

Enlarged Cotter Dam – Cost and Construction Timing

The ACT Auditor-General, Dr Maxine Cooper, today presented the report on the **Bulk Water Alliance** to the Speaker, for tabling in the ACT Legislative Assembly. This report includes consideration of the cost and timing of the construction of the Enlarged Cotter Dam.

Dr Cooper says ‘The construction of the Enlarged Cotter Dam was a high value, complex and long-term project and as such ACTEW’s use of an alliance to deliver it and the Murrumbidgee to Goongong Pipeline was appropriate and effective. This was despite a cost overrun for the Enlarged Cotter Dam and all three projects under the alliance being overdue.’

Dr Cooper says ‘the Enlarged Cotter Dam’s final cost of \$410.5 million exceeded the final estimated cost of \$363.0 million (Target Outturn Cost of \$299 million in Bulk Water Alliance costs and ACTEW’s direct costs of \$64.0 million) established in September 2009. An estimate of \$145.0 million developed by ACTEW and presented to the ACT Government in 2007, prior to the establishment of the Bulk Water Alliance, was preliminary and did not include all of the anticipated costs. The Enlarged Cotter Dam project was 20 months overdue’.

‘While a ‘lean’ Target Outturn Cost was established for the Enlarged Cotter Dam project, which aimed at achieving better performance from ACTEW’s alliance partners, and minimising overall costs, some cost estimates were based on unrealistic construction schedules. Unforeseeable events, including the 1:100 year flood, while impacting on schedule and cost, do not fully account for the extent of the overrun.’

The increased time and costs of the Enlarged Cotter Dam project were due to: a previously undetected geological fault a (not a reasonably foreseeable risk); a slower than forecast rate for excavating and cleaning up the foundations of the dam in preparation for the placement of the dam wall (a foreseeable risk); slower than anticipated placement of roller compacted concrete in the dam wall (a foreseeable risk); additional work to prepare for, and mitigate, flood events at the site (some were foreseeable, others not).

Communication issues associated with the Enlarged Cotter Dam, raised in a Public Interest Disclosure, were considered in the audit.

Dr Cooper says ‘while there were delays in providing cost information about the Enlarged Cotter Dam to the public there is no documented evidence that ACTEW or the ACT Government sought to deliberately mislead or deceive the public’.

The Summary from the Bulk Water Alliance: Report No 6/2015 is attached.

Copies of the **Bulk Water Alliance** Report No. 6/2015 are available from the ACT Audit Office’s website www.audit.act.gov.au . If you need assistance accessing the report please phone 6207 0833 or go to 11 Moore Street, Canberra City.

Summary

Between 1997 and 2009 south-eastern Australia experienced a significant drought which resulted in the implementation of water restrictions in the ACT for nearly eight years (December 2002 to November 2010). This 'Millennium Drought' resulted in a significant decrease in water storage levels in the ACT.

In 2007 a suite of measures aimed at providing water security for the ACT was announced. This included the enlargement of the Cotter Dam from 4 gegalitres to 78 gegalitres increasing the ACT's total water storage capacity by 35 percent; and the construction of the Murrumbidgee to Googong Pipeline.

ACTEW selected an alliance contracting arrangement, the Bulk Water Alliance, to deliver these two projects. The Googong Dam Spillway, although not a water security project, was included in the Bulk Water Alliance. The Bulk Water Alliance comprised: the owner - ACTEW; and Non-Owner Participants - GHD, the project designer, and constructors Abigroup and John Holland Group.

The Enlarged Cotter Dam project involved constructing a new dam wall, 80 metres high and 240 metres wide, approximately 100 metres downstream from the existing Cotter Dam wall. Other activities undertaken as part of the project included: the construction of two substantial earth embankment saddle dams adjacent to the main dam; the upgrade of recreational facilities within the Cotter precinct, including Casuarina Sands and Cotter Avenue; construction of a new walking trail and public viewing platform; and construction of seven kilometres of artificial fish habitat.

The Murrumbidgee to Googong Pipeline was intended to provide additional capacity and operational flexibility by allowing ACTEW to extract water from the Murrumbidgee River and transfer it to the Googong Dam. It involved the construction of a pipeline and associated infrastructure to facilitate the transfer of up to 100 megalitres of water per day from the Murrumbidgee River, through a 12 kilometre underground pipeline, to Burra Creek in NSW. The water would then flow approximately 13 kilometres along Burra Creek into the Googong Dam.

The Googong Dam Spillway, while not increasing the available water supply, was intended to ensure the structural integrity and functionality of the Googong Dam into the future. Detailed design plans and technical specifications were prepared and completed for upgrading the Googong Dam Spillway before the Bulk Water Alliance was formed. At the time the Googong Dam Spillway was being taken to the market for tender ACTEW was planning the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects.

