Tel No: 3224 [REDACTED] Date: 11 October 2011
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REVIEWED FLOOD MITIGATION MANUAL ASSESSMENT AND DECISION FORM

General Information

Name of dam North Pine Dam

Reference number/s (from Referable Dam Register) North Pine (#334)

Dam owner contact details Queensland Bulk Water Supply Authority (trading as Seqwater)

Date reviewed flood mitigation manual received by DERM 11 October 2011

Date approval for existing flood mitigation manual expires 17 December 2015

DERM file details DAM/130/000(0334) / CBD/024083

Supporting Information received from the dam owner Letter detailing what was contained in the submission.

Explanatory Notes produced by Seqwater detailing how the Queensland Flood Commission of Inquiry recommendations have been addressed.

Letter from Mr Len McDonald who acted as an independent peer reviewer on the behalf of Seqwater.

Name / position of assessment officer Peter Allen, Project Director Dam Safety

Name / position of decision maker Terry Wall, A/Director-General

Due date for completion of review Recommendation 2.25 of the Queensland Floods Commission of Inquiry Interim Report recommended that the Interim Review of the North Pine Dam Manual be approved before 1 October 2011. This was not achieved because priority was given to getting the Somerset/Wivenhoe Flood Mitigation Manuals approved by 1 October 2011.

REVIEWED FLOOD MITIGATION MANUAL CHECKLIST

	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	
Issue		Comments (include the reasons/details of the rating given)
Amendments since previous manual		
1.	3	Seqwater have provided a summary document of changes made to the manual, including those made in order to satisfy the recommendations made in the Queensland Floods Commission of Inquiry (QFCOI) Interim Report dated 1 August 2011. They have not provided a detailed list of all changes.
Consultation		
2.	3	The Manual has been reviewed as a result of a recommendation of the Queensland Floods Commission of Inquiry. The Dam Owner has indicated that because of the very tight timelines required to satisfy the Commission of Inquiry recommendations, it has not been practicable to consult with external stakeholders as part of the Interim Review of the Manual. However, significant external stakeholder consultation will be part of the Longer Term Review of the Manual.
3.	3	See item 2.
Direction of operations		
4.		
4.	5	<p>Does the manual include the following</p> <ul style="list-style-type: none"> • Operational arrangements to unambiguously define flood release operations for the dam during flood events <p>Yes. This is explicitly defined in the Manual. It has been the subject of overall review by Seqwater appointed independent peer reviewer (Len McDonald – formerly Chair of the NSW Dam Safety Committee) and an extensive legal review by Seqwater legal representatives and DERM lawyers.</p> <p>There has been some modification to the gate opening schedules from those detailed in Revision 5 of the Manual. This is discussed further in the Attachment to this document.</p>

Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
<ul style="list-style-type: none"> Designation and responsibilities of those responsible for Flood Operations including qualifications and experience. 	5	<p>Yes. Arrangements are largely unchanged to those of the previous Manual (Revision 5). There have been minor editorial changes to more clearly define responsibilities.</p> <p>One variation is the removal of the need for Flood Operations Engineers to be registered Professional Engineers of Queensland (RPEQ) because they are acting under the direction/supervision of the Senior Flood Operations Engineers. DERM legal advice indicates this is reasonable.</p>
5. Does the manual cover training for relevant personnel	5	<p>Yes. As per Revision 5. However, a briefing note is to be sent to the A/Director General recommending that he sign a letter to Seqwater detailing the 'chief executive's training requirements for the period 1 October 2011 to 30 September 2012' in accordance with Recommendation 2.6 of the Commission of Inquiry.</p>
6. Does the manual detail the following reporting requirements		
<ul style="list-style-type: none"> Training 	5	<p>Yes. Refer to Section 2.8 of Revision 6. See also comment for Item 5 above.</p>
<ul style="list-style-type: none"> Flood preparedness 	5	<p>Refer to Section 2.3 of Revision 6.</p>
<ul style="list-style-type: none"> Flood event reporting 	5	<p>Refer to Section 2.13 of Revision 6. The details of what is required in the post-event flood reporting have been identified.</p>
Flood Mitigation Objectives		
7. Does the manual cover the following objectives and assign priorities to each objective:-		
<ul style="list-style-type: none"> Structural safety of dam/s 	5	<p>Refer to Section 3.2 of Revision 6. Details are provided of the need to not overtop the dam.</p>

Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
<ul style="list-style-type: none"> Protection of urbanised areas from inundation. 	5	<p>Refer to Section 3.3 of Revision 6. Because there is virtually no flood mitigation capacity built into the dam, there is very little scope for special provisions for 'protection of urbanised areas from inundation'. Reference is made to a discharge of 500m³/sec which Seqwater indicates is effectively well within the bankfull discharge in the North Pine River. There is no specific mention of 'pre-releases' (refer to Commission of inquiry Interim Report Recommendation 2.26) in the revised manual. However it is made clear in Section 4.5 that in particular circumstances gates can be opened prior to FSL being exceeded. Also maintaining the Lake Level at EL 39.60 mAHd for longer duration events is effectively a pre-release which is done to maximise the ability to safely pass larger floods. This is effectively a 'dam safety' measure but can have minor overall flood mitigation benefits.</p>
<ul style="list-style-type: none"> Minimise disruption to downstream rural communities (if applicable) 	5	<p>Refer to Section 3.3 of Revision 6 indicates there is 'only limited flood mitigation benefits'. The details of the flood release strategies are contained in Section 4.</p>
<ul style="list-style-type: none"> Minimise impact on flora and fauna 	5	<p>Refer to Section 3.5 of Revision 6. It provides some consideration of minimising harm to fish populations. In a practical sense this allows for variations to gate openings in order to organise groups to carry out fish recovery operations during daylight hours.</p>
Flood monitoring and forecasting		
8. Does the manual detail the provision of real time flood data to BOM for the issuing of flood warnings and any necessary flood modelling?	4	<p>Described in Section 2.12. Because the BoM does not specifically provide flood warnings for the Pine River system (it is classified as a flash flooding situation), there is no specific requirement to advise BoM of flood releases (as is provided for in the Somerset/Wivenhoe Flood Manual). Advice is given to the Moreton Bay Regional Council who use this advice as part of their local disaster management plans.</p>

	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
9. Have details of the operation of the overall operating system been included	5	Because of the limited flood mitigation capacity, the dams operating strategy is based on setting a target discharges for given Lake Levels. In order to maximise the safety of the dam, there is provision to limit the Lake Level rise for longer duration events where inflows can be estimated more reliably. Limits on gate opening rates for small floods prevent rapid increases in discharges for these events. The gate operating procedures are detailed in Section 4 of the Manual.
10. Does the manual detail an appropriate flood monitoring and forecasting system?	4	Details of where the individual ALERT stations are located or the mechanics of the software are not provided. However, it is a well established system and there are sufficient details/requirements built into the Manual to require adequate maintenance and future development of the system.
Communications		
11. Does the manual cover communications with the following: <ul style="list-style-type: none"> • Stakeholder agencies (e.g. Bureau of Meteorology, DERM, relevant councils affected by the dam) • Operational staff employed by the dam owner • Public 	4 4 3	Refer to Item 8 above. List of types of communication included in Section 2.11. During flood events there is no provision for communicating with the public. This is handled in the Emergency Action Plan for the dam.
Review		
12. Does the manual allow for variation to the document when technical and physical conditions relating to the dam change.	5	Section 4.8 provides for the use of 'Reasonable Discretion' in the event that a Senior Flood Operations Engineer considers it necessary. Section 1.6 provides for non-temporary variations to the manual. These should be adequate for the purpose.

Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
13. If no other changes are required (as per No. 12 above) does the manual include details of the mandatory review that is required within the time frame set by the chief executive? Note: the manual should include details such as <ul style="list-style-type: none"> • how detailed the review should be • things to be considered during the review. A review may or may not result in a change to the manual.	N/A	See Item 12. It does not cover the ability of the chief executive to request particular changes to the Manual ... but that is contained in the Water Supply Act and does not need duplication.
Operation during flood events		
14. Does the manual include details of:		
<ul style="list-style-type: none"> • infrastructure for flood releases (this may include diagrammatic representations) 	5	Good overall description in Section 4.2.
<ul style="list-style-type: none"> • details of structures to be considered during flood operations 	4	Details of the bridges and crossings impacted on during flood operation are referred to in Section 4.3 and their location is shown in Appendix F. Where 'possible' the Moreton Bay Regional Council is advised of the commencement of flood releases so that they can close Youngs Crossing.
<ul style="list-style-type: none"> • Discharge rating information for gates, spillways and auxiliary spillways 	4	Full details provided in Appendix C with a set of rating curves for a single gate given on page 31.
<ul style="list-style-type: none"> • Initial flood control action 	4	Contains details of who is responsible for mobilisation and when a flood event is declared and when it is completed.

Issue		Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
	• Flood operation strategies	5	Detailed in Section 4. While the overall strategies have remained essentially unchanged from Revision 5, Seqwater have included some variations to provide for more rapid opening of the spillway gates so as to avoid the problems encountered during the January 2011 flood event where dam operators were standing in water and operating high voltage electrical equipment. This can produce marginally higher discharges for smaller floods but has a relatively neutral effect on the outflows from floods larger than the January 2011 flood event. For larger floods that require the gates fully open it provides greater flood mitigation because the headwaters don't build up as high because of the higher earlier releases. A fuller assessment of the implications of these variations is included in an attachment to this document. These strategies will need extensive review as part of the Longer Term Review of the Manual.
	• Gate closing strategies	5	Detailed in Section 4. Essentially it is the reverse of the gate opening strategies.
	• Gate operation sequences	5	Detailed in Section 4.
Emergency flood operations			
15.	Does the manual include the provision for and information on emergency flood operations	5	Emergency flood operations are to proceed in accordance with Section 5. These provisions are the same as those dictated in Section 4.
16.	Are flood operations consistent with the Emergency Action Plan (EAP)?	5	The EAP details the notifications required to other parties. The way the dam is operated is in accordance with this Manual.
Other Issues			
17.	Does this manual raise any other issues not covered in the above checklist?	5	No.
Queensland Floods Commission of Inquiry			
18.	Does this manual comply with the outcomes of the Queensland Floods Commission of Inquiry?	5	In my opinion it does comply with the relevant recommendations made in the QFCOI Interim Report. It has had an extensive legal review and a review of all the technical aspects to ensure consistency and compliance with the Recommendations.

Comment on the results of the detailed assessment of the reviewed manual. In particular comment on the overall extent and significance of any non-compliance with the issues in the checklist or any failures to address the above issues adequately or in sufficient detail

All aspects of the Manual have undergone an extensive review. It has undergone a peer review process by Len McDonald (the former Chairman of the New South Wales Dam Safety Committee) and his comments have been incorporated into the Manual. There have been a lot of editorial changes to reflect current arrangements and the QFCol recommendations.

Detail legal advice received on their review of the legal aspects of the flood mitigation manual (if it was deemed appropriate to seek legal advice).

██████████ (Principal Lawyer, Legal Services) has been reviewing the Manual from a DERM legal perspective and interacting with the Seqwater legal representatives. She has indicated that Revision 6 now satisfies DERM requirements from a legal perspective.

Recommendation and decision

Assessment officer's recommendation to decision maker



Approve the reviewed flood mitigation manual

Reasons for recommendation to approve the reviewed manual

Revision 6 of the Flood Mitigation Manual for North Pine Dam has undergone the Interim Review recommended by the Queensland Floods Commission of Inquiry in their Interim Report of 1 August 2011.

Revision 6 has been extensively reviewed from a technical and a legal perspective and now satisfies all the relevant recommendations made by the Commission of Inquiry. The Seqwater appointed independent peer reviewer is 'satisfied with the manual'.

It is recommended that it be approved for a period of five years. It is expected that it will ultimately be superseded by the next revision once the longer term review recommended by the Commission of Inquiry is completed.

Evidence for the findings

Note: Documents, information, Acts, standards and guidelines that were considered in the course of carrying out this assessment and making this recommendation. List all contacts with the dam owner, information given to the dam owner and information received or used in making the recommendation.

- *Water Supply (Safety and Reliability) Act 2008*
- Work practice DS 5.3 Assessing a flood mitigation manual for a dam following review (WIR/2011/4884 in the policy register)
- DERM files **DAM/130/000(0334)/ CBD/024083 (Keeper file)**
- Interim Report of Queensland Floods Commission of Inquiry (QFCol), 1 August 2011.
- Revision 5 of Manual of operational Procedures for Flood Mitigation at North Pine

Dam, August 2010.

- Revision 6 of Manual of operational Procedures for Flood Mitigation at North Pine Dam, October 2011.
- Peer Review Letter by Independent Peer Reviewer (Len McDonald) provided by Seqwater
- The Attachment A to this Recommendation form.

Findings on material facts

Note: That is, the results of the flood mitigation manual checklist.

- Under section 373 of the Act the owner of the dam reviewed and updated the existing approved flood mitigation manual for North Pine Dam and submitted it to the department for approval on 11 October 2011.
- The QFCoI recommended an interim review of the Manual with a view to having it ready for the 2011/2012 wet season.
- Revision 6 of the Manual satisfies all the recommendations made by the QFCoI.
- There has been extensive review of the release strategies for the dam with the aim of clarifying the existing procedures and ensuring consistency across the Manual.
- I have reviewed the revised gate opening strategy for North Pine Dam and found that while there is an increase in discharges for smaller floods I consider this is balanced by a significant improvement in the safety of the dam by fully opening the spillway gates earlier and avoiding dam operators having to go near high voltage operating gear while wading in water.
- The next stage for the review of the Manual is the 'Longer Term Review' in accordance with recommendations 2.27 and 2.28 of the QFCoI Interim Report. This has already begun but may not be completed for a couple of years.

Reasons for the recommendation

Note: These are the reasons for the conclusion, in this part you assess the evidence and say how it was applied; you give a logical explanation for the recommendation.

- Revision 6 satisfies all the recommendations made by the Queensland Floods Commission of Inquiry in their Interim Report published on 1 August 2011. In particular, there is no mention of 'pre-releases'. This was a term which caused confusion during the Inquiry hearings and needed to be clarified.
- Revision 6 has been extensively reviewed by DERM Lawyers. This has ensured a consistency of language throughout the Manual..

Certification and signature of assessment officer

I have complied with the procedure for processing a flood mitigation manual for a dam following review. When making this recommendation, I have taken the material described above, the requirements of the *Water Supply (Safety and Reliability) Act 2008*, relevant guidelines, the matters outlined in the procedure for processing a flood mitigation manual for a dam following review and departmental training I have received, into account when making this recommendation.

Signature of assessment officer



Position of assessment officer

Project Director Dam Safety

Date recommendation made

11 October 2011

Decision maker's decision (tick appropriate box/es and delete those not needed)

Authority to make decision

Water Supply (Safety and Reliability) Act 2008

Seek further advice

Person/s advice is to be sought from

Approve the reviewed flood mitigation manual

Approval timeframe (not more than 5 years)

5 YEARS.

Further investigations by the assessment officer are required before a final decision is made

Issues to be further investigated by the assessment officer

Time frame for completion of investigations

Not approve the reviewed flood mitigation manual

Reasons to not approve the reviewed manual

Require additional information about the reviewed flood mitigation manual

Details of additional information required

Time frame for the information to be provided to the chief executive

[Redacted box]

Certification and signature of decision maker

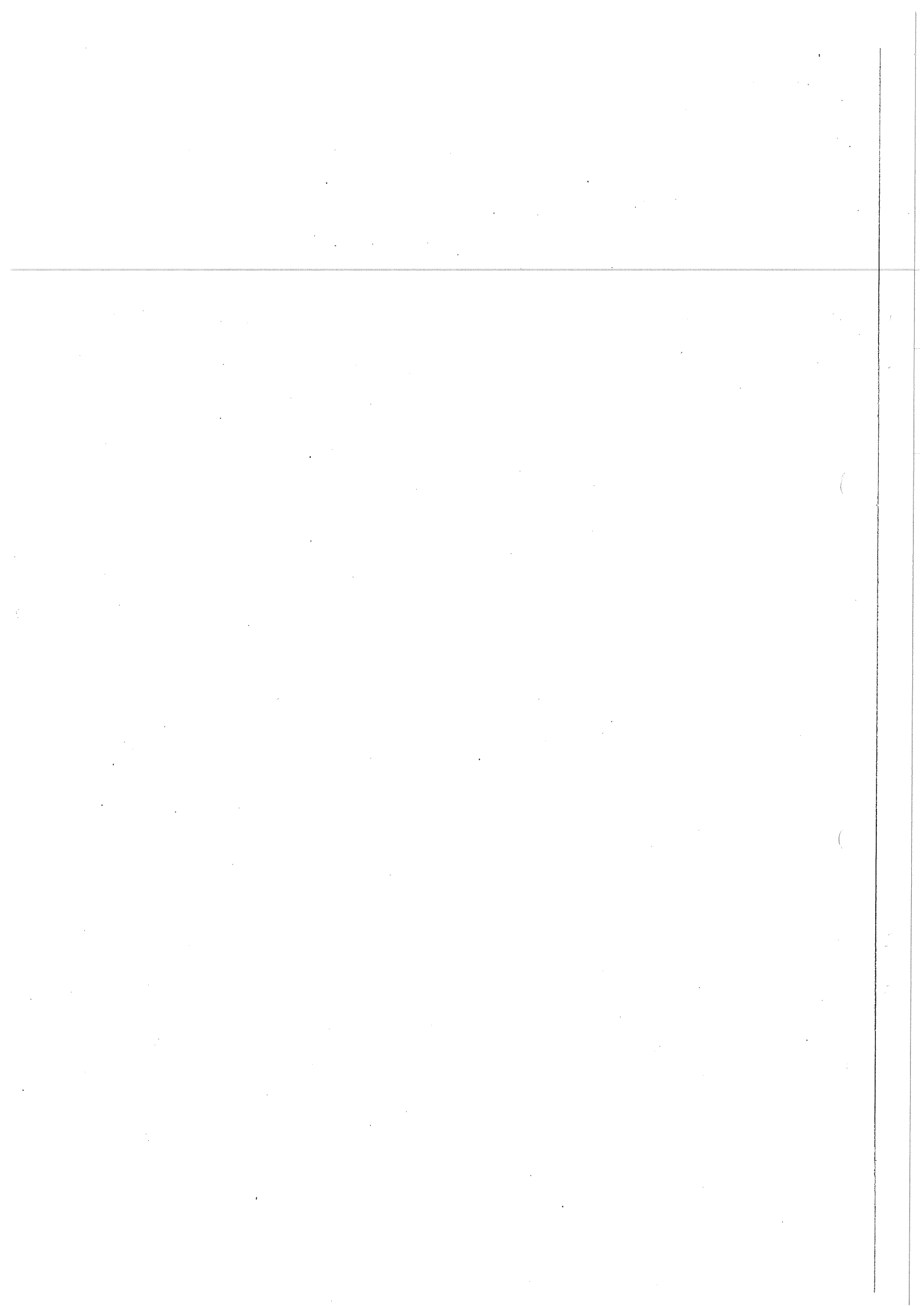
I have complied with the procedure for processing a flood mitigation manual for a dam following review when making this decision. I have taken the assessment officer's recommendation and the documents and information described above into account when making this decision.

Signature of decision maker

[Redacted signature]

Date of decision

11.10.11



Revision 6 of North Pine Dam Flood Mitigation Manual

Comment on Amendments to Revision 5 of Gate Operating Strategy

(Attachment to DS 5.3 Recommendation Form Dated 10 October 2011)

Changes into Appendix C Gate Openings

Because the only significant technical change to the North Pine Dam operating strategies were designed to ensure that the spillway radial gates were fully opened sooner, I have reviewed how the dam would perform with strict compliance with the minimum gate openings specified in Revision 5 and those proposed to be approved in Revision 6 for a range of design flood events and for the January 2011 flood event.

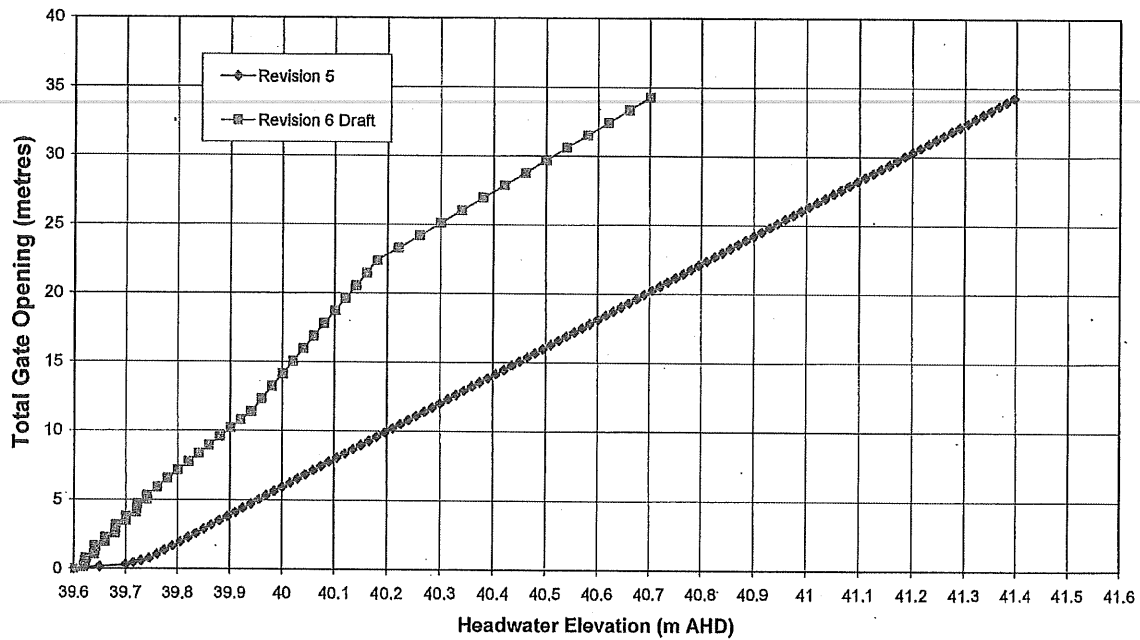
The gate openings are specified in Appendix C of both Manuals.

The major changes proposed in Revision 6 include:

- The relatively early openings (with respect to Lake Level)
- The complete opening of the gates by EL 40.7 metres and the provision of multiple gate movements for individual gates when the Lake Level rises above EL 39.76 so as to ensure the gate openings can be achieved during major floods.
- In order to minimise the rates of rise downstream at the start of a flood event, there is no reduction in the gate opening time intervals when the predicted maximum Lake Level is below EL 39.8 metres or when the predicted inflow is less than 500 m³/sec.

A comparison between the total minimum gate openings against headwater is illustrated below:

North Pine Dam - Gates Openings for a Given Headwater



This proposal from Seqwater did initially present potential problems for gate operations during floods which I have examined further in the following sections of this Attachment. My concerns mainly relate to the need to conduct a large number of gate movements early in an event which could produce 'hunting'¹ and discharges exceeding inflows.

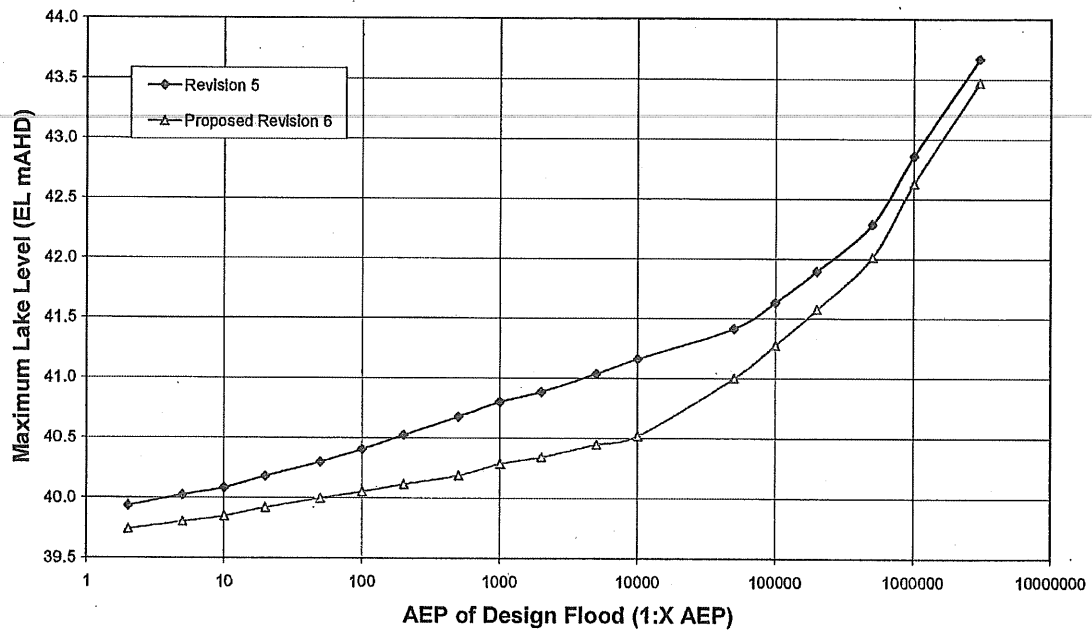
To determine what this change meant in practice, I undertook a comparison of what this meant for the operation of North Pine Dam during the design floods generated by SunWater in 2007 and for the January 2011 flood event.

Performance during Design Flood Events

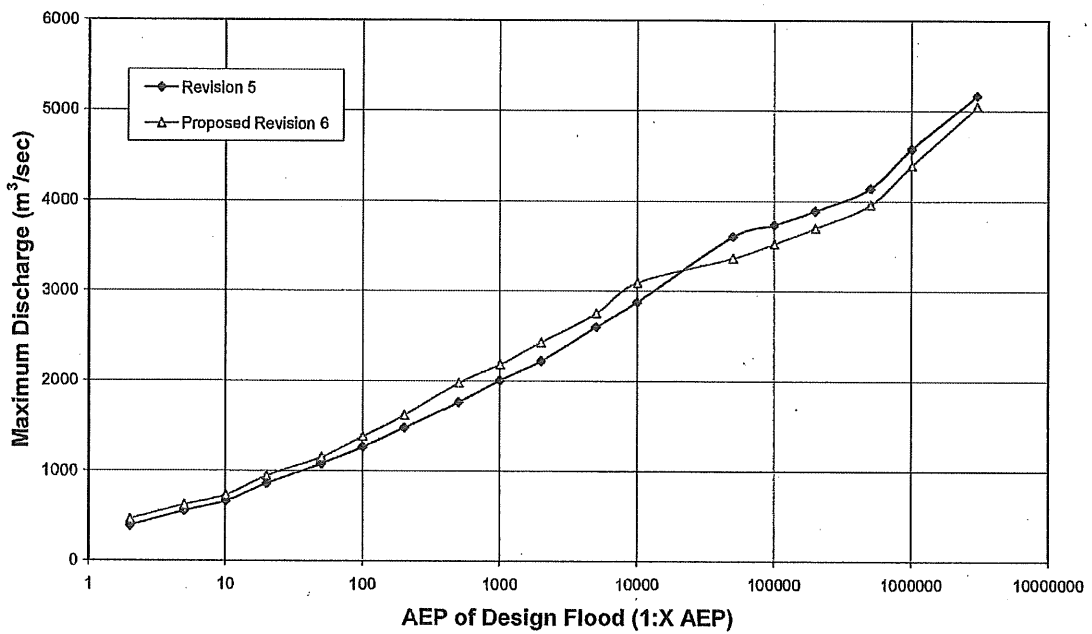
The results of this comparison for a range of design flood events are presented in the following graphs.

¹ In this instance, 'hunting' refers to the potential tendency for an elevated Lake Levels caused by small inflows over longer periods to require greater minimum gate openings which, if made, could then produce greater discharges than required to cope with the inflow. If such closures are made, the Lake Level will then build up again and so on.

Design Floods - Maximum Lake Levels



Design Floods - Maximum Discharges



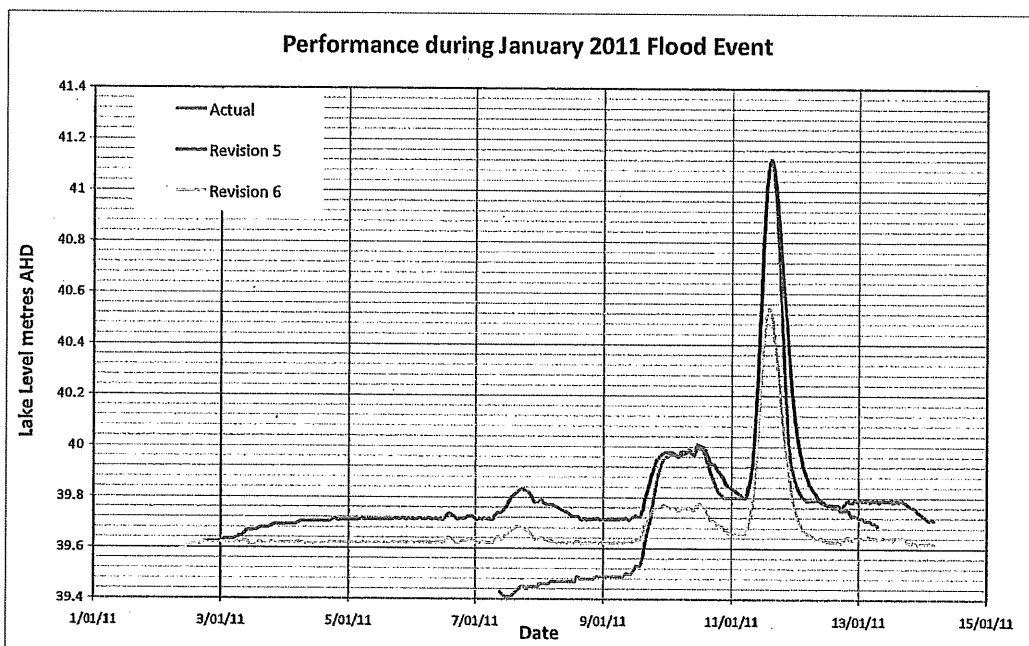
Performance during January 2011 Flood Event

A summary of the comparison results for the January 2011 flood event is given in the following Table:

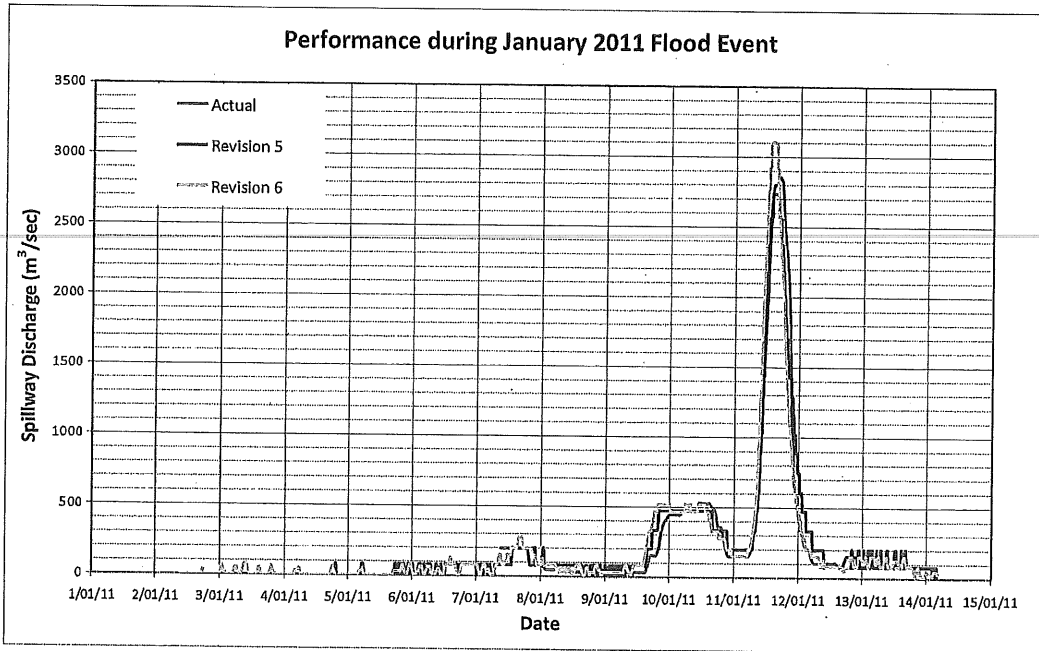
January 2011 Flood Event	Maximum Headwater EL (m)	Maximum Discharge (m ³ /sec)
Actual Operations ²	41.11	2850
Revision 5 Stage-Gate opening	41.123	2738
Revision 6 Stage-Gate opening	40.541	3106

Note that strict compliance with the target minimum gate openings doesn't correspond exactly with 'Actual Operations' during the January 2011 flood event because the Flood Operations Engineers were able to adequately estimate inflows during the early part of the event and were able to effectively match outflows to inflows for that part of the event. This resulted in slightly lower maximum Lake Levels in the dam. The physical difficulty of opening the gates may have produced the slightly lower discharge.

A comparison of the resultant Lake Levels and discharges for the January 2011 flood event for the different gate operations is shown in the following graphs. They show that there are not major differences in the spillway discharges while there is some benefit to the Lake Levels as a result of the earlier opening of the radial gates. When this is combined with the lower risk of actually achieving the required gate openings produced by opening them at lower levels, the overall risk reduction from a dam safety perspective is significant.



² January 2011 Flood Event, Report on the operation of North Pine Dam, 11 March 2011



The Revision 6 strategy for opening the spillway gates will need to be examined further as part of the Longer Term Review of the North Pine Dam Flood Mitigation Manual recommended in Recommendations 2.27 and 2.28 of the Queensland Floods Commission of Inquiry Interim Report.

It may ultimately demonstrate that beginning the gate openings at say a 0.5 metre lower Fully Supply Level might further improve the dam safety outcome while providing a less rapid increase in discharge early in a flood event.

Effect of Sideling Creek Discharges

Another issue that may have to be addressed as part of the Longer Term Review for the North Pine Dam Flood Mitigation Manual is whether or how the discharges from Sideling Creek Dam (which enters the North Pine River just upstream of Young's Crossing).

In the previous Flood Mitigation Manuals for North Pine Dam there has been no recognition of bankfull flows in the North Pine River or the flows discharging from Sideling Creek Dam (RDR #349) when determining discharges from North Pine Dam and this has remained unchanged in Revision 6.

I was advised by John Tibaldi (Seqwater) that their estimate of the bankfull discharge downstream of North Pine Dam was of the order of 800 m³/sec. This leaves a significant reserve for discharges from Sideling Creek Dam for Lake Levels up to EL 39.8 mAHD.

Because of the small flood storage capacity available in North Pine Dam there may be very little scope to take Sideling Creek discharges into account. (Design information for Sideling Creek Dam indicates the 1 in 100 AEP discharge from Sideling Creek is of the order of 300 m³/sec.) However, for very small floods there may be some scope to allow greater Lake Levels in North Pine Dam while Sideling Creek discharges. Youngs Crossing may have to be significantly raised before there is significant ability to take benefit of this aspect.

Peter Allen

Project Director Dam Safety

Office of the Water Supply Regulator

Telephone 07 [REDACTED], Mobile [REDACTED] Facsimile [REDACTED]

Email [REDACTED]

www.derm.qld.gov.au

Department of Environment and Resource Management

[REDACTED]

GPO Box 2454, Brisbane Q 4001

[s 370]

Part 2 **Flood mitigation**

370 **Owners of particular dams must prepare flood mitigation manual**

- (1) A regulation may nominate an owner of a dam as an owner who must prepare a manual (a *flood mitigation manual*) of operational procedures for flood mitigation for the dam.
- (2) The regulation must nominate the day by which the owner must comply with section 371(1).

371 **Approving flood mitigation manual**

- (1) The owner of a dam must give the chief executive a copy of the flood mitigation manual for the dam for the chief executive's approval.
- (2) The chief executive may, by gazette notice, approve the manual.
- (3) The approval must be for a period of not more than 5 years.
- (4) The chief executive may get advice from an advisory council before approving the manual.

372 **Amending flood mitigation manual**

- (1) The chief executive may require the owner of a dam, by notice, to amend the flood mitigation manual for the dam.
- (2) The owner must comply with the requirement.
- (3) If the owner complies with the requirement, the chief executive must, by gazette notice, approve the manual as amended.
- (4) The approval of the manual as amended must be for—
 - (a) the balance of the period of the approval for the manual before the amendment; or

Water Supply (Safety and Reliability) Act 2008

**APPROVAL OF FLOOD MITIGATION MANUAL NOTICE
(No 00) 2011**

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 00) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on X October 2011 approved the Manual of Operational Procedures for Flood Mitigation at North Pine Dam, Revision 6 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on
2. Not required to be laid before the Legislative Assembly.
3. The administering agency is the Department of Environment and Resource Management.

MISC APPROVAL OF FLOOD MITIGATION MANUAL

11 October 2011

Mr Terry Wall
Acting Director General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4000

Dear Mr Wall,

**Manual of Operational Procedures for Flood Mitigation at North Pine
Dam (*the North Pine Manual*)**

As you know, in the Interim Report of the Queensland Floods Commission of Inquiry, the Commission recommended that Seqwater conduct an interim review of the North Pine Manual (see recommendations 2.25 and 2.26).

I confirm that the interim review, addressing the matters referred to in the Commission's recommendation 2.26, has been completed. Seqwater has worked closely with Department officers in carrying out the review.

Enclosed are two copies of Revision 6 of the North Pine Manual for your approval under section 371 of the *Water Supply (Safety and Reliability) Act 2008 (the Act)*.


To assist in your consideration of the North Pine Manual, I enclose the following additional documents:

1. Explanatory Notes prepared by Seqwater, which describe the changes made from Revision 5; and
2. Letter from Len McDonald, the independent expert reviewer, to Seqwater's solicitors confirming his approval of Revision 6. It was a recommendation of the Commission that expert peer review of the North Pine Manual occur prior to the submission of it.

Seqwater requests that you approve the North Pine Manual, by gazette notice, for a period of 5 years, in accordance with the Act.

If you require any further information, please contact Jim Prüss (Tel [REDACTED]).

Yours sincerely,



Peter Borrows
Chief Executive Officer

Encl.

**INTERIM REVIEW OF THE MANUAL OF OPERATIONAL PROCEDURES FOR
FLOOD MITIGATION AT NORTH PINE DAM
OCTOBER 2011 (REVISION 6)
EXPLANATORY NOTES**

INTRODUCTION

On Monday 17 January 2011, Queensland Premier Anna Bligh established an independent Commission of Inquiry to examine the unprecedented flood disasters associated with the 2010/11 wet season that impacted 70 per cent of the State. The Commission of Inquiry delivered an Interim Report on 1 August 2011 covering matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season.

In relation to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam ("the Manual"), the Interim Report recommended that Seqwater should:

1. Conduct an interim review of the Manual.
2. Have the draft manual assessed by independent expert peer reviewers.
3. Consider the expert peer reviews.
4. Submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.

The Interim Report also recommended that particular attention should be paid during the interim review of the Manual to clarifying the circumstances in which pre-releases under Part 8.4 are permitted.

MANAGEMENT OF THE INTERIM REVIEW OF THE MANUAL

Undertaking a complete review of the Manual within six weeks as required by the Commission of Inquiry was a challenging task that required boundaries to be placed on extent of the investigations that could be undertaken, and on the consultation processes associated with the review. Primarily this is because there needs to be certainty that any changes made to the Manual do not worsen downstream flooding or risk the safety of North Pine Dam ("the Dam"). Generally, six weeks would be considered insufficient if a full study with extensive consultation were to be undertaken.

Further, the challenge of completing the interim review within such a short period of time was made more difficult by reason of the following factors that impacted on the resources available to undertake the review:

- Key staff associated with the review continued to have substantial ongoing commitments to the Commission of Inquiry and were required to provide extensive

statements on a range of multiple matters not associated with the operation of the Dams, while the review was in progress.

- A similar interim review of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam was undertaken in parallel. This was also a requirement of the Commission of Inquiry.
- Extensive routine preparations continued for the 2011/12 wet season. In particular annual training of Dam Operators and new Flood Operations Engineers and Officers was undertaken. This training traditionally occurs in August and September, just prior to the commencement of the defined flood season on 1 October.
- The relocation of the Flood Operations Centres to new premises and the need to ensure that systems and models are sufficiently robust has required significant Seqwater resources, including the Flood Engineers and Officers.
- Key staff associated with the review are involved in progressing around 30 other recommendations made by the Commission of Inquiry in the Interim Report.

In view of the above factors and the unprecedented short time period given to complete the review, the following boundaries were placed on the interim review:

- The review would focus on addressing the priority matters recommended for examination by the Commission of Inquiry.
- Independent expert review would be limited to an individual rather than a panel review.
- The focus would be on defining and clarifying existing strategies rather than changing them.
- It was not feasible for public consultation to be undertaken during the six week review.

COMMISSION OF INQUIRY PRIORITY MATTER

The circumstances in which "pre-releases" (previously referred to in Part 8.4 of the Manual) have been clarified as follows:

- The commencement of a Flood Event can be declared prior to the Actual Lake Level exceeding Full Supply Level ("FSL") – see Section 2.10.
- Flood releases can commence prior to the Actual Lake Level exceeding FSL if the Duty Flood Operations Engineer judges it likely that this action will minimise disruption to urban populations downstream of the Dam and reduce the adverse impacts of the Flood Event – see Section 4.4.

OTHER CHANGES

A number of other changes have been made in this revision of the Manual. These include the following:

- Simplification of the procedural matters within the Manual. In this regard, a new Section 2 replaces the former Parts 2-7;
- The language has been made consistent with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 8, September 2011 ("Wivenhoe/Somerset Manual") (where appropriate – see further below);
- Reference has been included within Appendix D to Seqwater's work program to install a new hydraulic emergency back up system to operate the radial gates (referred to in Section 2.10.3 of the Commission's Interim Report);
- Given the questions which have been raised following the January 2011 Flood Event in respect of the current design flood hydrology for the Dam, the reference to the previous hydrologic study for the Dam has been removed from Appendix E and replaced with a reference to Seqwater's work program to review the flood hydrology and associated matters (referred to in Section 2.10.3 of the Commission's Interim Report)
- The Section outlining Flood Operations Strategies (Section 4.4) and the associated Appendix of radial gate settings (Appendix C) have been amended. These changes are directed towards ensuring that the radial gates are fully open prior to water flowing over the gate piers as occurred during the January 2011 Flood Event. This action further protects the safety of the Dam by improving its flood immunity.

VARIATIONS TO FSL

In the Interim Report, the Commission did not make any recommendation about alterations to the FSL of the Dam. Further, the Commission did not make any recommendation that the Manual be amended so as to accommodate different FSLs for the Dam.

The Wivenhoe/Somerset Manual contains a definition of FSL that will facilitate (in conjunction with the amended trigger levels in the Wivenhoe/Somerset Manual) flood releases commencing at levels below FSL should the Minister decide to lower the FSL of Wivenhoe and Somerset Dams. The inclusion of such a definition in the Manual is not supported for the following reasons:

- The Duty Flood Operations Engineer must declare a Flood Event when it is judged likely that FSL will be exceeded (Section 2.10). There is no flexibility to not declare the commencement of the Flood Event.
- Once the Flood Event commences, Seqwater must comply with the Manual (Section 1.5).
- The Dam is taken to be full when it exceeds FSL. The Manual provides (Section 4.4) that when the Dam is full, ensuring the structural safety of the Dam is paramount.