Overall Conclusion

The Bulk Water Alliance delivered the Enlarged Cotter Dam, Murrumbidgee to Googong Pipeline and the Googong Dam Spillway. However, the Enlarged Cotter Dam's final cost of \$410.5 million exceeded its final estimated cost of \$363.0 million (Bulk Water Alliance's Final Target Outturn Cost of \$299.0 million and ACTEW's costs of \$64.0 million), as approved on 1 September 2009, and was overdue by 20 months. An earlier pre-Bulk Water Alliance estimate of \$145.0 million, developed by ACTEW and presented to the ACT Government in 2007, was preliminary and did not include all of the anticipated costs. The Murrumbidgee to Googong Pipeline cost \$140.5 million, less than the final estimated cost of \$154.5 million and was overdue by 3 months. The Googong Dam Spillway cost \$54.0 million, less than the final estimated cost of \$56.0 million and was overdue by 8 months. The three project's combined cost of \$605.0 million is an increase of 5.5 percent over the combined final budgeted costs.

Despite the cost overrun for the Enlarged Cotter Dam and all three projects being overdue, ACTEW's use of an alliance to deliver it and the Murrumbidgee to Googong Pipeline project was appropriate and effective, although some aspects could have been improved. The merits of including the Googong Dam Spillway project in the alliance have not been evidenced.

While an Enlarged Cotter Dam 'lean' Target Outturn Cost was designed to encourage better performance and minimise overall costs it proved to be too 'lean' as some costs were based on unrealistic construction schedules. Unforeseeable events, including the 1:100 year flood, while impacting on schedule and cost do not fully account for the extent of the overrun.

While there were delays in providing cost information about the Enlarged Cotter Dam to the public there is no documented evidence that ACTEW or the ACT Government sought to deliberately mislead or deceive the public.

Chapter Conclusions

PLANNING FOR THE BULK WATER ALLIANCE

Planning for the Bulk Water Alliance appropriately identified that an alliance was an effective procurement model and means to manage the construction of the Enlarged Cotter Dam as it was a high value, complex, long term project with a number of unknown factors (prior to construction). The decision to proceed with an alliance for the Enlarged Cotter Dam accords with the 2010 better practice guidance: *The National Alliance Contracting Guidelines: Guide to Alliance Contracting*. The Murrumbidgee to Googong Pipeline had similar risks and an alliance was also appropriate for this project. The appropriateness of including the Googong Dam Spillway in the Bulk Water Alliance is unable to be determined as there was no monitoring or reporting on the expected benefits.

The selection of the Bulk Water Alliance Non-Owner Participants was undertaken in accordance

with better practice elements of the *Project Alliancing Practitioners' Guide*.

ESTABLISHMENT AND MANAGEMENT OF THE ALLIANCE

The Final Target Outturn Cost for the Enlarged Cotter Dam, as at 1 September 2009, was \$299.0 million (i.e. the expected costs of the project attributable to the Bulk Water Alliance). It was based on optimistic and ambitious production targets, resulting in unrealistic expectations for the cost and timeliness of the project.

Coupled with optimistic and ambitious production targets was a low risk allocation (contingency sum) of \$22.0 million built into the Final Target Outturn Cost. The contingency, approximately 7.3 percent of the Final Target Outturn Cost, was low for a project of the size and complexity of the Enlarged Cotter Dam. The process for identifying and assigning a dollar value for the contingency considered each production component in isolation and assigned independent risk and dollar values. This was inadequate as many of the production components and risks associated with the Enlarged Cotter Dam were interdependent and needed to be recognised as such.

The Final Target Outturn Cost of \$299.0 million was negotiated down by ACTEW from a Pre-Final Target Outturn Cost figure of \$310.9 million. In negotiating a lower Target Outturn Cost, however, ACTEW agreed to a revised gain-share/pain-share mechanism for the project. Instead of sharing any cost-overruns equally with the Non-Owner Participants ACTEW agreed to bear any cost overruns up to \$13.4 million, after which they would be shared equally. This arrangement was commercially advantageous to the Non-Owner Participants.

The direct costs associated with the project, i.e. costs associated with the construction of the dam itself, exceeded Final Target Outturn Cost estimates by \$81.8 million (31.0 percent). This additional cost was shared between the Bulk Water Alliance participants (ACTEW and the Non-Owner Participants) as part of the 'pain-share' mechanism.

A lower Final Target Outturn Cost and a reduced contingency sum meant that the cost overrun was shared between ACTEW and the Non-Owner Participants at a lower dollar value, i.e. the Non-Owner Participants began sharing these costs earlier. Should the Final Target Outturn Cost have been higher, with a higher contingency, ACTEW would have borne more costs before the costs were shared.

ACTEW's management of the Bulk Water Alliance was effective with respect to governance (including roles and responsibilities); administrative arrangements (including documented policies and procedures); systems and processes; and the monitoring and reporting of the implementation of the projects.