- The Manual also provides that the operational aims are to pass the flood through the Dam as quickly as possible and return the Lake Level to FSL. This is different to Wivenhoe and Somerset Dams as while those dams have dedicated flood mitigation storage; North Pine Dam does not. It is a water supply dam only.
- It would be contrary to this objective and operational aim to not make flood releases for a period of time until the Lake Level rises to the point where the gate settings contained in Appendix C are reached (relevantly at 100% of FSL).
- The Manual also requires that the gate settings in Appendix C are to "guide" flood releases (Section 4.4). These settings do not apply until 100% of FSL (EL39.6 metres), so any decision about releasing water between lower FSLs and 100% will not be guided by Appendix C. If the Senior Flood Operations Engineer decided to commence flood releases, and the Flood Event continued such that the Actual Lake Level rose to levels beyond 100% of FSL, the gate openings could be well in advance of the settings contained in Appendix C. The Manual provides that beyond EL 39.8 metres, the settings are to remain within 3 settings of that shown in Appendix C (and the relevant exceptions do not apply).
- The position is different for Wivenhoe and Somerset Dams where flood strategies for the use of the additional flood storage (created by any lowering of the FSL) have been devised to take into account a flexible FSL (for example, see Strategy S1 for Somerset which applies until the actual lake level exceeds 100.45 metres and Strategies W1-W3 which have trigger levels based on metres above FSL).

Accordingly, until flood operations strategies and the associated gate settings for flood releases at all lower levels of FSL are developed (and this will take several months), Seqwater does not propose to include a flexible FSL definition in the Manual (in the terms set out in the Wivenhoe/Somerset Manual).

If the Minister does decide to lower the FSL of the Dam, the initial drain down can occur. However, flood releases will not commence until a Flood Event is declared (which will only occur when the Duty Flood Operations Engineer judges it likely that 100% of FSL is reached).

Alternatively, new tables for the new FSL can be developed within a reasonable period of time and then included within an amendment to the Manual, to facilitate flood releases commencing at lower FSLs.

Partner, Allens Arthur Robinson
PO Box 7082, Riverside Centre
BRISBANE QLD 4001

NSW 2145
10 October 2011

Dear Mr [REDACTED]

Manual of Operational Procedures for Flood Mitigation at North Pine Dam – Review and Comment

By letter dated 22 August 2011 you invited me to review and comment on Revision 6 of the subject manual. That offer was accepted and an agreement was executed.

Several iterations of the manual have been reviewed by me and matters raised have been the subject of discussion.

The revised manual (Seqwater, 2011, *Manual of Operational Procedures for Flood Mitigation at North Pine Dam, Revision 6, Controlled Copy, September*) has been prepared to ensure the manual clearly identifies permitted practice – see the last sentence of sub-section 2.10.5 of Queensland Floods Commission of Inquiry, 2011, *Interim Report, August*.

My review has concentrated on these aspects:

1. Ensuring that the concerns of the Floods Commission, mainly regarding pre-release of water, have been addressed – refer to sub-sections 2.10.3 and 2.10.5 and recommendations 2.25 and 2.26 of the Interim Report;
2. Ensuring so far as is reasonably practicable that the manual is free of uncertainty and ambiguity;
3. Ensuring that, so far as is reasonably practicable, any changes to the provisions of the Revision 5 manual do not adversely impact on the objectives set out in section 3.1 of the manual;
4. Ensuring so far as is reasonably practicable that compliance with the manual is feasible;
5. Ensuring that consistent language is used throughout the manual; and
6. Ensuring that language is accurate; that is, that the words of the manual convey the intended meaning.

My review did not include these matters:

1. A review of the flood hydrology and dam engineering studies which underpin the manual strategies that aim to protect the safety of the dam;
2. A verification check of data and of values derived by engineering calculations in the manual. Data and values have only been challenged where inconsistency was noted.

In accordance with my role as understood above, I am now satisfied with the manual.

Yours sincerely,

[REDACTED]
Leonard A McDonald, BE, MEngSc, FIEAust, CPEng, LGE
Dam Safety and Risk Consultant

Phone: [REDACTED]

Fax: 02 [REDACTED]

Mobile: [REDACTED]

E-mail: [REDACTED]

Department of Environment and Resource Management
A/DIRECTOR-GENERAL BRIEFING NOTE

Approved	Not Approved	Noted
Further information required		
[Redacted]		
DG	[Redacted]	
Dated	31/8/2011	

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TO: Director-General

SUBJECT: Queensland Floods Commission of Inquiry – Amendment of Flood Mitigation Manuals – Provision for Delegation of Chief Executive’s Powers

TIMEFRAME/REQUESTED BY

- [Redacted]
- [Redacted]

RECOMMENDATION

[Redacted]

BACKGROUND

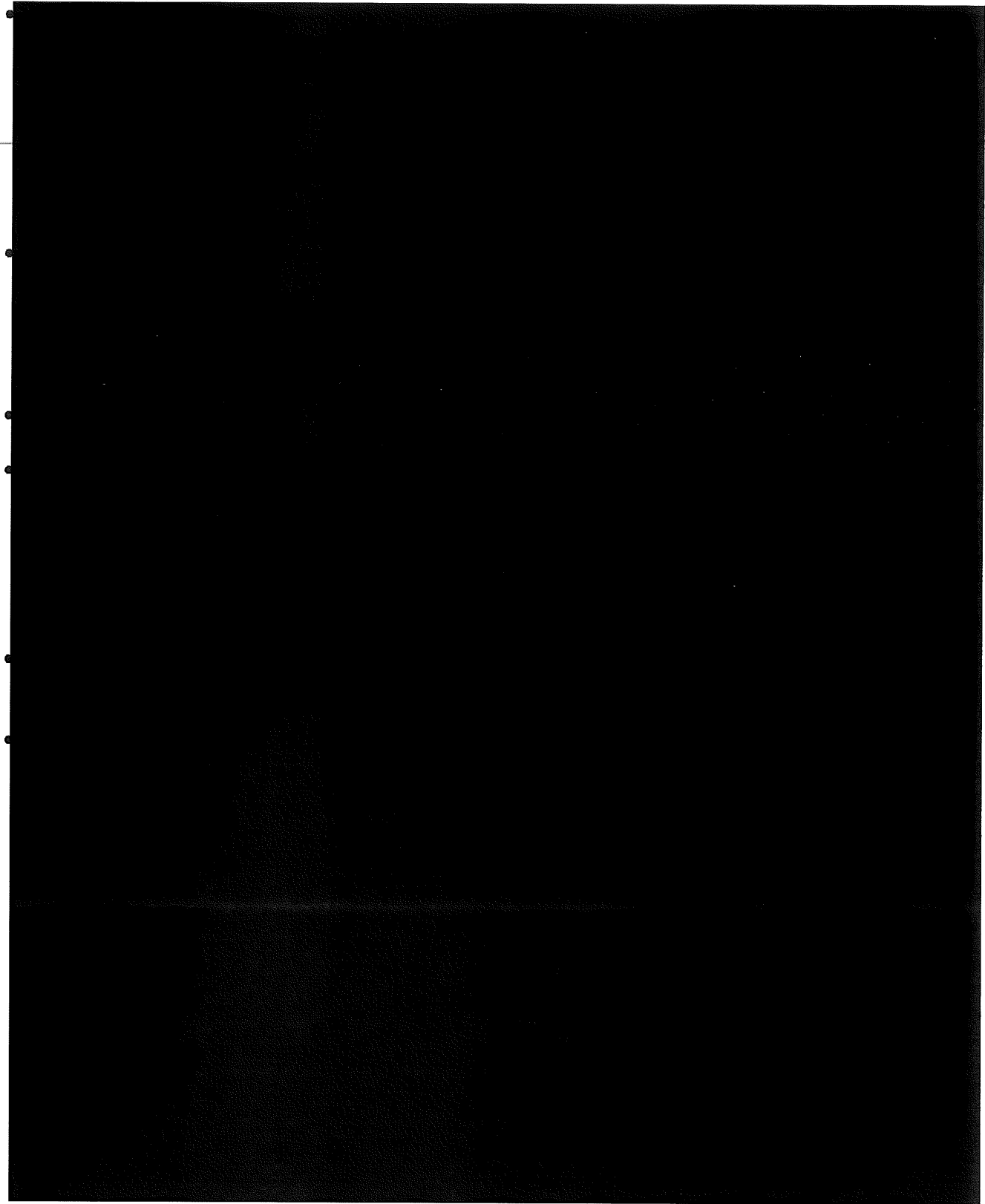
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Rec'd - ODG
29 AUG 2011

Author Name: [Redacted] Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [Redacted] Date: 18 August 2011	Cleared by Name: [Redacted] Position: A/Director, Legal Services Tel No: 323 [Redacted]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [Redacted]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [Redacted] Date: [Redacted]
	Name: Paul Walsh Position: A/Director, Legislative Development Services Tel No: 3330 [Redacted]	Name: [Redacted] Position: Assistant Director- General, Corporate Services Tel No: 3224 [Redacted]	

26.8.11
12/8/11

CURRENT ISSUES



Author Name: [REDACTED] Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [REDACTED] Date: 18 August 2011	Cleared by Name: [REDACTED] Position: A/Director, Legal Services Tel No: 323 [REDACTED] Name [REDACTED] Position: A/Director, Legislative Development Services Tel No: 3330 [REDACTED]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [REDACTED] Name [REDACTED] Position: Assistant Director- General, Corporate Services Tel No: 3224 [REDACTED]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [REDACTED] Date:
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RESOURCE/IMPLEMENTATION IMPLICATIONS

- [Redacted]

PROPOSED ACTION

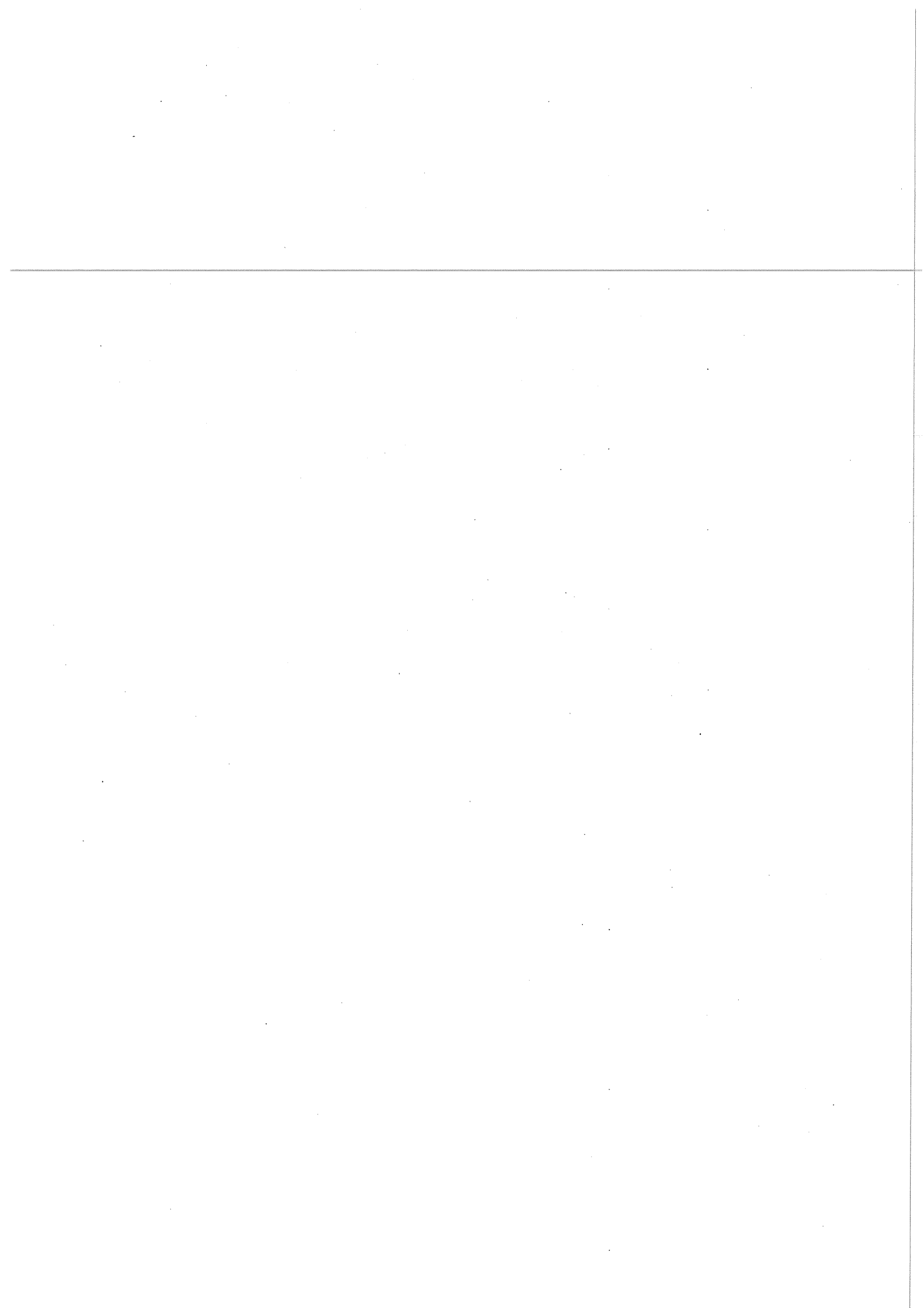
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A/DIRECTOR-GENERAL'S COMMENTS

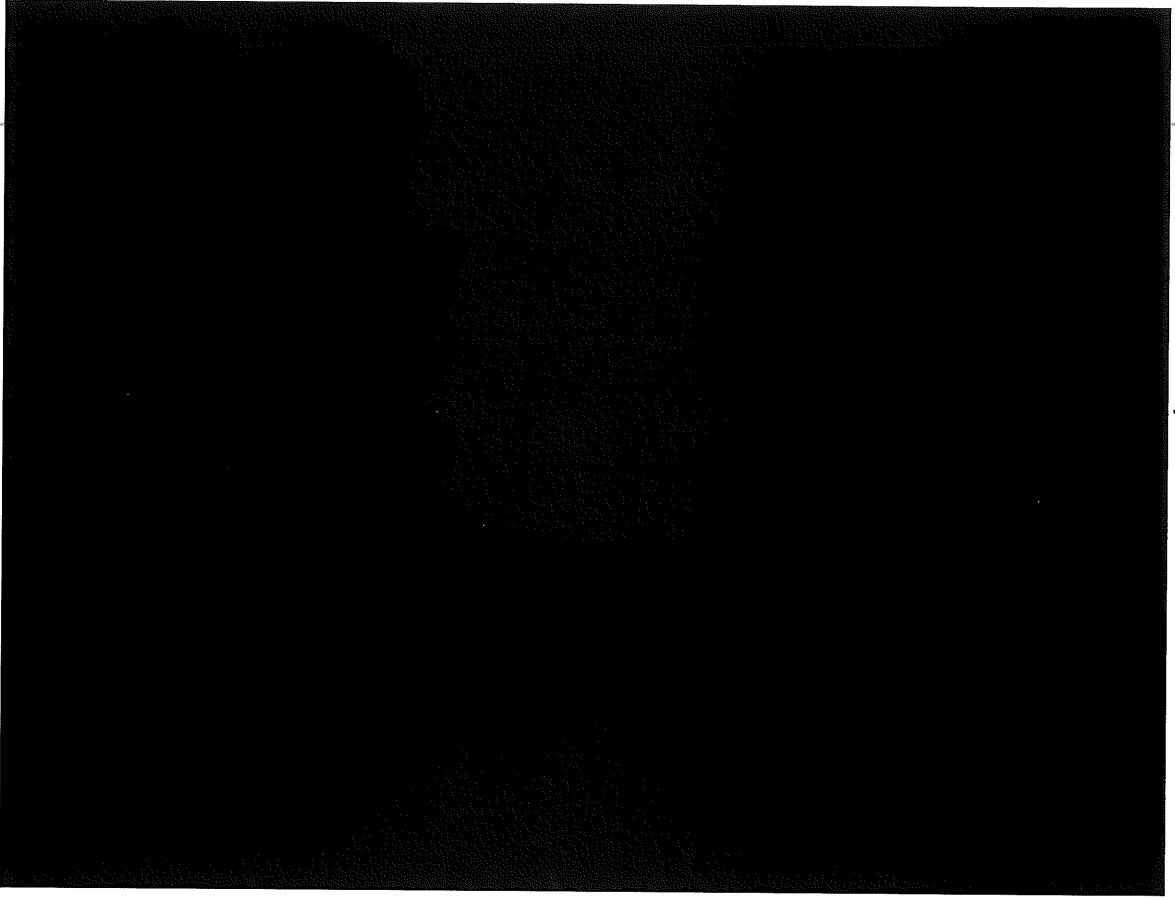
ATTACHMENTS

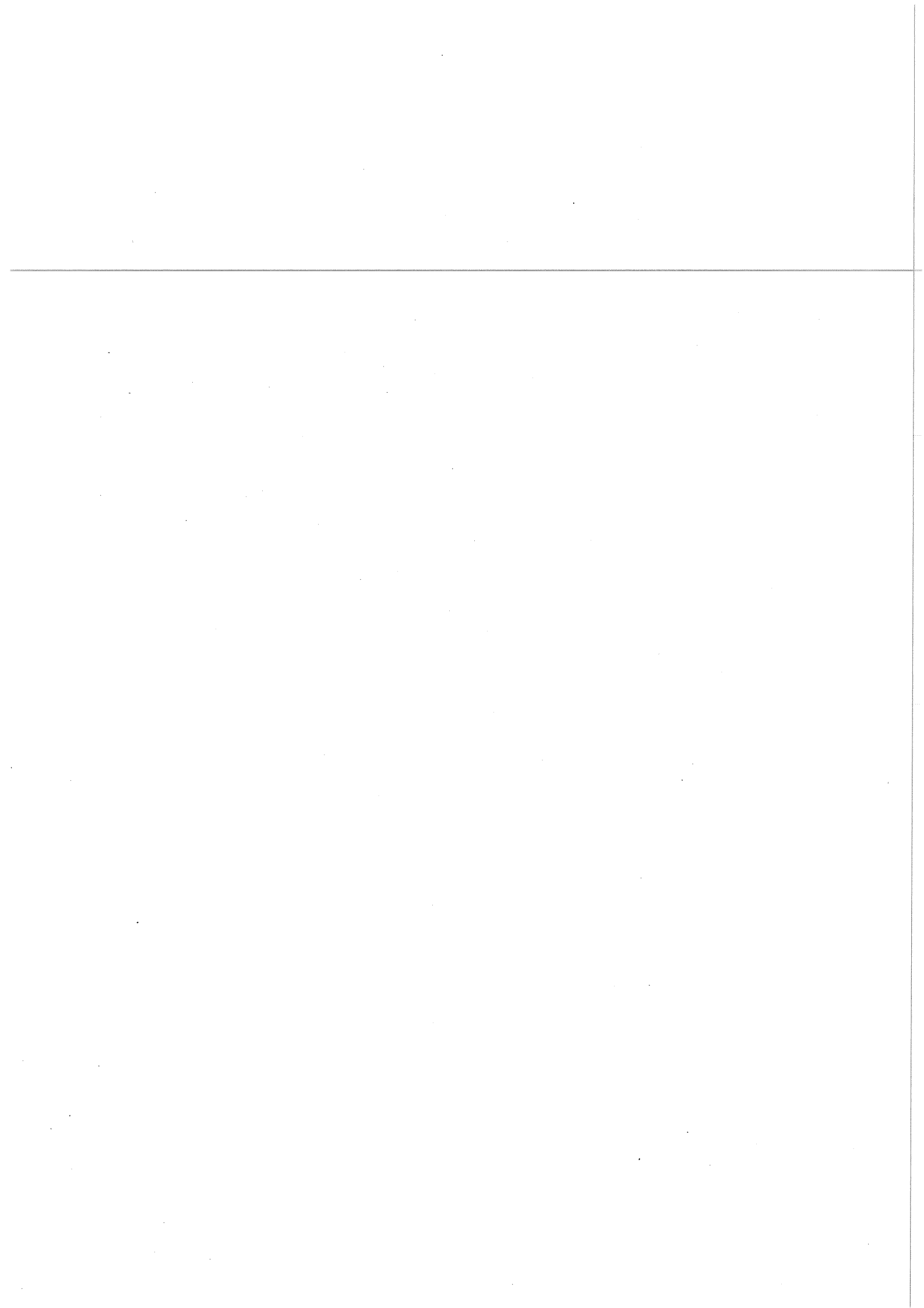
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Author Name: [Redacted] Position: Principal Lawyer, Directorate (Flood Commission of Inquiry Liaison), Legal Services Tel No: 3330 [Redacted] Date: 18 August 2011	Cleared by Name: [Redacted] Position: A/Director, Legal Services Tel No: 323 [Redacted]	Noted by Name: Bob Reilly Position: General Manager, Officer of the Water Supply Regulator Tel No: 3224 [Redacted]	Endorsed: Name: Terry Wall Position: Associate Director- General, Operations and Environmental Regulator Tel No: 3330 [Redacted] Date: [Redacted]
	Name: [Redacted] Position: A/Director, Legislative Development Services Tel No: 3330 [Redacted]	Name: [Redacted] Position: Assistant Director- General, Corporate Services Tel No: 3224 [Redacted]	



Attachment 1





Department of Environment and Resource Management

Managing our natural environment for today and for future generations

Legal Advice

Your ref: FMM Legal Review

Our ref: LEG [REDACTED]

Author: [REDACTED]

Phone: 3330 [REDACTED]

Fax: [REDACTED]

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Date: 11 October 2011

To: Terry Wall, A/Director-General

Through: [REDACTED] Director, Legal Services

Paul Walsh, A/Director, Legislative Development Services (Floods Commission of Inquiry Liaison)

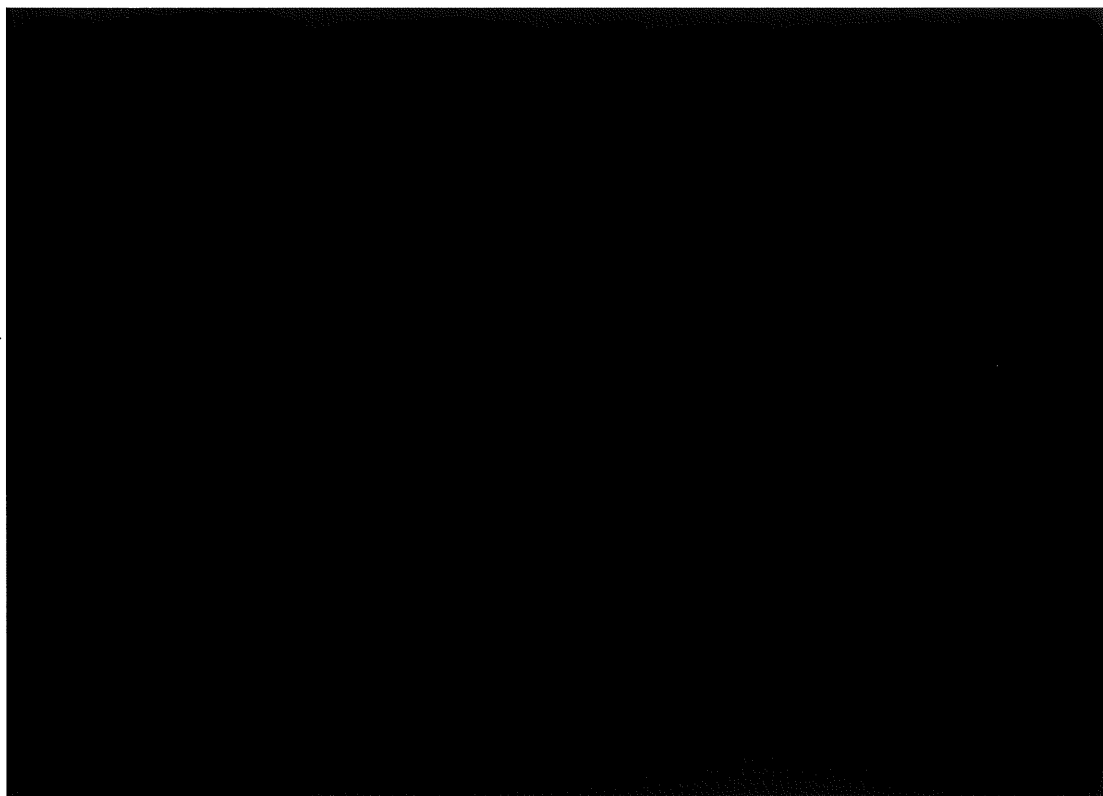
[REDACTED] Principal Policy Officer, Inquiry Recommendations Implementation Group (Floods Commission of Inquiry Liaison)

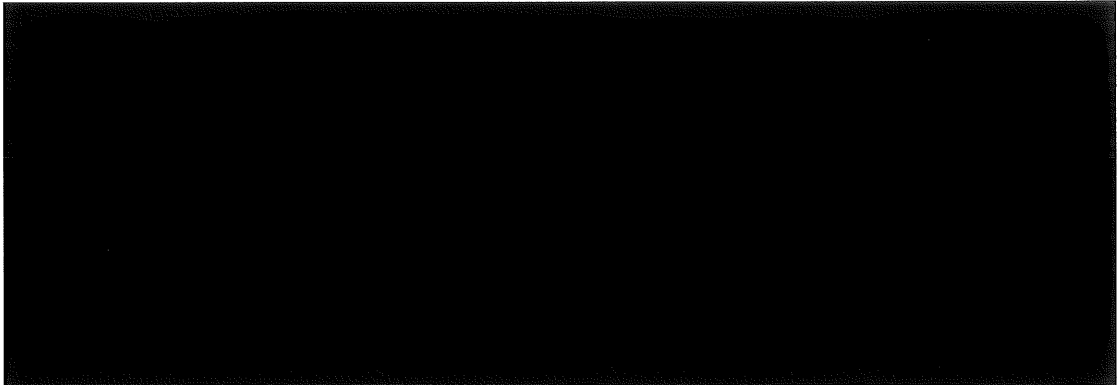
Bob Reilly, General Manger, Office of the Water Supply Regulator

From: [REDACTED] Principal Lawyer, Directorate Legal Services (Floods Commission of Inquiry Liaison)

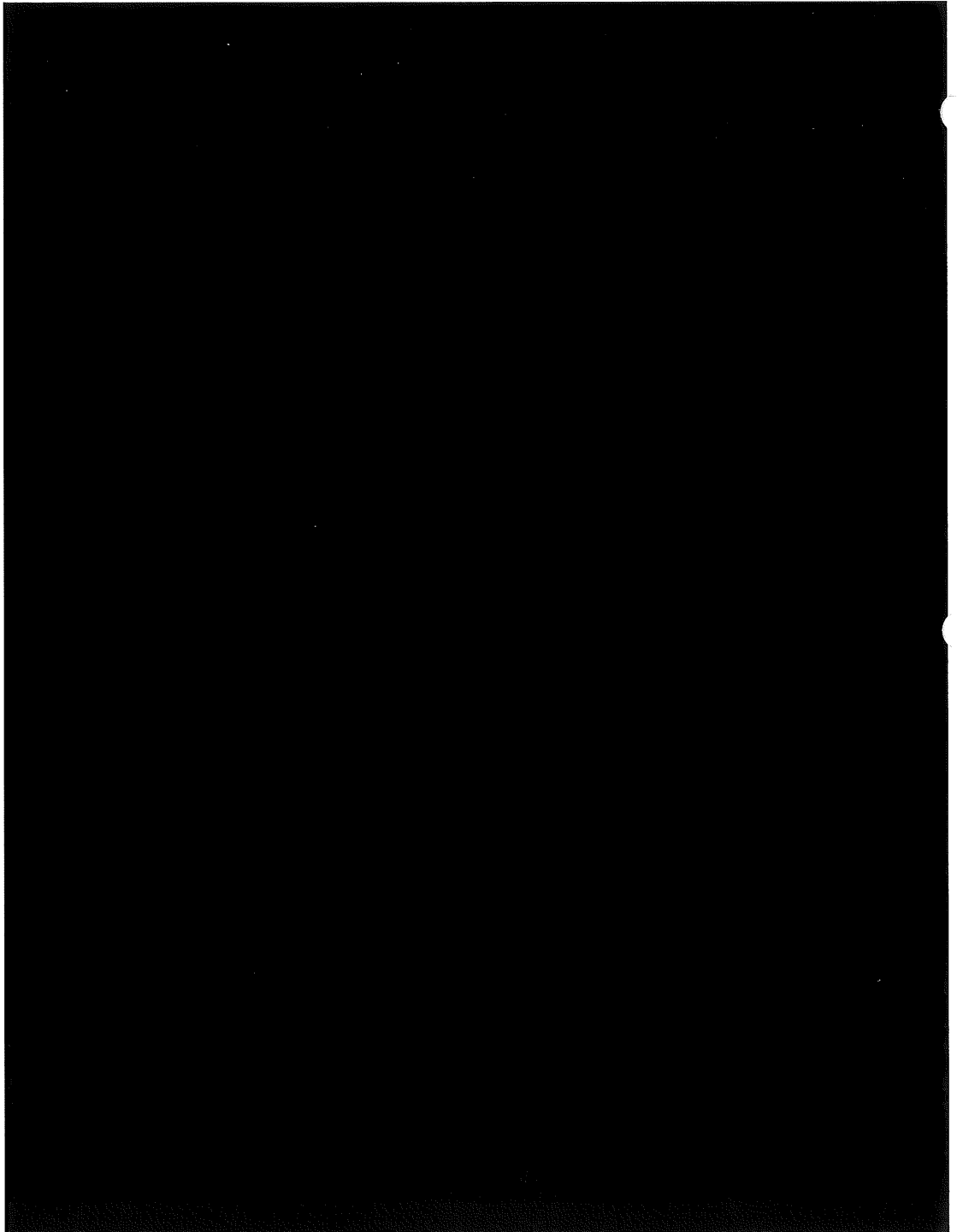
Subject: Review of Final Submitted Flood Mitigation Manual ("FFM") for North Pine Dam

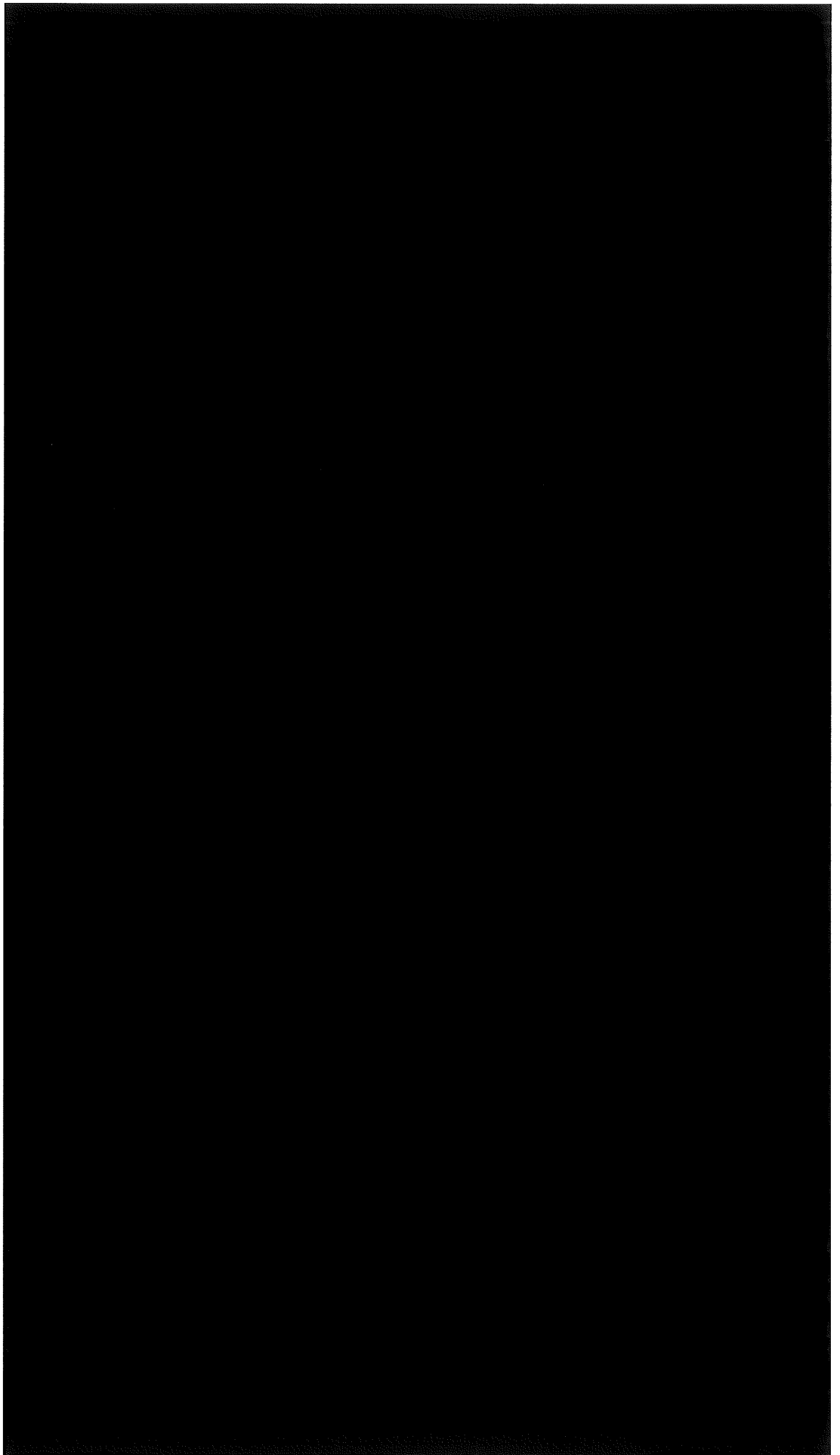
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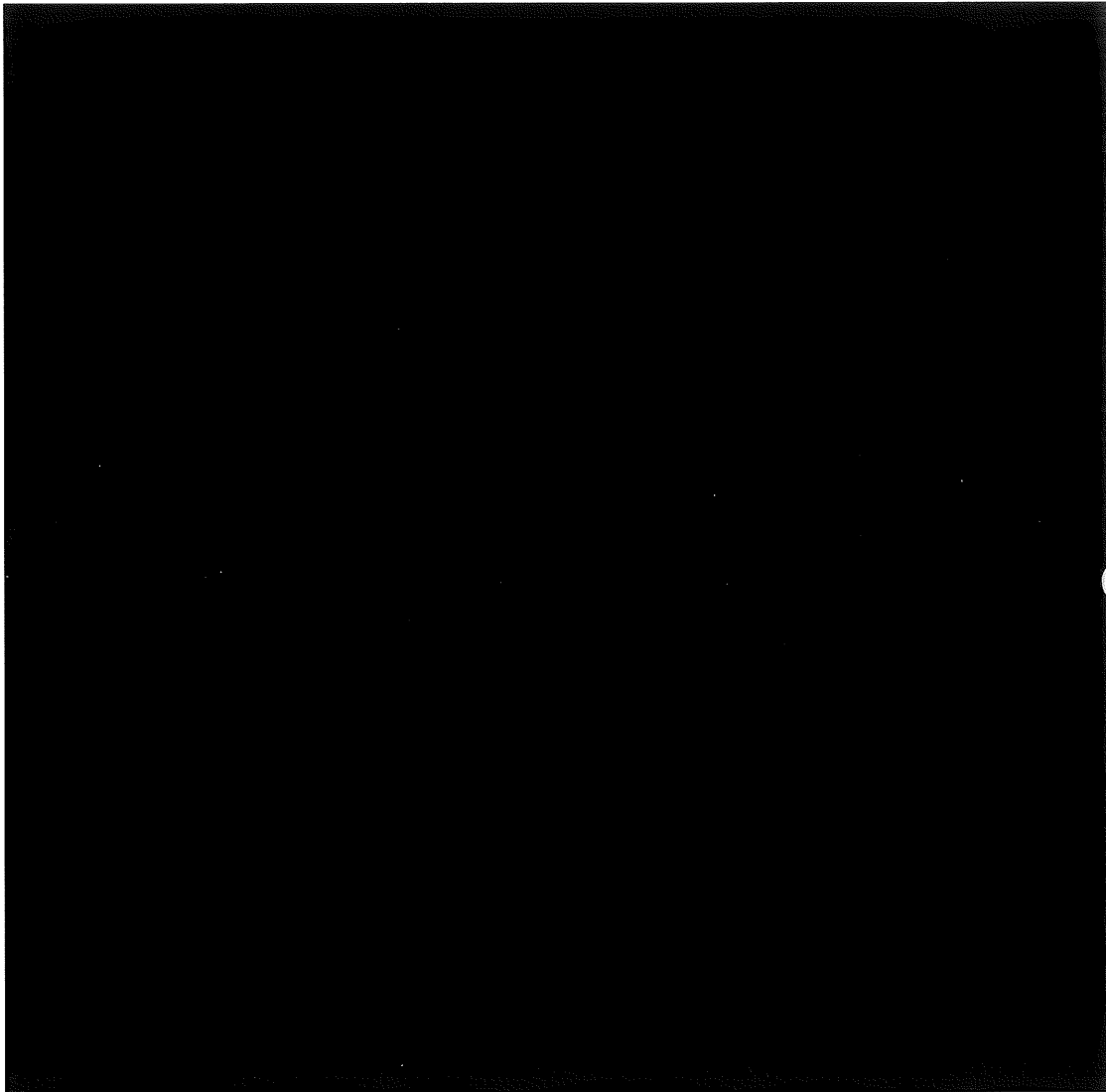
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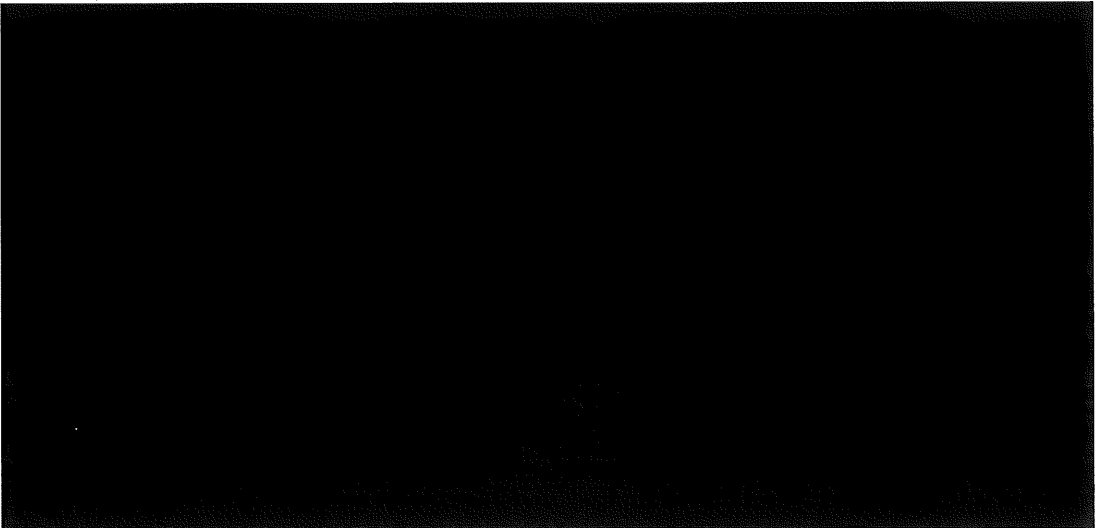
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3. Advice – North Pine FMM



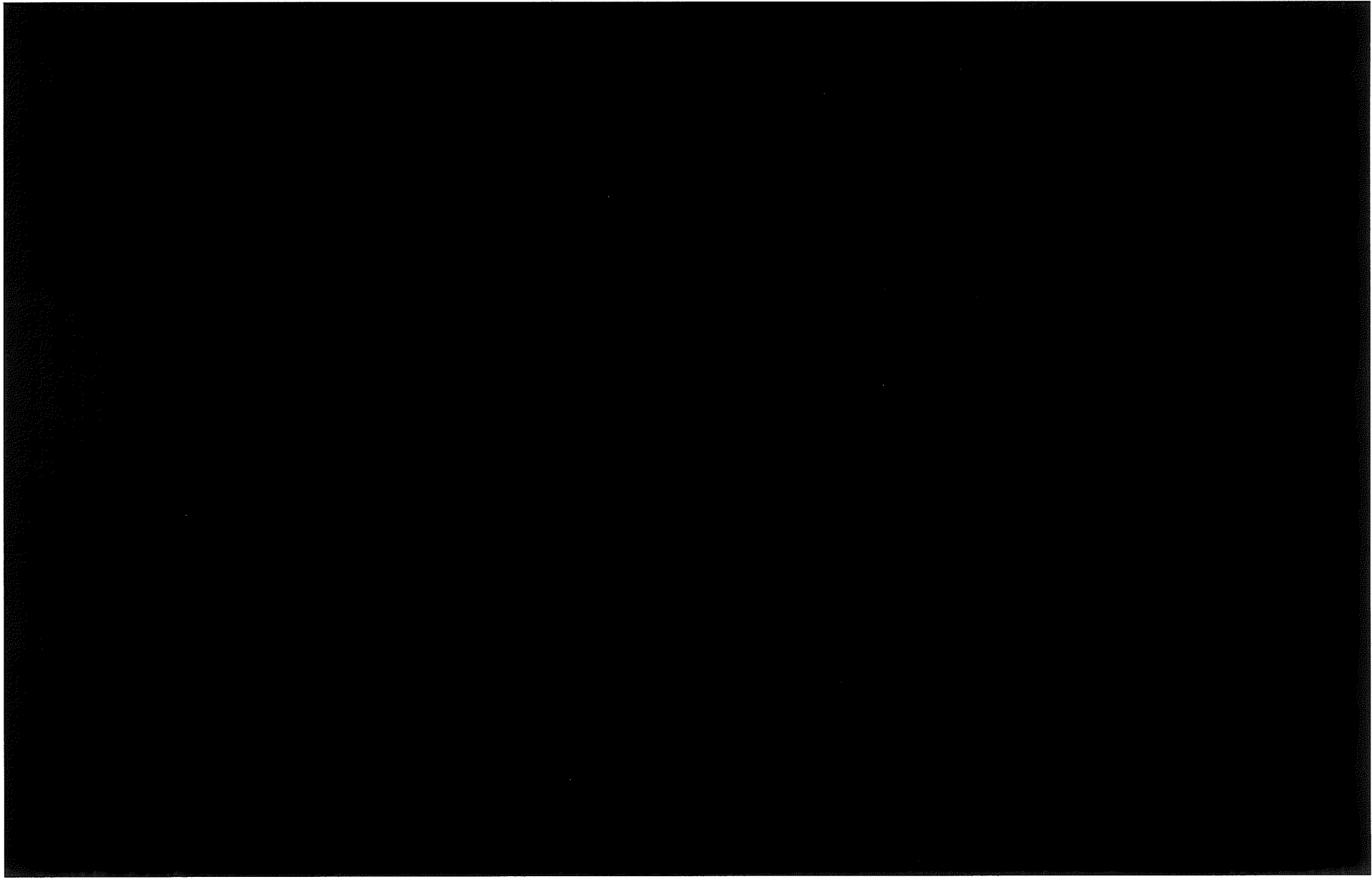
4. Compliance with recommendations from the Interim Report

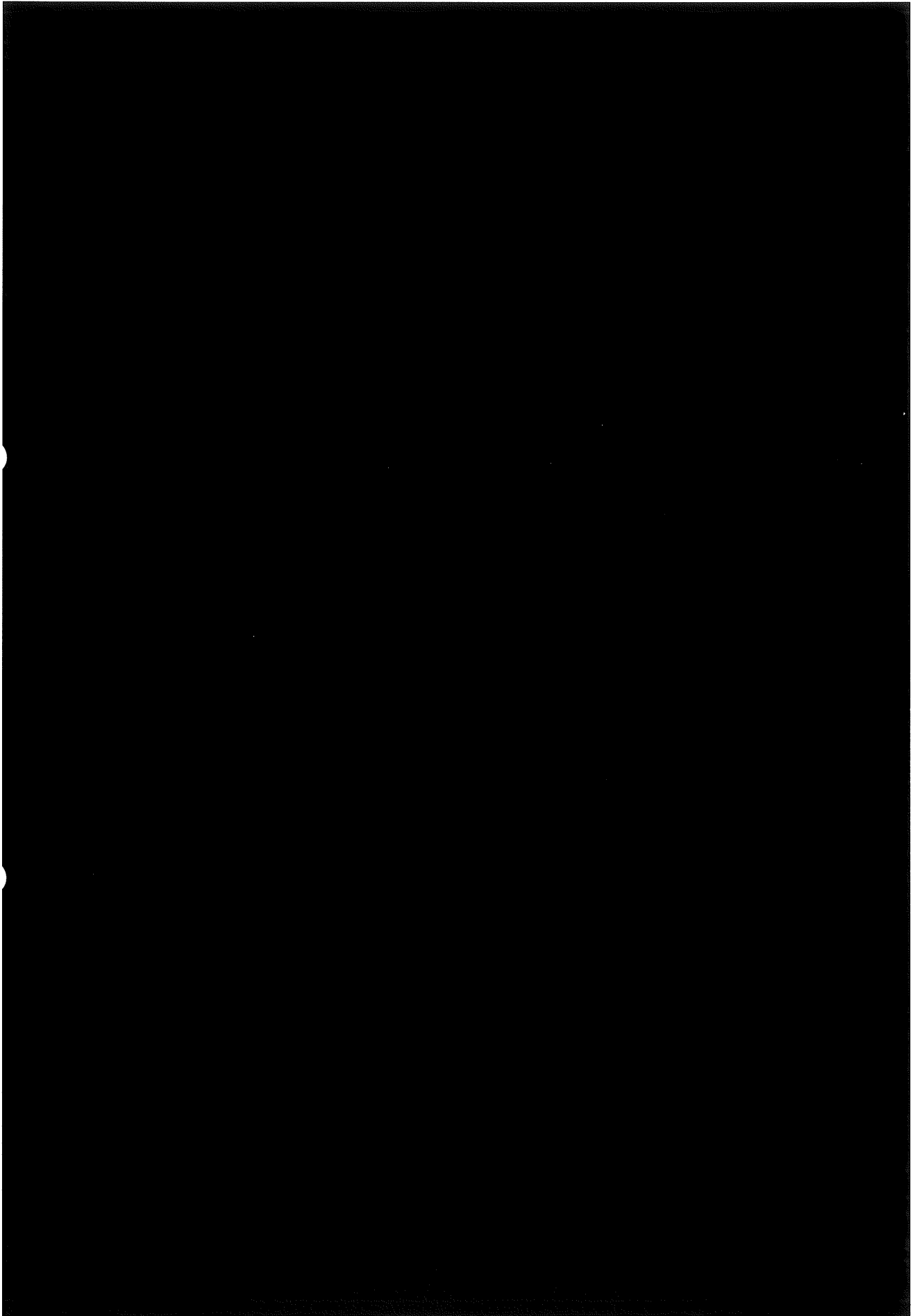


Please contact if me if you have any questions or if I may be of further assistance.