ENLARGED COTTER DAM PROJECT TIMING AND BUDGET

Factors contributing to the increased time and costs of the Enlarged Cotter Dam project included: a previously undetected geological fault at the base of the abutment of the dam (not a reasonably foreseeable risk); a slower than forecast rate of progress in excavating and cleaning up the foundations of the dam in preparation for the placement of the dam wall (a foreseeable risk); slower than anticipated placement of roller compacted concrete in the dam wall (a foreseeable risk); additional work undertaken to prepare for, and mitigate, flood events at the site (some of which were not foreseeable risks).

While a decision was made comparatively early in the construction phase of the project to change the scope of the project and increase the project's flood mitigation diversion capacity, the diversion was ultimately inadequate in dealing with the February/March 2012 flood event. However, the February/March 2012 flood event was a 1 in 100 year flood. The costs associated with preparing a diversion with the capacity to manage and mitigate a 1 in 100 year flood event would have been very high and unwarranted from a risk management perspective.

COMMUNICATION

Information was provided to the Chief Minister, Deputy Chief Minister and the Legislative Assembly on the expected cost increases.

In relation to information provided to the community and Legislative Assembly there were two instances where more care could have been taken to check accuracy:

- a statement in a 3 September 2009 newspaper article, quoting the then Managing Director of ACTEW saying that the cost had increased due to '... going down about another 9m on what we anticipated for the foundations' is not supported by the geotechnical investigations reported by the Bulk Water Alliance in April 2009. However, it is noted that an August 2009 Bulk Water Alliance report did identify that 'for reasons of constructability, stripping of the main dam foundation would proceed to levels generally deeper than the minimum excavation line by amounts up to and in places exceeding 10 m'; and
- a 17 September 2009 ACTEW report to the Legislative Assembly, explaining the reasons for the increase in the cost of the Enlarged Cotter Dam, used outdated information from an earlier December 2008 report in relation to the cost of materials, specifically reinforced steel.

Key findings

PLANNING FOR THE BULK WATER ALLIANCE

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The transaction advisor recommended an alliance as the most appropriate contractual arrangement for the delivery of the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects. 2.15

In a series of decisions between August 2007 and November 2007 the ACTEW Board decided to proceed with alliance contracting to deliver the water infrastructure projects. The transaction advisor's recommendation to proceed with alliance contracting for the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects formed the basis of the advice to the ACTEW Board. The advice to the ACTEW Board identified that the key benefits of combining the three projects in a single program alliance were that the projects would appear more attractive to potential alliance partners, an important risk mitigation measure in a constrained market, and that there would be overall cost savings. 2.24

The separate gain-share/pain-share arrangements and quality pools for each project meant that financial incentives to perform more efficiently were driven at the project level and not at the broader program level. There were a few examples provided by representatives from the Bulk Water Alliance as to how the program alliance structure benefited the delivery of the individual projects; for example common policies and procedures were adopted to manage the activities on-site. However, the Bulk Water Alliance did not track and measure the innovations, efficiency gains and/or knowledge transferred as a result of operating as a program alliance. Furthermore, there were no financial incentives built into the commercial framework(s) for these projects to be collectively managed to gain efficiencies. 2.33

An analysis of the Enlarged Cotter Dam project against the Guide to Alliance Contracting (2011) shows that alliance contracting, as a project delivery model for the Enlarged Cotter Dam, was a sound option. Reasons for the use of alliance contracting for this project include: 2.36

- a lack of certainty regarding some risks, which could be shared through the alliance; and
- ACTEW staff could be involved during the design and construction stages, an advantage in the future management of the projects.

It was apparent, through assessment of the Request for Proposal and Request for Proposal Evaluation Procedure, that there was not a key focus on the ability of the respondents to deliver a program alliance as opposed to individual project alliances. This created a risk that the Bulk Water Alliance would not achieve the advantages, put to the Board in November 2007, of a program alliance. 2.49

The risks and opportunities identified in the Board paper of 8 November 2007, seeking approval for an alliance procurement model, were primarily related to 2.52

schedule and procedural matters. There was insufficient consideration by the Board of issues associated with combining the projects into a single program alliance, for example:

- the suitability of each project for delivery under a non-competitive alliance commercial framework (required to be part of the alliance program);
- the efficiencies gained through program level organisational control and management;
- program implications for owner resourcing;
- the effect of program/portfolio as opposed to individual project management risks;
- program efficiencies with respect to:
 - management control and operations;
 - innovation and collaboration; and
 - knowledge transfer.