[REDACTED]
[REDACTED]
Principal Lawyer & Team Co-Leader - Floods Liaison Inquiry Response
Floods Commission of Inquiry Liaison
Legal Services / Governance & Strategy
Corporate Services
Department of Environment and Resource Management



Encl (14)







**Flood Mitigation Manual Legal Advice
Enclosures - Document Summary**

Item	Date	Comment Type
1	19 September 2011	Legal Review Comments
2	23 September 2011	Legal Review Comments
3	25 September 2011	Legal Review Comments
4	28 September 2011	Legal Review Comments
5	28 September 2011	Technical Comments
6	29 September 2011	Legal Review Comments and Technical Comments
7	30 September 2011 6.00am	Legal Review Comments and Technical Comments
8	30 September 2011 9.30am	Legal Review Comments and Technical Comments
9	7 October 2011 7.40am	Legal Review Comments and Technical Comments
10	7 October 2011 8.10am	Legal Review Comments and Technical Comments – same as item 8 but request for Explanatory Notes removed (as they had previously been provided)
11	7 October 2011 8.43am	Explanatory Notes comments
12	10 October 2011 1.15pm	Legal Review Comments and Technical Comments
13		
14		



1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011.

The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")).

The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified).

At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] ("Seqwater's lawyer"), a Partner at Allens Arthur Robinson the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyer by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with Paul Walsh (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I will be meeting with John Tibaldi from Seqwater and [REDACTED] a Partner at Allens Arthur Robinson on Wednesday 21 September 2011 at the Flood Operations Centre to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

3.1 General

For clarity and ease of reference, it would be better if each paragraph was numbered according to chapter and section (currently 2.9 is the only part with numbered paragraphs) and if the dot points were converted to (a), (b), (c) etc., however this is not a substantive issue.

In the flowcharts, approximately three quarters of the sentences contain punctuation at the end and the other quarter does not. Whichever option is chosen, consistency is recommended. Also, in the flowcharts the words "No" and "Yes" are variously and inconsistently black and red (I recommend black for yes and red for no).

Throughout the whole document there are various references to water levels and lake levels. I recommend only using the term "*lake level*". I further recommend stating that if a lake level does not specify "predicted" or "actual" that it could be taken to be either using professional engineering judgement and to check those references.

3.2 Title page, revisions table and table of contents

The "Date" column of the revisions table contains "November 2009". This should read, "November 2009 (approved by gazette notice 22 January 2010)" as this will correctly show the date that Revision 7 commenced. It is currently alright for Revision 8 to have "September 2011" because this is the latest draft of the FMM.

I have been advised by Seqwater's lawyer that the FMMs are yet to have final formatting and reference checking performed, so I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

3.3 Glossary

In the definition of Chief Executive "*Director General*" needs an en dash replacing the space to become "*Director-General*".

The FMM has the following definition of Full Supply Level (FSL).

"FSL" or "Full Supply Level" means:

(a) the level of the water surface when Wivenhoe Dam or Somerset Dam (as the case may be) is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP; or

(b) such other lower level in Wivenhoe Dam as shall apply pursuant to the Water Act 2000 (Qld).

but in any case not exceeding EL 67.0 metres for Wivenhoe Dam and EL 99.0 for Somerset Dam;

Currently the Moreton ROP specifies the FSL of Wivenhoe as EL 67.0m AHD and the FSL of Somerset as EL 99.0 AHD.

Seqwater's lawyer agreed to add the double underlined part on Friday 16 September 2011 to correct an obvious error (otherwise the maximum FSL for Somerset Dam would be EL 67.0m AHD).

Seqwater's lawyer was to come back to Paul Walsh regarding wording for the underlined part as Paul is not satisfied with the current wording as apparently it does not correctly reflect either:

- current legislative arrangements; or
- proposed legislative arrangements.

The following are words which could be used:

"FSL" or "Full Supply Level" means:

- (a) the level of the water surface when Wivenhoe Dam or Somerset Dam (as the case may be) is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP; or
- (b) such other level in Wivenhoe Dam or Somerset Dam as shall apply as an interim supply security level pursuant to an approved interim program or revised interim program under the Moreton ROP; but in any case not exceeding EL 67.0 metres for Wivenhoe Dam and EL 99.0 for Somerset Dam;

The Glossary should contain the following definitions:

- **"lake level"** means the water surface elevation of a Dam.
- **"actual lake level"** means the lake level at the manual headwater gauge, with reasonable adjustments to a figure judged very likely.
- **"dam crest flood"** or **"DCF"** means the Flood Event which would result in the headwater level in the Dam reaching the Dam crest.
- **"PMPDF"** means Probable Maximum Precipitation Design Flood;

3.4 Chapter 1

In the first paragraph "*the Dams*" can be removed because the Glossary already defines the term.

These words should be removed from section 1.3 "*Seqwater must communicate with Agencies during Flood Events in accordance with Section 2.12.*" because Seqwater's lawyer has advised me that section 2.12 is about data provision, not communications.

Seqwater's lawyer has agreed to remove the following words from section 1.5 "*In the circumstances set out in the Act, Seqwater and its directors, employees and agents are protected from liability when complying with the operational procedures in this Manual.*". The inclusion or removal of these words does not affect Seqwater's indemnity under section 374 of the *Water Supply (Safety and Reliability) Act 2008* so it was adjudged to alleviate confusion by removing them altogether.

3.5 Chapter 2

In the second paragraph of section 2.10, I recommend replacing the words "*actual level*" with "*actual lake level*".

Comments from Peter Allen are as follows.

In section 2.2 insert a new bullet point in an appropriate location within the other bullet points:
A log of the performance of the FFS is maintained.

In section 2.6 insert a new bullet point to be the first bullet point:

- *An appropriate engineering qualification*

In section 2.8:

remove "*in accordance with such program as is required by the Chief Executive.*" and replace with "*Such training shall incorporate the requirements of the Chief Executive.*"

In the section 2.9 title remove "*data collection network and*".

In section 2.10 at the end of the second paragraph change "*FSLs*" to "*FSL(s)*".

3.6 Chapters 3 and 4

Comments from Peter Allen and/or Bob Reilly are as follows.

In section 3.4 replace "*reducing*" with "*limiting*".

In section 3.5 replace "the primary" with "a major".

In section 4.3 first bullet point replace "will" with "can".

3.7 Chapter 5

The first box of the first flowchart states:

"Is it judged unlikely that the Wivenhoe Dam lake level will exceed the FSL?"

While "judged likely", "judges it likely" and "judged very likely" are all defined terms in the Glossary, "judged unlikely" is not defined. So while the meaning could be inferred, it would be preferable to change the wording to: "Is it judged likely that the Wivenhoe Dam lake level will not exceed the FSL?"

In the map of the crossings, Colleges Crossing has an asterisk but there is no corresponding explanation. I assume it is the same as the explanation in Appendix J, "* affected by tidal flows", however the asterisk should be removed if practicable.

In the Strategy W1 Flowchart, Colleges Crossing is used with a possessive apostrophe. This is contrary to accepted place name guidelines and inconsistent with the map. The two uses of "College's Crossing" should be replaced with "Colleges Crossing".

Page 36 - A table like this needs to be placed before the W3 flowchart (similar to W1 and W2):

LOCATION	TARGET MAXIMUM FLOW IN THE BRISBANE RIVER
Moggill	• 4,000m ³ /s.

Comments from Peter Allen and/or Bob Reilly are as follows.

Section 5.3.

Third paragraph second sentence remove the words ", prior to the event peak".

In the copy provided words are missing at the top of the first flowchart.

In the flowchart, insert the words "(close all bridges as in Strategy W1 flowchart)" underneath the words "Go to Strategy W2 Flowchart".

Page 29 first paragraph, first sentence insert the words "up to that time" after the second use of Wivenhoe Dam.

In the notes to Strategy W1, insert "Downstream" before "bridge locations and submergences flows are shown below".

In the Strategy W1 flowchart when should Fernvale Bridge be closed? Seqwater also needs to confirm whether closing Fernvale Bridge is the responsibility of DTMR or Somerset Regional Council.

In the Strategy W2 table, the first OR should be capitalised. Also, the fourth decision box from the flowchart should be appropriately reproduced.

Page 34 middle paragraph insert at end, "after taking into account the likely duration and size of the flood event".

Page 36 - In the Strategy W3 table, the first OR should be capitalised.

Page 39 – First paragraph remove “*that could be imagined*”.

Page 39 – Second bold heading insert “*peak*” between “*Predicted*” and “*Lake Level*”.

Page 39 – Last paragraph insert “*or lesser*” after the word “*greater*”.

Section 5.4.

First sentence change “*In general, drain down of the Dams commences when the water levels in the Dams are falling and it is judged likely that the levels will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.*” to “*In general, drain down of Wivenhoe Dam commences when the lake level in Wivenhoe Dam is falling and it is judged likely that the lake level will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.*”

First dot point insert “*in both Dams*” after “*FSL*”.

3.8 Chapter 6

the first paragraph of Chapter 6, “*both dams*” should become “*both Dams*”.

The first box of the first spreadsheet states:

“*Is it judged unlikely that the Somerset Dam lake level will exceed the FSL?*”

The second box of the first spreadsheet states:

“*Is it judged unlikely that the Wivenhoe Dam lake level will exceed the FSL?*”

While “*judged likely*”, “*judges it likely*” and “*judged very likely*” are all defined terms in the Glossary, “*judged unlikely*” is not defined. So while the meaning could be inferred, it would be preferable to change the wordings to:

“*Is it judged likely that the Somerset Dam lake level will not exceed the FSL?*”

“*Is it judged likely that the Wivenhoe Dam lake level will not exceed the FSL?*”

In the notes to Strategy S2, “*both dams*” should become “*both Dams*”.

In section 6.3 the second sentence of the second bullet point of the third paragraph states: “*The list of bridges impacted by Somerset Dam is contained in Appendix K.*” From the appendices provided, this needs to be changed to “*Appendix J*”.

Comments from Peter Allen and/or Bob Reilly as follows:

In 6.3 first paragraph remove “*In general, drain down of the Dams commences when the water levels in the Dams are falling, the flow in the Brisbane River at Moggill is reducing and the rainfall forecasts provided by the BoM indicate that no significant runoff producing rainfall is expected in the Brisbane River basin for at least 48 hours.*” and replace with “*In general, drain down of Somerset Dam commences when the lake level in Somerset Dam is falling.*”

In 6.3 second paragraph, first sentence insert at the end “*such closures should aim to ensure the actual lake levels in the Dams follow the Wivenhoe/Somerset Operating Target Line.*”

In 6.3 first bullet point insert “*in both Dams*” after “*Floodwaters stored above the FSL*”.

In 6.4 second paragraph after heading “**Regulator Valve Considerations**” delete the word “*operated*” and replace with “*open*”.

3.9 Chapter 7

Peter Allen has advised that he is not happy with the loss of communications procedures and wants them back as they were in Revision 7.

Peter also has a question to ask regarding LCS2.

Peter Allen would also like the following dot point inserted in 7.3:

- "Via the Dam Supervisor at the other Dam or via the Dam Supervisor at North Pine Dam;"

3.10 Wivenhoe/Somerset FMM Appendices

I have checked that any references to an appendix in the FMM is to the correct appendix and found one error (see paragraph 3.8 above regarding section 6.3), however I have not perused the appendices in detail.

Comments from Peter Allen and/or Bob Reilly are as follows.

The appendix which is titled "**Flood Forecasting System (FFS)**" should have "**APPENDIX L**" at the top.

In Appendix J, isn't closing Fernvale Bridge the responsibility of DTMR not Somerset Regional Council?

4. Comments – North Pine FMM

4.1 General

For clarity and ease of reference, it would be better if each paragraph was numbered according to chapter and section (currently 2.9 is the only part with numbered paragraphs) and if the dot points were converted to (a), (b), (c) etc., however this is not a substantive issue.

Throughout the whole document there are various references to water levels and lake levels. I recommend only using the term "*lake level*". I further recommend stating that if a lake level does not specify "predicted" or "actual" that it could be taken to be either using professional engineering judgement and to check those references.

I have attempted to point out where the Wivenhoe/Somerset FMM differs from the North Pine FMM. Generally this is for a good reason specific to nature of each of the three dams and the facts and circumstances surrounding operations.

4.2 Title page, revisions table and table of contents

The "*Date*" column of the revisions table contains "*August 2010*". This should read, "*August 2010 (approved by gazette notice 17 December 2010)*" as this will correctly show the date that Revision 7 commenced. It is currently alright for Revision 8 to have "*September 2011*" because this is the latest draft of the FMM.

I have been advised by Seqwater's lawyer that the FMMs are yet to have final formatting and reference checking performed, so I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

4.3 Glossary

In the definition of Chief Executive "*Director General*" needs an en dash replacing the space to become "*Director-General*".

DCF definition should be changed to "**dam crest flood**" or "**DCF** means the Flood Event which would result in the headwater level in the Dam just reaching the Dam crest.

The FMM has the following definition of Full Supply Level (FSL).

"FSL" or "Full Supply Level" means the level of the water surface when North Pine Dam is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP;

Currently the Moreton ROP specifies the FSL of North Pine Dam as EL 39.6m AHD.

Bob Reilly would like the following words added (underlined) to be consistent with the Wivenhoe/Somerset FMM

"FSL" or "Full Supply Level" means the level of the water surface when North Pine Dam is at maximum operating level, excluding periods of flood discharge, as specified in the Moreton ROP but in any case not exceeding EL 39.6 metres;

I am advised by Seqwater's lawyer that it is not possible to have a flexible FSL at North Pine Dam because the strategy tables are all set to the current FSL. It would take approximately four months to re-calculate the tables. Peter Allen agrees with this. So if there was a temporary reduction in FSL before the start of the wet season, the dam would simply be allowed to fill to the current permanent FSL and then procedures would commence in accordance with the Manual. Therefore the definition of FSL in the North Pine FMM cannot mirror the definition in the Wivenhoe/Somerset FMM.

I note there is no definition of or "Power Station" or "Wivenhoe/Somerset Operating Target Line" as there is in the Wivenhoe/Somerset FMM, however this is alright as these terms are not used in the North Pine FMM.

Also the Wivenhoe/Somerset FMM defines the term "Dams" while the North Pine FMM defines the term "Dam" but that is obviously alright as the FMMs cover two and one dam/s respectively.

The Glossary should contain the following definitions:

- ***"judged very likely"*** means an event or circumstance being, in the professional engineering judgment of the Duty Flood Operations Engineer, certain or near certain to occur given the likely consequences associated with any decision which depends upon the judgment;
- ***"lake level"*** means the water surface elevation of the Dam.
- ***"actual lake level"*** means the lake level at the manual headwater gauge, with reasonable adjustments to a figure judged very likely.

4.4 Chapter 1

These words should be removed from section 1.3 "Seqwater must communicate with Agencies during Flood Events in accordance with Section 2.12." because Seqwater's lawyer has advised me that section 2.12 is about data provision, not communications.

Seqwater's lawyer has agreed to remove the following words from section 1.5 "In the circumstances set out in the Act, Seqwater and its directors, employees and agents are protected from liability when complying with the operational procedures in this Manual." The inclusion or removal of these words does not affect Seqwater's indemnity under section 374 of the Water Supply (Safety and Reliability) Act 2008 so it was adjudged to alleviate confusion by removing them altogether.

4.5 Chapter 2

Obviously there are differences in section 2.2 of the Wivenhoe/Somerset FMM and the North Pine FMM caused by two dams and one dam, respectively, being operated. Also as North Pine does not have anything like the Strategy W4 in the Wivenhoe/Somerset FMM there is no requirement to inform the CEO and Chief Executive.

In the second paragraph, I recommend replacing the words "actual level" with "actual lake level".

Comments from Peter Allen are as follows.

In section 2.2 insert a new bullet point in an appropriate location within the other bullet points:

- *A log of the performance of the FFS is maintained.*

In section 2.6 insert a new bullet point to be the first bullet point:

- *An appropriate engineering qualification*

In section 2.8:

remove "*in accordance with such program as is required by the Chief Executive.*"
and replace with "*Such training shall incorporate the requirements of the Chief Executive.*"

In the section 2.9 title remove "*data collection network and*".

4.6 Chapters 3

In section 3.4 add the words "*However, it is permissible for the Dam to be drained below FSL before final gate closure where it is judged likely that continued base flow will return the lake level to near FSL following gate closure.*" at the end.

Obviously there are differences in section 2.2 of the Wivenhoe/Somerset FMM and the North Pine FMM caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

Comments from Peter Allen and/or Bob Reilly are as follows.

In section 3.4 replace "*a primary*" with "*a major*".

4.7 Chapter 4

Chapter 4 of the North Pine FMM is equivalent to Chapters 4, 5 and 6 of the Wivenhoe/Somerset FMM. There are obvious differences caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

Sections 4.10 (Lifting Radial Gates Clear of the Flow) and 4.11 (Lowering Radial Gates that have been lifted Clear of the Flow) of the North Pine FMM do not closely resemble those equivalent parts of section 5.5 of the Wivenhoe/Somerset FMM. Peter Allen has advised, however, that there is no need to change the wording.

Peter Allen potentially disagrees with John Tibaldi in this area and they need to confer until a resolution is reached.

Comments from Bob Reilly are as follows.

Section 4.4, 2nd paragraph, last line delete "*as close as practical to the FSL.*" and replace with "*near FSL*".

Section 4.6 last dot point on p.18, 2nd line change "*reduced*" to "*reduce*".

4.8 Chapter 5

Chapter 5 of the North Pine FMM is equivalent to Chapter 7 of the Wivenhoe/Somerset FMM. There are obvious differences caused by two dams and one dam, respectively, being operated and the specific nature of each of the three dams.

In section 5.3 the following bullet points should be inserted (to be consistent with the Wivenhoe/Somerset FMM):

- "*Via other Seqwater personnel using the contact details contained in the Emergency Action Plans for the Dam,*"
- "*Via the Dam Supervisor at Wivenhoe Dam or via the Dam Supervisor at Somerset Dam,*"

The North Pine FMM contains

"• *Ensure the Dam is at FSL at the end of the Flood Event.*"

This should read (change underlined) "*at near FSL*".

4.9 North Pine FMM Appendices

I have checked that any references to an appendix in the FMM is to the correct appendix, however I have not perused the appendices in detail. I have also not been provided with a copy of appendix G, but I assume it is the same as appendix L in the Wivenhoe/Somerset FMM.

Comments from Peter Allen and/or Bob Reilly are as follows.

Appendix A – should DTMR be included?

Appendix B – please include a column with the 2011 Flood Heights.

Appendix C – could Peter Allen have the revised version of this ASAP please. This is very important and he needs it by 12pm Tuesday 20 September 2011 at the latest.

Appendix E – could this include a statement about hydrological studies currently being carried out?

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe	• definition of what 'best forecast rainfall' means	Y – although suggest a minor clarification point	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding. I note that the phrase "forecast rainfall" is still included in the draft FMM for example at 4.3 " <i>Forecast rainfall products provided by the BoM including weather radar, qualitative and quantitative rainfall forecast products, and weather warnings</i> ". I would prefer that this still be more closely defined, otherwise "forecast rainfall" could, on one (torturous but still technically possible) argument, include

manual:

- prescription about how forecast rainfall information is to be used by the flood engineers

Y – although suggest a minor clarification point

long term climate change predictions (which really should not be included, given the purposes of the FMM are really dam safety and flood mitigation, and the FMM is not about water security).

Seqwater's lawyer advised me that section 4.2 in the draft FMM states "*When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which have been derived from the FFS based on forecast rainfall are:*

- *If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.*
- *If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.*

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

My comments from the above section about the words "forecast rainfall" (which are used multiple times in section 4.2 of the draft FMM) apply.

- definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Maybe

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking appears to confirm this. However I have found

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

approximately 50 places in the draft FMM where lake level is used without either actual/predicted and sometimes it appears to be within context but sometimes there is potential for confusion (for example in Chapter 6 "*As Somerset Dam is the upstream dam, decisions on flood releases from Somerset Dam must take into account the Wivenhoe Dam lake level*").

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical

- clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Maybe

perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "generally" is no longer used. My independent checking confirms that "generally" is not used in most of section 5.3 however it is used in the last sentence of the third paragraph of "Strategy W4A – No Fuse Plug Initiation Expected" as "In these circumstances the discharge should generally remain at less than 4000m³/s prior to the lake level reaching EL 74.0 metres unless a larger outflow is judged very likely to result in reduced urban flooding downstream of the Dam.". While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "

Review Comments 23 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified).

At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyer by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with [REDACTED] (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED] a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. [REDACTED] and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by [REDACTED] October 2011. Seqwater's lawyers provided the revised draft to DERM early on Thursday 22 September 2011. DERM is aiming to provide comments back by early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM and by Saturday 24 September 2011 on the North Pine FMM. I understand that the drafts have concurrently been sent to the independent peer reviewer.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

3.1 General

Appendix L was not provided with the appendices and should be provided. Seqwater has previously provided a version of Appendix L which I have presumed has not changed much.

3.2 Title page, revisions table and table of contents

The title page should have a date stamp as agreed. Bob Reilly particularly wants this. So the date stamp for this version would be 22 September 2011.

A general check for all the terms in the glossary should be performed to check that they are capitalised where appropriate.

In the table of contents, in 3.5 "lake level" should become "Lake Level". I expect that in the final FMM submitted for approval the table of contents will be formatted correctly.

Throughout the manual, second level bullet points have simply been indented. Peter Allen requires a clearer hierarchy to be shown and I suggest replacing second level bullet points with dashes. For example in section 1.1 this:

- the fact that flood forecasting involves estimation and judgment as there are limitations on being able to (amongst other things):
 - accurately estimate flood run-off within the Brisbane River basin;
 - obtain accurate forecasts of rainfall during Flood Events; and
- the limitations on being able to:
 - identify all potential flood hazards and their likelihood; and
 - remove or reduce community vulnerability to flood hazards.
 -

would become this:

- the fact that flood forecasting involves estimation and judgment as there are limitations on being able to (amongst other things):
 - accurately estimate flood run-off within the Brisbane River basin;
 - obtain accurate forecasts of rainfall during Flood Events; and
- the limitations on being able to:
 - identify all potential flood hazards and their likelihood; and
 - remove or reduce community vulnerability to flood hazards.

This needs to be rectified in:

- page 9, section 1.1
- page 14, section 2.6
- page 15, section 2.9 (2 instances)
- page 16 section 2.10 "1." and "2" should be changed to dot points.
- page 24, section 4.3
- page 50, Notes section

3.3 Glossary

Change:

"Actual Lake Level" means the Lake Level at the staff headwater gauge with reasonable adjustments (where possible made by an engineer) to take into account prevailing conditions;

Change

“**Lake Level**” (or where used in a flowchart, “lake level”) means the water surface elevation in a dam;”

Insert:

“**Network**” means a network of rainfall and water level Gauging Stations which provides data in near real time and enables continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.

Insert:

“**Probable Maximum Flood**” or “**PMF**” means the flood resulting from the theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin and, where applicable, snowmelt, coupled with the worst flood-producing catchment conditions that can realistically be expected in the prevailing meteorological conditions.

3.4 Chapter 1

Section 1.1 Paragraph 3 change:

“The strategies set out in Chapters 4, 5 and 6 are intended to guide decision making in seeking to achieve these objectives.”

Section 1.5 heading change (at Bob Reilly's request):

“~~Legal Authority and Statutory Protection~~”

3.5 Chapter 2

Section 2.9 change:

- The FFS is described in Appendix L.
- ~~Seqwater must maintain the Network as part of the FFS a network of rainfall and water level Gauging Stations which provide data in near real time and enable continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.~~
- Seqwater must maintain the FFS and have it available for use by the Duty Flood Operations Engineers during Flood Events.
- Seqwater must improve the practical operation of the FFS by:
 - Implementing improvements identified during Flood Event reviews;
 - Improving model calibration as improved data becomes available;
 - Updating software in line with industry standards; and
 - Improving the coverage and reliability of the data collection network in conjunction with Agencies and the BoM.
- Seqwater must maintain a record of the performance of the data collection Nnetwork (being part of the FFS), including revised field calibrations and changes to the number, type and locations of rainfall and stream height gauges.
- Seqwater must also maintain a record of the performance of the FFS and is to rectify any identified faults as soon as practical.
- Seqwater must ensure that all available data and documentation from each Flood Event is collected and catalogued for future use.
- Seqwater must ensure that any information it collects that is relevant to the calibration of its field stations is provided to the BoM and relevant Agencies.
- Seqwater must provide a report to the Chief Executive by 30 September each year on the state of the FFS and the state of the Nnetwork referred to in Section 2.9.1, as part of the Statement of Preparedness provided to the Chief Executive under Section 2.3. The report must assess (as appropriate) the following in terms of hardware, software and personnel:
 - adequacy of the FFS and the Nnetwork referred to in Section 2.9.1;
 - reliability of the FFS over the previous period;

- reliability of the FFS under prolonged flood conditions;
- accuracy of forecasting flood flows and heights; and
- the overall state of preparedness of the FFS.

3.6 Chapters 3 and 4

Section 3.2 change:

Stability calculations have indicated that Somerset Dam can safely withstand being overtopped to a Lake Level of at least EL 109.7 metres, provided all crest gates are fully open.

Section 3.2 change

Extreme Floods and Closely Spaced Large Floods

As indicated in the previous section, techniques for estimating extreme floods show that Flood Events are possible which would overtop both Dams. ~~In the case of Wivenhoe Dam~~ Such an overtopping could result in the destruction of ~~Wivenhoe the Dams~~. Such events however require several days of extremely intense rainfall to produce the necessary runoff.

Section 3.4

~~Generally,~~ this consideration is secondary to considerations associated with limiting bridge inundation.

Section 3.5 change (at Bob Reilly's request):

As the Dams are ~~the primary~~ major urban water supply for South East Queensland, it is important that all opportunities to fill the Dams are taken.

Section 3.6 change:

~~Generally,~~ gate closure sequences should aim to mimic the natural flood recession that would have occurred had the Dams not been constructed.

Section 4.3 change:

This is because the BoM has advised that rainfall forecast information issued by the BoM is ~~generally too~~ unreliable to be used as a basis for predicting definitive future Lake Levels and river flows and making releases from the Dams.

3.7 Chapter 5

Page 24 Section 5.1 change "level" to "Lake Level"

Page Section 5.2 change:

~~D~~dam ~~C~~crest ~~F~~flood

Page 26 Section 5.3 insert ";or" at the second last bullet point.

Page 27 change (at Peter Allen's request)

The magnitude of the release from Wivenhoe Dam at any point in time should not exceed the predicted maximum inflow into Wivenhoe Dam up to that time during the Flood Event unless it is judged very likely by the Duty Flood Operations Engineer that there is a need to exceed the predicted maximum inflow up to that time to minimise downstream flood impacts. The most likely circumstances for this course of action would be associated with a flood originating primarily from downstream of Wivenhoe Dam.

Page 37 change

There are no restrictions on gate opening increments or gate operating frequency once the Lake Level exceeds EL 74.0 metres, as ensuring the structural safety of the ~~Dams~~dam is the primary concern when these Lake Levels are experienced.

Page 37 (Peter Allen noted) there is a superfluous parenthesis under the title "Strategy W2 Flowchart".

Strategy W2 Flowchart the word "Flowchart" is in red not black (but do not change it if this will hold up approval of the manual).

Strategy W3 Flowchart second decision box change (at Peter Allen's request):

Is the predicted peak flow at Moggil excluding Wivenhoe Dam releases judged likely to exceed 2000 m³/s and can the predicted Wivenhoe Dam lake level remain below EL 74.0 metres if the flow at Moggill is maintained at less than this value 2000 m³/s?

Page 37/38 change (at Ron Guppy's request)

Overall, when operating Wivenhoe Dam under Strategy W4, the Duty Flood Operations Engineer must select a Radial Gate release rate that ensures the structural safety the Dams. While there may be significant adverse impacts arising from flooding downstream of the Dams, the impacts will be considerably worse if either or both of the Dams fail during a Flood Event. While it is well understood that the impacts of urban flooding below Wivenhoe Dam can be devastating to rural and urban communities, the impacts associated with the failure of Wivenhoe Dam during a Flood Event would be far worse than any natural flood. Therefore when operating under Strategy W4, it is never permissible for the Duty Flood Operations Engineer to select a Radial Gate release rate that retains flood water in the Dams in a manner that risks the structural safety of the ns.

Page 38 (at Peter Allen's request):

Change 4000m³/s to 4000m³/s so superscript font is used.

Page 38 (at Peter Allen's request):

However in some circumstances, the timing of a greater peak release may reduce urban flooding, as the final urban flooding outcome also depends on the timing of natural inflows into the Brisbane River that are occurring downstream of the Dam.

Page 39 in second row, second column of table change:

~~the Wivenhoe Dam~~

Page 41 section 5.4 first bullet point change:

The FSL in ~~both the~~ Dams

Floodwaters stored above the FSL in ~~both the~~ Dams should generally in most circumstances be emptied within seven days after the flood peak has passed through the Dams. However, provided a favourable weather outlook is available, this requirement can be relaxed for the volume of water stored between the FSL and a ~~at~~ 0.5 metres above the FSL.

Section 5.4 change:

- The stranding of fish downstream of the ~~Ddams~~ should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 41 section 5.5 change:

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of the ~~dam~~ Wivenhoe Dam is at risk;
- The radial gates are at risk of being overtopped; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 45 Section 5.7 change:

Under these circumstances, the uncontrolled flow passing through the eroded fuse plug embankments may be greater than the flow from ~~the~~ Wivenhoe Dam required to minimise downstream rural and urban impacts.

3.8 Chapter 6

Page 48 section 6.2 change (at Ron Guppy's request):

The intent of Strategy S1 is to maximise the combined benefits of the flood storage capabilities of the Dams to minimise disruption to rural life ~~downstream of Wivenhoe Dam.~~

Page 48 Section 6.2 change:

The actions when operating Somerset Dam under Strategy S1 are:

- The regulator valves and sluice gates are generally in most circumstances kept closed; and
- The crest gates are raised before the Somerset Dam Lake Level exceeds EL 100.45 metres.

Page 49 section 6.2 four changes:

The regulator valves and sluice gates are used to release water from ~~the Somerset Dam~~ with the aim of moving towards the Wivenhoe/Somerset Operating Target Line. Ideally, at the peak of a Flood Event, the Dams' Lake Levels should plot on or very close to the Wivenhoe/Somerset Operating Target Line. However, this may not be possible to achieve in practice. Prior to the peak of the Flood Event, it is also desirable (although may not be possible) for the Dams' Lake Levels to generally plot on or very close to the Wivenhoe/Somerset Operating Target Line. This will prevent the need for rapid sluice gate operations as the peak of the Flood Event approaches.

Page 52 section 6.3 change

~~In general, drain down of the Dams commences when the Lake Levels in the Dams are falling, the flow in the Brisbane River at Moggill is reducing and the rainfall forecasts provided by the BoM indicate that no significant runoff producing rainfall is expected in the Brisbane River basin for at least 48 hours.~~ Drain down of the Dams commences when the total volume of flood water stored in the combined flood storage compartments of the Dams begins to fall and it is judged likely that the total volume of flood water stored will continue to fall over the next 48 hours after taking into account BoM rainfall forecasts.

Once drain down commences, sluice gate closure, in usual circumstances, occurs in the reverse order to sluice gate opening. In usual circumstances Generally, the final sluice gate closure occurs well before the Somerset Dam Lake Level falls to the FSL, as the regulator valves are normally used for final drain down. The final closure of the last open sluice gate or regulator valve should be timed to allow the Lake Level to return to near the FSL.

The following factors must be considered when determining gate closure sequences at Somerset Dam during the drain down phase:

- Floodwaters stored above the FSL in both Dams should in most circumstances generally be emptied within seven days after the flood peak has passed through the Dams. However, provided a favourable weather outlook is available, this requirement can be relaxed for the volume of water stored between the designated FSL and a level 0.5 metres above the designated FSL.

Section 6.3 change:

- The stranding of fish downstream of the Dams should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 52 section 6.3 add as last bullet point:

- The objectives in Section 3.6 should be considered.

Page 52 section 6.4 change

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of either or both of the Dams the dam is at risk;
- The radial gates are at risk of being overtopped; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 53 in table change "dam level" to "Lake Level"

Page 53 section 6.4 change:

Regulator valves are to be kept fully closed when the tail water level below Somerset Dam is above the invert of the valves (EL 68.60 metres). Operating the valves under these circumstances can damage the valves. This requirement can be ignored if the structural safety of the Somerset Dam is at risk.

Page 53 section 6.4 change

If one or more of the regulator valves, sluice gates or crest gates are inoperable during the course of the Flood Event, the openings of the working valves and gates are to be adjusted to provide the required discharge from the Somerset Dam.

3.9 Chapter 7

Page 54 section 7.1 insert and/or at the end of the second last bullet point.

Section 7.2 change:

dDam eCrest fFlood

Section 7.3.1 in the table (page 55/56/57) change "Storage Level" to "Lake Level" in three instances.

Page 57 change:

The table above shows individual sequence steps against a target storageLake Llevel. The minimum time intervals between each step in the radial gate opening sequence are shown in the table below. Falling behind or being in front of the target gate openings is permissible when the storageLake Llevel is less than EL 74.0 metres, but not allowed when the storageLake Llevel is greater than EL 74.0 metres. When the storageLake Llevel is below EL 74.0 metres, the operating intervals shown in the table below must be followed and can be only be reduced to protect the structural safety of the Wivenhoe Ddam.

Page 57 change

In these circumstances, gates are preferably ~~generally~~ operated in the order of 3, 2, 4, 1, and 5 moving through the sequence shown in the table.

Page 58 section 7.3.2 change

In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log; and
- Remain in the general vicinity of the dam while on duty.

There are two separate procedures that can be followed at Somerset Dam if communications with the Flood Operations Centre are lost. The choice of the appropriate procedure to follow depends on the Somerset Dam Lake Level. The two procedures are:

- **Procedure LCS1** – The Somerset Dam Lake Level is below EL 100.45 metres; or
- **Procedure LCS2** – The Somerset Dam Lake Level is above EL 100.45 metres.

The following actions are applicable to each procedure:

- Unless communications with Wivenhoe Dam are available, the Wivenhoe Dam Lake Level is to be assumed as the level shown on gauge boards located downstream of Somerset Dam;
- The crest gates are to be kept fully raised to allow uncontrolled discharge;
- The regulator valves are to be closed and are in nearly all circumstances ~~generally~~ kept closed if the tail

water level exceeds EL 68.60 metres. The only exception to this is if the regulator valves are used to prevent overtopping of the Somerset Dam; and

- The sluice gates are operated as either fully opened or fully closed. The order of operation for opening the sluice gates is LMKNJOIP. Sluices are to be closed in reverse order of opening. Any inoperable sluices are to be dropped from the opening or closing sequences.

3.10 Wivenhoe/Somerset FMM Appendices

Appendix A (at Bob Reilly's request) insert an extra row:

AGENCY	RESPONSIBLE PERSON	LOCATION
DTMR	tba	tba

Appendix B

In the table change "Storage Level" to "Lake Level" in two instances.

In the text change "Storage Level" to "Lake Level" in four instances.

In the text change "headwater level" to "Lake Level" in two instances.

Appendix E

In the first table change "Storage Level" to "Lake Level" in two instances.

Notes after first table change (at Bob Reilly's request):

1. The information in this table is based on a FSL of EL 67.0 metres

2. This is the maximum discharge of an individual spillway bay or regulator. Total discharge is calculated by adding the contributions of each gate or regulator.

3. The temporary storage is assumed to be the storage above normal Full Supply Level of EL 67.0 metres.

4. The first fuse plug is designed to trigger at EL 75.7 metres. Above this level, fuse plug flows from the fuse plug tables need to be added to give the total outflow

In the second table change "Water EL (m AHD)" to "Lake Level (EL)" in two instances.

Change header in tables(at Peter Allen's/Ron Guppy's) and notes:

FUSE PLUG DETAILS

Fuse Plug	Type	Width (L)	Crest Level	Fuse Plug Pilot Channel Invert Level	Storage Level corresponding to Fuse Plug Pilot Channel Invert Level ¹
		m	m AHD	m AHD	m AHD

- 1 ~~Storage Lake~~ Level is as per that measured at the ~~Headwater Staff~~ Gauge. Initiation of Fuse Plug is expected to occur when the ~~Lake Water~~-Level exceeds the Lake Level at Fuse Plug Pilot Channel by 0.10 - 0.15 m.
- 2 Includes 0.03m of drawdown from the Fuse Plug Pilot Channel Invert to the ~~Lake Water~~-Level.
- 3 Includes 0.08m of drawdown from the Fuse Plug Pilot Channel Invert to the ~~Lake Water~~-Level.

Discharge for each fuse plug may be approximated using the following equation:

$$Q_{\text{Fuse Plug}} = 2.1 * L * (\text{Storage Lake Level} - 67.0)^{1.5}$$

Where L = width of fuse plug bay in metres.

FUSE PLUG RATINGS

Storage Lake Level	Fuse Plug Discharge			
	Left Bay	Central Bay	Right Bay	Total
m AHD	m ³ /s	m ³ /s	m ³ /s	m ³ /s

In the graph axis label change "Water Level" to "Lake Level".

Appendix G

Page 1 Change:

The main purpose of gating the spillway is to exercise maximum possible control over the flow in the Brisbane River insofar as river flows in excess of 4,000 m³/s at Moggill cause significant damage to urban areas downstream although lower flows will still cause damage. The radial gates also allow the routing of much larger floods with substantial flood mitigation being achieved.

Page 2 in table change "Reservoir Level" to "Lake Level".

Page 3 at the bottom change "Dam" to "dam".

Appendix J

In table change header

BRIDGE NAME	ROAD	DECK ELEVATION m AHD	LOCAL AUTHORITY <u>AREA</u>
-------------	------	----------------------------	-----------------------------

Appendix K

Change "Probable Maximum Precipitation Design Flood" to "PMPDF" in four instances.

Appendix L

A copy should be provided.

4. Comments – North Pine FMM

To be provided 24 September 2011

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "Lake Level" (or where used in a flowchart, "lake level") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3. I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "

Review Comments 25 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified). At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyers by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with [REDACTED] (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED] a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. [REDACTED] and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011. Seqwater's lawyers provided the revised draft FMMs to DERM early on Thursday 22 September 2011. I provided DERM comments back early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM. I provided DERM comments back late on Saturday 24 September 2011 on the North Pine FMM. I understand that Seqwater plan to engage a professional document editor to review the FMMs for typographic errors and internal inconsistencies. I understand that the drafts have concurrently been sent to the independent peer reviewer.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly and/or Ron Guppy
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

Provided 23 September 2011. Additional comments as follows.

Page 14 section 2.3 turn the last bullet point back into a paragraph (to be consistent with the North Pine FMM and to flow logically).

Page 55 section 7.3.1 change:

"In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log;
- Remain in the general vicinity of the Wivenhoe Dam while on duty; and
- Ensure Wivenhoe Dam is near FSL at the end of the Flood Event.

(to be consistent with the North Pine FMM **unless** there is a technical reason that the return to FSL has been excluded).

Page 58 section 7.3.2 change

"In the event of communications loss with the Flood Operations Centre, the Dam Supervisor at Somerset Dam is to assume responsibility for flood releases from the Dam. Once it has been established that communications have been lost, the Dam Supervisor at Somerset Dam is to:-

- Take all practicable measures to restore communications and periodically check the lines of communication for any change;
- Follow the procedures set out below to determine the appropriate regulator valve, sluice gate and crest gate settings;
- Log all actions in the event log;
- Remain in the general vicinity of the Somerset Dam while on duty; and
- Ensure Somerset Dam is near FSL at the end of the Flood Event.

(to be consistent with the North Pine FMM **unless** there is a technical reason that the return to FSL has been excluded).

4. Comments – North Pine FMM

4.1 General

Appendix G was not provided with the appendices and should be provided. I have presumed it is very similar to Appendix L of the Wivenhoe Somerset FMM. Seqwater's lawyers provided Appendix L on 24 September 2011 and I provided legal / proofreading comments back the same day with a note that I had asked DERM's engineers for technical comment.

Throughout the document, "Radial Gates" is used. This is not a defined term so it should be "radial gates" in many instances. The Wivenhoe/Somerset FMM uses "radial gates".

4.2 Title page, revisions table and table of contents

The title page should have a date stamp as agreed. Bob Reilly particularly wants this. So the date stamp for this version would be 22 September 2011.

A general check for all the terms in the glossary should be performed to check that they are capitalised where appropriate.

Throughout the manual, second level bullet points have simply been indented. Peter Allen requires a clearer hierarchy to be shown and I suggest replacing second level bullet points with dashes.

This needs to be rectified in:

- page 2, Glossary definition of Food Officers, "1." and "2" should be changed to dot points
- page 4, section 1.1, "1." and "2" should be changed to dot points and the dot points should be changed to dashes
- page 10, section 2.6 , numbers e.g. "1." and "2" should be changed to dot points and the dot points should be changed to dashes
- page 12, section 2.9 (2 instances)
- page 18, section 4.4.

4.3 Glossary

Change:

"Actual Lake Level" means the Lake Level at the staff headwater gauge with reasonable adjustments where possible made by an engineer to take into account prevailing conditions;

I note in regard to the definition of Full Supply Level that Bill McCredie was to consult with Michael Ilott of Seqwater's lawyers to establish if there was a particular reason that the North Pine FMM FSL could not mirror the Wivenhoe/Somerset FMM definition. DERM has reserved its position in this regard.

Insert:

"Network" means a network of rainfall and water level Gauging Stations which provides data in near real time and enables continuous monitoring of rainfall and stream water levels within the Dam's catchments. Key Gauging Station locations are identified in Appendix B for reference purposes.

Insert:

"Probable Maximum Flood" or "PMF" means the flood resulting from PMP and, where applicable, snowmelt, coupled with the worst flood-producing catchment conditions that can realistically be expected in the prevailing meteorological conditions.

Insert:

"Probable Maximum Precipitation" or "PMP" means the theoretical greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin.

Also change PMF and insert PMP in W&S FMM to be consistent across the FMMs

4.4 Chapter 1

Section 1.5 heading change (at Bob Reilly's request):

~~"Legal Authority and Statutory Protection"~~

4.5 Chapter 2

Section 2.2 move the twelfth bullet point to become the tenth bullet point (consistent with the W&S FMM) and change it to:

"The Dam's Radial Gates and the Regulators are kept in good working order at all times and are not to be removed from service for maintenance or any other reason without the specific permission of the a Senior Flood Operations Engineer.

Section 2.5 change:

"When rostered on duty during a Flood Event, the responsibilities of the Flood Operations Engineer are as

follows:

- ~~D~~irect the operation of the Dam during a Flood Event in accordance with the overall strategy determined by a Senior Flood Operations Engineer; and
- ~~F~~ollow any direction from the Senior Flood Operations Engineer in relation to applying reasonable discretion in managing a Flood Event as described in Section 4.5

~~[remove actual bullet]~~A Flood Operations Engineer is to follow this Manual in managing Flood Events and is not to apply reasonable discretion unless directed by a Senior Flood Operations Engineer or the Chief Executive.”

Section 2.9 change:

“The FFS is described in Appendix G.

- Seqwater must maintain the Network as part of the FFS~~a network of rainfall and water level Gauging Stations which provide data in near real time and enable continuous monitoring of rainfall and stream water levels within the Dams' catchments. Key Gauging Station locations are identified in Appendix I for reference purposes.~~
- Seqwater must maintain the FFS and have it available for use by the Duty Flood Operations Engineers during Flood Events.
- Seqwater must improve the practical operation of the FFS by:
 - Implementing improvements identified during Flood Event reviews;
 - Improving model calibration as improved data becomes available;
 - Updating software in line with industry standards; and
 - Improving the coverage and reliability of the data collection network in conjunction with Agencies and the BoM.
- Seqwater must maintain a record of the performance of the data collection N~~network~~ (being part of the FFS), including revised field calibrations and changes to the number, type and locations of rainfall and stream height gauges.
- Seqwater must also maintain a record of the performance of the FFS and is to rectify any identified faults as soon as practical.
- Seqwater must ensure that all available data and documentation from each Flood Event is collected and catalogued for future use.
- Seqwater must ensure that any information it collects that is relevant to the calibration of its field stations is provided to the BoM and relevant Agencies.
- Seqwater must provide a report to the Chief Executive by 30 September each year on the state of the FFS and the state of the rainfall and water level gauging n~~Network referred to above~~, as part of the Statement of Preparedness provided to the Chief Executive under Section 2.3. The report must assess (as appropriate) the following in terms of hardware, software and personnel:
 - adequacy of the FFS and the rainfall and water level gauging n~~Network referred to above~~;
 - reliability of the FFS over the previous period;
 - reliability of the FFS under prolonged flood conditions;
 - accuracy of forecasting flood flows and heights; and
 - the overall state of preparedness of the FFS.

Section 2.10 change “lake level” to “Lake Level” in three instances and “actual lake level” to “Actual Lake Level” in one instance.

Section 2.11 uncapitalise the bullet point parts (consistent with the W&S FMM).

Section 2.12 change:

“details of Aactual Lake Levels and predicted L~~L~~ake L~~L~~evels at the Dam”.

4.6 Chapter 3

Page 15, Section 3.2 change:

“Embankment sections on the other hand are likely to washout rapidly if overtopped and cause failure of the D~~d~~am”.

Page 15, Section 3.2 change:

"Techniques for estimating extreme floods show that ~~F~~Floods Events are possible which would overtop the Dam. Such events however ~~may require a couple of~~ several days of ~~[extremely~~ – this is a technical point as to whether extremely gets inserted or not] intense rainfall to produce the necessary runoff." (consistent with the W&S FMM).

Also should "storms" be "rainfall systems" (consistent with the W&S FMM) or is this a purposeful technical meteorological difference?

Page 16, Section 3.4, split into two paragraphs (consistent with the W&S FMM)

Page 16, Section 3.5 insert at the start of the sentence: "Near the conclusion of a Flood Event (consistent with the W&S FMM).

4.7 Chapter 4

Page 18 second paragraph change:

"As the Dam has no provision for flood mitigation, when the Dam is full ensuring the structural safety of the ~~d~~Dam is paramount. Accordingly, the aim is to pass any significant flood through the reservoir, while on most occasions ~~generally~~ ensuring that peak outflow does not exceed peak inflow, and to empty stored floodwaters as quickly as possible."

Page 19 section 4.5 for last bullet point remove actual bullet (consistent with the W&S FMM).

Page 19 Section 4.6 in second sentence and in third bullet point (two instances) change "lake level" to "Lake Level"

Page 19 Section 4.6 change:

The following factors must be considered when determining gate closure sequences:

- Floodwaters stored above the FSL should in most circumstances ~~generally~~ be emptied

Page 19 Section 4.6 change last bullet point:

- The stranding of fish downstream of the ~~D~~Ddam should be minimised by ensuring that a coordinated fish recovery operation takes place in conjunction with final gate closure.

Page 20 section 4.7 change:

It is permissible for the Duty Flood Operations Engineer to reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- The safety of the Dam is at risk;
- The ~~R~~Rradial ~~G~~Ggates are at risk of being overtopped;
- Radial ~~G~~Ggate operations fall more than three openings behind the gate opening settings contained in Appendix C; or
- There is a requirement to preserve stored water or to reduce downstream flooding.

Page 21 change "lake levels" to "Lake Levels".

4.8 Chapter 5

Page 22 section 5.1 insert and/or at the end of the second last bullet point.

Page 23 section 5.3 third bullet point change "~~E~~Eevent ~~L~~Log".

Page 23 section 5.3 fourth bullet point change "Remain in the general vicinity of the Ddam while on duty; and"

Page 23 section 5.3 fifth bullet point change "Ensure the Ddam is near FSL at the end of the Flood Event."

4.9 North Pine FMM Appendices

Appendix B

Add a column in the table for the 2011 flood as agreed in the meeting of 21 September 2011.

Appendix C

I am just passing on technical comments here from Peter Allen. Any questions should be directed to him.

Comments from Peter Allen:

Peter notes that the movements in the new Appendix C have been spaced out from 50mm to 100mm. Peter still believes that this will be a problem in small floods because there will be so many gate openings. He thinks that there will still be "hunting". Peter would recommend spacing it out to 400mm or making it part of the longer term review of North Pine FMM. Peter has provided his views to John Tibaldi about this. Peter is happy to discuss further with John Tibaldi. In the event that Seqwater still wish to submit the North Pine FMM with Appendix C as it currently is, Peter would like some formal assurance from Seqwater that it is confident that it will be able to operate that way.

Comments from Peter Allen:

In the first table there needs to be a zero gate setting.

Comments from Peter Allen:

Appendix C then has all gates operational but it must have one gate out (or alternatively the body of the FMM which states that one gate is out should be amended).

Appendix D

Add details of the hydraulic system currently being installed as agreed in the meeting of 21 September 2011.

Appendix E

Add details of the hydrologic investigations currently being carried out as agreed in the meeting of 21 September 2011.

Appendix G

A copy should be provided.

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "**Lake Level**" (or where used in a flowchart, "**lake level**") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3 I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Friday 23 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "



Review Comments 28 September 2011

1. Background

The Queensland Floods Commission of Inquiry ("Commission") was established on 17 January 2011. The Commission of Inquiry completed the first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties (which included a draft finding that there was not a proper delegation of the chief executive's powers under the Flood Mitigation Manuals ("FMMs")). The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011 (the Interim Report did not contain any findings or recommendations in relation to delegation of the chief executive's powers under the FMMs however it was considered prudent that this issue be rectified). At present there are two FMMs that have been approved under the *Water Supply (Safety and Reliability) Act 2008* (the Act), namely, the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 7 - November 2009* which was gazetted on 22 January 2010 and the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam Revision 5 - August 2010* which was gazetted on 17 December 2010.

2. Process

I commenced my review of the FMMs on 12 September 2011 (although I had of course discussed matters generally before this time). I met with [REDACTED] a Partner at Allens Arthur Robinson ("Seqwater's lawyers") the firm of solicitors representing the Queensland Bulk Water Supply Authority trading as Seqwater ("Seqwater"), on 13 September 2011 and 15 September 2011. I also spoke to Seqwater's lawyers by telephone on numerous occasions and there were several email correspondences and exchange of versions of the FMMs. I also consulted internally within DERM with [REDACTED] (A/Director, Legislative Development Services, Peter Allen (Project Director, Dam Safety, OWSR), Ron Guppy (Principal Engineer, Dam Safety), John Ruffini (Director, Water Planning Sciences, ERS), Bob Reilly (General Manager, OWSR) and [REDACTED] (Executive Officer, Inquiry Recommendations Implementation Group).

Bob Reilly, Peter Allen, John Ruffini, Ron Guppy and I met with John Tibaldi and Terry Malone from Seqwater and [REDACTED] a Partner at Seqwater's lawyers on Wednesday 21 September 2011 at the Flood Operations Centre. [REDACTED] and [REDACTED] from DERM attended part of the meeting and Jim Pruss from Seqwater attended another part of the meeting. The aim of the meeting was to produce a final draft FMM for independent peer review (by Len McDonald) and submission by Seqwater by 23 September 2011 for approval by the Chief Executive (being the A/Director-General DERM Mr Terry Wall) by gazette notice by 1 October 2011. Seqwater's lawyers provided the revised draft FMMs to DERM early on Thursday 22 September 2011. I provided DERM comments back early on Friday 23 September 2011 on the Wivenhoe & Somerset FMM. I provided DERM comments back late on Saturday 24 September 2011 on the North Pine FMM. I understand that Seqwater engaged a professional document editor to review the FMMs for typographic errors and internal inconsistencies and also sent the drafts concurrently to the independent peer reviewer. Seqwater's lawyers provided the further revised draft Wivenhoe & Somerset FMM together with the draft explanatory notes early in the evening of Tuesday 27 September 2011.

I have provided comments about:

- grammar and spelling
- consistency
- statutory interpretation
- compliance with recommendations of the Commission.

I have not personally provided comments about:

- general writing style, except where it might cause confusion
- technical engineering matters as Peter Allen is conducting this part of the review together with Ron Guppy (Principal Engineer, Dam Safety, OWSR) – any technical comments below are clearly identified as being a particular requirement of Peter Allen and/or Bob Reilly and/or Ron Guppy
- basic mathematical analyses of the calculations in the FMMs however John Ruffini has, on my request, conducted a basic mathematical analysis of each FMM and advises that he has not located any basic mathematical errors.

3. Comments - Wivenhoe/Somerset FMM

My legal / proofreading comments are as below. I note that Peter Allen is yet to provide technical comment in this area.

Body of Manual

EITHER

Glossary change (**preferred**):

"Dams" means Wivenhoe Dam and Somerset Dam and "Dam" means either Wivenhoe Dam or Somerset Dam depending on the context used;

OR

If the "Dam" Glossary change requested above is not made then the following changes must be made but if the Glossary change is made then the following changes can be ignored:

- page 23 change "the Dam" to "Wivenhoe Dam" in paragraph 1.
- page 26 change "the Dam" to "Wivenhoe Dam" in paragraph 1.
- page 37 change seven instances of "Dam" to "Wivenhoe Dam" in paragraph 2.
- page 43 change "the Dam" to "Wivenhoe Dam" in three instances.
- page 46 change "upstream Dam" to "upstream dam" in paragraph 1.
- page 50 section 6.3 third bullet point change "each Dam" to "each of the Dams".
- Page 52 section 7.3 change "between a Dam" to "between one of the Dams" and change "at the other Dam" to "at the other one of the Dams".
- Page 52 section 7.3.1 change "the Dam" to "Wivenhoe Dam".
- Page 56 change "the Dam" to "Somerset Dam"
- Page 58 table 7.3.6 change "the Dam" to "Somerset Dam" in two instances.
- Appendix C page 64 change "Dam" to "Somerset Dam" in two instances.
- Appendix D page 68 change "elevation of Dam" to "elevation of Somerset Dam".
- Appendix G page 85 change "Dam" to "Wivenhoe Dam" in paragraph 1.
- Appendix G page 88 change "Dam" to "Wivenhoe Dam" in paragraph 2.
- 'Appendix L page 101 fourth bullet point change "Dam" to "each fo the Dams" " in two instances and second tier bullet points change "Dam inflows" to "Dams' inflows".
- Ask the technical writer to perform a full check for the use of the word "Dam" in case I have missed any examples.

Section 2.6 add "and" as below :

- a total of at least five years of suitable experience and demonstrated expertise in at least two of the following areas:
 - investigation, design or construction of major dams;
 - operation and maintenance of major dams;
 - hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology; and
 - applied hydrology with particular reference to flood forecasting and/or flood forecasting systems.

Section 3.4 second paragraph change "the Dam" to "Wivenhoe Dam".

Section 4.2 Bob Reilly wants these sentences (which had not been in previous drafts) completely removed from the Manual as they are more of a general commentary than an operational procedure.

"By way of guidance, this unreliability was evident during the January 2011 Flood Event. In that event, total reliance upon rainfall forecasts would likely have caused an increase in urban flooding below Moggill, thereby highlighting the adverse consequences which can arise when significant weight is placed upon rainfall forecasts."

However, DERM has no objection to these sentences (suitably amended) being included in the Explanatory Notes.

Section 4.4 change:

Prior to a public road bridge (as listed in Appendix J) being inundated due to either releases of water from Wivenhoe Dam or water being stored above the FSL of Somerset Dam, the Duty Flood Operations Engineer should aim to ensure that the Agency responsible for the closure of the bridge is notified.

Section 5.3 Table 5.3.8 row 1 column 1 change "Somerset" to "Somerset Dam".

Section 5.5 page 43:

Change eight instances of "Radial Gate" to "radial gate".

Change two instances of "Radial gate" to "radial gate".

Section 6.2 (page 49):

- Figure 6.2.2 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.
- Notes change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in two instances.
- Notes change "storages" to "Dams".

Section 7.2 fourth bullet point (page 56) and tenth bullet point (page 57) change "the Somerset Dam" to "Somerset Dam".

Section 7.3.1 page 55 change "the Wivenhoe Dam" to "Wivenhoe Dam".

Page 56 renumber "7.2.2 Somerset Dam Emergency Procedure" to be "7.3.2 Somerset Dam Emergency Procedure".

Page 58 Table 7.3.6 row 2 column 2 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.

Page 59 Figure 7.3.1 change "Operating Target Line" to "Wivenhoe/Somerset Operating Target Line" in three instances.

Appendices

Page 63 Appendix B clarify which dam in "Dam tail water level (Wivenhoe Lake Level)".

Page 69 Appendix D figure 5 change "Wivenhoe Dam Level" to "Wivenhoe Dam Lake Level" and change "Somerset Dam Level" to "Somerset Dam Lake Level" in the axis labels

Page 81 Appendix E figure 6 change "Water Level" to "Lake Level" in the axis label.

Pages 82 and 83 and 84 Appendix F change in one instance on each page:

* Opening required to prevent Radial Gate overtopping.

This is the discharge for EL 72.5m (not for all lower Lake Levels).

Page 85 Appendix G change this:

Therefore in operating the spillway, the principles to be observed are, in order of priority:

1. The discharge jet into the plunge pool is not to impinge on the right or left walls of the plunge pool.
2. The flow in the spillway is to be generally symmetrical.

to this:

Therefore in operating the spillway, the principles to be observed are, in descending order of priority:

- The discharge jet into the plunge pool is not to impinge on the right or left walls of the plunge pool; and
- The flow in the spillway is to be generally symmetrical.

Page 86 Appendix G change "reservoir level" to "Lake Level".

Page 87 Appendix G change "This procedure should only be used if the safety of the dam is at direct risk or to preserve the water supply stored in the Dam." to "This procedure should only be used if the safety of Wivenhoe Dam is at direct risk or to preserve the water supply stored in Wivenhoe Dam."

Page 100 Appendix K change "peak water levels" to "peak Lake Levels".

Page 101 Appendix L third bullet point change "Duty Flood Operations Engineers" to "Duty Flood Operations Engineer(s)".

Explanatory Notes

As above in relation to comment on Section 4.2 of the Manual, words to the effect of these sentences might be included:

"By way of guidance, the unreliability of QPF was evident during the January 2011 Flood Event. In that event, total reliance upon rainfall forecasts would likely have caused an increase in urban flooding below Moggill, thereby highlighting the adverse consequences which can arise when significant weight is placed upon rainfall forecasts."

I have no other legal / proofreading comments in regard to the draft Explanatory Notes.

I note that Peter Allen is yet to provide technical comment in this area.

4. Comments – North Pine FMM

Not applicable as further revised draft of the North Pine FMM yet to be provided.

5. Compliance with recommendations from the Interim Report

See table below.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - Wivenhoe/Somerset Dams Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the Wivenhoe manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	Y	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	Y	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Wednesday 27 September 2011.
2.9 The following matters require particular attention during the interim review of the Wivenhoe manual:	• definition of what 'best forecast rainfall' means	Y	Seqwater's lawyer advised me that the phrase "best forecast rainfall has been removed from the draft FMM and replaced in section 4.2 as " <i>The most recent 24-hour Quantitative Precipitation Forecast ("QPF")</i> ". While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been replaced rather than defined), it actually provides clearer understanding.
	• prescription about how forecast rainfall information is to be used by the flood engineers	Y	Seqwater's lawyer advised me that section 4.2 in the draft FMM states " <i>When selecting a strategy, zero or minimal weight will usually be given to the predictions which have been derived from the FFS based on forecast rainfall, other than in the exceptional circumstances referred to below. The exceptional circumstances where weight may be given to predictions which</i>

• definition of 'predicted lake level' and the use of consistent language throughout the Wivenhoe manual about predicted lake levels

Y

have been derived from the FFS based on forecast rainfall are:

- If, due to the nature of the rainfall system or other circumstances, the BoM is able to provide a rainfall forecast with a very high probability of occurrence. This may be possible for forecasts with short lead times of 6-12 hours.
- If, due to future advances in technology, the BoM is able to provide a rainfall forecast with a much higher probability of occurrence than is presently available.

However, the degree of weight to be given to the predictions which have been derived from the FFS based on forecast rainfall is always a matter for the professional engineering judgment of the Duty Flood Operations Engineer.

The following definition has been added to the glossary: "**predicted**" means, unless the context requires otherwise, the prediction of an event or circumstance made by the Duty Flood Operations Engineer using the FFS in the manner set out in Section 4.2. Seqwater's lawyer advised me that every "lake level" in the Strategy Conditions boxes in the draft FMM has either "actual" or "predicted" before it, and my independent checking confirms this.

The following definition has been added to the glossary: "**Lake Level**" (or where used in a flowchart, "**lake level**") means the water surface elevation in a dam.

All the instances of lake level in the draft FMM have been capitalised (except the flowcharts) and Lake Level now replaces other terms such as "headwater level" and "dam level".

• clarification of options for transition to strategies W2 or W3 from strategy W1

Maybe*

Seqwater's lawyer advised me that the flowcharts clarify these options. I have checked with Peter Allen and he advises that the way it is written he believes there may be the possibility of a gap regarding a W4 issue (affecting a transition from W1 to W3). This will need to be discussed. *check with Peter if this has been satisfied in the changes*

• clarification of the rules for drawdowns of the dams following flood events

Y

Seqwater's lawyer advised me that sections 4.5, 5.4 and 6.3 clarify the rules for drawdowns and my independent checking confirms this.

• removal of the term 'non-damaging flows' (and similar terms) to describe flows below 4000 m³/s at Moggill

Y

Seqwater's lawyer advised me that "*non-damaging flows*" has been removed from the draft FMM and my independent checking confirms this.

• clarification of whether W3 allows the flood engineers to release water which would create a flow at Moggill of over 4000 m³/s

Y

Seqwater's lawyer advised me that W3 does actually allow this but it would be extremely rare and the clarification is set out in section 3.3 and in the Strategy Selection Flowchart in section 5.3 I have checked with Peter Allen he concurs. Peter has advised that while the engineers might be "permitted" under the FMM to release water which would create a flow at Moggill of over 4000 m³/s that they would never deliberately do so in strategy W3 (if they went to W4 obviously this changes). Flows downstream of the Dams (e.g. rain in the Lockyer Valley) may cause the flow at Moggill to be above the target level and there is nothing the engineers can do once the water is released.

• precise definition of the maximum mechanical capability of the gate opening mechanism

Y

Seqwater's lawyer advised me that the term "*maximum mechanical capability*" has been removed from the draft FMM and my independent checking confirms this. Peter Allen and John Ruffini have both advised me that, from a technical perspective, there is no real benefit in a definition. While arguably this does not strictly specifically satisfy the recommendation (in that the phrase has been removed rather than defined), it actually provides clearer understanding.

• clarification of how part 8.6 should be followed in strategy W4, including clarifying the use of the word 'generally'.

Y

Seqwater's lawyer advised me that a whole new section has been inserted for strategy W4 and my independent checking confirms this. Seqwater's lawyer advised me that the word "*generally*" is no longer used. My independent checking confirms this. While arguably removal does not strictly specifically satisfy the recommendation (in that the word has been removed rather than clarified), it provides clearer

understanding.

Queensland Floods Commission of Inquiry Recommendations - Interim Review - North Pine Dam Flood Mitigation Manual (FMM)

Rec	Details	Addressed	Comments
2.8 Seqwater should:	1. conduct an interim review of the North Pine manual	Y	
	2. have the draft manual assessed by independent expert peer reviewers	In progress	Seqwater's lawyer advised me that Len McDonald has been engaged by Seqwater as an independent peer reviewer – Seqwater's lawyer advised me that he will provide a letter to Seqwater with his views, and it is planned that Seqwater will provide a copy of that letter to DERM with the final FMM submission.
	3. consider the expert peer reviews	In progress	As per Rec 2.8(2) above. Further, Seqwater's lawyer advised me that it is planned that Seqwater will provide a letter to DERM with the final FMM submission confirming that Seqwater has considered Len McDonald's views.
	4. submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.	In progress	Seqwater's lawyer advised me that it is planned that Seqwater will provide the final FMM submission and letters on Thursday 29 September 2011.
2.9	Particular attention should be paid during the interim review of the North Pine manual to clarifying the circumstances in which pre-releases under part 8.4 are permitted.	Y	In a new section 4.4 of the draft FMM the first bullet point states, " <i>The Radial Gates can be opened for flood management purposes prior to the reservoir level exceeding FSL if the aim of such actions is to reduce disruption to downstream communities or protect the structural safety of the Dam.</i> "



28 September 2011 1.15 PM

Technical Comments (Peter Allen/ Bob Reilly / Ron Guppy)

1.

Page 2 column 3 row 8 change:

“Revision, but no substantive alteration of objectives or, strategies or operating practices.”

Page 6 Table of Contents – Appendices remove the superscript “1” from Appendix E.

2.

Page 23, Section 4.2 second sentence change to:

These conditions include, amongst other things (~~including Actual Lake Levels~~) in the Dams, predicted Lake Levels in the Dams and predicted peak flow rates at downstream locations, including Moggill.

3.

Page 23, Section 4.2 fourth paragraph move the third and fourth sentences to explanatory notes and insert these two sentences in their place:

“By way of guidance, total reliance upon rainfall forecasts may cause an increase in urban flooding below Moggill. Adverse consequences can arise when significant weight is placed upon rainfall forecasts.”

Note: I note Seqwater’s position that the original sentences will not change - DERM legal is obtaining specific instructions regarding the department’s position should this not be changed as suggested.

4.

Page 23, Section 4.2 fourth paragraph fifth and last sentence change to:

The Duty Flood Operations Engineer must always consider these potential adverse consequences when considering predictions based upon forecast rainfall.

5.

Page 43, Section 5.6, Table 5.6.1 Header Row Column 6 – the number “1” in the header should be in superscript i.e.:

Lake Level corresponding to
Fuse Plug Pilot
Channel Invert Level¹

6.

Page 53 change:

- follow the procedures set out below to determine the appropriate radial gate openings settings; and
- ensure Wivenhoe Dam is near FSL at the end of a Flood Event.

If communications with the Flood Operations Centre are lost, appropriate radial gate openings settings at Wivenhoe Dam are determined by following the radial gate operating sequence as set out in the following table (Table 7.3.1).

7.

Page 55, Table 7.3.2 row 4 column 1 change > to ≥ .

8.

Page 56, paragraph 2 change:

When extreme rises in Lake Level are being experienced, Dam Operators may have difficulty in continually matching minimum gate openings settings to Lake Level.

9.

Page 62 and 63 Appendix B column 2 "Reservoir Capacity" either round all the figures or provide a satisfactory explanation as to why they are quoted to an extra significant digit as compared to the same column in Appendix E.

10.

Page 70 and 71 Appendix E – Heading Row columns 3, 4 and 5 the numbers "3", "2", and "2, 5" respectively need to be in superscript i.e.

Flood Capacity³

Discharge per Regulator²

Discharge per Spillway Bay^{2,5}

11.

Pages 72 to 77 Appendix E the spreadsheet needs to be reprinted, imaged and re-inserted with more room in the columns so that three digit numbers are not going down in the cell. For example, page 72 row 8 column 5 the number 113 is showing as:

11

3

when it should be showing:

113

12.

Page 78 & 79 Appendix E second header row column 1 change:

GATE OPENING

(m) (tangential opening)

Peter has also requested that for the long term review, Seqwater consider using the same gate openings in page 78 & 79 Appendix E as in the discharge rating tables (i.e. in 0.5 metre openings in both as opposed to 0.2 metre openings in one and 0.5 metre openings in the other).

13.

Page 80 Appendix E change:

$$Q_{\text{Fuse Plug}} = 2.11.98 * L * (\text{Lake Level} - 67.0)^{1.5}$$

Peter has advised in relation to this point he retrieved the design information for the fuse plugs and in section 2.4.3 of the report from the Wivenhoe Dam Alliance on "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade Q1091, September 2005" it indicates that the Coefficient of Discharge is 1.98 so that figure should be used at this time. The report indicates that the figure was sourced from the USBR Design of Small Dams which is what Peter would have used to generate a figure for the coefficient. However, this will need to be reviewed as part of the Longer Term Review as the coefficient will vary with the depth of flow over the fixed crest at EL 67.0 metres.

14.

Page 82 – Appendix F – column 1 the figures in column 1 should replicate the figures used in Table 7.3.1 and the table should be updated accordingly because the aim is to give the same total discharge. For example, Table 7.3.1 starts at 67.00 but the table in Appendix F starts at ≤72.5.

**Review Comments 29 September 2011 1.45am
Wivenhoe/Somerset FMM**

Comments – [REDACTED]

I am satisfied with the amended FMM. I have only 2 very minor changes.

Pages 32, 34, 62 change "generally" to "in most circumstances". (I am satisfied that the use of the word generally on page 87 is appropriate).

Page 105 Appendix L fourth bullet point change "Duty Flood Operations Engineers" to "Duty Flood Operations Engineer(s)".

Comments – Peter Allen

While the fuse plug discharge equation in Appendix E has been modified (co-efficient change from 2.1 to 1.98) the fuse plug discharges in the following Table have not been modified. Peter suspects the figures in the Tables have a variable coefficient included in the calculated figures (as it should be) and that they should be checked and amended if necessary.

Peter says that the replacement figures in Appendix F for Table 7.3.1 are not correct.

Peter is happy to discuss either of these points directly with Seqwater's engineers and could probably calculate the figures if necessary.

Comments – Bob Reilly

Bob's comments are in relation to the Explanatory Notes (although he realises that DERM is not approving the Explanatory Notes, only the Manual, but is concerned that it could be interpreted as an approval)

The last paragraph in point 2 in the section on Commission of Inquiry Priority Matters deals with the "scaling up" of the QPF:

It should also be noted that the QPF adopted at a particular point in time may be reduced or discounted to take into account the rainfall recorded since the QPF was issued, or it may not (that is, practically the QPF may be scaled up).

This is interpreted to mean that the Duty Flood Operations Engineer(s) will continue the practice of "scaling up" the QPF the way they did in the January 2011 flood event. Bob does not agree with this practice, and would be concerned if it applied again, given its potential to mislead other organisations/persons trying to get a sense of what could happen if the rainfall forecast eventuates.

It is noted that there is no mention in the Manual about scaling up of the QPF. DERM is not of the view that the QPF should be 'scaled up' without the advice of the BoM. It is something that will have to be addressed at length in the Longer Term Review of the Manual.

Bob is happy to discuss this point directly with Jim Pruss.



**Review Comments 30 September 2011 6.00am
North Pine FMM**

Comments - [REDACTED]

Within the document, radial gate openings are variously referred to as "opening settings" or "settings" or "openings" in approximately 25 locations. In the Wivenhoe/Somerset FMM they are always referred to as "openings" so for consistency please use either the term "opening settings" in most cases and the term "openings" where appropriate (e.g. if "opening settings" is already used in the sentence"). If you have any questions regarding this please contact me.

The glossary defines "Acceptable Flood Capacity" using title case, but on the two occasions in the FMM where the term is used it is in lowercase. So either the glossary definition or the occasions should change.

Page 20 section 3.1 fourth bullet point needs a full stop at the end, not a semi-colon.

Page 20 Section 3.2 change:

The most likely cause of dam failure is overtopping. The Dam consists of a mass concrete section, and earthen embankment sections. The cConcrete sections can withstand limited overtopping without damage. The eEmbankment sections on the other hand are likely to washout rapidly if overtopped and cause failure of the Dam, resulting in severe flooding downstream. The prevention of overtopping is thus of paramount importance.

Page 23 section 4.4 change first bullet point:

- pass large floods (inflow into the Dam equal to or greater than 500 m³/s) that threaten the safety of the Dam through the reservoir Dam as quickly as possible, while aiming to ensure that peak outflow from the Dam does not exceed peak inflow into the Dam; and

Page 23 section 4.4 change second header:

Considerations when the total outflow from the Dam is greater than 500 m³/s or the Lake Level equals or exceeds EL 39.8 metres:

Page 23 section 4.4 change eighth bullet point:

- radial gate settings can be adjusted to values between those shown in Appendix C if the aim is to keep the peak outflow from the Dam to less than peak inflow into the Dam.

Pages 25 and 26 change "North Pine Dam" to "the Dam".

Appendix A change:

"DERM" to "Department of Environment and Resource Management (DERM)".

Appendix D change:

In the event of failure of both of the mains electric supply and the standby diesel generator, and failure or submergence of the electric winch motors, the trailer mounted motor and petrol driven generator must be used to operate the radial gates.

Appendix D change:

In the event of failure of the systems referred to above (mains supply and standby diesel generator), the new backup system must ensure ~~the operation of the radial gates~~ be used to operate the radial gates.

Appendix E page 55 change:

the critical storm duration for the inflow is in most circumstances generally the 12-hour storm except for the very frequent and very rare events which tend to be longer;

Appendix E page 55 change:

under normal conditions with all gates operating, the critical duration of the outflow remains in most circumstances generally as 12 hours for events between 1 in 20 and 1 in 200 AEP and for the 1 in 2,000 AEP event. For other AEPs, the critical duration increases up to 36 hours;

Comments – Peter Allen

Peter will have comments (particularly as he will need to review the Appendix C provided late last night) which I will hopefully be able to provide to you later this afternoon

Comments – Bob Reilly

Page 36 Appendix E – please include the date that URS was commissioned to undertake the review.

Bob has further comments which I will hopefully be able to provide to you later this morning

**Review Comments 30 September 2011 9.30am
North Pine FMM**

Final Comments – [REDACTED]

Nil

Final Comments – Peter Allen

Peter will have comments (particularly as he will need to review the Appendix C provided late last night) which I will hopefully be able to provide to you later this afternoon

Final Comments – Bob Reilly

Bob is happy to discuss these directly with Jim Pruss if required.

1.

The current definition of FSL in the glossary:

“FSL” or “Full Supply Level” means the level specified in the Moreton ROP, but in any case not exceeding EL 39.6 metres;

should be changed to:

“FSL” or “Full Supply Level” means:

- *The level specified in the Moreton ROP; or*
- *Such other lower level in North Pine Dam as shall apply pursuant to the Water Act or as shall apply under an interim program approved pursuant to the Moreton ROP, but in any case not exceeding EL 39.6 metres*

This needs to be consistent with approach adopted in the Wivenhoe/Somerset FMM. This issue regarding the tables is the same for Somerset Dam, which will have a variable FSL as soon as the Wivenhoe/Somerset FMM is approved by a gazette notice being published. The practical issues regarding mobilisation of the FOC

2.

DERM has not yet seen the draft Explanatory Notes for the draft North Pine FMM.

Please provide a copy of the the draft Explanatory Notes for the draft North Pine FMM to DERM as soon as possible.

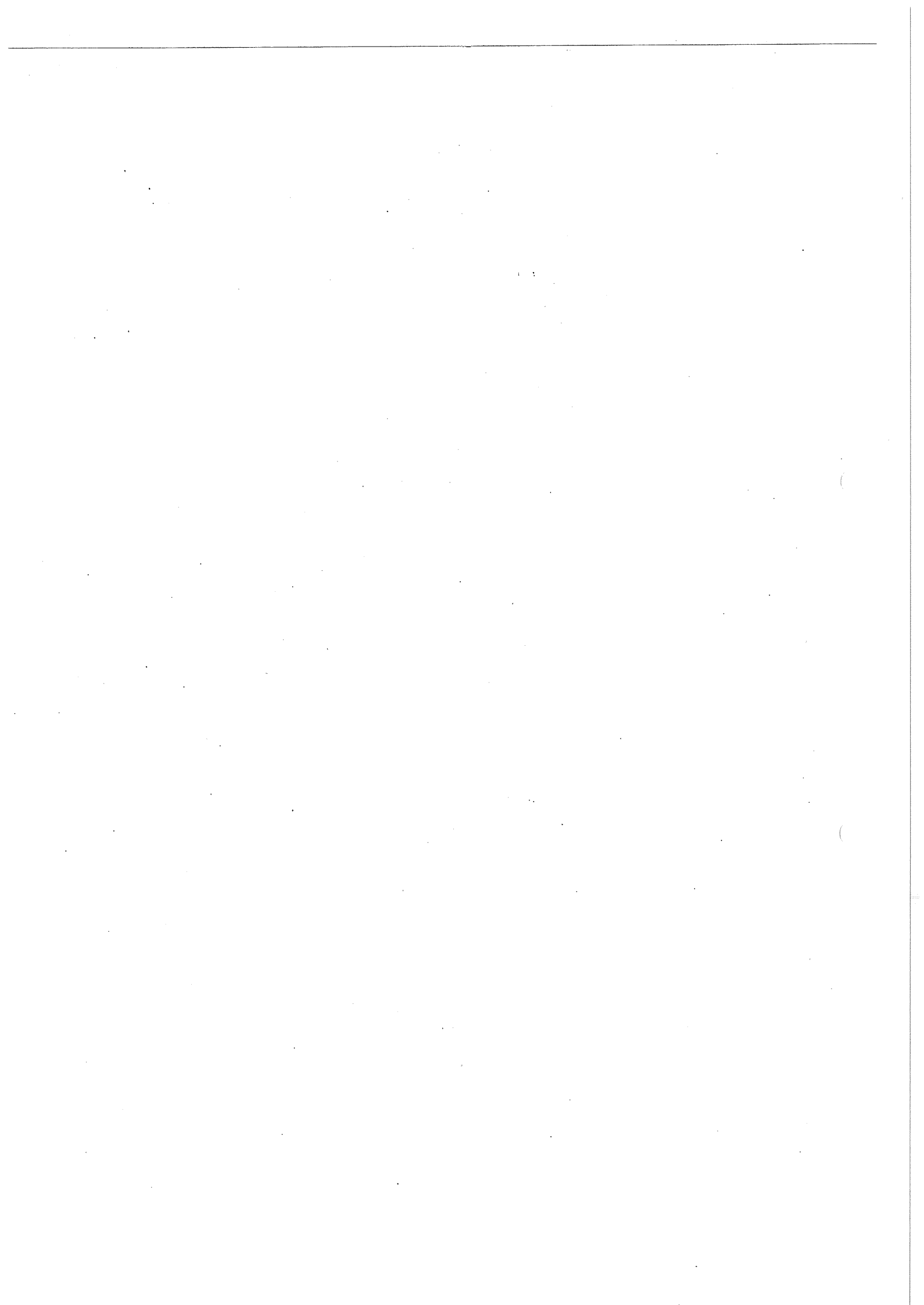
These notes should explicitly state that this is a complete revision of the North Pine FMM as opposed to the more limited review that occurred of the Wivenhoe/Somerset FMM.

3.

Appendix D - Seqwater should add at the end of the additional words in Appendix D when they expect the work to be completed e.g. *by November 2011*. By doing this, it will reinforce (for the Senior Flood Engineers etc) the need to check whether this work has been completed prior to each flood event

4.

Page 36 Appendix E – please include the date that URS was commissioned to undertake the review. (If not already done pursuant to comments provided this morning at 6.00am)



**Review Comments 7 October 2011 7.40am
North Pine FMM**

Final Comments – [REDACTED]

1.
DERM has not yet seen the draft Explanatory Notes for the draft North Pine FMM. Please provide a copy of the draft Explanatory Notes for the draft North Pine FMM to DERM as soon as possible.
2.
Page 2 change September 2011 to October 2011.
3.
Page 22 insert:
The Duty Flood Operations Engineer may reduce these target intervals to whatever value considered necessary in any of the following circumstances:
 - the safety of the Dam is at risk;
 - the radial gates are at risk of being overtopped; or
 - there is a requirement to reduce overall downstream flooding.
4.
Appendix D change “dDam crest” in two instances.
5.
Appendix E change:
The Senior Flood Operations Engineers and the Flood Operations Engineers should develop an understanding of this information once it becomes available.

Final Comments – Peter Allen

Nil. Peter has comments relating to the long term review of the North Pine FMM, which he has discussed with John Tibaldi.

Final Comments – Bob Reilly

Nil.



**Review Comments 7 October 2011 8.10am
North Pine FMM**

Final Comments – [REDACTED]

1.

<removed>

2.

Page 2 change September 2011 to October 2011.

3.

Page 22 insert:

The Duty Flood Operations Engineer may reduce these target intervals to whatever value considered necessary in any of the following circumstances:

- the safety of the Dam is at risk;
- the radial gates are at risk of being overtopped; or
- there is a requirement to reduce overall downstream flooding.

4.

Appendix D change “eDam crest” in two instances.

5.

Appendix E change:

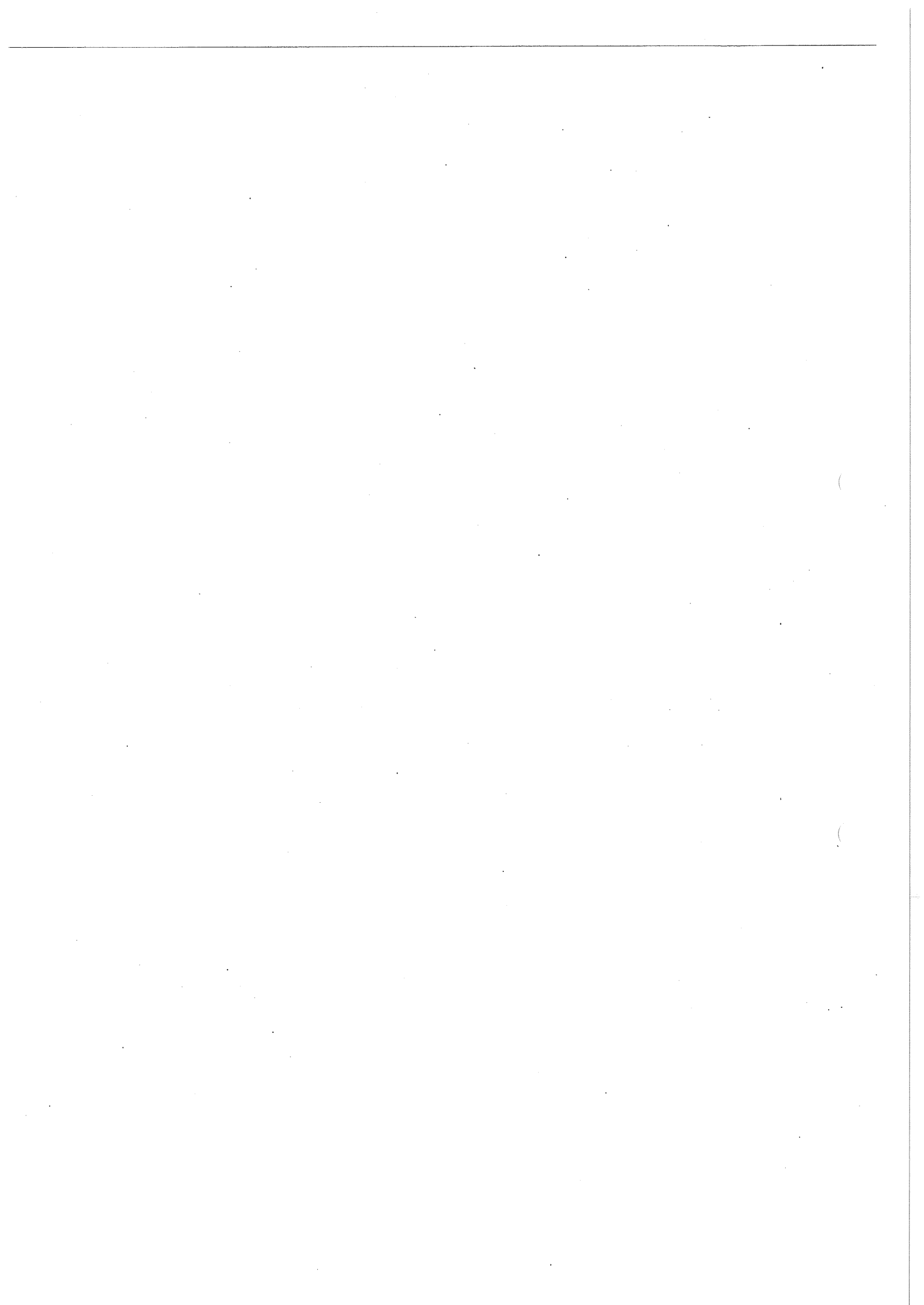
The Senior Flood Operations Engineers and the Flood Operations Engineers should develop an understanding of this information once it becomes available.

Final Comments – Peter Allen

Nil. Peter has comments relating to the long term review of the North Pine FMM, which he has discussed with John Tibaldi.

Final Comments – Bob Reilly

Nil.



**INTERIM REVIEW OF THE MANUAL OF OPERATIONAL PROCEDURES FOR
FLOOD MITIGATION AT NORTH PINE DAM
OCTOBER 2011 (REVISION 6)
EXPLANATORY NOTES**

Deleted: SEPTEMBER

INTRODUCTION

On Monday 17 January 2011, Queensland Premier Anna Bligh established an independent Commission of Inquiry to examine the unprecedented flood disasters associated with the 2010/11 wet season that impacted 70 per cent of the State. The Commission of Inquiry delivered an Interim Report on 1 August 2011 covering matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season.

In relation to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam ("the Manual"), the Interim Report recommended that Seqwater should:

1. Conduct an interim review of the Manual.
2. Have the draft manual assessed by independent expert peer reviewers.
3. Consider the expert peer reviews.
4. Submit the draft manual to DERM for approval under the Act so that it can be approved before 1 October 2011.

The Interim Report also recommended that particular attention should be paid during the interim review of the Manual to clarifying the circumstances in which pre-releases under Part 8.4 are permitted.