A more comprehensive consideration by the Board may have resulted in the identification of additional risks and opportunities. Not including these matters meant there was a risk that an alliance procurement model was approved without the Board having fully considered all risks and opportunities. 2.53

The 8 November 2007 Board paper, which approved the combination of the projects in the Bulk Water Alliance, did not include an analysis of the merits of the single Target Outturn Cost approach when compared to a multiple Target Outturn Cost approach. The preferred approach adopted for all of the Bulk Water Alliance projects was based on the recommended method for the Enlarged Cotter Dam, a single Target Outturn Cost. 2.60

The Bulk Water Alliance designer was selected independently of the constructor to enable ACTEW to select the best designer and the best constructor from the industry rather than have their selection limited by a combination of designer/constructor developed by interested parties. A risk in selecting the designer prior to the constructor was the challenge for ACTEW in assessing the manner in which the designer and constructor were able to work and operate as a team within an alliance. ACTEW sought to mitigate this risk through evaluation criteria in the Request for Proposal, although it is apparent that there were relationship difficulties early in the project. Using a two step process to choose the designer, and then the constructor, had positives and negatives. It meant that ACTEW could make its own selection of designer and constructor rather than being presented with a combination not necessarily of its choosing, but this created a risk that ACTEW would not fully realise the important collaborative aspect of the alliance. Due to the technical nature, size and length of the design phase it is unclear whether the cost of managing two separate bidding teams through this process would have outweighed the benefits. 2.66

ACTEW had a documented Request for Proposal Evaluation Plan and criteria to assess each nominated criteria in the Request for Proposal document. The process in the Request for Proposal Evaluation Plan was followed. 2.72

The process for measuring, scoring and evaluating each respondent participating in the Bulk Water Alliance was transparent and overall covered the key risks associated with the Bulk Water Alliance (with some limitations). 2.76

There were a limited number of ACTEW personnel with previous experience who had either supervised or managed a dam project of a similar size to the Enlarged Cotter Dam. It is noted, however, that a benefit of an alliance model is to share each party's knowledge, skills and resources in order to effectively manage risks. ACTEW advised that an additional means by which it sought to manage this risk was through the establishment of a Technical Review Panel in early 2009, independent of the Bulk Water Alliance, which provided advice to ACTEW on technical matters. The panel comprised experts on relevant subjects such as dam design and construction, roller compacted concreting, excavation and mechanical and electrical engineering. 2.82

The requirements of the Request for Proposal provided a good basis for selecting the preferred Non-Owner Participants. They mitigated the risk that adjustments made to the commercial model and/or departures to the General Terms and Conditions of Contract and Contract Schedules, subsequent to the selection of the preferred Non-Owner Participant, may have resulted in a different selection outcome. 2.84

ESTABLISHMENT AND MANAGEMENT OF THE ALLIANCE

Paragraph

The allocation of risk and reward amounts is key to an effective alliance contracting arrangement. The Program Alliance Agreement provided for the allocation of risks and rewards among the Bulk Water Alliance Non-Owner Participants through two key mechanisms: 3.15

- a gain-share/pain-share mechanism for each of the projects; and
- the use of a quality pool for each of the projects.

The gain-share/pain-share mechanism provided for the allocation of any cost-savings achieved or, alternatively, cost overruns experienced in the Bulk Water Alliance projects. This mechanism incorporated elements associated with financial risks and rewards, i.e. incentives for the Bulk Water Alliance participants to perform effectively and manage the delivery of the project in accordance with time, cost and quality objectives. 3.18

The original gain-share/pain-share mechanism for the Bulk Water Alliance projects allowed for: 3.21

- 50 percent of any cost-savings achieved in the delivery of the

projects to be paid to the Non-Owner Participants, with the other 50 percent representing a 'saving' for ACTEW; and

- 50 percent of any additional costs experienced in the delivery of the projects to be borne by the Non-Owner Participants and 50 percent of the additional costs will be borne by ACTEW.

The revised gain-share/pain-share mechanism for the Enlarged Cotter Dam project provided for: 3.25

- the Non-Owner Participants to receive all cost savings associated with the Enlarged Cotter Dam project up to \$10.4 million, with further cost savings achieved over \$10.4 million to be shared with ACTEW; and
- ACTEW to bear all of the additional costs associated with the Enlarged Cotter Dam project up to \$13.4 million, with further cost increases to be shared with the Non-Owner Participants.

The revised gain-share/pain-share mechanism, agreed to in August 2009, for the Enlarged Cotter Dam project was commercially advantageous to the Non-Owner Participants, given that ACTEW would cover the cost of any over runs up to \$13.4 million. (Previously it would have only covered half of that cost.) 3.30

The use of a quality pool for the Bulk Water Alliance projects allowed for some adjustments to be made to payments to Non-Owner Participants, including those notionally identified through the gain-share/pain-share mechanism, depending on whether key performance indicators had been achieved. Payments from the quality pool were to be made on the basis of 'outstanding' performance and not 'business as usual performance.' The quality pool could also be adversely affected by poor performance against some key performance indicators, specifically related to safety and environmental performance. 3.34

The Bulk Water Alliance, formed in May 2008, commenced activities to prepare the Target Outturn Cost for the Enlarged Cotter Dam (and other projects) through the latter part of 2008 and throughout 2009. During this period there were a number of estimates developed for the Target Outturn Cost and processes applied to review and revise the estimate as necessary. 3.46

On 10 August 2009 the Alliance Leadership Group revised, at ACTEW's request, the Pre-Final Target Outturn Cost figure of \$310.9 million to \$299.0 million (Final Target Outturn Cost). The revision to the Pre-Final Target Outturn Cost of approximately 4 percent was achieved in the context of: 3.49

- a revised gain-share/pain-share mechanism; and
- a reduction in the quality pool for the project.