MANAGEMENT OF THE INTERIM REVIEW OF THE MANUAL

Undertaking a complete review of the Manual within six weeks as required by the Commission of Inquiry was a challenging task that required boundaries to be placed on extent of the investigations that could be undertaken, and on the consultation processes associated with the review. Primarily this is because there needs to be certainty that any changes made to the Manual do not worsen downstream flooding or risk the safety of North Pine Dam ("the Dam"). Generally, six weeks would be considered insufficient if a full study with extensive consultation were to be undertaken.

Further, the challenge of completing the interim review within such a short period of time was made more difficult by reason of the following factors that impacted on the resources available to undertake the review:

- Key staff associated with the review continued to have substantial ongoing commitments to the Commission of Inquiry and were required to provide extensive

statements on a range of multiple matters not associated with the operation of the Dams, while the review was in progress.

- A similar interim review of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam was undertaken in parallel. This was also a requirement of the Commission of Inquiry.
- Extensive routine preparations continued for the 2011/12 wet season. In particular annual training of Dam Operators and new Flood Operations Engineers and Officers was undertaken. This training traditionally occurs in August and September, just prior to the commencement of the defined flood season on 1 October.
- The relocation of the Flood Operations Centres to new premises and the need to ensure that systems and models are sufficiently robust has required significant Seqwater resources, including the Flood Engineers and Officers.
- Key staff associated with the review are involved in progressing around 30 other recommendations made by the Commission of Inquiry in the Interim Report.

Deleted: North Pine Dam

Deleted:

In view of the above factors and the unprecedented short time period given to complete the review, the following boundaries were placed on the interim review:

- The review would focus on addressing the priority matters recommended for examination by the Commission of Inquiry.
- Independent expert review would be limited to an individual rather than a panel review.
- The focus would be on defining and clarifying existing strategies rather than changing them.
- It was not feasible for public consultation to be undertaken during the six week review.

COMMISSION OF INQUIRY PRIORITY MATTER

The circumstances in which "pre-releases" (previously referred to in Part 8.4 of the Manual) have been clarified as follows:

- The commencement of a Flood Event can be declared prior to the Actual Lake Level exceeding Full Supply Level ("FSL") – see Section 2.10.
- Flood releases can commence prior to the Actual Lake Level exceeding FSL if the Duty Flood Operations Engineer judges it likely that this action will minimise disruption to urban populations downstream of the Dam and reduce the adverse impacts of the Flood Event – see Section 4.4.

OTHER CHANGES

A number of other changes have been made in this revision of the Manual. These include the following:

- Simplification of the procedural matters within the Manual. In this regard, a new Section 2 replaces the former Parts 2-7;
- The language has been made consistent with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam Revision 8, September 2011 ("Wivenhoe/Somerset Manual") (where appropriate – see further below);
- Reference has been included within Appendix D to Seqwater's work program to install a new hydraulic emergency back up system to operate the radial gates (referred to in Section 2.10.3 of the Commission's Interim Report);
- Given the questions which have been raised following the January 2011 Flood Event in respect of the current design flood hydrology for the Dam, the reference to the previous hydrologic study for the Dam has been removed from Appendix E and replaced with a reference to Seqwater's work program to review the flood hydrology and associated matters (referred to in Section 2.10.3 of the Commission's Interim Report)
- The Section outlining Flood Operations Strategies (Section 4.4) and the associated Appendix of radial gate settings (Appendix C) have been amended. These changes are directed towards ensuring that the radial gates are fully open prior to water flowing over the gate piers as occurred during the January 2011 Flood Event. This action further protects the safety of the Dam by improving its flood immunity.

VARIATIONS TO FSL

In the Interim Report, the Commission did not make any recommendation about alterations to the FSL of the Dam. Further, the Commission did not make any recommendation that the Manual be amended so as to accommodate different FSLs for the Dam.

The Wivenhoe/Somerset Manual contains a definition of FSL that will facilitate (in conjunction with the amended trigger levels in the Wivenhoe/Somerset Manual) flood releases commencing at levels below FSL should the Minister decide to lower the FSL of Wivenhoe and Somerset Dams. The inclusion of such a definition in the Manual is not supported for the following reasons:

- The Duty Flood Operations Engineer must declare a Flood Event when it is judged likely that FSL will be exceeded (Section 2.10). There is no flexibility to not declare the commencement of the Flood Event.
- Once the Flood Event commences, Seqwater must comply with the Manual (Section 1.5).
- The Dam is taken to be full when it exceeds FSL. The Manual provides (Section 4.4) that when the Dam is full, ensuring the structural safety of the Dam is paramount.

- The Manual also provides that the operational aims are to pass the flood through the Dam as quickly as possible and return the Lake Level to FSL. This is different to Wivenhoe and Somerset Dams as while those dams have dedicated flood mitigation storage; North Pine Dam does not. It is a water supply dam only.
- It would be contrary to this objective and operational aim to not make flood releases for a period of time until the Lake Level rises to the point where the gate settings contained in Appendix C are reached (relevantly at 100% of FSL).
- The Manual also requires that the gate settings in Appendix C are to "guide" flood releases (Section 4.4). These settings do not apply until 100% of FSL (EL39.6 metres), so any decision about releasing water between lower FSLs and 100% will not be guided by Appendix C. If the Senior Flood Operations Engineer decided to commence flood releases, and the Flood Event continued such that the Actual Lake Level rose to levels beyond 100% of FSL, the gate openings could be well in advance of the settings contained in Appendix C. The Manual provides that beyond EL 39.8 metres, the settings are to remain within 3 settings of that shown in Appendix C (and the relevant exceptions do not apply).
- The position is different for Wivenhoe and Somerset Dams where flood strategies for the use of the additional flood storage (created by any lowering of the FSL) have been devised to take into account a flexible FSL (for example, see Strategy S1 for Somerset which applies until the actual lake level exceeds 100.45 metres and Strategies W1-W3 which have trigger levels based on metres above FSL).

Accordingly, until flood operations strategies and the associated gate settings for flood releases at all lower levels of FSL are developed (and this will take several months), Seqwater does not propose to include a flexible FSL definition in the Manual (in the terms set out in the Wivenhoe/Somerset Manual).

If the Minister does decide to lower the FSL of the Dam, the initial drain down can occur. However, flood releases will not commence until a Flood Event is declared (which will only occur when the Duty Flood Operations Engineer judges it likely that the old FSL will be reached).

Alternatively, new tables for the new FSL can be developed within a reasonable period of time and then included within an amendment to the Manual, to facilitate flood releases commencing at lower FSLs.

**Review Comments 10 October 2011 1.15pm
North Pine FMM**

Final Comments

These two comments are not critical and the changes do not need to be made if they will hold up the progression of the Manual, however they are so minor that they will take about a minute to correct and DERM would prefer that if possible.

1.

Page 22 Section 4.5 insert:

- if the duration of the Flood Event exceeds 24 hours, the aim should be to operate with the Lake Level as close as possible to EL 39.6 metres; and
- during the initial opening or final closure sequences of the radial gates, it is permissible to replace the release from a radial gate by the release from the regulator valves or the low level release valves. This allows for greater control of low flows.

2.

Page 22 Section 4.5 insert:

- the aim is for the outflow from the Dam at any time not to exceed the peak inflow into the Dam up to that time. If flood operations do not commence until after the Lake Level has exceeded the EL 39.8 metres, initial radial gate operations should aim to result in an outflow from the Dam that is less than the predicted peak inflow into the Dam, while ensuring that the safety of the Dam is protected; and
- radial gate settings can be adjusted to values between those shown in Appendix C if the aim is to keep the peak outflow from the Dam to less than peak inflow into the Dam. In these circumstances, estimates of the peak Dam inflow derived from the FFS can be used to guide appropriate radial gate settings.

Final Comments – Peter Allen

Comments 1 and 3 below are critical as there is inconsistency of figures within the Manual. Comment 2 is not critical and the changes do not need to be made if they will hold up the progression of the Manual, however it is so minor that it will take about a minute to correct and DERM would prefer that if possible.

1.

Page 20 Section 4.2 Figure 4.2.1. The Minimum Time Interval table within the Figure is wrong and should be corrected to the right figures. The 'Gate Operation Trigger level' is no longer EL 39.650 and it should be replaced with the correct figure of EL 39.61. These changes could be difficult to make in the figure itself, if so perhaps an appropriate note at the foot of the figure would suffice or alternatively these parts could be blacked out of the figure.

2.

Page 26 last sentence change:

Appendix C includes tables for one radial gate closed of action.

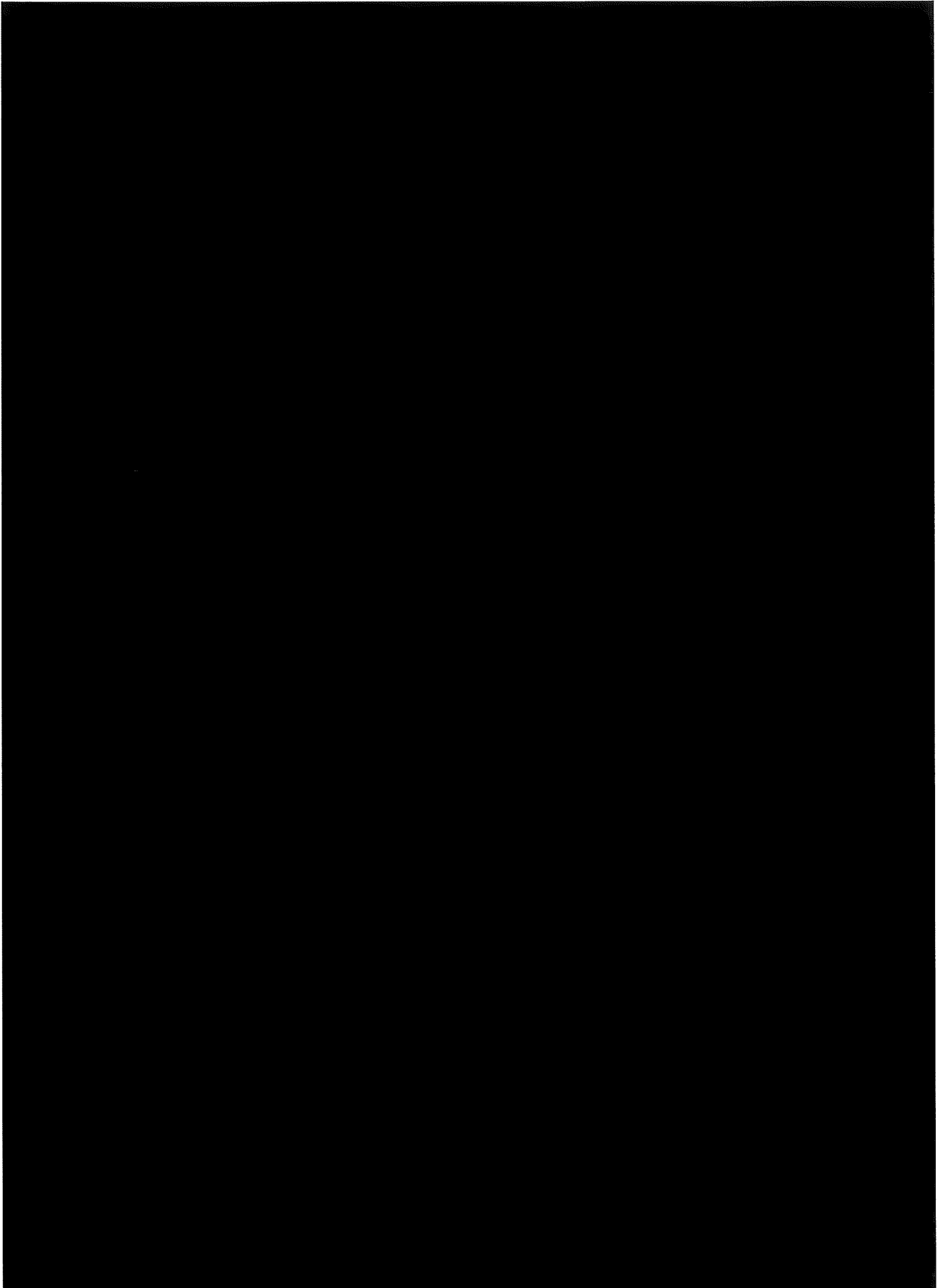
3.

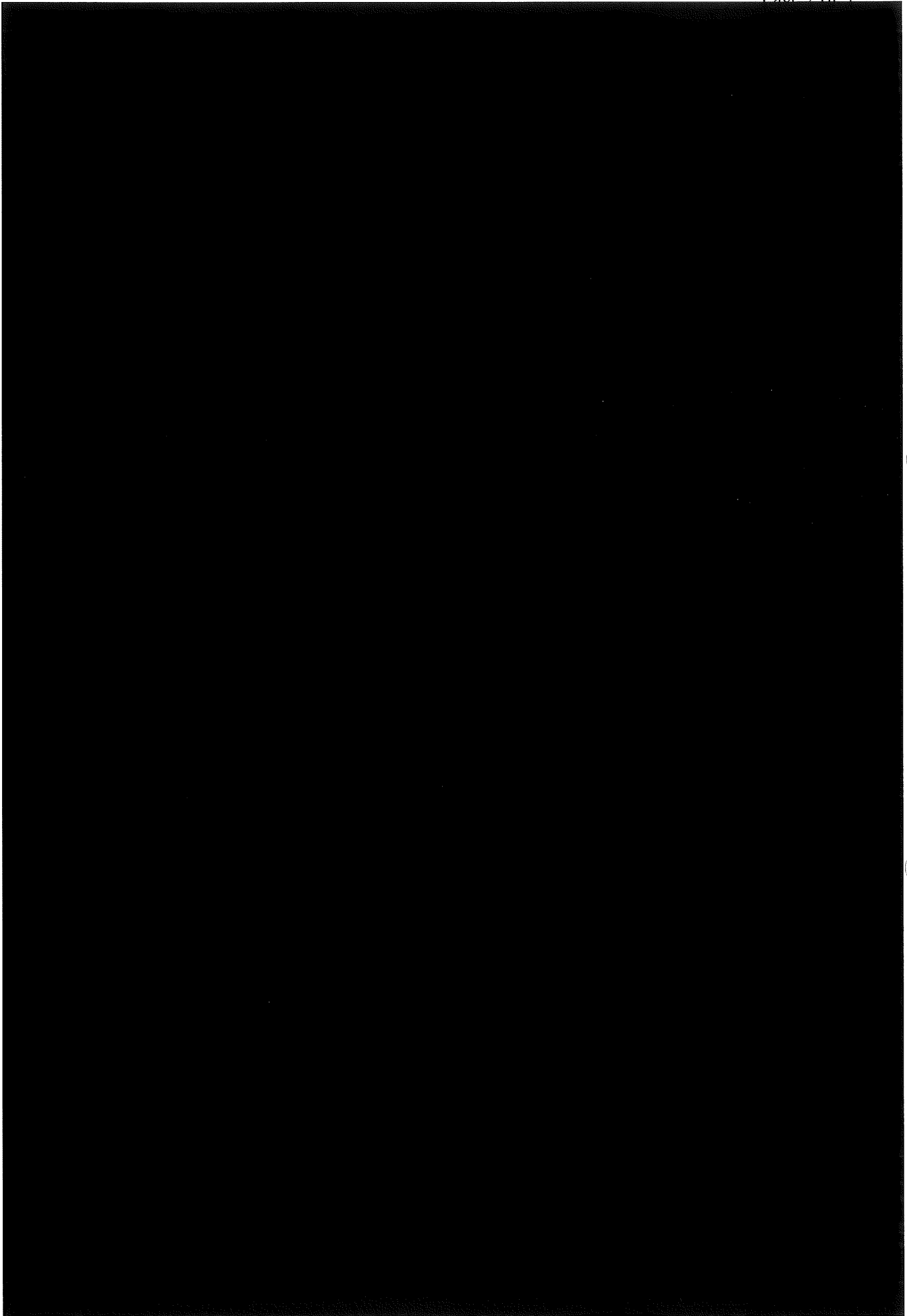
Page 46 Appendix F Figure 4 North Pine Dam spillway. The Minimum Time Interval table within the Figure is wrong and should be corrected to the right figures. The 'Gate Operation Trigger level' is no longer EL 39.650 and it should be replaced with the correct figure of EL 39.61. These changes could be difficult to make in the figure itself, if so perhaps an appropriate note at the foot of the figure would suffice or alternatively these parts could be blacked out of the figure.

Final Comments – Bob Reilly

Nil.

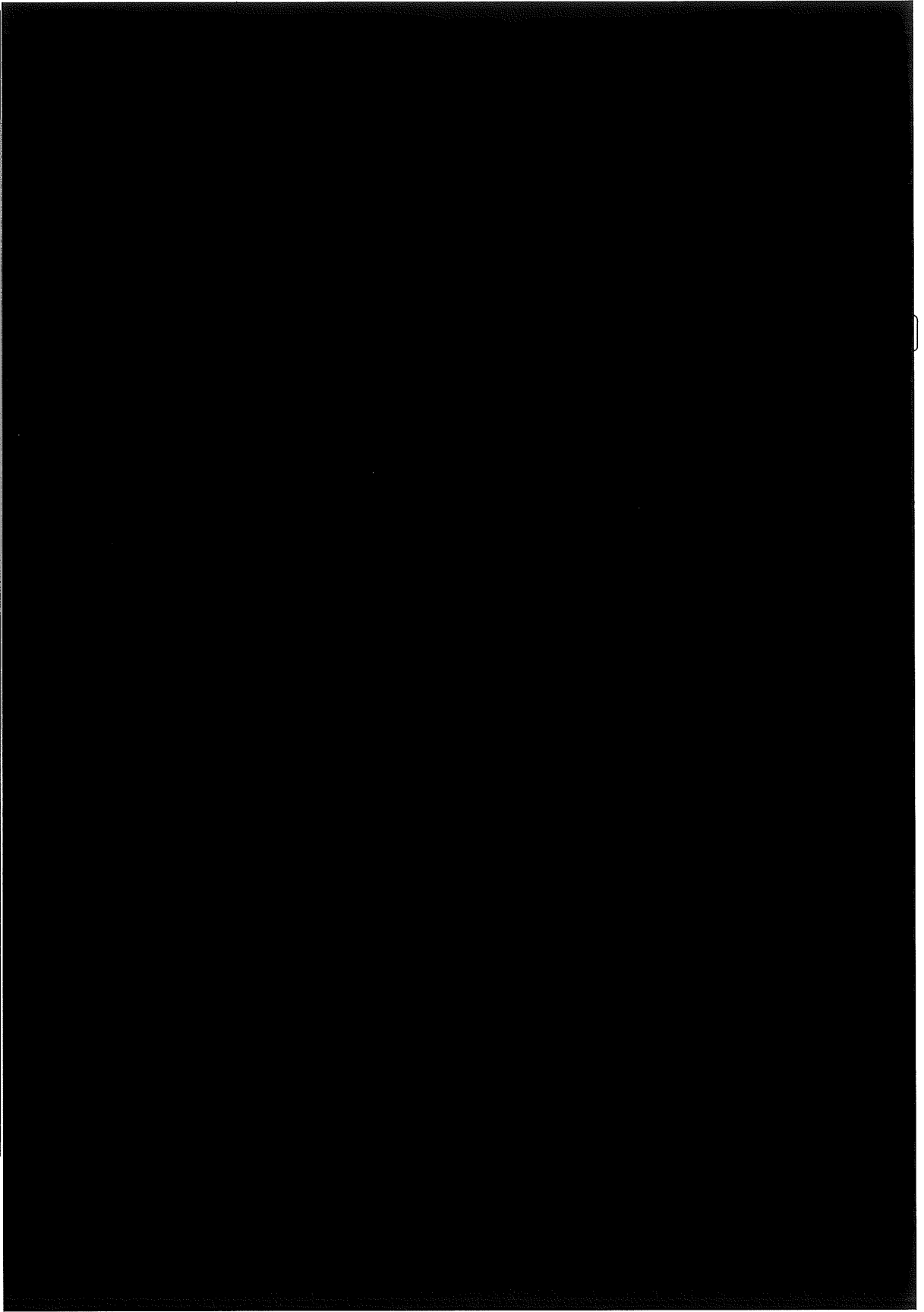


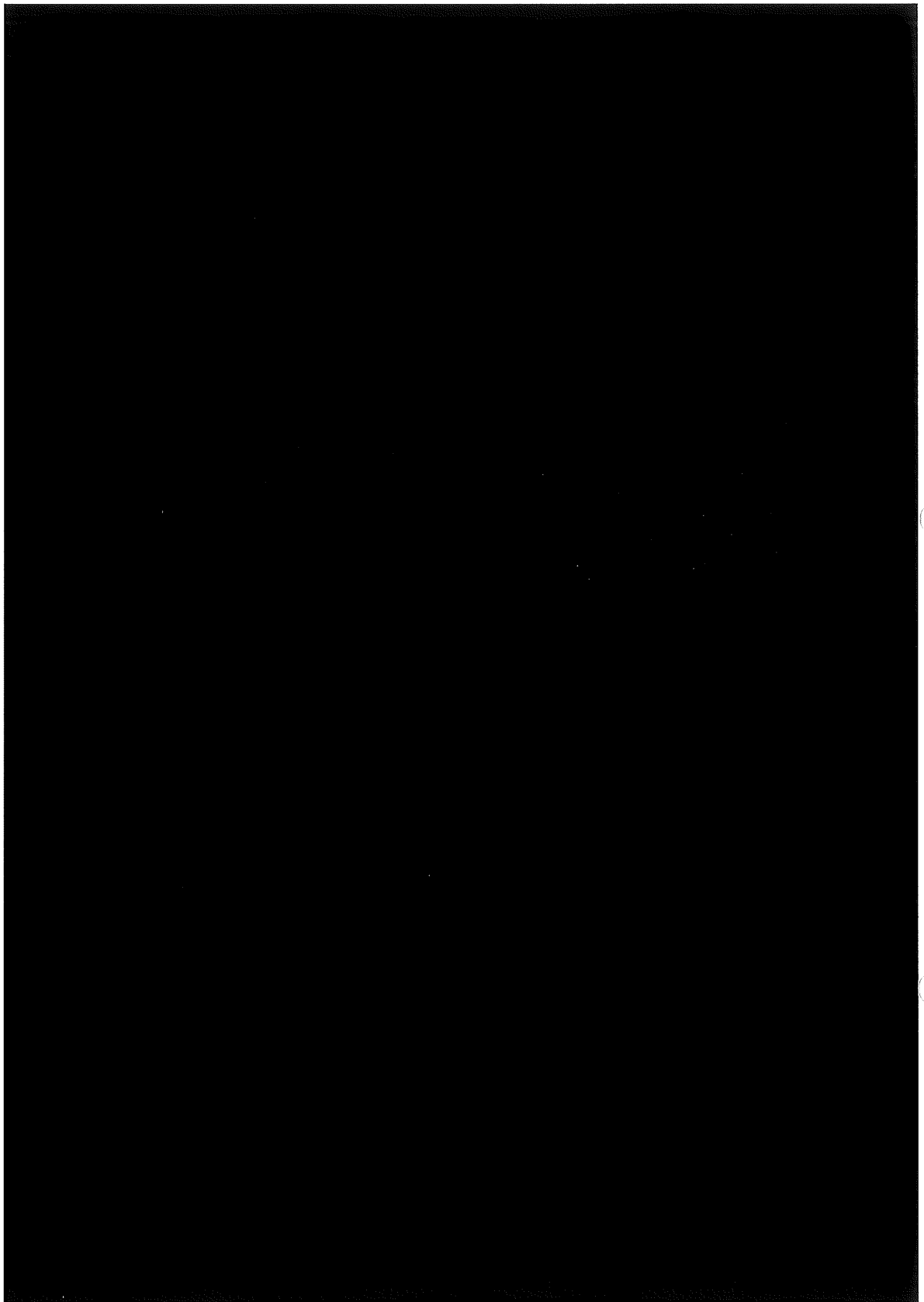


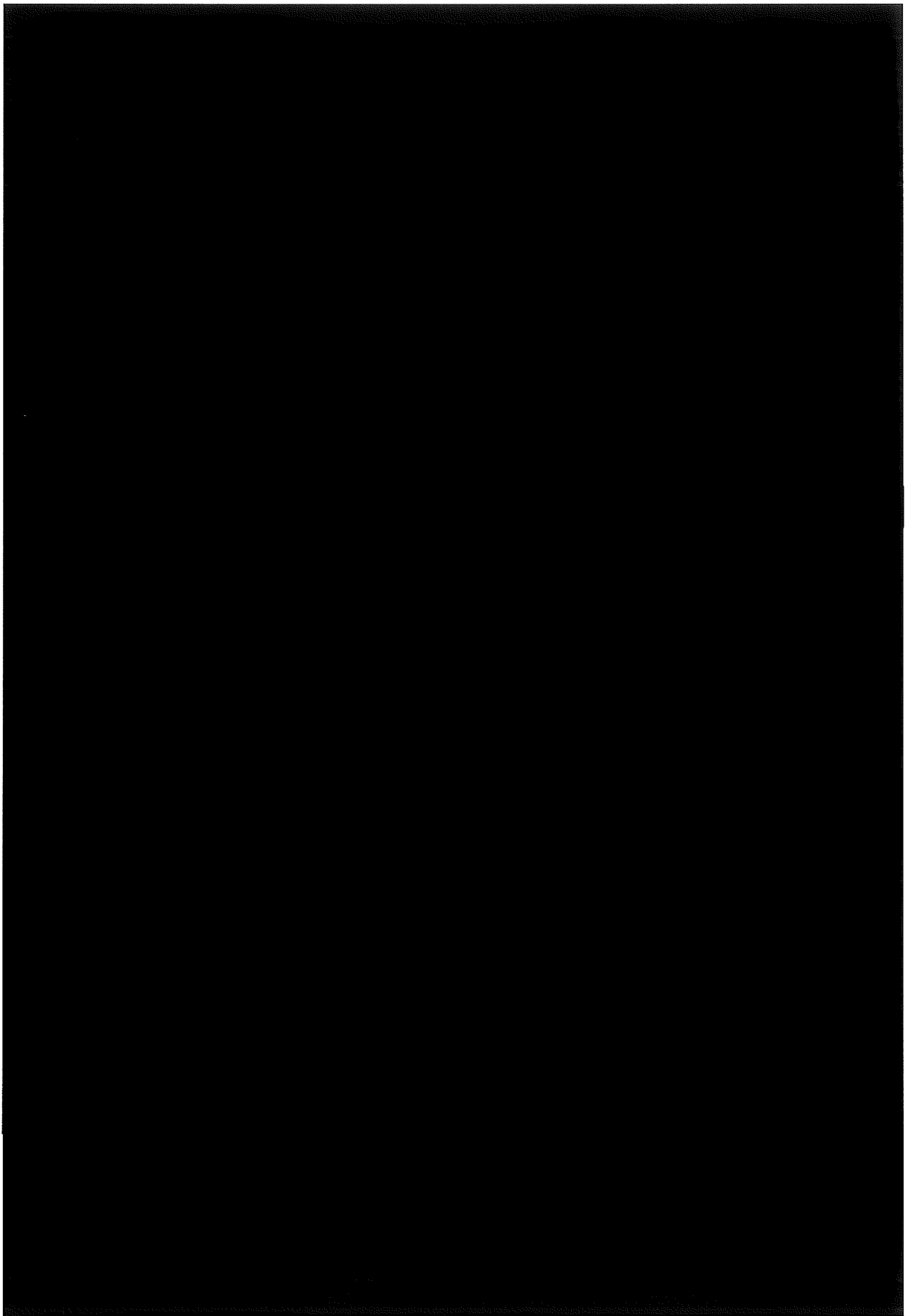






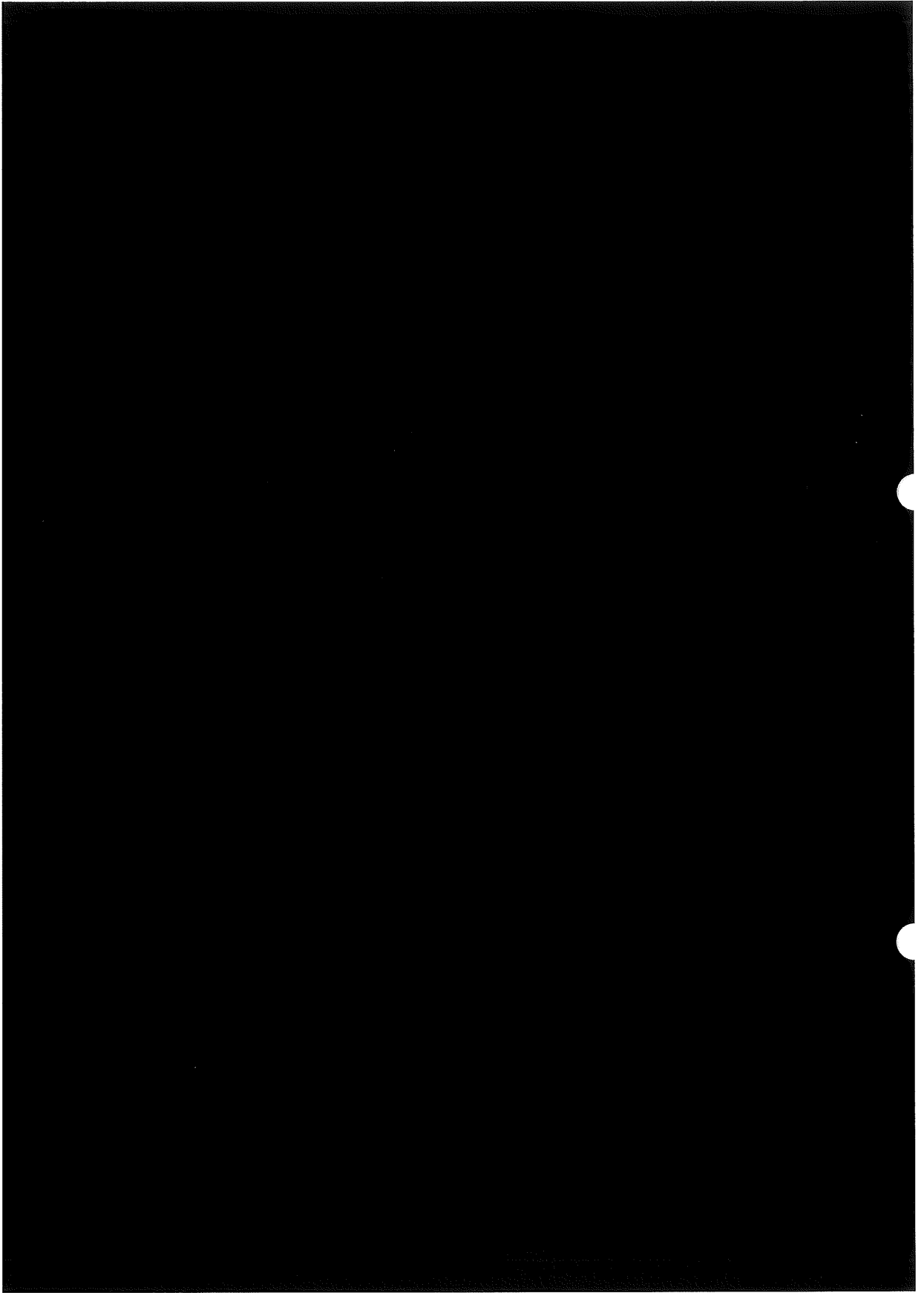


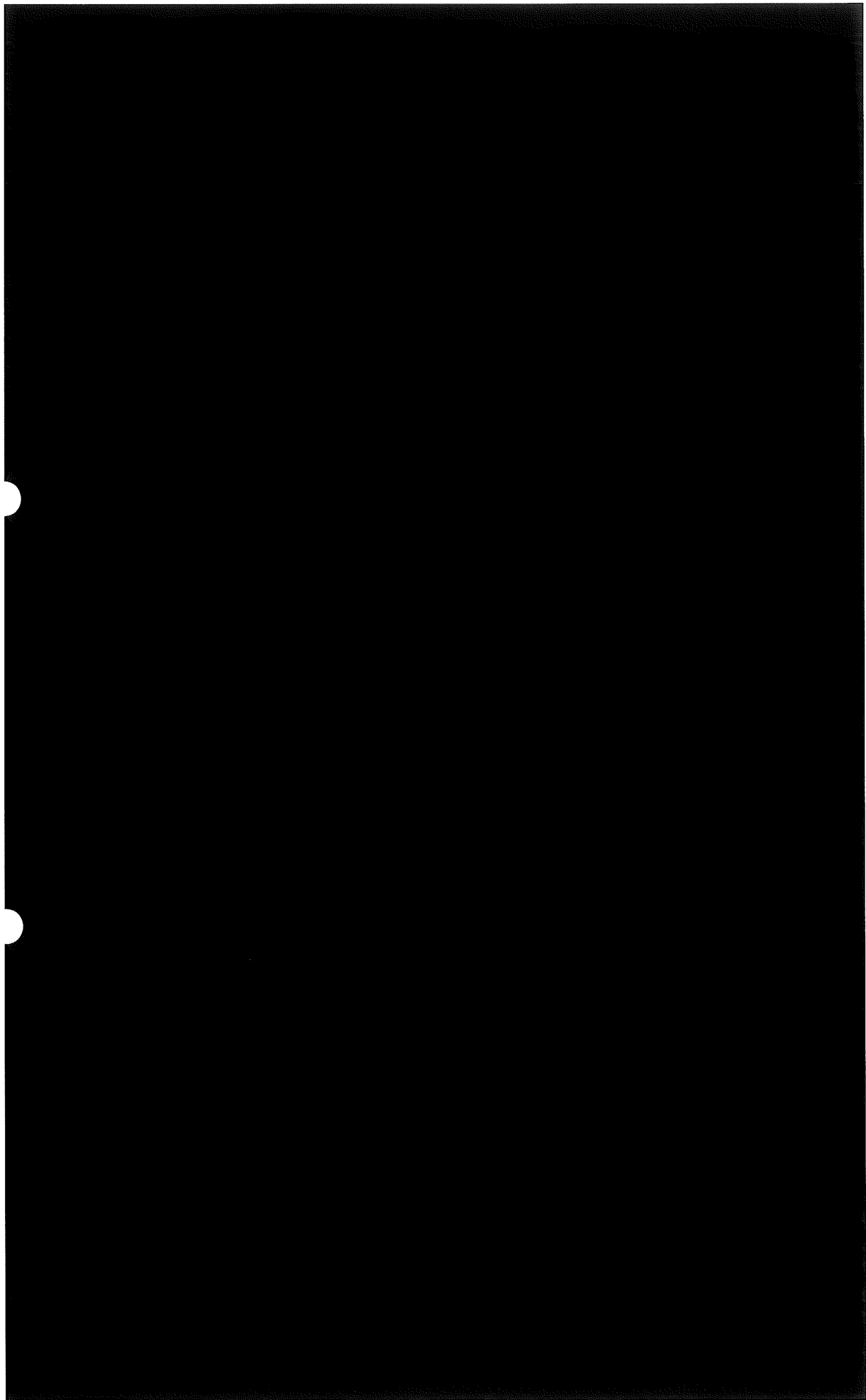


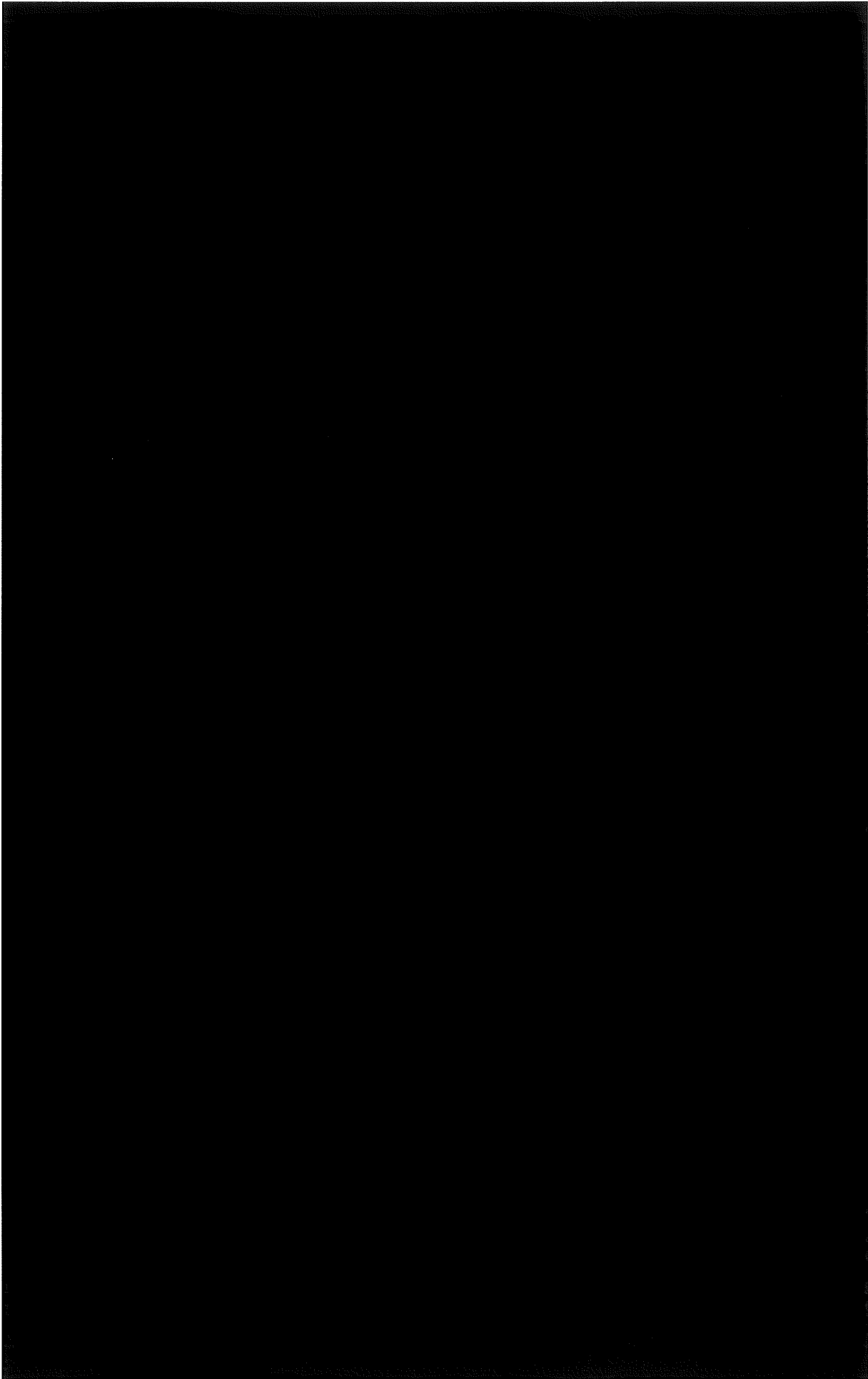


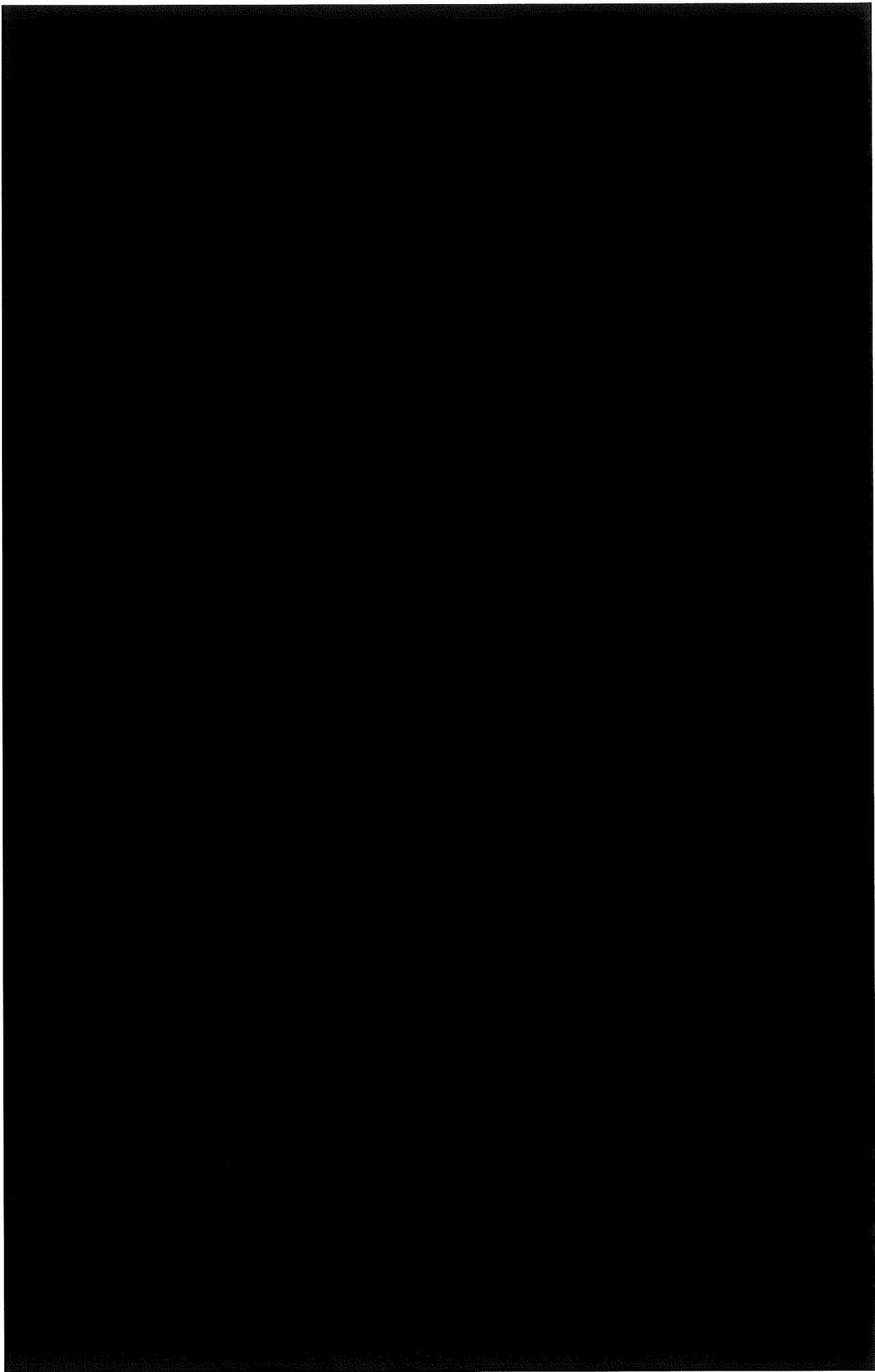
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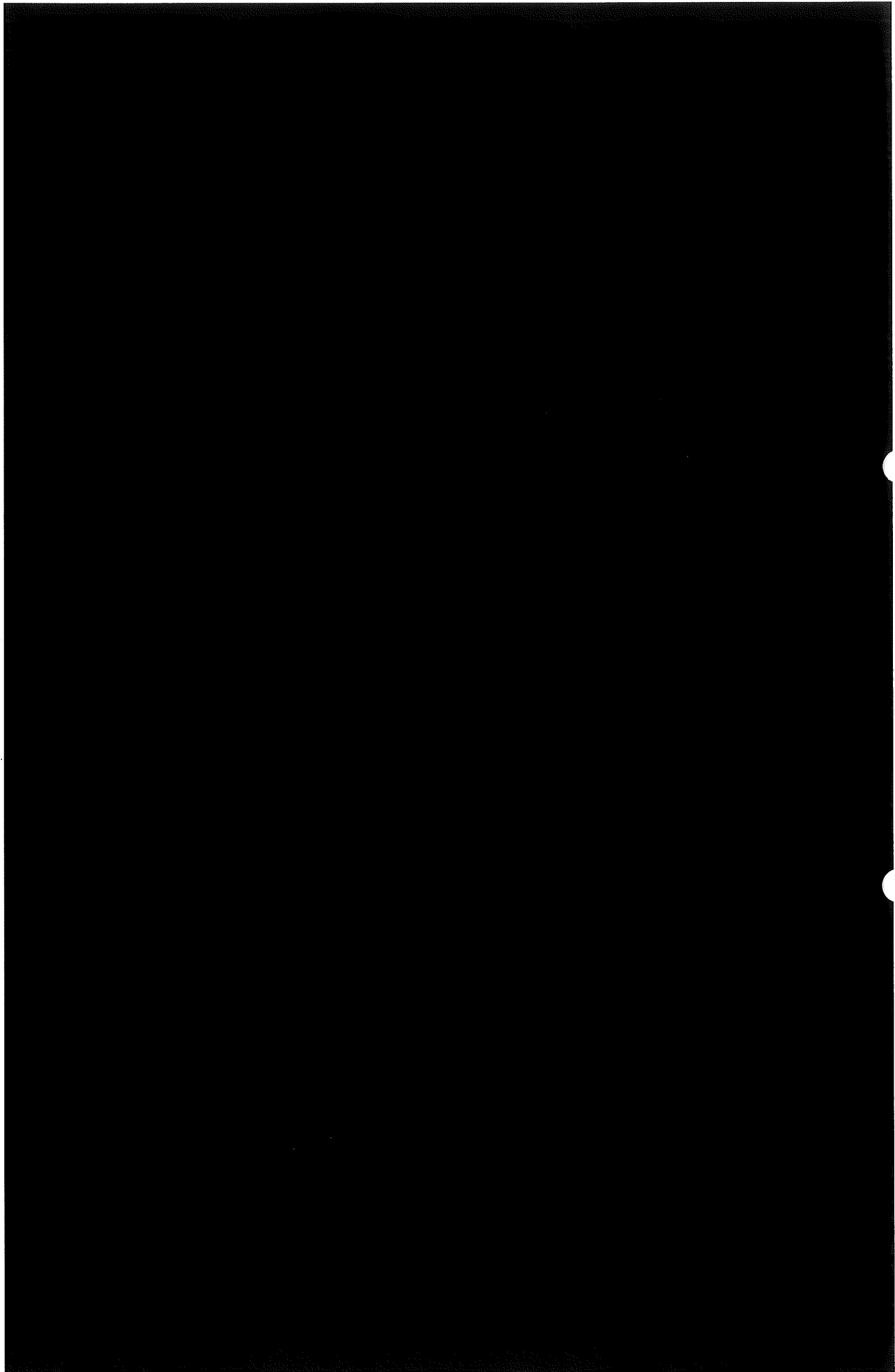
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DS 5.3 Processing a flood mitigation manual for a dam following review

WIR/2011/4884 – Version 1

Endorsed 16/09/2011
by Robert Reilly, General Manager, Office of the Water Supply Regulator

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Version History

Version	Date	Comment
1	16/09/2011	Original approval

Purpose

To provide a framework for processing a reviewed flood mitigation manual for a dam submitted by the dam owner under section 373, Part 2, Chapter 4 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Rationale

All dams provide some flood mitigation benefits. However, certain dams are explicitly required to be managed so as to optimise these benefits. These dams are able to provide flood mitigation benefit through the temporary storage and later release of flood flows. As the release of such floodwaters can cause damage to property and/or the environment or potentially put lives at risk, it is essential that the dam be operated in accordance with clearly defined procedures to minimise hazard and damage to life and property while protecting the safety of the dam. A flood mitigation manual ensures that such dams make controlled releases of water for flood mitigation purposes in accordance with pre-agreed conditions. The regulatory framework within which these dams are managed for flood mitigation purposes is contained in sections 370 to 374 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Regulatory context

Section 373 of the Act requires the owner of a dam to review the flood mitigation manual for a dam before the approval for the manual expires. The dam owner must provide the chief executive with a copy of the reviewed flood mitigation manual, for approval under s. 371 of the Act.

The chief executive may also get advice from an advisory council before approving the manual.

Application

This work practice applies to a dam owner who has an existing flood mitigation manual which has been reviewed and/or updated and submitted to the chief executive for approval. The process for approval of the first flood mitigation manual for a dam is a separate work practice. Please refer to the work practice DS 5.1 Flood Mitigation Manual for a Dam.

The dam owner, can at any time, submit an amended or reviewed flood mitigation manual for approval. For continuity the reviewed and/or updated manual must be approved before the expiry of the previous manual.

Procedure

This work practice is set out below.

A flow chart for this work practice can be found in Attachment A <attachments/a-ds5-3-fmm-flowchart.pdf> .

Step 1 - Receiving a reviewed flood mitigation manual

Upon receiving the reviewed flood mitigation manual being submitted for approval, the project officer:

- Stamps the covering letter (or a copy of the front page and contents page of the manual if there was no covering letter) with the Document Received by DERM stamp
- Scans the document (or copy created above) and records details in Keeper on the file for the dam and fills in the relevant sections of the document received stamp in accordance with local office processes and departmental standards
- Updates WICD–RDR
- Prepares an acknowledgement letter to the dam owner that the reviewed flood mitigation manual has been received and is being assessed. Refer to Attachment B <attachments/b-ds5-3-fmm-ack-let.pdf> for a template for an acknowledgement letter (A template for this letter is available in G:\WIR\Dam_Safety\Templates).
- Gives all documents and the file (if required) to the decision maker.

The Director, Dam Safety (Water Supply):

- Checks and signs the letter confirming receipt of the manual. If changes are necessary to the draft letter confirming receipt of the reviewed manual, the Director, Dam Safety (Water Supply) should make the changes and return the letter to the project officer for updating prior to signing.
- Allocates an assessment officer to assess the amended manual.
- Gives the signed letter, the manual and the file to the project officer.

The project officer:

- Copies and sends the signed letter.
- Scans the signed letter and registers the letter in Keeper in accordance with local office processes and relevant departmental standards.
- Places the copy of the signed letter on the file relating to the flood mitigation manual for the dam.
- Updates WICD–RDR with appropriate information.
- Gives the manual and file to the assessment officer.

Proceed to Step 2

Step 2 - Assessment officer conducts an assessment of the reviewed flood mitigation manual

The assessment officer:

- Conducts a detailed assessment of the reviewed flood mitigation manual. Assessment officers are expected to conduct the detailed assessment having regard to the matters outlined in the guidelines and work procedures issued under the Act's provisions and other Queensland Government policy statements as advised by the chief executive of DERM (see references section of this work practice). The assessment must also include the Reviewed Flood Mitigation Manual (FMM) Assessment and Decision Form and the notes in that form (see Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf> . A template for this form is available in G:\WIR\Dam_Safety\Templates).

- Requests, if appropriate, legal review of the reviewed FMM from the Legal Services section of the department (in accordance with departmental processes).
- Completes the Reviewed FMM Assessment and Decision Form as the assessment occurs.

The purpose of the flood mitigation manual checklist (checklist) which forms part of the Reviewed FMM Assessment and Decision Form is to assist the assessment officer to determine whether the flood mitigation manual complies with the Act and the guidelines and to enable the assessment officer to make a recommendation on whether the reviewed flood mitigation manual should be approved. However, assessment officers should note that the checklist is not intended to be relied upon by assessment officers as an exact statement of the Act and the guidelines and it is essential that assessment officers regularly refer to the full text of those documents to determine the precise details of these requirements.

Discussions with dam owners and other stakeholders may be undertaken to refine the content of the manual and to ensure that the reviewed flood mitigation manual is adequate for its required purpose. See Step 3.

In completing the Reviewed FMM Assessment and Decision Form the assessment officer:

- Records on the Reviewed FMM Assessment and Decision Form whether the manual complies with the Act and the guidelines.
- Includes appropriate comments in the Reviewed FMM Assessment and Decision Form about individual items (in the comments column for the appropriate item/s). Note: if the assessment officer believes additional information or clarification of information is required proceed to Step 3 prior to completing this step.
- Completes the 'assessment officer's recommendation to decision maker' part of the Reviewed FMM Assessment and Decision Form, including all items that are relevant to the recommendation/s made.
- Gives the Reviewed FMM Assessment and Decision Form, the manual and the file to the decision maker.

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept and retained in Keeper and on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

Proceed to Step 4.

Step 3 - Request further information

In some situations the assessment officer may need to communicate with the owner of the dam, or other people, to clarify certain issues for the assessment of the reviewed flood mitigation manual (this may include editorial amendments and minor corrections to the FMM). **Accurate and written records of any communications, including verbal communications, must be kept and retained in Keeper and on the relevant departmental file.** These records should indicate who was contacted or consulted about particular issues, when this occurred and the advice that was given. It may also be appropriate for the assessment officer to make some reference to these communications in the Reviewed FMM Assessment and Decision Form itself (for example, in the comments column for the appropriate item/s in the checklist).

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

A suggested format for a letter requiring further information can be found at Attachment D <attachments/d-ds5-3-fmm-req-info.pdf> . A template for this letter is available in G:\WIR\Dam_Safety\Templates.

The letter requiring further information must:

- Be prepared on the basis of the information contained in the Reviewed FMM Assessment and Decision Form (see Step 2) and
- Be sent to the owner of the dam.

Return to Step 2 when requested information is received.

Step 4 - Decision maker makes decision about reviewed flood mitigation manual

The decision maker:

- Considers the reviewed flood mitigation manual and the recommendation made by the assessment officer.
- Decides what action should be taken in relation to the reviewed manual. The decision maker is expected to assess the appropriate action to take having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form and the notes to that form (Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf>).
- Completes the 'decision maker's decision' part of the Reviewed FMM Assessment and Decision Form.
- Gives the completed Reviewed FMM Assessment and Decision Form, the manual and the file to the assessment officer.

Depending on the situation, available options for the decision maker may be to:

- Seek further advice (this could be legal advice or advice from an advisory council)
- Not approve the manual because it does not meet the expected requirements for approval. *Go to Step 5.*
- Approve the manual – *Go to Step 6.*
- Require more information from the dam owner – *Go to Step 3.*
- Require a more detailed assessment of the FMM by the assessment officer – *Go to Step 2.*

If the decision maker decides more information is required from the dam owner, they should indicate this on the Reviewed FMM Assessment and Decision Form and return all documentation to the assessment officer who will return to Step 3.

Step 5 - Assessment officer prepares non-approval letter for the reviewed flood mitigation manual

Assessment officer receives the decision to not approve the reviewed manual from the decision maker and prepares a draft letter (including yellow file copy) advising that the reviewed flood mitigation manual doesn't meet the requirements of the Act and relevant guidelines. See Attachment E <attachments/e-ds5-3-fmm-non-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter to the decision maker who either signs the letter or requests changes to be made.

Once the decision maker has signed the letter the assessment officer sends the letter to the dam owner.

If a new flood mitigation manual is received from the dam owner in response to the letter return to Step 1.

Go to Step 7.

Step 6 - Assessment officer prepares gazette notice

Assessment officer receives the decision to approve the reviewed manual from the decision maker and prepares a draft gazette notice and completes a request to publish in the Queensland government gazette form.

- The gazette notice should state the following:
- The notice number and year
- The date and approval details for the reviewed manual
- The dates for which the reviewed manual is approved. This may be for the remainder of the approval period for the existing approved manual or for not more than five years from the date of approval of the reviewed manual.

Note: see Attachment F <attachments/f-ds5-3-fmm-gaz-notice.pdf> for a draft template of the gazette notice. A template for this document is available in G:\WIR\Dam_Safety\Templates. The request to publish in the Queensland Government Gazette form is available from Executive Council Team (ECT), Cabinet and Parliamentary Services or on insite.

Once the notice has been prepared and the form completed they must be signed off by the Director, Dam Safety (Water Supply) (or a higher position) and sent to ECT. The electronic version of the gazette notice must also be sent by email. The ECT will arrange for publication of the notice in the gazette and will advise the assessment officer by email of the publishing of the notice. Go to Step 7 when gazettal has taken place.

Step 7 - Letter sent to dam owner advising of approval of reviewed manual

The assessment officer prepares draft letter (including yellow file copy) to dam owner advising of approval of the reviewed manual and enclosing a copy of the gazette notice. See Attachment G <attachments/g-ds5-3-fmm-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter and copy of the gazette notice to the decision maker for signing.

Once the letter has been signed by the decision maker the project officer sends the letter and gazette notice to the dam owner.

Go to Step 8.

Step 8 - Assessment officer takes appropriate action with respect to RDR, the file and departmental records

The assessment officer:

- conducts a final check to ensure all relevant data has been entered into WICD–RDR.
- checks the completed Reviewed FMM Assessment and Decision Form has been signed by the assessment officer and decision maker, and that this form and all other documents created or received during the course of this work practice have been placed on the appropriate departmental file/s.
- returns the departmental file to the project officer who will check that all relevant documents have been registered in Keeper. If not, the project officer will register the documents in Keeper in accordance with local office processes and relevant departmental standards.

The processing of a flood mitigation manual for a dam following review is complete.

Responsibilities

Dam owner – under section 373 of the Act, the dam owner must, before an approval for the flood mitigation manual for a dam expires, review, and if necessary, update the flood mitigation manual and give a copy of the reviewed manual, for the dam to the chief executive for approval under s. 371.

Chief executive – section 371(2) of the Act gives the chief executive the power to approve the reviewed flood mitigation manual for a dam.

Under the Water Supply (Chief Executive) Delegation the above powers of the chief executive have been delegated to the following positions:

1. Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator
2. Project Director, Dam Safety, Office of the Water Supply Regulator (position number 76025966)
3. Director, Water Industry Asset Management and Standards, Office of the Water Supply Regulator
4. General Manager, Office of the Water Supply Regulator.

Decision makers – if the decision maker is not the Director-General, DERM he/she must ensure that he/she has, at the time of making his/her decision, a current delegation allowing him/her to make his/her decision. This is important as instruments of delegation can be revoked and replaced from time to time.

Assessment officer – is required to carry out the assessment of a reviewed flood mitigation manual, submitted to the Department under s. 373 for approval under s. 371 of the Act, having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form (Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf>) and the notes to that form. The assessment officer is expected to complete the form, as the assessment occurs, and must take into account the requirements of the guidelines, departmental policy documents and this work practice.

Project officer – performs any administrative duties as required under this work practice or by the assessment officer or decision maker or Director Dam Safety (Water Supply).

Definitions

"**the Act**" – means the Water Supply (Safety and Reliability) Act 2008

"**assessment officer**" – refer to the responsibilities section of this work practice.

"**chief executive**" – means the Director-General, Department of Environment and Resource Management

"**dam**" –

1. *Dam* means–
 - Works that include a barrier, whether permanent or temporary, that does or could impound water; and
 - The storage area created by the works.
2. The term includes an embankment or other structure that controls the flow of water and is incidental to works mentioned in paragraph (1) above.
3. The term does not include the following:
 - A rainwater tank;
 - A water tank constructed of steel or concrete or a combination of steel and concrete;
 - A water tank constructed of fibreglass, plastic or similar material.

"**decision maker**" – means the person making the decision to approve a reviewed flood mitigation manual for a dam, under this work practice. This may be the Director-General, DERM or a person who has been delegated the power to approve a flood mitigation manual.

"**DERM**" – Department of Environment and Resource Management.

"**Director, Dam Safety (Water Supply)**" – for the purposes of this work practice – means Director, Dam Safety (Water Supply) or the Project Director, Dam Safety (Position No. 76025966).

"**flood mitigation manual**" or "**manual**" or "**FMM**" – means a manual prepared under s. 370, or reviewed and updated under s. 373.

"**guidelines**" - means Guidelines for Failure Impact Assessment of Dams; Queensland Dam Safety Management Guidelines; Guidelines on Acceptable Flood Capacity for Dams; Emergency Management Planning for Floods Affected by Dams (2009) - Australian Government (Manual 23 of Australian Emergency Manual Series); Work practice DS 5.3 Processing a flood mitigation manual for a dam following review (WIR/2011/4884 in the Policy Register) and other Queensland Government policy statements as advised by the chief executive.

"**insite**" – means the internal website for use by officers of the department.

"**project officer**" – refer to the responsibilities section of this work practice.

"**RDR**" – means the Referable Dam Register of the Water Industry Compliance Database – the module within WICD that records administrative information about referable dams.

"**WICD**" – means Water Industry Compliance Database – a database that records information relating to service providers and dams.

References

The following documents should be referenced in conjunction with this work practice:-

- *Water Supply (Safety and Reliability) Act 2008*
- Water Supply (Chief Executive) Delegation (No. 1) 2011
- Work Practice DS 5.1 Flood mitigation manual for a dam (WIR/2009/3991 in policy register).
- Queensland Dam Safety Management Guidelines
- Guidelines for Acceptable Flood Capacity for Dams
- Guidelines for Failure Impact Assessment of Water Dams
- Emergency Management Planning for Floods Affected by Dams (2009) – Australian Government (Manual 23 of Australian Emergency Manual Series).

Officers involved in this work practice should also be familiar with, and comply with, requirements of the following departmental standards:

- Departmental policy RKP/2006/2907 – Recordkeeping overarching policy
- Departmental policy RKP/2006/2899 – Recordkeeping email policy
- Departmental standard IMP/2005/2253 – Procedures for using electronic mail
- Departmental standard ADM/2005/941 – Paper-based document management
- Departmental standard ADM/2002/965 – Decision making and requests for statements of reasons under the Judicial Review Act 1991
- Departmental standard ADM/2003/1402 – Information privacy.

Legislation

Water Supply (Safety and Reliability) Act 2008

Attachments

Attachment A – Flowchart <attachments/a-ds5-3-fmm-flowchart.pdf>

Attachment B – Acknowledgement letter <attachments/b-ds5-3-fmm-ack-let.pdf>

Attachment C – Assessment and decision form <attachments/c-ds5-3-fmm-a-d-form.pdf>

Attachment D – Request for information letter <attachments/d-ds5-3-fmm-req-info.pdf>

Attachment E – Non-approval amended flood mitigation manual letter
<attachments/e-ds5-3-fmm-non-app-let.pdf>

Attachment F – Gazette notice <attachments/f-ds5-3-fmm-gaz-notice.pdf>

Attachment G – Approval of amended flood mitigation manual letter <attachments/g-ds5-3-fmm-app-let.pdf>



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TUESDAY 11 OCTOBER 2011

[No. 46

Water Supply (Safety and Reliability) Act 2008

**APPROVAL OF FLOOD MITIGATION MANUAL
NOTICE (No 02) 2011**

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 02) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on 11 October 2011 approved the Manual of Operational Procedures for Flood Mitigation at North Pine Dam, Revision 6 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on 11 October 2011.
 2. Not required to be laid before the Legislative Assembly.
 3. The administering agency is the Department of Environment and Resource Management.
-

17 October 2011

Mr Terry Wall
Acting Director General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4000

Dear Mr Wall,

SCHEDULE OF AUTHORITIES – NORTH PINE DAM

Please find attached updated Schedule of Authorities as required under the Manual of Operational Procedures for Flood Mitigation at North Pine Dam (Revision 6).

Please do not hesitate to contact either myself or Jim Pruss (Executive General Manager – Water Delivery) on Tel. [REDACTED] should any further information be required.

Yours sincerely,

[REDACTED]
[REDACTED]
Peter Borrows
Chief Executive Officer

*Copy to: Mr Bob Reilly
Office of the Water Supply Regulator
Department of Environment and Resource Management*

Schedule of Authorities

17 October 2011 – 30 September 2012

Made pursuant to Section 2.7 of the *Manual of Operational Procedures for Flood Mitigation at North Pine Dam*.

Senior Flood Operations Engineers

John Tibaldi

Terrence Malone

Flood Operations Engineers

Barton Maher

Louw Van Blerk

David Pokarier



CTS No. 19901111

Department of Environment and Resource Management
DIRECTOR-GENERAL BRIEFING NOTE

Approved	Not Approved	Noted
Further information required		
DG.	[Redacted]	
Dated	11 / 11 / 2011	

TO: Director-General

SUBJECT: Approval of Flood Mitigation Manual – Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam.

TIMEFRAME/REQUESTED BY

- This brief was initiated by the department.
- A decision is urgently required by **11 November 2011** to facilitate any temporary reductions of the full supply levels (FSL) of Wivenhoe Dam or Somerset Dam should a declaration be made by the Minister for Finance, Natural Resources and The Arts.

RECOMMENDATION

It is recommended that the Director-General:

- by gazette notice, **approve** the attached (**Attachment A**) Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 9, November 2011 (the Manual) under section 371 of the *Water Supply (Safety and Reliability) Act 2008* (the Water Supply Act).
- **tick the approval box and sign** the Reviewed Flood Mitigation Manual Assessment and Decision Form as decision maker (**Attachment B**) and write in the time period for the Manual (5 years is the maximum and is recommended).
- **note** that if the Manual is approved, an urgent Extraordinary Government Gazette Notice (gazette notice) will be published. The gazette notice will function as the approval of the Manual under the *Water Supply Act*.

BACKGROUND

- The Queensland Bulk Water Supply Authority trading as Seqwater (Seqwater) owns and operates Wivenhoe and Somerset Dams. Flood operations at Wivenhoe and Somerset Dams are controlled by a Flood Mitigation Manual.
- The Queensland Floods Commission of Inquiry (“Commission”) was established on 17 January 2011. The Commission completed its first round of public hearings on 27 May 2011. The Commission of Inquiry released draft findings for comment to particular interested parties. The Commission of Inquiry provided an Interim Report on 1 August 2011 for implementation before the next wet season commencing on 1 October 2011.
- The Interim Report recommended that the Flood Mitigation Manual for Wivenhoe and Somerset Dams be revised on an interim basis before the next wet season and further on a longer term basis.
- The current Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 8 was approved by the chief executive under section 371 of the *Water Supply Act* by gazette notice on 1 October 2011 in response to the Commission’s Interim Report.
- The Director-General is authorised to approve the Manual by gazette notice pursuant to section 371 of the *Water Supply Act*. The relevant section of the legislation is extracted and attached (**Attachment C**). It is important to note that the approval is effected by publication of a gazette notice and the date of approval will be the date of the gazette notice (i.e.

Author: Name: Peter Allen [Redacted] Position: Project Director, Dam Safety Tel No: [Redacted] Date: 11 November 2011	Recommended: Name: [Redacted] Position: Acting General Manger, Office of the Water Supply Regulator Tel No: [Redacted] Date: 11 November 2011
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14 November 2011) not the date this briefing note is approved. A draft gazette notice is attached (**Attachment D**)

- The authority to approve Flood Mitigation Manuals under the above section has also been properly delegated pursuant to the *Water Supply (Chief Executive) Delegation (No. 1) 2011* to:
 - General Manager, Office of the Water Supply Regulator
 - Director, Water Industry Asset Management & Standards, Office of the Water Supply Regulator
 - Project Director, Dam Safety, Office of the Water Supply Regulator (Position No 76025966)
 - Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator.
- However, because compliance with the Interim Report recommendations of the Commission is a whole of government commitment it is appropriate that the Director-General make the decision on whether to approve the Manual.

CURRENT ISSUES

- Since Revision 8 of the Flood Mitigation Manual was approved, legislative changes have been made to the *Water Act 2000* (the Water Act) enabling the Minister administering that Act, in certain circumstances, to make declarations of temporary full supply levels to mitigate the impacts of a potential flood.
- The Moreton Resource Operations Plan (December 2009) (approved under the Water Act) does not provide for authorised flood mitigation releases to drain down either Wivenhoe Dam or Somerset Dam to any declared temporary full supply levels.
- As noted above, Flood Mitigation Manuals are approved under the Water Supply Act. Section 3 “Purpose of Act and its achievement” of the Water Supply Act states that the Act is to “provide for the safety and reliability of water supply” including “providing for flood mitigation responsibilities”. It is therefore appropriate that operational procedures to effect such drain downs, which are for flood mitigation purposes, be included in the flood mitigation manual.
- Seqwater have requested that a new flood mitigation manual be approved for Wivenhoe Dam and Somerset Dam proposing that a new chapter 8 “Declarations of Temporary Full Supply Levels for Flood Mitigation” be incorporated and minor consequential amendments to Clause 1.2 (Application) be made. These are the only proposed amendments to be made to the Manual.
- During the interim review of the Manuals, departmental officers suggested to Seqwater that similar provisions to those now being proposed by Seqwater should be considered for inclusion given such releases are for flood mitigation purposes. Seqwater did not accept the departmental suggestion and did not include such provisions in Revision 8 of the Flood Mitigation Manual (**Attachment E**).
- Seqwater’s position subsequently changed, presumably due to insurance requirements. Through the proposed amendment to the Manual, Seqwater will also be afforded the benefit of some protection for liability under section 374 of the Water Supply Act, a copy of which is extracted and attached (**Attachment F**).
- On 4 November 2011 Seqwater wrote to the Director-General (**Attachment G**) advising that Seqwater’s insurers had declined cover for drain down and that Seqwater wished to discuss the prospect of the State providing indemnities similar to those provided in February 2011.
- In February 2011, Seqwater made a release of water from Wivenhoe Dam to bring the water level down to 75% of full supply level with the background set out in CTS 02576/11 (**Attachment H**). The State provided Seqwater with two indemnities with the background

Author: Name: Peter Allen Position: Project Director, Dam Safety Tel No: [REDACTED] Date: 11 November 2011			Recommended: Name: [REDACTED] Position: Acting General Manger, Office of the Water Supply Regulator Tel No: [REDACTED] Date: 11 November 2011
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set out in CTS 02722/11 (**Attachment I**). One was equivalent to protection from liability under section 374 of the *Water Supply (Safety and Reliability) Act 2008* and the other was equivalent to Seqwater's commercial insurance policies. The indemnities referred to above were given in what was considered to be very exceptional circumstances. At the time the indemnities were given, Treasury officials indicated that further such indemnities were unlikely to be supported by the Treasurer. The indemnities expired on 31 March 2011. No claim was made under the indemnities.

- On 10 November 2011 Seqwater wrote to the Director-General (**Attachment J**) advising that, if the Flood Mitigation Manual for Wivenhoe and Somerset Dams was amended with the new proposed Chapter 8, then Seqwater's insurers would provide cover for drain down and Seqwater would not require indemnities from the State.
- A letter dated 10 November 2011 from Seqwater submitting the proposed Manual for approval is attached (**Attachment K**).
- That letter also enclosed Explanatory Notes (**Attachment L**) to the proposed Manual.
- A Principal Lawyer, Legal Services (Floods Commission of Inquiry Liaison) has reviewed the proposed Manual and prepared a Legal Advice (**Attachment M** - This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services).
- The Project Director, Dam Safety, as the assessment officer, has assessed the Manual under policy and procedure DS5.3 (**Attachment N**) and recommended that the decision maker approve the Manual (**Attachment B**).

RESOURCE/IMPLEMENTATION IMPLICATIONS

- There are no major resource/implementation implications for DERM.
- The department's Office of the Water Supply Regulator Branch will bear the cost of the gazette notice (approximately \$1 000).

PROPOSED ACTIONS

- If the Manual is approved the department will publish, pursuant to section 371 of the *Water Supply Act*, the chief executive's approval of the *Operation Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 9* by extraordinary gazette notice on 14 November 2011.
- The department will continue to work with Seqwater on the longer term review of the Flood Mitigation Manual.

DIRECTOR-GENERAL'S COMMENTS

ATTACHMENTS

- Attachment A: Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (the Manual), Revision 9, November 2011 for approval.
- Attachment B: Reviewed Flood Mitigation Manual Assessment and Decision Form for signing.
- Attachment C: Extract section 371 of the *Water Supply (Safety and Reliability) Act 2008*.
- Attachment D: Draft gazette notice.
- Attachment E: Email from Jim Pruss (Seqwater) to Bob Reilly (DERM) dated 6 September 2011


Author: Name: Peter Allen Position: Project Director, Dam Safety Tel No [REDACTED] Date: 11 November 2011			Recommended: Name: [REDACTED] Position: Acting General Manger, Office of the Water Supply Regulator Tel No [REDACTED] Date: 11 November 2011
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- Attachment F: Extract section 374 of the *Water Supply (Safety and Reliability) Act 2008*
- Attachment G: Letter dated 4 November 2011 from Seqwater
- Attachment H: CTS 02576/11 – Briefing note approved 17 February 2011 for water releases
- Attachment I: CTS 02722/11 – Briefing note approved 17 February 2011 for indemnity
- Attachment J: Letter dated 10 November 2011 from Seqwater
- Attachment K: Letter dated 10 November 2011 from Seqwater submitting Manual for approval.
- Attachment L: Explanatory Notes to the proposed Manual prepared by Seqwater.
- Attachment M: Legal Advice
- Attachment N: DS 5.3 Processing a flood mitigation manual for a dam following review.

Author: Name: Peter Allen Position: Project Director, Dam Safety Tel No [REDACTED] Date: 11 November 2011			Recommended: Name: [REDACTED] Position: Acting General Manger, Office of the Water Supply Regulator Tel No [REDACTED] Date: 11 November 2011
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REVIEWED FLOOD MITIGATION MANUAL ASSESSMENT AND DECISION FORM

General Information

Name of dam	Somerset/Wivenhoe Dams
Reference number/s (from Referable Dam Register)	Somerset (#354), Wivenhoe (#377)
Dam owner contact details	Queensland Bulk Water Supply Authority (trading as Seqwater)
Date reviewed flood mitigation manual received by DERM	10 November 2011
Date approval for existing flood mitigation manual expires	1 October 2016
DERM file details	DAM/130/000(0377)/ CBD/024089 and CBD/024093
Supporting information received from the dam owner	Letter detailing what was contained in the submission Explanatory Notes produced by Seqwater detailing what amendments have been made to the existing Manual (Revision 8). There was no external independent review of the amended Manual. This should be accepted in this instance because of the nature of the amendments and the fact that no changes have been made to the existing flood strategies.
Name / position of assessment officer	Peter Allen, Project Director Dam Safety
Name / position of decision maker	 , Director-General
Due date for completion of review	The review should be completed prior to the implementation of any decision made to drain Wivenhoe Dam down to a temporary Fully Supply Volume of 75% of current Full Supply Level.

REVIEWED FLOOD MITIGATION MANUAL CHECKLIST

	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
Amendments since previous manual		
1.	Does the manual or accompanying correspondence provide a summary of changes and why they are necessary?	3
<p>The only significant change to Revision 8 is the addition of Chapter 8 to cover the case where Wivenhoe Dam or Somerset Dam are to be drained down as an operational release (as against a flood release) to a new temporary Full Supply Level without a flood event being declared.</p> <p>The new Chapter 8 of the Manual also provides for the development of specific transitional flood strategy if a flood event occurs during the drain down period.</p> <p>Apart from the addition of Chapter 8, there are only a couple of minor editorial changes to enable the inclusion of Chapter 8.</p>		
Consultation		
2.	Are any stakeholders adversely affected by the changes? If so, has the dam owner consulted with relevant stakeholders?	3
<p>The amended Manual effectively provides the same provisions as occurred in March 2011 for the drain down of Wivenhoe from 100% storage to 75% storage.</p> <p>As far as I am aware, Seqwater has not undertaken any external consultation other than routine discussions with affected local authorities in preparation for the coming 'wet season'. However, with a maximum operational release to produce a discharge of 400 m³/sec at Burton's Bridge (which would also have occurred had the March 2011 release protocols been applied), there is probably not a great need to do any external consultation ... it is just the mechanism of repeating the March 2011 releases.</p> <p>The affected parties are those who would normally use:</p> <ul style="list-style-type: none"> • Twin Bridges 50 m³/sec • Savages Crossing 130 m³/sec • College's Crossing 175 m³/sec <p>Release of ≈290,000 ML at 400 m³/sec will take about 8 to 9 days. There are alternative routes if these crossings are inundated.</p> <p>In the current circumstance with Wivenhoe at 80.4%, approximately 63,000 ML has to be released to bring Wivenhoe to 75% of FSL volume. At 160 m³/sec (to keep College's Crossing open) approximately 4.5 days is required.</p>		

Issue		Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
3.	Have concerns/issues been raised by stakeholders? If so, have the concerns been addressed in the manual?	3	I am not aware of any concerns/issues raised by stakeholders over the releases during March 2011.
Direction of operations Only amendments relate to drain down of storages to temporary Full Supply Levels. It does not affect previously approved flood operations.			
4.	Does the manual include the following		
	<ul style="list-style-type: none"> Operational arrangements to unambiguously define flood release operations for the dam during flood events 	5	Yes. Flood Operations have not been amended since the previous approval on 1 October 2011. However the amendments for Revision 9 do provide an overall framework for developing a operational release strategy
	<ul style="list-style-type: none"> Designation and responsibilities of those responsible for Flood Operations including qualifications and experience. 	5	Yes. The only amendment for Revision 9 is for Seqwater to ensure a Senior Flood Operations Engineer is in overall control of operational releases to drop the storages to any new Temporary Full Supply Volume.
5.	Does the manual cover training for relevant personnel	5	Yes. These have not been amended since the previous approval on 1 October 2011. The training requirements of the chief executive have been sent to Seqwater for the period to 30 September 2012.
6.	Does the manual detail the follow reporting requirements		
	<ul style="list-style-type: none"> Training 	5	Yes. These have not been amended since the previous approval on 1 October 2011.
	<ul style="list-style-type: none"> Flood preparedness 	5	Yes. These have not been amended since the previous approval on 1 October 2011.
	<ul style="list-style-type: none"> Flood event reporting 	5	Yes. These have not been amended since the previous approval on 1 October 2011.
Flood Mitigation Objectives No amendments to previous version			
7.	Does the manual cover the following objectives and assign priorities to each objective:-		Yes to all these issues. These have not been amended since the previous approval on 1 October 2011.
	<ul style="list-style-type: none"> Structural safety of dam/s 	5	
	<ul style="list-style-type: none"> Protection of urbanised areas from inundation 	5	
	<ul style="list-style-type: none"> Minimise disruption to downstream rural communities (if applicable) 	5	
	<ul style="list-style-type: none"> Minimise impact on flora and fauna 	5	

Issue	Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
Flood monitoring and forecasting procedures of Revision 8 No amendments have been made to the flood event		
8.	Does the manual detail the provision of real time flood data to BOM for the issuing of flood warnings and any necessary flood modelling?	4 Yes. These have not been amended since the previous approval on 1 October 2011.
9.	Have details of the operation of the overall operating system been included	5 Yes. The amendments allow for operational releases up to 400 m ³ /sec at Burton's Bridge with the actual discharge strategy being assessed for each drainage episode and being dependent on a range of parameters such as the prevailing weather conditions, the volume to be drained and the period in which to drain it. A Senior Flood Operations Engineer will be in charge at all times during Chapter 8 releases and the Flood Engineers will monitor rainfalls and other inflows to minimise the risk of bridges being unexpectedly inundated. Provisions have been made to transition into flood operations if a flood event occurs during the drainage phase. Guiding principles have been provided to the Senior Flood Operations Engineer on how to determine appropriate transitional flood releases in the explanatory notes
10.	Does the manual detail an appropriate flood monitoring and forecasting system?	4 Yes. These have not been amended since the previous approval on 1 October 2011.
Communications No amendments to previous version		
11.	Does the manual cover communications with the following: • Stakeholder agencies (e.g. Bureau of Meteorology, DERM, relevant councils affected by the dam) • Operational staff employed by the dam owner • Public	4 List of stakeholders is detailed in 2.12. Details of who is to be given warnings etc. is detailed in the Emergency Action Plan. 4 List of types of communication included in Section 2.11. 3 During flood events there is no provision for communicating with the public. This is handled in the Emergency Action Plan for each dam.
Review No amendments to previous version		

Issue		Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
12.	Does the manual allow for variation to the document when technical and physical conditions relating to the dam change.	5	Section 4.5 provides for the use of 'Reasonable Discretion' in the event that a Senior Flood Operations Engineer considers it necessary. Section 1.6 provides for non-temporary variations to the manual. These should be adequate for the purpose.
13.	If no other changes are required (as per No. 12 above) does the manual include details of the mandatory review that is required within the time frame set by the chief executive? Note: the manual should include details such as <ul style="list-style-type: none"> • how detailed the review should be • things to be considered during the review. A review may or may not result in a change to the manual.	N/A	See Item 12. It does not cover the ability of the chief executive to request particular changes to the Manual ... but that is contained in the Water Supply Act and does not need duplication.
Operation during flood events		No amendments to previous version	
14.	Does the manual include details of:		
	<ul style="list-style-type: none"> • infrastructure for flood releases (this may include diagrammatic representations) 	5	Good overall description in Sections 5.2 and 6.1.
	<ul style="list-style-type: none"> • details of structures to be considered during flood operations 	4	Details of the bridges to be considered in flood operations are provided in Figure 5.3.2 and Appendix J.
	<ul style="list-style-type: none"> • Discharge rating information for gates, spillways and auxiliary spillways 	5	Full details provided in Appendices.
	<ul style="list-style-type: none"> • Initial flood control action 	4	Contains details of who is responsible for Chapter 8 releases and when a flood event is declared during a drainage event.
	<ul style="list-style-type: none"> • Flood operation strategies 	5	Flood operations are detailed in Sections 5, 6 and 7. Chapter 8 provides the framework for operational releases to drop the Lake Level to any new Temporary Fully Supply Volume.
	<ul style="list-style-type: none"> • Gate closing strategies 	5	Detailed in Sections 5.4 and 6.3.
	<ul style="list-style-type: none"> • Gate operation sequences 	5	Detailed in Sections 5.5 and 6.4.
Emergency flood operations		No amendments to previous version	

Issue		Y or N or a rating from 0-5 where 0 = lowest and 5 = highest, as appropriate	Comments (include the reasons/details of the rating given)
15.	Does the manual include the provision for and information on emergency flood operations	5	Provisions for emergency flood operations remain as they were in Revision 8.
16.	Are flood operations consistent with the Emergency Action Plan (EAP)?	5	The EAP details the notifications required to other parties. The way the dam is operated is in accordance with this Manual.
Other Issues			
17.	Does this manual raise any other issues not covered in the above checklist?	5	No.
Queensland Floods Commission of Inquiry			
18.	Does this manual comply with the outcomes of the Queensland Floods Commission of Inquiry?	5	Revision 8 satisfied all the QFCoI recommendations for the Interim Review of the Manual. This version of the Manual has been the subject of significant DERM legal review.

Comment on the results of the detailed assessment of the reviewed manual. In particular comment on the overall extent and significance of any non-compliance with the issues in the checklist or any failures to address the above issues adequately or in sufficient detail

All aspects of the amendments to the Manual have undergone significant review. The technical aspects of the amendments have been reviewed by Peter Allen (Project Director, Dam Safety) and Ron Guppy (Principal Engineer, Dam Safety)

Detail legal advice received on their review of the legal aspects of the flood mitigation manual (if it was deemed appropriate to seek legal advice).

Petra Faas (Principal Lawyer, Legal Services) and Paul Walsh (A/Director and Principal Lawyer, Legislative Development Services (Floods Commission of Inquiry Liaison)) have reviewed the Manual from a DERM legal perspective and interacting with the Seqwater legal representatives. They have indicated that Revision 9 satisfies DERM requirements from a legal perspective.

Recommendation and decision

Assessment officer's recommendation to decision maker



Approve the reviewed flood mitigation manual

Reasons for recommendation to approve the reviewed manual

Revision 9 of the Flood Mitigation Manual for Wivenhoe and Somerset Dams has been modified to incorporate provisions to drain Wivenhoe and Somerset Dams from the "as designed" Full Supply Level down to a temporary Full Supply Level (if so directed by the controlling Minister)

The amendments are appropriate for the purpose. There are no dam safety implications for either dam if the Full Supply Levels for the dams are lowered.

It is recommended that it be approved for a period of five years until 14 November 2016 (being the date of the proposed Gazettal). It is expected that it will ultimately be superseded by the next revision once the longer term review recommended by the Commission of Inquiry is completed.

Evidence for the findings

Note: Documents, information, Acts, standards and guidelines that were considered in the course of carrying out this assessment and making this recommendation. List all contacts with the dam owner, information given to the dam owner and information received or used in making the recommendation.

- *Water Supply (Safety and Reliability) Act 2008*
- Work practice DS 5.3 Assessing a flood mitigation manual for a dam following review (WIR/2011/4884 in the policy register)
- DERM files **DAM/130/000(0377)/ CBD/024089 and CBD/024093 (Keeper files)**
- Interim Report of Queensland Floods Commission of Inquiry (QFCol), 1 August 2011.
- Revision 8 of Manual of operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, September 2011.
- Revision 9 of Manual of operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, November 2011.

Findings on material facts

Note: That is, the results of the flood mitigation manual checklist.

- Under section 373 of the Act the owner of the dam reviewed and updated the existing approved flood mitigation manual for Wivenhoe and Somerset dams and submitted it to the department for approval on 10 November 2011.
- Revision 9 of the Manual provides for drainage of the storage of Somerset and Wivenhoe dams down to new temporary Full Supply Levels under the provisions of the Manual. This was done largely by the addition of Chapter 8 to the previously approved Revision 8 of the Manual.
- Chapter 8 leaves significant discretion to the Senior Flood Operations Engineer in determining the details of the drainage release strategy. This is appropriate under the drainage phase as releases will be limited to a flow of (or less than) 400 m³/sec at Burton's Bridge.
- Adequate transitional strategies have been incorporated to transition into the existing flood operations strategies if a flood event occurs during the drainage phase. Guidance is provided in the Explanatory Notes to guide the Senior Flood Operations Engineer in the selection of appropriate dam releases.
- The next stage for the review of the Manual is the 'Longer Term Review' in accordance with recommendations 2.10 to 2.13 of the QFCol Interim Report. This review is already well underway but may not be completed for a couple of years.


Reasons for the recommendation

Note: These are the reasons for the conclusion, in this part you assess the evidence and say how it was applied; you give a logical explanation for the recommendation.

- Revision 8 satisfied all the recommendations made by the Queensland Floods Commission of Inquiry in their Interim Report published on 1 August 2011.
- Approval of Revision 9 has been requested by Seqwater to cover the drain down phase when transitioning from the current Full Supply Level to the new Temporary Full Supply Volume level.
- The proposed operational release strategies to drain down to a new Temporary FSL are relatively flexible and are dependent on a number of parameters such as the current weather conditions, the volume to be drained and the time available to drain it.
- All such releases will be under the overall control of a Senior Flood Operations Engineer.
- The proposed arrangements are considered reasonable.

Certification and signature of assessment officer

I have complied with the procedure for processing a flood mitigation manual for a dam following review. When making this recommendation, I have taken the material described above, the requirements of the *Water Supply (Safety and Reliability) Act 2008*, relevant guidelines, the matters outlined in the procedure for processing a flood mitigation manual for a dam following review and departmental training I have received, into account when making this recommendation.

Signature of assessment officer	
Position of assessment officer	<u>Project Director Dam Safety</u>
Date recommendation made	<u>11 November 2011</u>

Time frame for the information to be provided to the chief executive

<<insert timeframe>>

Certification and signature of decision maker

I have complied with the procedure for processing a flood mitigation manual for a dam following review when making this decision. I have taken the assessment officer's recommendation and the documents and information described above into account when making this decision.

Signature of decision maker



Date of decision

01/11/2011

PLEASE ENSURE ALL BLUE WRITING AND <<>> SIGNS HAVE BEEN DELETED PRIOR TO PRINTING THIS DOCUMENT

Decision maker's decision (tick appropriate box/es and delete those not needed)

Authority to make decision

<<insert instrument of delegation>>

Seek further advice

Person/s advice is to be sought from

<<insert source of further advice – could be legal advice or advice from an Advisory Council etc>>

Approve the reviewed flood mitigation manual

Approval timeframe (not more than 5 years)

<<insert date approval expires (not more than 5 years)>> 5 years.

Further investigations by the assessment officer are required before a final decision is made

Issues to be further investigated by the assessment officer

<<list details of issues>>

Time frame for completion of investigations

<<insert timeframe>>

Not approve the reviewed flood mitigation manual

Reasons to not approve the reviewed manual

<<insert reasons for not approving the manual>>

Require additional information about the reviewed flood mitigation manual

Details of additional information required

<<insert details of additional information required>>

[s 370]

Part 2 **Flood mitigation**

370 **Owners of particular dams must prepare flood mitigation manual**

- (1) A regulation may nominate an owner of a dam as an owner who must prepare a manual (a *flood mitigation manual*) of operational procedures for flood mitigation for the dam.
- (2) The regulation must nominate the day by which the owner must comply with section 371(1).