The process for developing the Final Target Outturn Cost for each of the projects was broadly similar and included: 3.55

- preparation and approval of a Project Scope Brief and Design Basis Report for each of the projects; and
- preparation of a Final Target Outturn Cost report for each of the projects, which included information and analysis on:
 - benchmarking;
 - options analysis and whole of life costing review;
 - risk and opportunity assessment for each option;
 - contingency setting;
 - project strategy and constructability review;
 - identification of long lead procurement items; and
 - establishment and development of an innovations register.

The development of the Final Target Outturn Cost for the Enlarged Cotter Dam also featured: 3.61

- Value for Money workshops: held throughout the concept design phase to bring together the parties to identify ways to reduce the costs of the proposed design; and
- Challenge workshops: focused on the design and construction methodologies to bring together the participants to identify potential cost savings.

ACTEW engaged an independent estimator to review all of the project estimates and provide advice with respect to their reasonableness. This included the review and testing of the different assumptions that underpinned the estimates of the different elements of the Pre-Final Target Outturn Cost. 3.67

Risk and Opportunity workshops were held for the purpose of identifying and allocating a risk and associated cost to the different components of the Target Outturn Cost. The workshops were attended by representatives from ACTEW and the Non-Owner Participants. 3.68

A Monte Carlo simulation was performed to analyse the risks for the Enlarged Cotter Dam; it sought to identify and quantify the costs associated with the risks (and savings associated with the opportunities). This resulted in the quantification of a risk allocation component, contingency, of the Target Outturn Cost of approximately \$22 million. This was, in effect, the contingency sum for the Enlarged Cotter Dam project. 3.70

The risk analysis undertaken by the Bulk Water Alliance was not effective in identifying and calculating the value of the risks associated with the Enlarged Cotter Dam project for the purpose of identifying a 'contingency sum'. The Monte Carlo analysis used by the Bulk Water Alliance is primarily effective in identifying and quantifying risks that are discrete and independent. The interdependency of many of the risks associated with the Enlarged Cotter Dam project, and their associated costs, would not have been identified in the Monte Carlo analysis. 3.79

Roles and responsibilities of the Bulk Water Alliance, including the roles and responsibilities of the Non-Owner Participants and ACTEW, as the Owner, were clearly and appropriately articulated in the Program Alliance Agreement.	3.91
The Bulk Water Alliance established a comprehensive set of policy and procedural documents to guide the management and administration of the Bulk Water Alliance projects.	3.101
Management and governance committees associated with the Bulk Water Alliance were appropriately established. These groups met regularly and provided an effective means for management and oversight of the Bulk Water Alliance projects. In particular, the Alliance Leadership Group and Alliance Project Management Team were key to the effectiveness of the Bulk Water Alliance.	3.112
There were effective and appropriate dispute resolution processes for the Bulk Water Alliance.	3.117
Monthly progress reports prepared by the Project Managers provided relevant information on the progress of the Bulk Water Alliance projects. They provided an effective means of control and oversight.	3.120
ACTEW implemented effective monitoring and oversight arrangements to ensure that it received regular information on the progress and performance of the Bulk Water Alliance and associated projects.	3.123

ENLARGED COTTER DAM PROJECT TIMING AND BUDGET

Paragraph

An analysis of the cost and timing of the Bulk Water Alliance projects showed:	4.3
<ul style="list-style-type: none"> • the final cost of the Enlarged Cotter Dam project was \$410.5 million, compared with the Final Target Outturn Cost plus Owner costs of \$363.0 million (an increase of approximately 13.0 percent). Its completion was overdue by 20 months; • the final cost of the Murrumbidgee to Googong Pipeline project was \$140.5 million, compared with the Final Target Outturn Cost plus Owner costs of \$154.5 million (a decrease of approximately 9.1 percent). Its completion was overdue by 3 months; • the final cost of the Googong Dam Spillway project was \$54.0 million, compared with the Final Target Outturn Cost plus Owner costs of \$56.0 million (a decrease of approximately 3.6 percent). Its completion was overdue by 8 months; and • the three projects have been delivered for a total final cost of \$605.0 million, compared with Final Target Outturn Costs plus Owner costs of \$573.5 million (an increase of 5.5 percent). The expected completion dates for all projects were exceeded. 	

An analysis of the estimated actual and target costs associated with the direct costs component of the Enlarged Cotter Dam project showed: 4.12

- total direct costs associated with the Enlarged Cotter Dam increased by \$81.8 million (31.0 percent). These included additional, unbudgeted flood-related costs of \$11.5 million;
- all other components of the Enlarged Cotter Dam's direct costs (excluding overhead costs) exceeded the initial estimate; and
- costs of excavation of the abutment and construction of the dam represented the biggest component of the direct costs associated with the Enlarged Cotter Dam project. These were estimated at \$93.7 million with an actual cost of \$146.8 million (an increase of 56.8 percent).

The Enlarged Cotter Dam was expected to take 25 months to construct (November 2009 until December 2011). It took 45 months to construct (November 2009 until August 2013) which represents a 20 month delay. 4.15

The foundation excavation and preparation phase of the Enlarged Cotter Dam project took 20.5 months to complete compared to an estimated 14.5 months. The key delays associated with this stage of the project included: 4.25

- a generally slower rate of progress than initially envisaged for the dam's foundation excavation and clean-up (approximately three months);
- additional time taken to construct a larger, second stage water diversion facility (approximately 1.5 months); and
- additional time taken to address an unexpected geological fault near the base of the right abutment (approximately 1.5 months).

The additional excavation of the Enlarged Cotter Dam's foundation resulted in greater excavation costs and a subsequent increase in the quantity of roller compacted concrete. 4.30

The clean-up of the foundation was, overall, a more difficult job than expected by the constructors because the expectations of the designers were poorly understood by the constructors at Final Target Outturn Cost stage. The low efficiency and slower-than-target progress on the excavation and foundation clean-up of the steep valley sides was foreseeable. 4.35

The decision to construct an additional diversion followed what was perceived to be unusual wet weather and two flood events that occurred in late 2010. The construction of the additional diversion cost an additional \$3.5 million and delayed the project by approximately 1.5 months. 4.37

The decision to spend more on the diversion works and delay the foundation work, 4.41

in order to provide a greater diversion capacity, and thus mitigate the flood risk, was a sensible one. This diversion, however, was not sufficient to manage the significant flood event that occurred in March 2012. However, the March 2012 flood was a severe flood event that could not have been managed or mitigated cost-effectively.

In May 2011 a geological fault was uncovered during foundation excavations. The fault, located under the right abutment of the dam, required additional excavation, specifically of a large wedge of rock, in order to provide a stronger foundation for the dam. 4.43

The geotechnical investigations for the Enlarged Cotter Dam, prior to the development of the Final Target Outturn Cost, were detailed and appropriate. A significant geological fault was discovered at the right abutment of the dam which delayed the construction of the dam and added cost. The fault was unexpected and unpredictable and could not have been reasonably foreseen. 4.50

The roller compacted concreting phase of the Enlarged Cotter Dam project took 17 months to complete compared to an estimated 7 months. There were key delays associated with the foundation excavation and preparation phase including: 4.52

- a generally slower rate of progress than initially envisaged (approximately 7.5 months); and
- a delay due to the severe March 2012 flood event (approximately 2.5 months).

The length of time taken to place the roller compacted concrete also led to an additional \$40.5 million in costs for the project and an additional \$5.7 million in craneage expenditure, primarily attributed to the length of time taken to place the roller compacted concrete. 4.53

The Final Target Outturn Cost identified an average roller compacted concrete placement rate of approximately 54,000 m³ per month with a peak monthly placement rate of 90,000 m³ per month. The actual roller compacted concrete placement rate was less than 30,000 m³ per month with a peak placement rate of 42,000 m³ per month. 4.57

The *Bulk Water Alliance Enlarged Cotter Dam Value for Money Report (2014)* included a comparison of roller compacted concrete placement rates of dams throughout the world.¹ The report identified that the forecast roller compacted concrete rate for the Enlarged Cotter Dam project would have made the Enlarged Cotter Dam the second fastest roller compacted concrete dam constructed in the world. While the Bulk Water Alliance conducted trials to identify the optimal method for efficient placement, obtained independent verification of forecast placement rates and engaged appropriate expertise its assumptions as to the 4.59

¹ The Bulk Water Alliance Enlarged Cotter Dam Value for Money Report (2014), page 39.

placement rate that could be achieved were very optimistic.

The reasons for lower roller compacted concrete placement are:

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- delays associated with the March 2012 flood event;
- issues with the gallery construction method leading to delays;
- the high number of cold joints resulting from rain, including the significant amount of time required to 'green-cut' and clean up the cold joints;
- the congestion of the roller compacted concreting surface, due to equipment and embedments within the dam, causing slow progress;
- delays caused by the time taken to move formwork; and
- the Christmas shut down period.