371 **Approving flood mitigation manual**

- (1) The owner of a dam must give the chief executive a copy of the flood mitigation manual for the dam for the chief executive's approval.
- (2) The chief executive may, by gazette notice, approve the manual.
- (3) The approval must be for a period of not more than 5 years.
- (4) The chief executive may get advice from an advisory council before approving the manual.

372 **Amending flood mitigation manual**

- (1) The chief executive may require the owner of a dam, by notice, to amend the flood mitigation manual for the dam.
- (2) The owner must comply with the requirement.
- (3) If the owner complies with the requirement, the chief executive must, by gazette notice, approve the manual as amended.
- (4) The approval of the manual as amended must be for—
 - (a) the balance of the period of the approval for the manual before the amendment; or

Water Supply (Safety and Reliability) Act 2008

**APPROVAL OF FLOOD MITIGATION MANUAL NOTICE
(No 3) 2011**

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 3) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on 11 November 2011 approved the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 9 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on Monday 14 November 2011.
2. Not required to be laid before the Legislative Assembly.
3. The administering agency is the Department of Environment and Resource Management.

From: Reilly Bob
Sent: Tuesday, 6 September 2011 10:20 AM
To: [REDACTED]; Allen Peter; [REDACTED]
Subject: Fw: Draw down to new, temporary, Wivenhoe FSL
Fyi

Bob

From: Jim Pruss [REDACTED]
Sent: Tuesday, September 06, 2011 10:11 AM
To: Reilly Bob
Subject: RE: Draw down to new, temporary, Wivenhoe FSL

Thanks Bob.

We understand the State's position on this issue. We are content to proceed without a specific indemnity to cover any slow, controlled draw down this wet season.

Happy to discuss further in person

Jim

From: Reilly Bob [REDACTED]
Sent: Monday, 5 September 2011 11:34 AM
To: Jim Pruss
Cc: Allen Peter; [REDACTED] Floods Commission of Inquiry Liaison; [REDACTED]
Subject: Draw down to new, temporary, Wivenhoe FSL

Hi Jim

Further to your letter of last Friday on the revised draft manual, it needs to be understood that if the drawdown was done outside of the Manual's provisions, then Seqwater would not have an indemnity for this action (An indemnity was provided, administratively, in connection with draw down earlier this year; but, as we have discussed previously, this will not, on current advice, be provided again. In essence, if Seqwater wants an indemnity, then the Government's current position is that it needs to be provided through the Manual)

Could you please advise if Seqwater is OK with this outcome i.e. no indemnity for the initial draw down. If you are not, then I suggest we have a meeting later this week to focus on this issue.

Thanks

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone: [REDACTED]

Email: [REDACTED]

www.derm.qld.gov.au

Department of Environment and Resource Management

Lvl 3 41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

+-----+
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[s 374]

374 Protection from liability for complying with flood mitigation manual

- (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.
- (3) If subsection (1) or (2) prevents civil liability attaching to a person, the liability attaches instead to the State.
- (4) In this section—
owner, of a dam, includes—
 - (a) the operator of the dam; or
 - (b) a director of the owner or operator of the dam; or
 - (c) an employee of the owner or operator of the dam; or
 - (d) an agent of the owner or operator of the dam.

375 Sections 375–399 not used

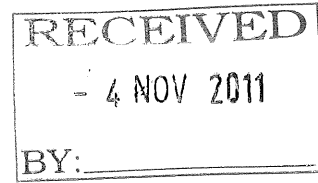
See editor's note for section 1.

19426/11
19287/11
19266/11



4 November 2011

Director-General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001



Dear Mr [REDACTED]

Notice pursuant to section 32(4) and 32(5) of the Water Act 2000 – Proposed temporary full supply level for Wivenhoe Dam of 75%

I refer to the notice issued by you to Seqwater dated 2 November 2011 pursuant to the *Water Act 2000*. This is Seqwater's response to the notice.

Preliminary

In responding to your notice, we have assumed the "proposed" temporary full supply level ("FSL") of Wivenhoe Dam about which we are to provide advice is 75% (namely, EL 64.0 metres AHD). We have based this assumption on the fact that by letter dated 25 October 2011 (which your notice replaces), the Minister sought advice from Seqwater on the extent to which reducing and maintaining Wivenhoe Dam at 75% of the FSL until 31 March 2012:

1. would likely mitigate the impacts of a potential flood; and
2. may impact the safety of the dam and how the dam operates.

We note the scope of the advice required to be provided by Seqwater pursuant to your notice is limited to the matters listed in paragraph 2. Notwithstanding this, given the scope of the Minister's letter, our advice below addresses both matters referred to above.

We confirm that Seqwater officers have liaised with officers from the Queensland Water Commission, the SEQ Water Grid Manager and your Department in preparing this advice.

Flood Mitigation Impacts of a Reduction to 75% of FSL

Seqwater has previously provided advice in relation to the flood mitigation impacts of operating Wivenhoe Dam at 75% of FSL in letters dated 22 September 2011 to Minister Nolan, 7 February 2011 to Mr Bradley, the then Director General of DERM and 4 February 2011 to Minister Robertson. Copies of these letters are attached for your convenience.

19528/11



By way of summary, based on the modelling undertaken by Seqwater (including the assumptions which attend that modelling (as set out in the above letters)), Seqwater's advice is:

1. Each flood event is unique and rainfall characteristics and associated flooding can vary dramatically. Wivenhoe Dam can only mitigate floods which emanate from the catchments above the dam. No increased flood mitigation benefits will be obtained from a reduction in FSL if the majority of the rain falls in the catchments below the Dam.
2. The flood mitigation impact for operating Wivenhoe Dam at 75% of FSL varies depending on the magnitude and characteristics of the flood. Floods can be described depending on their severity as frequent, large, rare or extreme.
3. For frequent events such as the October 2010 and December 2010 flood events which cause disruption to rural communities, operating Wivenhoe Dam at 75% of FSL will not result in any measurable change to the frequency and duration of flooding from that experienced under the current operating rules.
4. For large to rare events, such as the January 1974 and January 2011 flood events, operating at 75% of FSL will result in relatively small reductions in peak water levels at downstream locations when compared with the current operating rules. However, although relatively small, this may result in an appreciable reduction in the number of houses adversely impacted.
5. For rare to extreme events of a magnitude not yet recorded in Brisbane, operating at 75% of FSL will not have any significant impact on downstream flood levels.

Since our letter of 22 September 2011, the new Revision 8 of the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam* has been approved ("the New Manual"). To assist you in further considering the flood mitigation impact of operating at 75% of FSL for large to rare events such as the January 2011 flood event (see paragraph 4 above), we have now modelled the January 2011 flood event based on the New Manual (which as you know has the flexibility to accommodate reductions in FSL). The details of the modelling (including the assumptions on which it is based) are set out in the Annexure.

By way of summary, the modelling (including the assumptions on which it is based) suggests that if a flood event similar to January 2011 was experienced in the future, a reduction in water storage to 75% of FSL prior to the commencement of the event could reduce the flood level at the Brisbane Port Office Gauge by between 0.2m and 0.4m.¹ You will recall the actual peak level at the Port Office during the January 2011 event was 4.46m AHD.

Finally, we note the Minister requested that we adopt a precautionary approach in our advice. Obviously, we are not addressing the water supply security (and pricing) issues which attend a decision to temporarily lower Wivenhoe Dam to 75% of FSL. If those issues are not considered, a lower Wivenhoe Dam level will increase the dam's flood mitigation capacity. The extent to which this increased capacity will result in improved flood outcomes downstream of the dam will depend on the nature of the flood event (as explained above).

Dam Safety and Operational Implications

As noted above, the New Manual incorporates the flexibility to operate Wivenhoe Dam from a reduced FSL. The New Manual is consistent with Seqwater's dam safety responsibilities, and was reviewed by the Dam Safety Regulator in its preparation. A reduction to 75% of FSL does not create any new safety implications.

In terms of operational implications, we confirm that operating Wivenhoe Dam at 75% of FSL this wet season may result in longer periods of inundation of downstream bridges. As you know, inundation of downstream bridges can cause isolation and inconvenience to residents in the Brisbane Valley. There were a number of flood events in October and December 2010 which required flood releases to be made from Wivenhoe Dam. During these events, requests were received from Councils and residents, either isolated or adversely impacted by bridge closures downstream of the dam, to curtail releases as soon and as quickly as possible. Wivenhoe Dam is currently at approximately 82% of FSL. If a decision is made to lower the dam level to a temporary 75% FSL, two issues arise. *First*, the dam would need to be drained to the lower level. We are expecting (see the details further below) that the drain down (from the current level) may take up to 10-12 days, assuming an upper release rate of 175m³/s and no rainfall during the drain down period. These releases will inundate Twin Bridges and Savages Crossing.

¹ Please note the modelled result for 100% of FSL under the previous version 7 of the manual for the January 2011 flood event gives a result of 4.60m AHD at the Brisbane Port Office Gauge. The actual level recorded for the event at that gauge was 4.46m AHD, which is considered an acceptable difference for the model.

Secondly, if a decision is made to not lower the FSL, the 18% capacity within Wivenhoe Dam (which equates to around 208,000 ML) can be used to store water before *any* flood releases (and therefore any inundation of downstream bridges by releases) are necessary. If a decision is made to lower the dam to 75% of FSL, flood releases will be required as soon as any inflow into the dam is received. For inflow which occurs this wet season, this scenario, in comparison to using the available 18% capacity before any flood releases are made, will result in increased periods of inundation of downstream bridges.

Revised Interim Program under Moreton ROP

As you are aware, the reduction to 75% of FSL will not be conducted under the New Manual. Rather, those releases will need authorisation under a revised Interim Program for the Moreton Resource Operations Plan.

A draft revised Interim Program is attached. By way of summary, we are proposing that any drain down occur in a similar way to the drain down which occurred in February 2011. With the lake presently at 82%, this means there are two possibilities for draining the dam. The first is to drain the dam over 4-5 days at a peak release of 400m³/s (assuming no rainfall during the drain down period). Closure of Twin Bridges, Savages Crossing and Colleges Crossing will be required in this scenario and we will liaise with local councils to arrange this.

We note that repair work to guard rails and the road at Mt Crosby Weir is scheduled to commence in the next couple of weeks and may take up to four weeks to complete. Given this, and in order to reduce the inconvenience to residents which would be associated with a closure of Colleges Crossing at the same time, an alternative drain down scenario is to lower the peak release to less than 175m³/s, thereby keeping Colleges Crossing open. This would extend the drain down period to 10-12 days (assuming no rainfall during the drain down period). Closure of Twin Bridges and Savages Crossing will still be required.

Once the dam reaches the 75% level, flood releases will be governed by the New Manual.

Insurance Issues

In our letter of 22 September 2011, we confirmed that we were making enquiries of our insurers in relation to coverage of releases in draining down the dam to a temporary FSL. We can now provide an update.

Our insurers subsequently issued new policy terms which exclude coverage for drain downs. Since then, we have been working with them to overcome their concerns. At this stage, their principal concern appears to be in respect of the structural integrity of the downstream bridges which will be submerged as part of the drain down. Insurers confirmed on 3 November 2011 that they require detailed structural assessments of the bridges confirming they will be able to withstand the releases before any decision on coverage will be made. We have asked insurers if they will provide coverage with an exclusion on damage to the bridges. Insurers have today confirmed that they will not cover the drain down even with an exclusion.

In view of the above, we would like to discuss with you putting in place an indemnity (similar to that put in place in February) to cover Seqwater in respect of claims which might be made arising from the drain down.

Should you require any further clarification, please contact Mr Jim Pruss, Executive General Manager – Water Delivery, on Tel [REDACTED]

Yours sincerely,

[REDACTED]

Peter Borrows
Chief Executive Officer

Attachments:

1. *Letter to Minister Nolan (dated 22 September 2011)*
2. *Letter to Mr John Bradley (dated 7 February 2011)*
3. *Letter to Minister Robertson (dated 4 February 2011)*
4. *Modelling*
5. *Draft Revised Interim Program*

22 September 2011

The Hon Rachel Nolan MP
Minister for Finance, Natural Resources and The Arts
GPO BOX 611
BRISBANE QLD 4001

By email: [REDACTED]

Dear Minister,

I am writing in response to your letter dated 18 September 2011 seeking advice from Seqwater on the flood mitigation impacts of reducing and maintaining Wivenhoe Dam at 75% of the Full Supply Level (FSL) volume from 1 October 2011 to 31 March 2012.

We note that you are obtaining advice from the Queensland Water Commission (QWC), Water Grid Manager (WGM) and Department of Environment and Resource Management (DERM) as outlined in your letter.

In considering this advice, you should be aware that each flood event is unique and rainfall characteristics and associated flooding can vary dramatically. As the 1974 and 2011 flood events were amongst the largest ever recorded for the Brisbane River, they have been used to model potential benefits of different operating scenarios. However, it is almost certain that the flows and levels of any actual future events will be different to the model estimates based on historical events. The modelling shows what mitigation can likely be achieved based on the current information and analysis tools available.

In accordance with your request, Seqwater has been liaising with the QWC, WGM and DERM in relation to this advice.

Background

Prior to the January 2011 flood event, the January 1974 flood in the Brisbane River was one of the largest floods ever to occur in Queensland. Notwithstanding both the 1974 and 2011 floods caused damage, the two events had different characteristics and the 2011 event was mitigated by the Wivenhoe Dam.

Immediately following the January 2011 flood event, Seqwater undertook a study (*Impact of Reducing Full Supply Level of Wivenhoe on Flood Discharges*) to assess the impact of reducing the FSL of Wivenhoe Dam on flows *immediately* downstream of the dam for a range of design and historical floods, including the 1974 and 2011 flood events (Initial Study).

The Initial Study considered lower starting levels ranging from 95% to 50% of the current FSL and concluded that:

- limited reductions of up to 39% in peak releases from Wivenhoe Dam might be achievable in rare floods, and release reductions of between 20% and 30% for January 1974 and January 2011 type floods; but
- a more detailed study was required to consider downstream impacts along the Brisbane River because of the size and nature of the downstream catchments. Around 6,500 square kilometres of the Brisbane River catchment (approximately 50%) is located downstream of the Wivenhoe and Somerset Dams and includes the Lockyer Creek and Bremer River.

In order to model flood levels downstream of Wivenhoe Dam, Seqwater commissioned SKM to develop and calibrate a hydrodynamic model of the Brisbane River for the January 2011 flood event (*Joint Calibration of a Hydrologic and Hydrodynamic Model of the Lower Brisbane River*, 5 August 2011) (Model).

The Model combines releases from Wivenhoe Dam with flows from hydrologic models of the catchments downstream of the dam, including the Lockyer Creek and the Bremer River, and estimates peak water levels at numerous locations along the Brisbane River. Using the results of the Initial Study and the Model, the impact of operating Wivenhoe Dam at 75% of FSL has been investigated for the January 1974 and January 2011 flood events.

Assumptions and Constraints

The following assumptions and constraints apply to the Model:

1. The estimated inflows to Wivenhoe Dam for the January 1974 and January 2011 flood events were adopted to assess the changes in FSL.
2. The starting level of Wivenhoe Dam is assumed to be EL 64m AHD (i.e. 75% of FSL). At this point, there is an additional 290,000 ML of flood storage available. Notably, the volume of inflow to Wivenhoe Dam during the January 2011 flood event was 2,650,000 ML or nearly 10 times the volume of the additional storage.
3. The releases from Wivenhoe Dam were modelled with modifications to account for the lower operating level.
4. The adopted 75% operating strategy assumes that releases are started once the storage level exceeds EL 64m AHD and releases are kept below 400m³/s (the capacity of Burton Bridge), to minimise disruption to rural residents until the dam reaches EL 69m AHD when it becomes necessary to resume gate operational strategies pursuant to the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe and Somerset Dams, Revision 7* (Manual).
5. The release strategy derived for this modelling is approximate only, and would need more detailed, refined modelling were it to be considered for implementation. The Study results to calibrate the model have been peer reviewed but the actual Model results using these scenarios have not been peer reviewed. More work is required to redefine the Model but it is considered fit for the purpose of this study.
6. A starting level of 50% FSL has not been modelled at this time. Flow reductions from a 50% release have already been modelled in the Initial Study and provided to the government however these have not been run through the Model in terms of level reductions in Brisbane River.

Discussion

Reducing the FSL of Wivenhoe Dam to 75% of the current FSL volume increases the available flood storage by 290,000 ML. This additional flood storage would not be needed or utilised during frequent flood events such as those which occurred in October 2010 and December 2010 because the dam's design and Manual allow floods of this type to be effectively mitigated. Furthermore, the frequency and duration of the inundation of crossings downstream of Wivenhoe Dam is not expected to change by virtue of the additional flood storage from that experienced under the current operating rules.

The impact of a 75% FSL operating level on downstream flood levels in large to rare events, such as the January 1974 and January 2011 flood events, was investigated by inserting the modelled reductions in release flows into the Model.

Comparisons are described using peak dam outflow and river height. The height of the river is demonstrated by reference to the Brisbane Port Office Gauge (The Gauge) as this is a well known and accepted indicator of river height in Brisbane.

Model Results for January 1974 Flood

Under a pre-Wivenhoe Dam scenario as was the case in 1974, the modelled peak water level for the January 1974 flood at The Gauge is 5.5m AHD. The actual recorded level was 5.45m AHD, therefore indicating a good alignment with the Model.

Under the current operating rules with Wivenhoe Dam at 100% of FSL:

- the peak outflow from the Dam would have been approximately 3,300m³/s; and
- the modelled peak water level at The Gauge would have been 3.6m AHD, a reduction of nearly 2 metres when compared to the pre-dam scenario.

By comparison, operating with the storage at 75% of FSL:

- the peak outflow from the Dam is estimated to have been approximately 2,600m³/s; and
- the modelled peak water level at The Gauge would have been 3.5m AHD, a reduction of 2 metres when compared to the pre-dam scenario. Therefore, only 0.1m less than the dam operated at 100% FSL.

This relatively small improvement in the modelled peak water levels at The Gauge when the Dam is operated at 100% and 75% of FSL respectively during a 1974 type event is due to the contribution of downstream catchments to the total flood volume and the dam's ability to effectively capture and mitigate events of this size in the upstream catchment. In the January 1974 flood, nearly 72% of the flood runoff was generated from downstream catchments. Accordingly, Wivenhoe Dam can only manage 28% of the event runoff as this was all that fell on the upstream catchments.

Under the current operating rules, the bulk of the inflow volume in the 1974 flood would have been managed by Wivenhoe Dam and released at a controlled rate to avoid coincidence with downstream peaks. Even if the dam was operated at 75% of FSL, Wivenhoe Dam could still only manage 28% of the total flood volume so there is a very small improvement in flood mitigation at downstream locations.

Therefore for events similar in size and rainfall distribution to 1974, operating the dam from 75% FSL would make little difference to the overall flood levels in Brisbane. The same conclusion can be drawn for the flood peak at Ipswich as in 1974 the initial peak flood level was a result of runoff emanating from the Bremer River catchment.

Model Results for January 2011 Flood

In the January 2011 flood event scenario, the volume of runoff generated from downstream catchments was 35% of the total event volume, meaning proportionally more rain fell on the upstream catchment and therefore Wivenhoe Dam had more capacity for flood management during this event when compared with a 1974 type flood.

Operating with the storage at 100% of FSL:

- the peak outflow from the Dam was 7,500m³/s; and
- the modelled peak water level at The Gauge was 4.6m AHD (compared with the recorded peak of 4.46m AHD, an acceptable difference for such a model).

By comparison, operating with the storage at 75% of FSL:

- the peak outflow from the Dam is estimated to be 5,700m³/s, a reduction of about 24% from the actual outflow recorded during the January 2011 event; and
- the modelled peak water level at The Gauge is 4.42m AHD, a reduction of about 150mm from the peak when the Dam is maintained at 100% of FSL.

Under this operating scenario of 75% of FSL, the peak water levels will reduce at various locations along the river between Brisbane and Wivenhoe Dam. In addition to The Gauge, another key indicator location is the level at Moggill. Under this operating scenario, the level at Moggill would be reduced by up to a metre yet at Ipswich, the reduction in peak water level would be much less.

Summary

In summary, the flood mitigation impact for operating Wivenhoe Dam at 75% of FSL varies depending on the magnitude and characteristics of the flood. Floods can be described depending on their severity as frequent, large, rare or extreme.

For frequent events such as the October 2010 and December 2010 flood events which cause disruption to rural communities, operating Wivenhoe Dam at 75% of FSL will not result in any measurable change to the frequency and duration of flooding from that experienced under the current operating rules.

For large to rare events, such as the January 1974 and January 2011 flood events, operating at 75% of FSL will result in relatively small reductions in peak water levels at downstream locations when compared with the current operating rules. However, although relatively small, this may result in an appreciable reduction in the number of houses adversely impacted.

However, for rare to extreme events of a magnitude not yet recorded in Brisbane, operating at 75% of FSL will not have any significant impact on downstream flood levels.

Revised Interim Program under Moreton ROP

Seqwater presently operates the Wivenhoe and Somerset Dams in accordance with a revised Interim Program approved by the Chief Executive under the Moreton Resource Operations Plan in February 2011, which includes authorisation for releases to be made in accordance with the Manual.

If the Government directs the FSL in Wivenhoe Dam should be reduced for the 2011/2012 wet season, one of the means of implementing that decision would be through the inclusion of suitable authorisation in a revised interim program. In accordance with your request, Seqwater has prepared some draft provisions which could be included in a revised interim program to give effect to a Government decision to reduce the FSL at Wivenhoe Dam for the relevant period. The proposed draft provisions are attached.

It should also be noted that Seqwater has made enquiries of its insurers to ascertain the extent to which its commercial general liability coverage would respond to any claims made in relation downstream impacts potentially incurred during a period in which the FSL of the Dam is reduced from 100% to 75%. I will keep DERM informed of developments in this regard.

I trust this advice assists your consideration of the matters raised in your correspondence of 18 September 2011. Should you require any further clarification, please contact Mr Jim Pruss, Executive General Manager – Water Delivery on Tel [REDACTED]

Yours sincerely,

[REDACTED]

PB
Peter Borrows
Chief Executive Officer

Proposed draft provisions for a potential revised Interim Program to effect a reduction in FSL for the Wivenhoe Dam

The proposed text below would be inserted in the third column of the Interim Program, in the row relevant to 'Central Brisbane River and Stanley River Water Supply Schemes – Operating Levels for Infrastructure'. There would be other minor flow on amendments also, that we have not nominated for present purposes.

(B). Seqwater will, between 1 October 2011 and 31 March 2012 ("2012 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 2012 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. 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 [insert] m AHD.

Further consultation should be undertaken in relation to the consequent flow on amendments, should the Government determine to proceed with a revised Interim Program.

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 [REDACTED] to Minister Robertson, dated 4 February 2011.

Yours sincerely,

[REDACTED]
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, 2005¹). 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 m ³ /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 EL.74m, 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.

4 February 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,

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,



Chairman

MODELLING OF JANUARY 2011 FLOOD EVENT UNDER REVISION 8 OF THE WIVENHOE MANUAL

This assessment has been carried out using data from the January 2011 flood event, however for the reasons outlined in our correspondence of 22 September 2011, it must be appreciated that each flood event is unique and rainfall characteristics and associated flooding can vary dramatically. Although modelling of the impacts of a reduced FSL at Wivenhoe Dam using the January 2011 flood event provides useful information on the extent of any flood mitigation benefits, it is almost certain that the flows and levels of any actual future events will be different to the model estimates based on a single historical event.

The modelling conducted for present purposes utilised Seqwater's hydrodynamic model of the Brisbane River, combined with flow inputs from the Bremer River and Lockyer Creek determined by hydrologic models of the catchments downstream of Wivenhoe Dam, and estimates of peak water levels at numerous locations along the Brisbane River.

The following assumption and constraints apply to this modelling exercise:

1. The estimated inflows into Wivenhoe Dam and downstream catchments for the January 2011 flood event were adopted to assess the reduction in FSL.
2. The starting level of Wivenhoe Dam was 75% of FSL, which equates to a level of 64.0m AHD. This reduction in starting volume increases the storage available for flood mitigation purposes by around 300,000 ML.
3. Gate operations were applied in the gate operations model in a similar way to that adopted during actual flood events, using the strategies in the New Manual.

Two scenarios were modelled under these constraints as follow:

1. Option A – A conservative approach by flood operations engineers which attempts to retain flood water as long a possible to delay the onset of urban flood damage.
2. Option B – A more aggressive approach to dam operations by flood operations engineers, releasing and closing gates more reactively.

The option which produces the best result ultimately depends upon whether the flood event is large enough to trigger Strategy W4 under the New Manual. In the options considered, Strategy W4 would be initiated in both cases. However, both options have been investigated to indicate potential lower and upper limits for potential flood mitigation benefits.

The modelled results for each option, adopting the reduction to 75% of FSL, in conjunction with the operating rules under the New Manual, can assessed against the modelled results for the January 2011 flood event, as indicated in the following table.

Location	100% FSL		75% FSL & New Manual				75% FSL & New Manual			
	m3/s	m AHD	Option A		Option B		Option B		Option B	
			m3/s	Reduction	m AHD	Reduction	m3/s	Reduction	m AHD	Reduction
Moggill	10,100	17.59	9,400	7%	17.00	0.6	9,100	10%	16.70	0.9
Jindalee		13.06			12.52	0.5			12.27	0.8
Brisbane		4.60			4.40	0.2			4.25	0.4

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 [and North Pine Dam].

Draft

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
<p>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.</p>	<p>Refer ss151-160.</p>	<p>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</p>	<p>1 September 2010 - 1 March 2012.</p>
<p>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.</p>	<p>Refer ss161-167.</p>	<p>Seqwater applies the Queensland Government Water Monitoring Data Reporting Standards (Feb 2007) to its current reporting procedures.</p>	<p>Refer ss161-167.</p>
<p>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.</p>	<p>Not compliant with ROP (releases made for operational purposes and water quality and ecosystem health including fish management)</p>	<p>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 ("Wivenhoe Manual") 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, from [date following approval of RIP], make releases from infrastructure necessary to reduce the lake level in Wivenhoe Dam to 64.0 m AHD. Such releases will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable. If, after the releases have commenced, a flood event (within the meaning of the Wivenhoe Manual) is declared, Wivenhoe Dam will be operated in accordance with the Wivenhoe Manual. Once the flood event has ended, Seqwater shall (as part of the drain down following the flood event and in accordance with the Wivenhoe Manual) reduce the lake level to 64.0 m AHD.</p>	<p>Ongoing</p>
<p>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.</p>	<p>No operational outlet works at Mt Crosby Weir, therefore no managed releases made.</p>	<p>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).</p>	<p>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.</p>

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
<p>Central Brisbane River and Stanley River Water Supply Schemes – Announced Allocations 76 The resource operations licence holder must—</p> <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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)— <ul style="list-style-type: none"> (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. 	<p>Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazetta)</p>	<p>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).</p>	<p>1 July 2010.</p>
<p>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— $SPUVS = ((UVWivenhoe + UVSomerset) / CUFVS) * 100$ 77(3) The parameters used in the formula for combined percentage of volume in storage are defined in Attachment 5, Table 6.</p>	<p>Not compliant with ROP (no programs currently in existence – MP customers transferred to Seqwater on ROP gazetta)</p> <p>Please note: the volume stored in Split Yard Creek Dam may influence the Announced Allocation.</p>	<p>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).</p>	<p>1 July 2010.</p>
<p>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—</p> <ul style="list-style-type: none"> (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— $AAHPA = ((UV - (AAMP * MPA) + DIVHPA + DIVMP) / HPAA) * 100$ <p>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</p>	<p>Not compliant with ROP (no programs currently in existence)</p>	<p>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).</p>	<p>1 July 2010.</p>

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.			
<p>Central Brisbane River and Stanley River Water Supply Schemes – Critical Water Sharing Arrangements</p> <p>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.</p> <p>80(2) During times when critical water sharing arrangements are in force the resource operations licence holder must—</p> <p>(a) cease making releases from Mount Crosby Weir under section 75 of this plan;</p> <p>(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</p> <p>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.</p>	Not compliant with ROP (no programs currently in existence)	<p>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).</p> <p>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).</p>	1 July 2010.
<p>Central Brisbane River and Stanley River Water Supply Schemes – Seasonal water assignment rules</p> <p>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.</p> <p>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.</p>	Not compliant with ROP (no programs currently in existence, customers unmetered)	<p>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.</p>	Metering program to be undertaken in close consultation with Mid-Brisbane irrigators (likely to take until December 2012).
<p>Pine Valleys Water Supply Schemes – Operating Levels for Infrastructure</p> <p>97(1) The operating levels for the infrastructure in the Pine Valleys Water Supply Scheme are specified in Attachment 6, Table 1.</p> <p>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.</p> <p>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.</p>	Not compliant with ROP (releases made for operational purposes and for water quality and ecosystem health including fish management)	<p>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.</p> <p>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.</p> <p>A. s97(3): Seqwater will continue to make releases from infrastructure-</p> <ol style="list-style-type: none"> 1. for consumption; 2. pursuant to the Manual of Operational Procedures for Flood Mitigation at North Pine Dam ("NP Manual"); 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. <p>B. Seqwater will, between [date] 2011 and 31 March 2012 ("2012 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure –</p> <ol style="list-style-type: none"> (a) the volume necessary to initially reduce North Pine 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 2012 Summer Season that take the North Pine Dam level to between the Interim Supply Security Level and the Full Supply Level. <p>The releases specified in (a) and (b) will only be made at a peak rate not exceeding 300m³/s. If, after releases specified in (a) or (b) have commenced, a flood event (within the meaning of the NP Manual) is declared, the dam will be operated in accordance with the NP Manual. 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 [insert] m AHD.</p>	Part A: Ongoing Part B: [date] 2012 – 31 March 2012.
<p>Pine Valleys Water Supply Schemes – Announced Allocations</p> <p>100 The resource operations licence holder must—</p> <p>(a) calculate an announced allocation for each priority group for use in defining the share of water available to be taken under water</p>	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
<p>allocations in that priority group;</p> <p>(b) use the water sharing rules specified in this part to calculate announced allocations throughout the water year;</p> <p>(c) calculate and set the announced allocation for each priority group to take effect on the first day of each water year;</p> <p>(d) following the commencement of a water year—</p> <p>(i) recalculate the announced allocation to take effect no later than 5 business days following the first day of the month;</p> <p>(ii) reset the announced allocation if a recalculation indicates that the recalculated announced allocation would—</p> <p>(A) for high priority water allocations increase by 5 or more percentage points; or</p> <p>(B) increase to 100 per cent</p> <p>(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;</p> <p>(f) not reduce the announced allocation during a water year;</p> <p>(g) round the announced allocation to the nearest whole percentage point; and</p> <p>(h) not set an announced allocation that is greater than 100 per cent.</p> <p>101(1) The announced allocation for 'High Priority A' water allocations in the Pine Valleys Water Supply Scheme must be as follows—</p> <p>(a) 100 per cent when the level of water in storage in North Pine Dam is greater than E.L. 29.3m AHD; and</p> <p>(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—</p> $AAHPA = ((UV + DIVHPA) / HPAA) * 100$ <p>101(2) The parameters used in the formula for announced allocations are defined in Attachment 6, Table 2.</p> <p>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.</p>			
<p>Pine Valleys Water Supply Schemes – Critical Water Sharing Arrangements</p> <p>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.</p> <p>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.</p>	Not compliant with ROP (no programs currently in existence)	<p>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).</p> <p>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).</p>	1 July 2010.
<p>Pine Valleys Water Supply Schemes – Seasonal Water Assignment Rules</p> <p>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.</p> <p>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.</p>	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.
<p>Resource operations licence holder monitoring and reporting – Monitoring data must be made available</p> <p>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.</p>	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).

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
<p>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.</p>	<p>Not compliant with ROP (ALERT data available for Baxters Ck and Dayboro WWTP)</p>	<p>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.</p>	<p>1 July 2010 – July 2011.</p>
<p>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.</p>	<p>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</p>	<p>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.</p>	<p>1 July 2010 (note: overflows and not releases will be reported for Mt Crosby Weir).</p>
<p>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.</p>	<p>Not compliant with ROP (no programs currently in existence)</p>	<p>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).</p>	<p>1 July 2010.</p>
<p>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.</p>	<p>Only HP water take measured – no meters for measuring MP water take</p>	<p>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.</p>	<p>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).</p>
<p>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.</p>	<p>Not compliant with ROP (no programs currently in existence)</p>	<p>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).</p>	<p>1 July 2010 for all schemes except Central Brisbane River Water Supply Scheme (anticipated to take until December 2012).</p>
<p>Monitoring requirements – Critical water sharing arrangements 157 The resource operations licence holder must record details of critical</p>	<p>Not compliant with ROP (no programs currently in existence)</p>	<p>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).</p>	<p>1 July 2010.</p>

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
<p>water sharing arrangements including the following—</p> <p>(a) the commencement date(s) and effective period of critical water sharing arrangements; and</p> <p>(b) the effectiveness of the critical water sharing arrangements.</p>			
<p>Monitoring requirements – Water Quality</p> <p>158 the resource operations licence holder must monitor and record water quality data in relation to relevant infrastructure listed in Attachments 5, 6 and 7.</p>	<p>Somerset Dam</p> <p>Inflow: None. Quality monitoring and recording is event-related only. Water quality meters are DERM infrastructure.</p> <p>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.</p> <p>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.</p> <p>Wivenhoe Dam</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>North Pine Dam</p> <p>Inflow: None. Quality monitoring and recording is event-related only.</p>	<p>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 2010.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>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.</p>	<p>1 January 2011.</p>

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
	<p>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.</p> <p>Tailwater: None.</p> <p><u>Mt Crosby Weir (also TS sampling)</u> Inflow: Kholo: Fortnightly – total phytoplankton, depth probe pH, Cond., Turb., Temp., Chl, BGA, DO.</p> <p>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.</p> <p>Tailwater: None, estuarine</p>		
<p>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.</p>	<p>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.</p>	<p>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).</p>	<p>1 July 2010 – December 2011.</p>
<p>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.</p>	<p>Not compliant with ROP. No reporting.</p>	<p>Refer ss162-167</p>	<p>Refer ss162-167.</p>
<p>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</p>	<p>Not compliant with ROP. No reporting.</p>	<p>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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>	<p>1 July 2010 – December 2011.</p>

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
(e) the details and status of any programs implemented under section 13 of this plan.			
<p>Reporting requirements – Annual Report</p> <p>163(1) The resource operations licence holder must submit an annual report to the chief executive after the end of the water year.</p> <p>163(2) The annual report must include—</p> <ul style="list-style-type: none"> (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. 	<p>Not compliant with ROP.</p> <p>No reporting.</p>	<p>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.</p>	<p>1 July 2010 – December 2012</p>
<p>Reporting requirements – Water quantity monitoring – Annual Report</p> <p>164 The resource operations licence holder must include in the annual report under section 163—</p> <ul style="list-style-type: none"> (a) A summary of announced allocation determinations, including— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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. 	<p>Not compliant with ROP.</p> <p>No reporting.</p>	<p>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.</p> <p>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).</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>ss164(f-g): Seqwater will be compliant with these requirements from 1 July 2010.</p>	<p>ss164(a-b, f-g): 1 July 2010.</p> <p>s164(c): 1 July 2010 (note: overflows rather than releases will be reported for Mt Crosby Weir). Please refer to s153 for further details.</p> <p>s164(d-e): 1 July 2010 – December 2012. Please refer to ss88, 155 and 156 for further details.</p>
<p>Reporting requirements – Impact of infrastructure operation on natural ecosystems – Annual report</p> <p>165 The resource operations licence holder must include in the annual report under section 163—</p> <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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 	<p>Not compliant with ROP.</p> <p>No reporting.</p>	<p>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.</p>	<p>1 July 2010 – December 2011.</p>

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
<ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (i) thermal and chemical stratification in each water storage associated with infrastructure; (ii) contribution of the water storage and its management to 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. 			
<p>Reporting requirements – Operational Report</p> <p>166 The resource operations licence holder must—</p> <ul style="list-style-type: none"> (a) notify the chief executive within one business day of becoming aware of any of the following operational incidents— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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— <ul style="list-style-type: none"> (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). 	<p>Not compliant with ROP.</p> <p>No reporting.</p>	<p>ss166(a)(i), (b): Seqwater will submit operational reports as required, commencing for the 2010/2011 water year.</p> <p>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.</p> <p>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).</p> <p>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).</p> <p>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).</p> <p>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).</p>	<p>1 July 2010 – December 2011.</p>
<p>Reporting requirements – Emergency report</p> <p>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—</p> <ul style="list-style-type: none"> (a) notify the chief executive upon discovery of the emergency; and (b) provide to the chief executive a report that includes— <ul style="list-style-type: none"> (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. 	<p>Not compliant with ROP.</p> <p>No reporting.</p>	<p>Seqwater will submit emergency reports as required, commencing for the 2010/2011 water year.</p>	<p>1 July 2010.</p>

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, High Class A Priority, "This authorisation was authorised to continue under section 360ZDP of the <i>Water Act 2000</i> .	The map in Attachment 2(b) of the ROP 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.	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 <i>Water Act 2000</i> .	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).

<input checked="" type="checkbox"/> Approved <input type="checkbox"/> Not Approved <input type="checkbox"/> Noted
Dated 17 / 2 / 11

Department of Environment and Resource Management
 DIRECTOR-GENERAL BRIEFING NOTE

TO: Director-General

SUBJECT: Seqwater Revised Interim Program (Sect 13 - Moreton ROP): Arrangements for Releasing Water from Wivenhoe Dam

TIMEFRAME

- This brief was requested by the Director General for urgent approval.

RECOMMENDATION

It is recommended that the Director-General:

- Note** that Seqwater has submitted, under section 13(6a) of the Moreton Resource Operations Plan 2009 (Moreton ROP), a revised Interim Program for Central Brisbane River and Stanley River Water Supply Schemes (Attachment 1)
- Consider** the implications associated with the proposed interim operating arrangements for releasing water from Wivenhoe Dam that are detailed in the revised Interim Program; and if the Director-General agrees -
- Approve** the revised Interim Program without conditions; and
- Sign** the attached letter to Seqwater advising of the approval of the revised Interim Program.

BACKGROUND

- Seqwater is the holder of the Resource Operation Licences (ROLs) for the Central Brisbane River and Stanley River Water Supply Schemes (covering Wivenhoe and Somerset dams).
- On 10 February 2011, Seqwater wrote to the Director-General advising that Seqwater recommended that the Wivenhoe Dam's storage level be temporarily reduced to 75 percent of its Full Supply Level (FSL) in order to temporarily increase its flood mitigation capacity. (Attachment 2). Seqwater premised this recommendation on the following factors:
 - Advice from SEQ Water Grid Manager's to Seqwater (see letter from SEQ Water Grid Manager to Seqwater dated 9 February 2011 – Attachment 3) that it had no objection from a water security perspective to Wivenhoe Dam being drawn down to 75 percent of its FSL and that such a draw down, if temporary, would be unlikely to impact its obligations;
 - Modelling by Seqwater of various potential flood events which confirmed that a reduction in Wivenhoe Dam's storage level to 75 percent of its FSL will provide appreciable flood mitigation measures;
 - The extreme nature of the January 2011 event.
- The severe flooding experienced in the Brisbane River system in January 2011 and the ongoing *La Nina* weather patterns have resulted in Seqwater, the holder of the ROLs, to submit a revised Interim Program for the operation of Wivenhoe Dam.
- The Moreton ROP was amended on 14 February 2011 to allow the holder of a ROL with an Interim Program, approved under section 13 of the Moreton ROP, to submit a revised Interim Program for the chief executive's consideration and approval.
- Consultation:* Extensive consultation has taken place between Seqwater, the SEQ Water Grid Manager and the Department, on behalf the Queensland Government, in determining a strategy for implementing interim arrangements for reducing the risk to Brisbane residents of

Author Name: [Redacted] Position: A/General Manager (Water Allocation and Planning) Tel No: [Redacted] Date: 17/11/2011	Cleared by [Redacted] Name: [Redacted] Position: Executive Director (Strategic Water Initiatives) Tel No: [Redacted]	Cleared by Name: Position: Tel No:	Recommended: Name: Position: Tel No: Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

- further flooding that could result under the current La Nina weather pattern.
- Crown Law and Legal Services have also been consulted throughout the process.
- Advice was provided on the proposed release regime and its acceptability from a flood management perspective by Mr Bob Reilly and Mr Peter Allen from the Office of the Water Supply Regulator. Their advice is that Burton's Bridge remains trafficable up to a flow at the bridge of 430 m³/sec. As they understand it, it is the only crossing without an alternative crossing of the Brisbane River. To that extent, there will be alternative routes available for the other crossings that will be inundated at such a release rate.
- *Legislation:* The chief executive has the power under section 13(7) of the Moreton ROP to consider any program submitted by the holder of a resource operations licence (including a revised Interim Program), and may either-
 - Approve the program with or without conditions;
 - Amend and approve the amended program; or
 - Require the resource operations licence holder to submit a revised program.

CURRENT ISSUES

- Seqwater submitted a revised Interim Program for the operation of Wivenhoe Dam on 17 February 2011. Under the program, water that would ordinarily be stored in the dam for future water supplies would be released under the arrangements detailed in Attachment 1. The proposal would effectively reduce the water level in Wivenhoe Dam from 100 percent to 75 percent of the full supply volume.
- Seqwater in support of the application for approval by the Chief Executive of the Interim Program have submitted a covering letter explaining why the Interim Program has been submitted (Attachment 1).
- The proposal will have no immediate impact on water availability for irrigators supplied from Wivenhoe Dam. These irrigators are entitled to take 100 percent of their allocation while ever the combined storage volume of Wivenhoe and Somerset Dams exceeds 50 percent at the start of the water year. Even with the reduced water level in Wivenhoe Dam and if future inflows are below average, irrigators could expect to be able to utilise 100 percent of their allocation for a period of time.
- The Moreton ROP does not regulate the manner in which Wivenhoe Dam is operated to mitigate flooding. The strategy and requirements for operating the dam, including flood mitigation and water releases, are outlined in the Dam Operations Manual. The Manual is approved by the State's Dam Safety Regulator, in accordance with the *Water Supply Act 2008*.
- The water releases proposed under the revised Interim Program would otherwise be contrary to section 72 of the Moreton ROP, which prohibits water from being released unless it is required to supply water under water allocations associated with the schemes or for environmental flow needs. The proposed revised Interim program would override this provision in the Moreton ROP until 1 April 2011.
- Provisions of the Moreton ROP relating to the management of operational releases, monitoring and reporting will apply to the releases that are being authorised under the revised Interim Program.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- There are no implications for the Department in implementing the Moreton ROP associated with the approval of the proposed revised Interim Program for the Central Brisbane River and Stanley River Water Supply Schemes.

PROPOSED ACTION

Author Name: [REDACTED] Position: A/General Manager (Water Allocation and Planning) Tel No: [REDACTED] Date: 17/11/2011	Cleared by Name: [REDACTED] Position: Executive Director (Strategic Water Initiatives) Tel No: [REDACTED] Name: Position: Tel No:	Cleared by Name: Position: Tel No: Name: Position: Tel No:	Recommended: Name: Position: Tel No: Date:
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- If the Director-General approves the revised Interim Program, the Department will ensure that Seqwater complies with the requirements of section 13(9) of the Moreton ROP, which require the holder to:
 - Implement and operate in accordance with the approved program; and
 - Make public details of the approved program on their internet site.

DIRECTOR-GENERAL'S COMMENTS

ATTACHMENTS

- Attachment 1: Covering letter from Seqwater with a revised Interim Program for Central Brisbane River and Stanley River Water Supply Schemes;
- Attachment 2: Seqwater letter to Director-General of 10 February 2011;
- Attachment 3: Letter from SEQ Water Grid Manager to Seqwater dated 9 February 2011

Author Name: [REDACTED] Position: A/General Manager (Water Allocation and Planning) Tel No: [REDACTED] Date: 17/11/2011	Cleared by Name: [REDACTED] Position: Executive Director (Strategic Water Initiatives) Tel: [REDACTED]	Cleared by Name: Position: Tel No:	Recommended: Name: Position: Tel No: Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

CTS No [CTS No]

Department of Environment and Resource Management
DIRECTOR-GENERAL BRIEFING NOTE

<input checked="" type="radio"/> Approved <input type="radio"/> Not Approved <input type="radio"/> Noted Further information required
DG. [REDACTED]
Dated 17/2/11

LEGAL ADVICE – This document is subject to legal professional privilege and must not be copied, distributed or discussed within or outside the department without reference to the Director, Legal Services.