Despite the optimistic planned roller compacted concrete placement rates for the Enlarged Cotter Dam there was no specific roller compacted concrete placement rate risk identified when the Target Outturn Cost was finalised. As a result there was an insufficient risk allocation component in the Final Target Outturn Cost for roller compacted concrete placement and an insufficient contingency sum built into the Final Target Outturn Cost for the non-achievement of the planned placement rate.

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The Bulk Water Alliance did not conduct sufficient trials and/or pilots to test whether roller compacted concrete placement, batch plant and/or other materials production rates could be achieved prior to construction. The trials that were conducted tested the quality of the roller compacted concrete but not how long it would take to place it on the dam wall. In addition, the design of the construction work management plan was not considered until after the development of the Final Target Outturn Cost.

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A significant proportion of the cost over-run on the Enlarged Cotter Dam was a direct result of not achieving the roller compacted concrete placement rates identified in the Final Target Outturn Cost. This was also recognised by ACTEW in its Value for Money Report² which noted that the Final Target Outturn Cost placements rates were overly optimistic and the excessive wet weather dramatically impacted the Bulk Water Alliance's ability to achieve higher placement rates.

4.103

The roller compacted concrete placement rates identified in the Final Target Outturn Cost were optimistic. Not achieving the placement rate was a foreseeable risk. The Bulk Water Alliance took steps to mitigate the risk once it had eventuated but these actions were not sufficient to prevent its adverse effect on the project's

4.104

² ACTEW, Bulk Water Alliance Value for Money Report, 2014, p 41, 42

cost and timeframe.

Once the slower placement rate became evident significant effort was devoted to identifying remedies. This included trialling the use of 400 mm layers rather than 300 mm (for 50 layers).³ The lack of success in finding remedies is largely due to the constraints on the operation, incorporated in the planning stage, such as the highly congested work surface. Wetter than normal conditions during the placement period provided additional challenges. 4.105

During the construction of the dam there were two minor flood events in late 2010 and one major flood event in February/March 2012. These flood events led to additional work to mitigate possible future floods and additional costs for ACTEW, as the project Owner, to manage and remedy the damage caused by the flood events. 4.106

The Bulk Water Alliance undertook construction flood estimates including an assessment of the seasonality of floods. This was based on over 30 years of flow records from the Cotter River from 1974 to 2009. These flood studies also examined: the variation of the dam levels over time for the Cotter Dam and the upstream Corin and Bendora dams; and the impact these levels had on floods likely to be experienced at the Enlarged Cotter Dam site. 4.111

The Bulk Water Alliance initially considered a river diversion arrangement with a tunnel or conduit to provide protection up to a 1 in 20 annual exceedence probability flood, i.e. a flood event that might happen once every twenty years. However the Bulk Water Alliance's approach appeared to change in early 2009. 4.114

The Bulk Water Alliance subsequently adopted a higher risk approach with an assessment undertaken indicating a reduced diversion capacity of around the 1 in 5 annual exceedence probability flood and potentially as low as the 1 in 2 annual exceedence probability flood. A flood event that might happen once every two to five years is expected to be on a smaller scale than a flood event that might happen once every twenty years. 4.116

To avoid a significant contingency sum being included in the Final Target Outturn Cost to address the construction flood risk it was decided by the Bulk Water Alliance that: 4.125

- one overtopping event at a cost of \$1.42 million would be added to the direct costs of the project;
- ACTEW would carry the flood risk during construction beyond \$1.42 million; and
- the contractors could recover these costs as a variation.

³ 400 m layers were ceased in part due to the change in dam geometry and the increased possibility of not achieving continuous hot joint placement (Value for Money Report, p 182), a risk of the larger layers.

There were appropriate systems in place to try to minimise the flood impacts should an overtopping event occur.	4.133
Floods, while being unpredictable in terms of timing and magnitude, are expected. It was unfortunate that a flood of magnitude 1:100 exceedence probability per year occurred during the Enlarged Cotter Dam construction.	4.136
The completion phase of the Enlarged Cotter Dam project took eight months to complete, compared to an estimated four months. The four month delay in the completion phase of the project is primarily attributable to the sequence of works of the program which was also complicated by having to operate the diversion for longer than anticipated.	4.138
Extra time and cost were incurred for the structures, including the stilling basin and other completion works, after roller compacted concrete placement was finished. This was foreseeable although probably not to the extent that actually occurred. By the time detailed designs were completed for these structures, after the Final Target Outturn Cost stage, extra construction time and cost were largely unavoidable.	4.142
The Bulk Water Alliance had the necessary processes in place to identify, allocate and manage risks.	4.143
With respect to the Bulk Water Alliance's assessment of risk there were optimistic assessments of some construction parameters:	4.150
<ul style="list-style-type: none"> • the production rates adopted; <ul style="list-style-type: none"> ○ foundation excavation production rates; ○ roller compacted concrete production and placement rates; • the likelihood of the following risks eventuating: <ul style="list-style-type: none"> ○ flooding; ○ slow rate of progress on the foundation excavation, much of which was steep; ○ slow rate of progress with the roller compacted concrete placement in the dam; ○ more time taken to complete construction after the end of roller compacted concrete placement; • the consequences of many risks: <ul style="list-style-type: none"> ○ secondary impacts, that is consequential risks associated with the above risks eventuating; ○ increased scope and/or complexity of work due to the detailed design not having been completed at the time of the Final Target Outturn Cost. 	

COMMUNICATION

Paragraph

In October 2007 the ACT Government, on the advice of ACTEW, announced that the expected cost of construction of the Enlarged Cotter Dam would be \$145 million. Notwithstanding the limitations of this figure it was not specifically and publically refuted until early September 2009. Following its initial consideration and prior to its endorsement of the Final Target Outturn Cost (\$299 million) the ACTEW Board communicated the revised figure to the Chief Minister and Deputy Chief Minister (and Cabinet).

5.47

Between December 2007 and May 2009 ACTEW communicated to the then Chief Minister and Deputy Chief Minister (the Voting Shareholders), and the Legislative Assembly, the likelihood that the costs of the Enlarged Cotter Dam would exceed \$145 million. As early as December 2007 ACTEW advised the ACT Public Accounts Committee of the increasing costs of construction and the likelihood that this would lead to higher costs for the Enlarged Cotter Dam. Further, in December 2008, ACTEW advised the then Chief Minister and Deputy Chief Minister (the Voting Shareholders) that the cost of the Enlarged Cotter Dam was likely to increase by 50 to 70 percent. In July 2009 an ACTEW Board paper also acknowledged that activities were underway to 'bring the total project cost within \$300m'.

5.48

At the time the Draft Target Outturn Cost figure was developed in April 2009, and up to the presentation of the Final Target Outturn Cost in August 2009, ACTEW was in commercial negotiations with the Non-Owner Participants. It would have been premature and potentially prejudicial to ACTEW's subsequent negotiation with the Non-Owner Participants to communicate specifically and publically with respect to expected cost increases. However, it would also have been prudent for ACTEW to be more explicit with the then Chief Minister and Deputy Chief Minister (the Voting Shareholders) with respect to expected increases in the cost of the project as they became apparent. It would also have been prudent for ACTEW to be more explicit with respect to the breakdown of the costs, including articulating ACTEW's direct costs and costs incurred to date.

5.51

Based on an analysis of documented material there is evidence that information was made available to the then Chief Minister and Deputy Chief Minister, throughout 2008 and 2009, on expected cost increases for the project. This was acknowledged by the then Chief Minister and Deputy Chief Minister in communication to the Chair of the ACTEW Board on 2 September 2009 which indicated that the then Chief Minister (and Cabinet) had an understanding that the project would cost '\$145 million, with a possible upside cost of 50 – 70 % [approximately \$250 m].'

5.57

The ACTEW Board paper of 26 August 2009, provided to departmental representatives on Friday 21 August 2009, identified a cost of approximately \$326.5 million but did not include costs incurred to date in relation to the project. However, the Managing Director advised the ACTEW Board on 26 August 2009 of

5.58

the expected total cost of the Enlarged Cotter Dam (advised as \$362.3 million). A total figure of \$363 million was provided in a presentation to Cabinet on 31 August 2009. It was also communicated in a letter from the then Managing Director of ACTEW to the Voting Shareholders on 1 September 2009.

The then Chief Minister stated ‘the government was advised of the final cost last week ... I think we were advised somewhere around - I’m guessing - perhaps Thursday of last week.’ ‘Thursday of last week’ was 27 August 2009. There is no documented evidence identifying that the estimated final cost of \$363 million for the Enlarged Cotter Dam project had been provided prior to the Minister for Planning’s announcement on 26 August 2009 regarding the use of call-in powers. 5.59

The then ACTEW Managing Director’s 17 September 2009 report to the Legislative Assembly, in response to a 16 September 2009 Legislative Assembly motion, used material from a report that had been provided to the ACT Government by ACTEW in December 2008. Information in the December 2008 report conveyed that there had been a significant increase in the cost of reinforced steel. It is apparent, however, that the cost of reinforced steel had reduced in 2009. While it would have been prudent for ACTEW to review and revise this information it had only approximately one day to prepare and present this information to the Assembly. 5.68

The geological condition of the Enlarged Cotter Dam site became better known as geotechnical surveys were conducted between 2007 and September 2009. A statement in a September 2009 newspaper article, quoting the then Managing Director of ACTEW saying that the cost had increased due to ‘... going down about another 9m on what we anticipated for the foundations’ is not supported by geotechnical investigations that were undertaken. 5.75