TO: Director-General

SUBJECT: Queensland Bulk Water Supply Authority trading as Seqwater – Revised Interim Plan under the Moreton Resource Operations Plan 2009 – Deeds of Indemnity

TIMEFRAME

• [REDACTED]

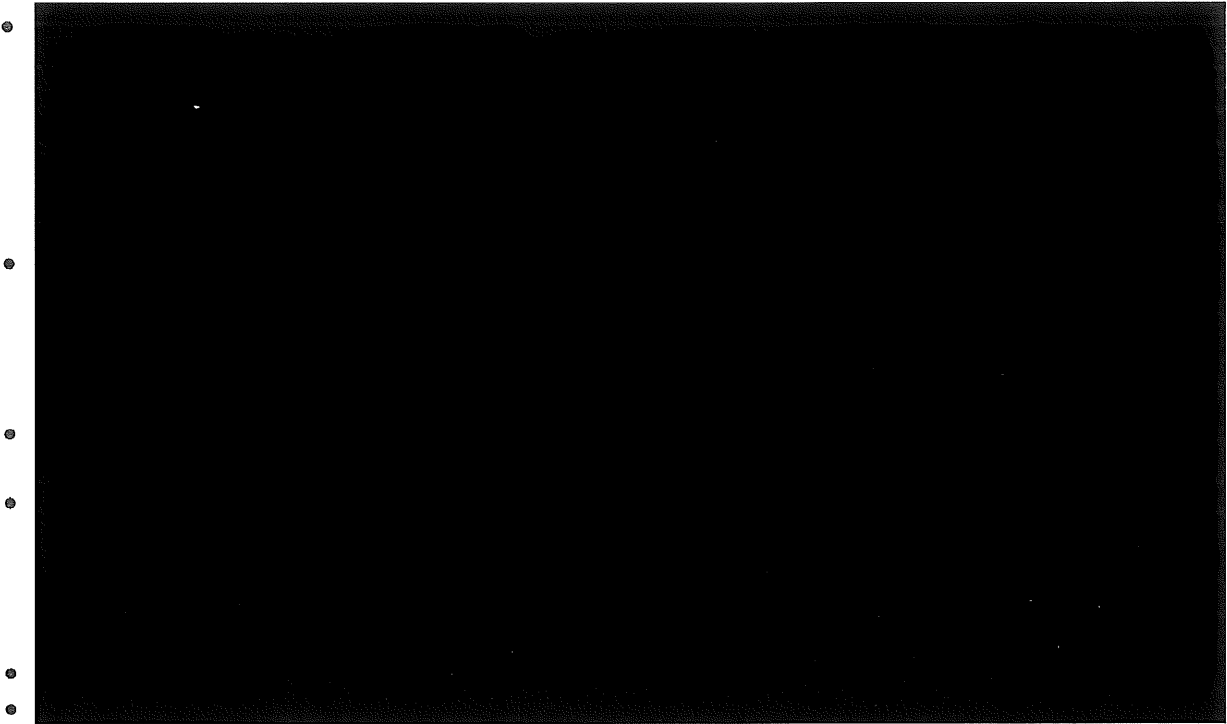
RECOMMENDATION

• [REDACTED]

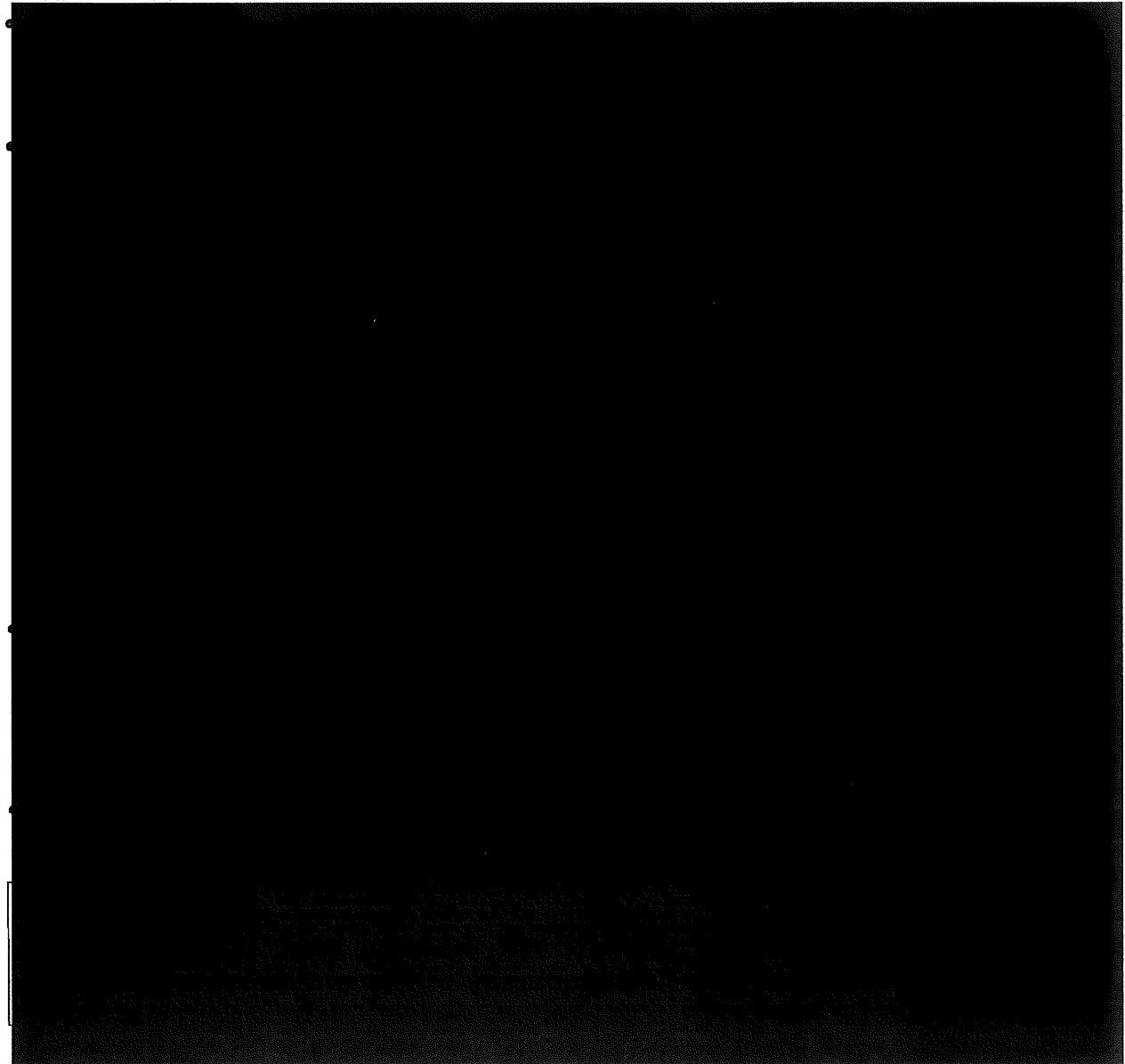
BACKGROUND

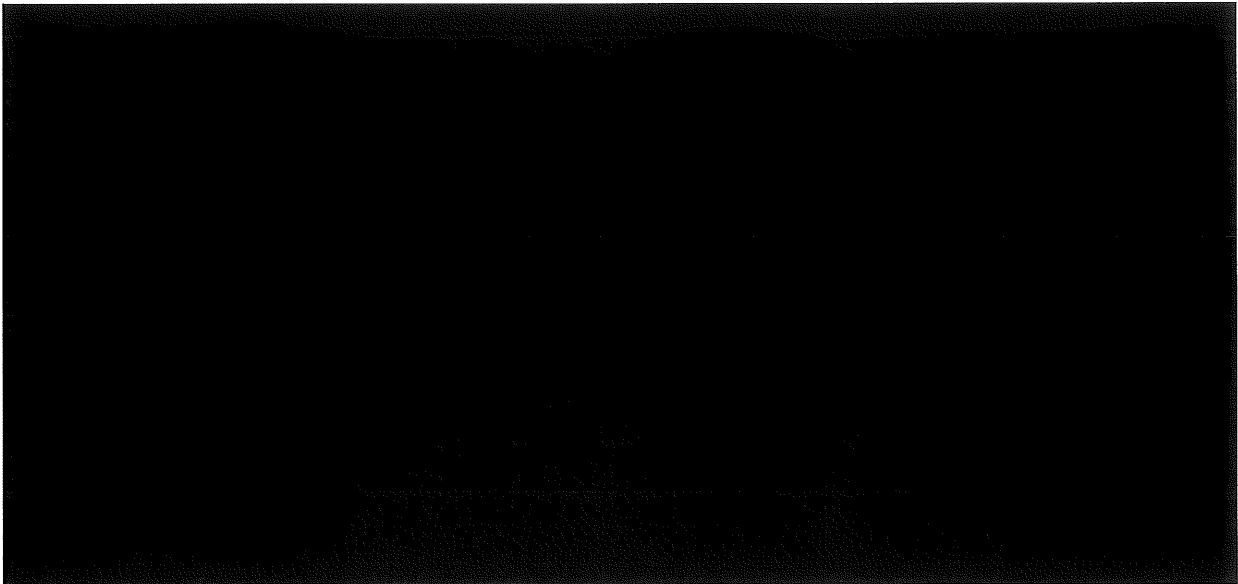
• [REDACTED]

Author Name: [REDACTED] Position: Principal Lawyer, Legal Services, Corporate Services Tel No: 322 42452 [REDACTED] Date: 17/02/2011 [REDACTED]	Noted by Name: [REDACTED] Position: Director, Legal Services, Legal Services Tel No: 323 [REDACTED] Date: 17/2/2011	Endorsed: Name: [REDACTED] Position: Executive Director, Strategic Water Initiatives, Water and Ecosystem Outcomes Tel No: 333 [REDACTED] Date: 17/02/2011 [REDACTED]
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CURRENT ISSUES





RESOURCE/IMPLEMENTATION IMPLICATIONS



PROPOSED ACTION

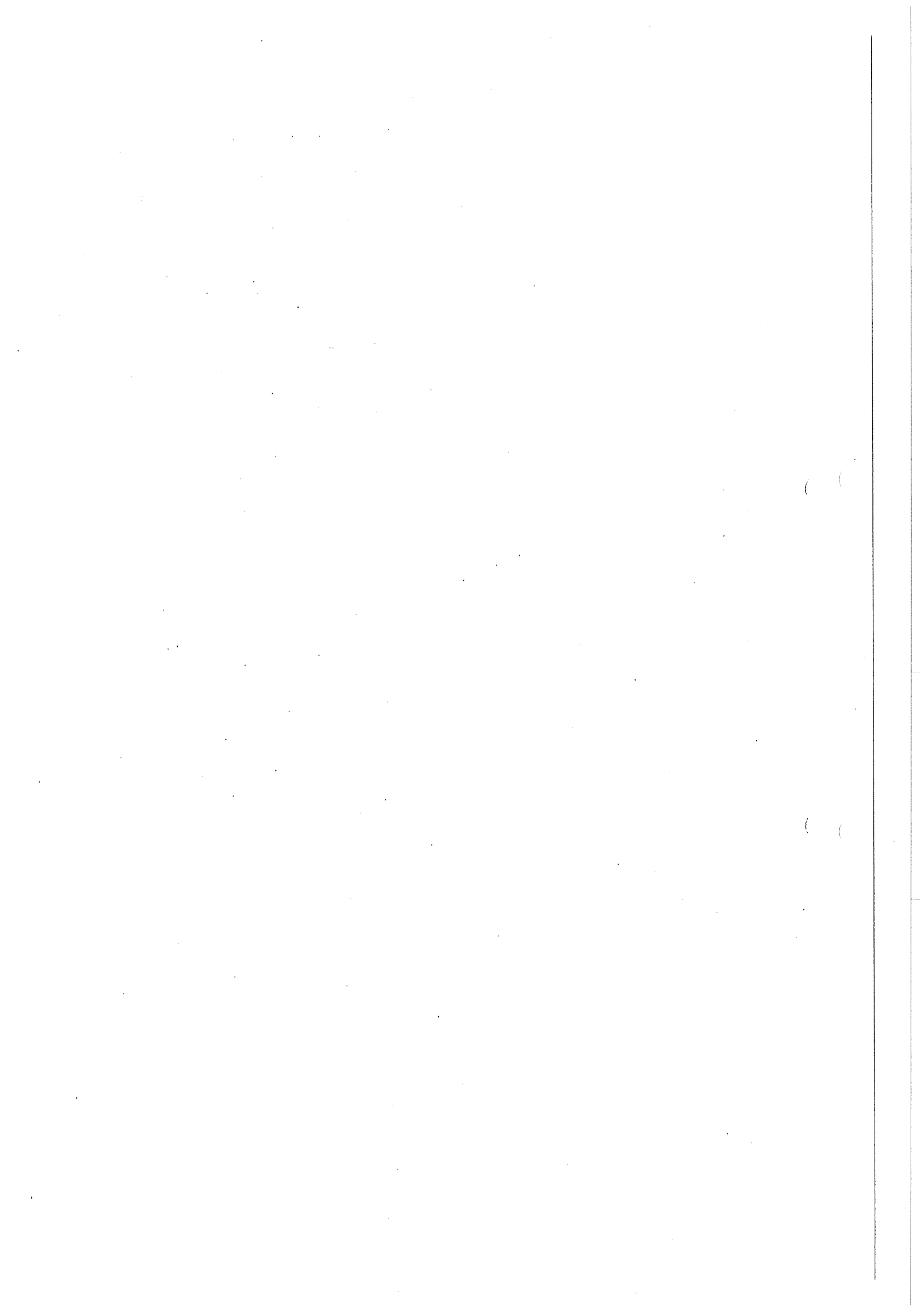


DIRECTOR-GENERAL'S COMMENTS

ATTACHMENTS



Author Name: [REDACTED] Position: Principal Lawyer, Legal Services, Corporate Services Tel No: 322 [REDACTED] Date: 17/02/2011	Noted by Name: [REDACTED] Position: Director, Legal Services, Corporate Services Tel No: 323 [REDACTED]	Endorsed: Name: [REDACTED] Position: Executive Director, Strategic Water Initiatives, Water and Ecosystem Outcomes Tel No: 333 [REDACTED] Date: 17/02/2011
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10 November 2011

██████████
Director-General
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001

Dear Mr ██████████

PROPOSED TEMPORARY FULL SUPPLY LEVEL FOR WIVENHOE DAM AND NORTH PINE DAM

I refer to our letters of 4 November 2011 regarding the above.

Update on Insurance Issues

Since our letters we have been working with our insurers and Department officers on a range of solutions to the issues raised in our letter.

We confirm that if the Manuals for both dams are amended to include provision for any drain down to occur within the Manuals (as is appropriate given the potential volumes of water which may need to be drained for flood mitigation), our insurers will provide coverage to Seqwater. In those circumstances, we will not require further discussions with the State in relation to a possible indemnity for Seqwater.

We have been discussing the appropriate changes to the Manuals with your officers and expect to submit the amended Wivenhoe Manual for approval today. We expect the amended North Pine Manual will be submitted in the next few days following further discussions between our officers.

Further Advice on North Pine Dam

Following our letter of 4 November 2011 and subsequent discussions with your officers, we have undertaken some further modelling to illustrate the benefit associated with amending the Manual to incorporate new flood release tables for lower operating levels, compared to the situation under the present Manual which would mean flood releases would only commence when the lake rises to 100%.

The table below reports the results of our modelling. In summary, lowering the lake level to 90% and operating from that level (assuming the Manual was amended to permit this) gives a better result, both from a reduced outflow and dam safety perspective, than reducing the lake level to 75% and allowing the lake to rise to 100% before commencing flood releases. Of course, the comments we make in our earlier letter regarding the unknown downstream consequences associated with this reduction in outflow remain.

Operating Level	Start Level	Jan 2011 Peak Inflow m ³ /s	Peak Water Level m AHD	Peak Outflow m ³ /s
Actual (Rev 5 Manual)		3,484	41.1	2,854
Modelled 100% (Rev 6 Manual)	100%	3,484	40.6	3,135
Modelled 75% (Rev 6 Manual)	100%	3,484	40.6	3,142
Modelled 90% (Manual to be amended to incorporate new table)	90%	3,484	40.4	2,897

We have provided the new 90% tables to the Dam Safety Regulator for his consideration (we have previously provided him with the 75% and 50% tables).

Should you require any further clarification, please contact Mr Jim Pruss, Executive General Manager – Water Delivery, on Tel. [REDACTED]

Yours sincerely,

[REDACTED]
Peter Borrows
Chief Executive Officer

Copies to: *Minister Rachel Nolan MP*
Mr [REDACTED] Assistant Under Treasurer, Queensland Treasury

**ADDITION TO THE MANUAL OF OPERATIONAL PROCEDURES FOR FLOOD
MITIGATION AT WIVENHOE DAM AND SOMERSET DAM
NOVEMBER 2011 (REVISION 9)
EXPLANATORY NOTES**

INTRODUCTION

Revision 8 of the Manual allowed the maximum urban protection flood mitigation benefit to be obtained from temporary reductions in the Full Supply Level ("FSL") of Wivenhoe Dam and Somerset Dam. Since Revision 8 of the Manual was approved, legislative changes have been made to the Water Act 2000. Broadly, these amendments enable the Minister, in certain circumstances, to make declarations of temporary FSLs to mitigate the impacts of a potential flood.

The Queensland Government has been carefully considering the costs and benefits of temporary reductions in the FSL of Wivenhoe Dam in the 2011-2012 wet season. Such reductions may also possibly occur on a regular basis in the future, depending on the seasonal weather outlooks provided to the Queensland Government by the Bureau of Meteorology (BoM).

To enable releases of water to be made from the Dams to facilitate these temporary reductions in the FSL, it was considered sensible to add suitable provisions to the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam (the Manual). Accordingly a new Chapter 8 was drafted as an addition to the Manual and this document explains the detail of this new Chapter.

SENIOR FLOOD OPERATIONS ENGINEER SHALL DETERMINE THE RELEASE STRATEGY AND DIRECT THE OPERATION

Prior to releases from a Dam commencing for the purposes of achieving a temporary full supply level, a Senior Flood Operations Engineer shall develop a formal release strategy following consultation with the relevant local authorities and the Department of Transport and Main Roads. The release strategy will contain details of dam release rates and times, estimated river flows and expected bridge closure times. The release strategy will be discussed with DERM via the Dam Safety Regulator prior to implementation and then the final release strategy will be circulated to relevant Agencies prior to implementation. This will allow bridge closures to be arranged in an orderly manner. Bridge closures will also be confirmed by Seqwater with the relevant Agency.

Once releases commence, the Senior Flood Operations Engineer will monitor the release and Dam site staff will monitor the physical operation of the Dam and the flow of water in the Brisbane River. Advice on the releases will also be provided to the community through the Seqwater website and community phone line and also to irrigators downstream of Wivenhoe Dam via the Seqwater communications team.

All impacted Agencies including DERM will be notified when bridges are no longer impacted, at the conclusion of the release or if any modifications to the release strategy are required.

FLOOD EVENT RISKS

A Senior Flood Operations Engineer will monitor catchment rainfall on a 24/7 basis for the duration of the release and will declare a Flood Event if the need arises. The transition arrangements for such a declaration are outlined in Chapter 8 of the Manual (version 9).

The transition arrangements require the Senior Flood Operations Engineer to develop a specific program for giving consideration to maintaining bridges downstream of Wivenhoe Dam trafficable. This defines the transition from considerations of minimising disruption to rural life in the valleys of the Brisbane and Stanley Rivers to considerations of protecting urban areas. Because the program must be developed under the discretionary provisions of the Manual, the program will be discussed with DERM prior to implementation. As the range of circumstances associated with such a transition is indefinitely large, each transition program will be unique and a function of the prevailing circumstances. The factors that will be considered by the Senior Flood Operations Engineer in the development of the program will include:

- The difference in level between the previous FSL and the new temporary FSL.
- The current Actual Lake Levels of the Dams.
- The current actual release rates from the Dams.
- The actual and predicted inflows into the Dams and whether the Dam release rates should exceed these inflow rates.
- The 24 hours, three day, five day and ten day rainfall forecasts issued by the BoM.
- The impacts on downstream communities.
- The impacts on riparian flora and fauna.

A starting point for the development of a suitable program may be to assume that the current Actual Lake Levels of the Dams are the FSLs for the purposes of transitional strategy application. The target Lake Level at the end of the Flood Event would be the new temporary FSL. An iterative process can then be used to develop the most suitable program.

OPERATIONAL RISKS

Dam Operators will regularly monitor the physical operation of the Dam during the release. Due to the relatively low level release and the absence of inflows into the Dam, no significant operational risks have been identified that are not managed by Seqwater's Standing Operating Procedures and Emergency Action Plans for the Dams, and Seqwater's communications procedures and protocols.

Legal Advice

Your ref: W&S FMM Rev 9 Legal Review

Our ref: LEG/ [REDACTED]

Author: [REDACTED]

Phone: 3330 [REDACTED]

Fax: [REDACTED]

LEGAL ADVICE – This document or any attached advices is subject to legal professional privilege and must not be copied, distributed or paraphrased within or outside the department without the express written consent of the Director, Legal Services.

Date: 11 November 2011

To: [REDACTED] Director-General

Through: [REDACTED] Director, Legal Services

[REDACTED], A/Director, Legislative Development Services (Floods Commission of Inquiry Liaison)

[REDACTED] Principal Policy Officer, Inquiry Recommendations Implementation Group (Floods Commission of Inquiry Liaison)

Peter Allen, Project Director, Dam Safety, Office of the Water Supply Regulator

[REDACTED], A/General Manger, Office of the Water Supply Regulator

[REDACTED] A/Deputy Director-General, Water and Ecosystem Outcomes

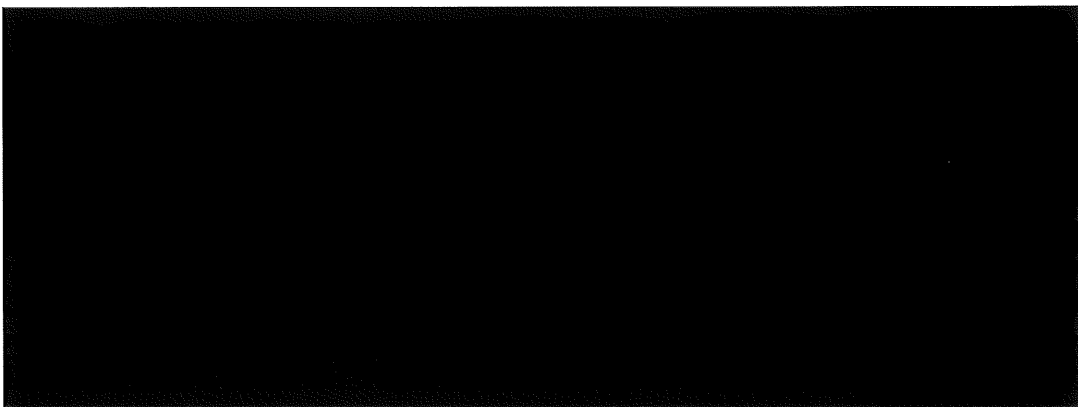
From: [REDACTED] Principal Lawyer, Directorate Legal Services (Floods Commission of Inquiry Liaison)

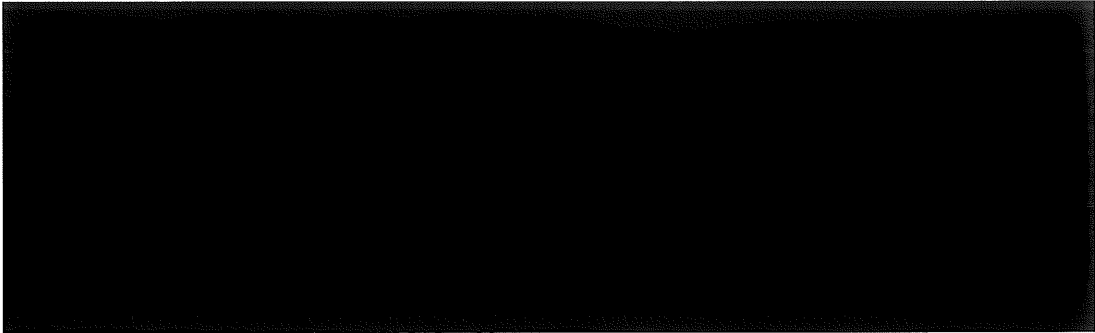
Subject: **Review of Final Submitted Flood Mitigation Manual (“FFM”) for Wivenhoe and Somerset Dams, version 9**

1. Background



2. Process





3. Advice - Wivenhoe/Somerset FMM



Please contact if me if you have any questions or if I may be of further assistance.



Principal Lawyer & Team Co-Leader - Floods Liaison Inquiry Response
Floods Commission of Inquiry Liaison
Legal Services / Governance & Strategy
Corporate Services
Department of Environment and Resource Management

DS 5.3 Processing a flood mitigation manual for a dam following review

WIR/2011/4884 – Version 1

Endorsed 16/09/2011
by Robert Reilly, General Manager, Office of the Water Supply Regulator

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Version History

Version	Date	Comment
1	16/09/2011	Original approval

Purpose

To provide a framework for processing a reviewed flood mitigation manual for a dam submitted by the dam owner under section 373, Part 2, Chapter 4 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Rationale

All dams provide some flood mitigation benefits. However, certain dams are explicitly required to be managed so as to optimise these benefits. These dams are able to provide flood mitigation benefit through the temporary storage and later release of flood flows. As the release of such floodwaters can cause damage to property and/or the environment or potentially put lives at risk, it is essential that the dam be operated in accordance with clearly defined procedures to minimise hazard and damage to life and property while protecting the safety of the dam. A flood mitigation manual ensures that such dams make controlled releases of water for flood mitigation purposes in accordance with pre-agreed conditions. The regulatory framework within which these dams are managed for flood mitigation purposes is contained in sections 370 to 374 of the *Water Supply (Safety and Reliability) Act 2008* (the Act).

Regulatory context

Section 373 of the Act requires the owner of a dam to review the flood mitigation manual for a dam before the approval for the manual expires. The dam owner must provide the chief executive with a copy of the reviewed flood mitigation manual, for approval under s. 371 of the Act.

The chief executive may also get advice from an advisory council before approving the manual.

Application

This work practice applies to a dam owner who has an existing flood mitigation manual which has been reviewed and/or updated and submitted to the chief executive for approval. The process for approval of the first flood mitigation manual for a dam is a separate work practice. Please refer to the work practice DS 5.1 Flood Mitigation Manual for a Dam.

The dam owner, can at any time, submit an amended or reviewed flood mitigation manual for approval. For continuity the reviewed and/or updated manual must be approved before the expiry of the previous manual.

Procedure

This work practice is set out below.

A flow chart for this work practice can be found in Attachment A <attachments/a-ds5-3-fmm-flowchart.pdf> .

Step 1 - Receiving a reviewed flood mitigation manual

Upon receiving the reviewed flood mitigation manual being submitted for approval, the project officer:

- Stamps the covering letter (or a copy of the front page and contents page of the manual if there was no covering letter) with the Document Received by DERM stamp
- Scans the document (or copy created above) and records details in Keeper on the file for the dam and fills in the relevant sections of the document received stamp in accordance with local office processes and departmental standards
- Updates WICD–RDR
- Prepares an acknowledgement letter to the dam owner that the reviewed flood mitigation manual has been received and is being assessed. Refer to Attachment B <attachments/b-ds5-3-fmm-ack-let.pdf> for a template for an acknowledgement letter (A template for this letter is available in G:\WIR\Dam_Safety\Templates).
- Gives all documents and the file (if required) to the decision maker.

The Director, Dam Safety (Water Supply):

- Checks and signs the letter confirming receipt of the manual. If changes are necessary to the draft letter confirming receipt of the reviewed manual, the Director, Dam Safety (Water Supply) should make the changes and return the letter to the project officer for updating prior to signing.
- Allocates an assessment officer to assess the amended manual.
- Gives the signed letter, the manual and the file to the project officer.

The project officer:

- Copies and sends the signed letter.
- Scans the signed letter and registers the letter in Keeper in accordance with local office processes and relevant departmental standards.
- Places the copy of the signed letter on the file relating to the flood mitigation manual for the dam.
- Updates WICD–RDR with appropriate information.
- Gives the manual and file to the assessment officer.

Proceed to Step 2

Step 2 - Assessment officer conducts an assessment of the reviewed flood mitigation manual

The assessment officer:

- Conducts a detailed assessment of the reviewed flood mitigation manual. Assessment officers are expected to conduct the detailed assessment having regard to the matters outlined in the guidelines and work procedures issued under the Act's provisions and other Queensland Government policy statements as advised by the chief executive of DERM (see references section of this work practice). The assessment must also include the Reviewed Flood Mitigation Manual (FMM) Assessment and Decision Form and the notes in that form (see Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf> . A template for this form is available in G:\WIR\Dam_Safety\Templates).

- Requests, if appropriate, legal review of the reviewed FMM from the Legal Services section of the department (in accordance with departmental processes).
- Completes the Reviewed FMM Assessment and Decision Form as the assessment occurs.

The purpose of the flood mitigation manual checklist (checklist) which forms part of the Reviewed FMM Assessment and Decision Form is to assist the assessment officer to determine whether the flood mitigation manual complies with the Act and the guidelines and to enable the assessment officer to make a recommendation on whether the reviewed flood mitigation manual should be approved. However, assessment officers should note that the checklist is not intended to be relied upon by assessment officers as an exact statement of the Act and the guidelines and it is essential that assessment officers regularly refer to the full text of those documents to determine the precise details of these requirements.

Discussions with dam owners and other stakeholders may be undertaken to refine the content of the manual and to ensure that the reviewed flood mitigation manual is adequate for its required purpose. See Step 3.

In completing the Reviewed FMM Assessment and Decision Form the assessment officer:

- Records on the Reviewed FMM Assessment and Decision Form whether the manual complies with the Act and the guidelines.
- Includes appropriate comments in the Reviewed FMM Assessment and Decision Form about individual items (in the comments column for the appropriate item/s). Note: if the assessment officer believes additional information or clarification of information is required proceed to Step 3 prior to completing this step.
- Completes the 'assessment officer's recommendation to decision maker' part of the Reviewed FMM Assessment and Decision Form, including all items that are relevant to the recommendation/s made.
- Gives the Reviewed FMM Assessment and Decision Form, the manual and the file to the decision maker.

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept and retained in Keeper and on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

Proceed to Step 4.

Step 3 - Request further information

In some situations the assessment officer may need to communicate with the owner of the dam, or other people, to clarify certain issues for the assessment of the reviewed flood mitigation manual (this may include editorial amendments and minor corrections to the FMM). **Accurate and written records of any communications, including verbal communications, must be kept and retained in Keeper and on the relevant departmental file.** These records should indicate who was contacted or consulted about particular issues, when this occurred and the advice that was given. It may also be appropriate for the assessment officer to make some reference to these communications in the Reviewed FMM Assessment and Decision Form itself (for example, in the comments column for the appropriate item/s in the checklist).

Assessment officers should be aware that the information and documents referred to in the Reviewed FMM Assessment and Decision Form and kept on departmental file/s may later need to be made available to the decision maker, or other people, for independent consideration or inspection.

A suggested format for a letter requiring further information can be found at Attachment D <attachments/d-ds5-3-fmm-req-info.pdf> . A template for this letter is available in G:\WIR\Dam_Safety\Templates.

The letter requiring further information must:

- Be prepared on the basis of the information contained in the Reviewed FMM Assessment and Decision Form (see Step 2) and
- Be sent to the owner of the dam.

Return to Step 2 when requested information is received.

Step 4 - Decision maker makes decision about reviewed flood mitigation manual

The decision maker:

- Considers the reviewed flood mitigation manual and the recommendation made by the assessment officer.
- Decides what action should be taken in relation to the reviewed manual. The decision maker is expected to assess the appropriate action to take having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form and the notes to that form (Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf>).
- Completes the 'decision maker's decision' part of the Reviewed FMM Assessment and Decision Form.
- Gives the completed Reviewed FMM Assessment and Decision Form, the manual and the file to the assessment officer.

Depending on the situation, available options for the decision maker may be to:

- Seek further advice (this could be legal advice or advice from an advisory council)
- Not approve the manual because it does not meet the expected requirements for approval. *Go to Step 5.*
- Approve the manual – *Go to Step 6.*
- Require more information from the dam owner – *Go to Step 3.*
- Require a more detailed assessment of the FMM by the assessment officer – *Go to Step 2.*

If the decision maker decides more information is required from the dam owner, they should indicate this on the Reviewed FMM Assessment and Decision Form and return all documentation to the assessment officer who will return to Step 3.

Step 5 - Assessment officer prepares non-approval letter for the reviewed flood mitigation manual

Assessment officer receives the decision to not approve the reviewed manual from the decision maker and prepares a draft letter (including yellow file copy) advising that the reviewed flood mitigation manual doesn't meet the requirements of the Act and relevant guidelines. See Attachment E <attachments/e-ds5-3-fmm-non-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter to the decision maker who either signs the letter or requests changes to be made.

Once the decision maker has signed the letter the assessment officer sends the letter to the dam owner.

If a new flood mitigation manual is received from the dam owner in response to the letter return to Step 1.

Go to Step 7.

Step 6 - Assessment officer prepares gazette notice

Assessment officer receives the decision to approve the reviewed manual from the decision maker and prepares a draft gazette notice and completes a request to publish in the Queensland government gazette form.

- The gazette notice should state the following:
- The notice number and year
- The date and approval details for the reviewed manual
- The dates for which the reviewed manual is approved. This may be for the remainder of the approval period for the existing approved manual or for not more than five years from the date of approval of the reviewed manual.

Note: see Attachment F <attachments/f-ds5-3-fmm-gaz-notice.pdf> for a draft template of the gazette notice. A template for this document is available in G:\WIR\Dam_Safety\Templates. The request to publish in the Queensland Government Gazette form is available from Executive Council Team (ECT), Cabinet and Parliamentary Services or on insite.

Once the notice has been prepared and the form completed they must be signed off by the Director, Dam Safety (Water Supply) (or a higher position) and sent to ECT. The electronic version of the gazette notice must also be sent by email. The ECT will arrange for publication of the notice in the gazette and will advise the assessment officer by email of the publishing of the notice. Go to Step 7 when gazettal has taken place.

Step 7 - Letter sent to dam owner advising of approval of reviewed manual

The assessment officer prepares draft letter (including yellow file copy) to dam owner advising of approval of the reviewed manual and enclosing a copy of the gazette notice. See Attachment G <attachments/g-ds5-3-fmm-app-let.pdf> for a template. A template for this letter is available in G:\WIR\Dam_Safety\Templates.

Assessment officer gives the draft letter and copy of the gazette notice to the decision maker for signing.

Once the letter has been signed by the decision maker the project officer sends the letter and gazette notice to the dam owner.

Go to Step 8.

Step 8 - Assessment officer takes appropriate action with respect to RDR, the file and departmental records

The assessment officer:

- conducts a final check to ensure all relevant data has been entered into WICD–RDR.
- checks the completed Reviewed FMM Assessment and Decision Form has been signed by the assessment officer and decision maker, and that this form and all other documents created or received during the course of this work practice have been placed on the appropriate departmental file/s.
- returns the departmental file to the project officer who will check that all relevant documents have been registered in Keeper. If not, the project officer will register the documents in Keeper in accordance with local office processes and relevant departmental standards.

The processing of a flood mitigation manual for a dam following review is complete.

Responsibilities

Dam owner – under section 373 of the Act, the dam owner must, before an approval for the flood mitigation manual for a dam expires, review, and if necessary, update the flood mitigation manual and give a copy of the reviewed manual, for the dam to the chief executive for approval under s. 371.

Chief executive – section 371(2) of the Act gives the chief executive the power to approve the reviewed flood mitigation manual for a dam.

Under the Water Supply (Chief Executive) Delegation the above powers of the chief executive have been delegated to the following positions:

1. Director, Dam Safety (Water Supply), Dam Safety, Office of the Water Supply Regulator
2. Project Director, Dam Safety, Office of the Water Supply Regulator (position number 76025966)
3. Director, Water Industry Asset Management and Standards, Office of the Water Supply Regulator
4. General Manager, Office of the Water Supply Regulator.

Decision makers – if the decision maker is not the Director-General, DERM he/she must ensure that he/she has, at the time of making his/her decision, a current delegation allowing him/her to make his/her decision. This is important as instruments of delegation can be revoked and replaced from time to time.

Assessment officer – is required to carry out the assessment of a reviewed flood mitigation manual, submitted to the Department under s. 373 for approval under s. 371 of the Act, having regard to the matters outlined in the Reviewed FMM Assessment and Decision Form (Attachment C <attachments/c-ds5-3-fmm-a-d-form.pdf>) and the notes to that form. The assessment officer is expected to complete the form, as the assessment occurs, and must take into account the requirements of the guidelines, departmental policy documents and this work practice.

Project officer – performs any administrative duties as required under this work practice or by the assessment officer or decision maker or Director Dam Safety (Water Supply).

Definitions

"**the Act**" – means the Water Supply (Safety and Reliability) Act 2008

"**assessment officer**" – refer to the responsibilities section of this work practice.

"**chief executive**" – means the Director-General, Department of Environment and Resource Management

"**dam**" –

1. *Dam* means–
 - Works that include a barrier, whether permanent or temporary, that does or could impound water; and
 - The storage area created by the works.
2. The term includes an embankment or other structure that controls the flow of water and is incidental to works mentioned in paragraph (1) above.
3. The term does not include the following:
 - A rainwater tank;
 - A water tank constructed of steel or concrete or a combination of steel and concrete;
 - A water tank constructed of fibreglass, plastic or similar material.

"**decision maker**" – means the person making the decision to approve a reviewed flood mitigation manual for a dam, under this work practice. This may be the Director-General, DERM or a person who has been delegated the power to approve a flood mitigation manual.

"**DERM**" – Department of Environment and Resource Management.

"**Director, Dam Safety (Water Supply)**" – for the purposes of this work practice – means Director, Dam Safety (Water Supply) or the Project Director, Dam Safety (Position No. 76025966).

"**flood mitigation manual**" or "**manual**" or "**FMM**" – means a manual prepared under s. 370, or reviewed and updated under s. 373.

"**guidelines**" - means Guidelines for Failure Impact Assessment of Dams; Queensland Dam Safety Management Guidelines; Guidelines on Acceptable Flood Capacity for Dams; Emergency Management Planning for Floods Affected by Dams (2009) - Australian Government (Manual 23 of Australian Emergency Manual Series); Work practice DS 5.3 Processing a flood mitigation manual for a dam following review (WIR/2011/4884 in the Policy Register) and other Queensland Government policy statements as advised by the chief executive.

"**insite**" – means the internal website for use by officers of the department.

"**project officer**" – refer to the responsibilities section of this work practice.

"**RDR**" – means the Referable Dam Register of the Water Industry Compliance Database – the module within WICD that records administrative information about referable dams.

"**WICD**" – means Water Industry Compliance Database – a database that records information relating to service providers and dams.

References

The following documents should be referenced in conjunction with this work practice:-

- *Water Supply (Safety and Reliability) Act 2008*
- Water Supply (Chief Executive) Delegation (No. 1) 2011
- Work Practice DS 5.1 Flood mitigation manual for a dam (WIR/2009/3991 in policy register).
- Queensland Dam Safety Management Guidelines
- Guidelines for Acceptable Flood Capacity for Dams
- Guidelines for Failure Impact Assessment of Water Dams
- Emergency Management Planning for Floods Affected by Dams (2009) – Australian Government (Manual 23 of Australian Emergency Manual Series).

Officers involved in this work practice should also be familiar with, and comply with, requirements of the following departmental standards:

- Departmental policy RKP/2006/2907 – Recordkeeping overarching policy
- Departmental policy RKP/2006/2899 – Recordkeeping email policy
- Departmental standard IMP/2005/2253 – Procedures for using electronic mail
- Departmental standard ADM/2005/941 – Paper-based document management
- Departmental standard ADM/2002/965 – Decision making and requests for statements of reasons under the Judicial Review Act 1991
- Departmental standard ADM/2003/1402 – Information privacy.

Legislation

Water Supply (Safety and Reliability) Act 2008

Attachments

Attachment A – Flowchart <[attachments/a-ds5-3-fmm-flowchart.pdf](#)>

Attachment B – Acknowledgement letter <[attachments/b-ds5-3-fmm-ack-let.pdf](#)>

Attachment C – Assessment and decision form <[attachments/c-ds5-3-fmm-a-d-form.pdf](#)>

Attachment D – Request for information letter <[attachments/d-ds5-3-fmm-req-info.pdf](#)>

Attachment E – Non-approval amended flood mitigation manual letter
<[attachments/e-ds5-3-fmm-non-app-let.pdf](#)>

Attachment F – Gazette notice <[attachments/f-ds5-3-fmm-gaz-notice.pdf](#)>

Attachment G – Approval of amended flood mitigation manual letter <[attachments/g-ds5-3-fmm-app-let.pdf](#)>



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MONDAY 14 NOVEMBER 2011

[No. 75

Water Act 2000

TEMPORARY FULL SUPPLY LEVEL DECLARATION NOTICE (No 01) 2011

Short title

1. This notice may be cited as the *Temporary Full Supply Level Declaration Notice (No 01) 2011*.

Notice of declaration [s.34A of the Act]

2. Notice is hereby given that the Minister declares a temporary full supply level for Wivenhoe Dam of E.L. 64.0m A.H.D.

3. The temporary full supply for Wivenhoe Dam takes effect 15 calendar days from the date of this notice.

4. The temporary full supply level for Wivenhoe Dam ceases to have effect on 31 March 2012.

5. This *Temporary Full Supply Level Declaration* is made on the date this notice is published in the Gazette.

ENDNOTES

1. Published in the Gazette on 14 November 2011.
2. Not required to be laid before the Legislative Assembly.
3. The administering agency is the Department of Environment and Resource Management.

Water Supply (Safety and Reliability) Act 2008

APPROVAL OF FLOOD MITIGATION MANUAL NOTICE (No 03) 2011

Short title

1. This notice may be cited as the *Approval of Flood Mitigation Manual Notice (No 03) 2011*.

Approval of flood mitigation manual [s.371 of the Act]

2. Notice is hereby given that the Chief Executive on 14 November 2011 approved the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam, Revision 9 as a flood mitigation manual.

3. This approval is for a period of 5 years.

ENDNOTES

1. Published in the Gazette on 14 November 2011.
2. Not required to be laid before the Legislative Assembly.
3. The administering agency is the Department of Environment and Resource Management.

17 November 2011

Ms Sally Sturgess
Acting General Manager
Office of Water Supply Regulator
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4000

Dear Ms Sturgess,

SCHEDULE OF AUTHORITIES

We refer to the approval of Revision 9 of the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam.

Attached is the Schedule of Authorities.

You will note it names the two Senior Flood Operations Engineers and four Flood Operations Engineers who have previously been approved by the Chief Executive to direct flood operations at the dams during flood events. We are proceeding on the basis that the Chief Executive's approval of these engineers remains in force. If we are incorrect about this in any respect, please let us know.

Please do not hesitate to contact either myself or Jim Pruss, Executive General Manager – Water Delivery, on Tel. [REDACTED], should any further information be required.

Yours sincerely,

[REDACTED]
Peter Borrowes
Chief Executive Officer

Attach.

Schedule of Authorities

17 November 2011 – 30 September 2012

Made pursuant to Section 2.7 of the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam*.

Senior Flood Operations Engineers

John Tibaldi

Terrence Malone

Flood Operations Engineers

Barton Maher

Louw Van Blerk

David Pokarier

