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BULK WATER ALLIANCE

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ACT Audit Office

AUDITOR-GENERAL AN OFFICER OF THE ACT LEGISLATIVE ASSEMBLY

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The Speaker
ACT Legislative Assembly
Civic Square, London Circuit
CANBERRA ACT 2601

Dear Madam Speaker

I am pleased to forward to you a Performance Audit Report titled 'Bulk Water Alliance' for tabling in the Legislative Assembly pursuant to Subsection 17(5) of the *Auditor-General Act 1996*.

Yours sincerely

Dr Maxine Cooper
Auditor-General
24 June 2015

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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 gigalitres to 78 gigalitres 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 Practioners' 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	Paragraph
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	2.24

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.

2.33 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.

2.36 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:

- 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.

2.49 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.

2.52 The risks and opportunities identified in the Board paper of 8 November 2007, seeking approval for an alliance procurement model, were primarily related to 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 2.82

technical matters. The panel comprised experts on relevant subjects such as dam design and construction, roller compacted concreting, excavation and mechanical and electrical engineering.

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 3.30

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.)

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	3.123

that it received regular information on the progress and performance of the Bulk Water Alliance and associated projects.

ENLARGED COTTER DAM PROJECT TIMING AND BUDGET

Paragraph

An analysis of the cost and timing of the Bulk Water Alliance projects showed: 4.3

- 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, 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. 4.41

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 4.53

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.

The Final Target Outturn Cost identified an average roller compacted concrete placement rate of approximately 54,000 m^3 per month with a peak monthly placement rate of 90,000 m^3 per month. The actual roller compacted concrete placement rate was less than 30,000 m^3 per month with a peak placement rate of 42,000 m^3 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 placement rate that could be achieved were very optimistic. 4.59

The reasons for lower roller compacted concrete placement are: 4.67

- 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. 4.84

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 4.98

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

Final Target Outturn Cost.

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 Report[2] 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 cost and timeframe. 4.104

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 4.116

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

[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.

five years is expected to be on a smaller scale than a flood event that might happen once every twenty years.

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.

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

- the production rates adopted;
  - foundation excavation production rates;
  - roller compacted concrete production and placement rates;
- the likelihood of the following risks eventuating:
  - 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:
  - 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 5.57

project would cost '$145 million, with a possible upside cost of 50 – 70 % [approximately $250 m].'

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 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. 5.58

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

Auditee response

Icon Water Limited[4] (formerly ACTEW Corporation Limited); Chief Minister, Treasury and Economic Development Directorate; and the Chief Minister[5] (ACTEW Voting Shareholder) were provided with:

- a draft proposed report for comment. Comments received were considered and required changes were included in the final proposed report; and
- a final proposed report for further comment.

Sections of the draft and proposed final report were sent to other relevant entities as was considered appropriate.

The Bulk Water Alliance partners, Icon Water Limited (formerly ACTEW Corporation Limited), GHD and Lend Lease (formally Abigroup) and John Holland Group, provided a consolidated response:

The Bulk Water Alliance (BWA) was responsible for the delivery of a program of works comprising six projects, three of which are the subject of this audit. Two of the six projects – the construction of the enlarged Cotter Dam and the Murrumbidgee to Googong pipeline – were critical to achieving water security for the ACT, while the third - the Googong Dam Spillway upgrade - was essential to secure the long term safety of a major water supply asset.

The construction of the enlarged Cotter Dam was one of the most significant infrastructure projects in Canberra's history. The project increased Canberra's water storage capacity by 35% and provides water security for the next hundred years of ACT regional expansion. It was undertaken in the context of booming mining and resources sectors, the global financial crisis and a severe drought uniquely coupled with two of the wettest years in Canberra's recorded history.

The Cotter Dam is the highest dam of its type (Roller Compacted Concrete) in Australia, reaching to the equivalent of about 28 stories. Its construction required unique skills and practices, 24 hour a day production, careful consideration of environmental requirements and continuous management of the high level of risk to personal safety associated with the work. During construction a total of 2.5 million hours were worked by over 4000 project personnel working in temperatures ranging from -8 to 40 degrees. Their work was rain-affected on 246 days and their worksite was devastated by an extraordinary flood event in 2012, which followed smaller floods in 2010 and 2011.

[4] Including for communication with the Bulk Water Alliance Non-Owner Participants and other relevant entities.

[5] Including for communication with previous ACTEW Voting Shareholders.

The quality of the project has been recognised through the receipt of 10 industry awards. These included:

- two Engineering Excellence Awards
- two Institute of Public Works Engineering Australasia awards
- an Australian Water Association National Program Innovation Award
- an Environmental excellence award from the International Erosion Control Association Australasia.

All projects completed by the BWA provided lessons learned for the alliance partners, many of which are identified in this audit report. These are lessons that Icon Water is taking forward to its latest (though smaller) water infrastructure projects. Similarly, GHD is already applying construction lessons to overseas projects where there is a demand for improved dam aesthetics and John Holland has rolled out key safety initiatives from the project across the rest of its business. The work completed by this audit, along with the BWA's own Value for Money reports, ensures that those involved and others undertaking similar work have a detailed record of successes and lessons learned from these projects.

The BWA partners and their employees remain immensely proud of their involvement in this significant construction, achieved through collaboration and innovation. We are proud of the positive legacy the Cotter Dam project leaves for the people of Canberra and the surrounding areas. Most importantly, despite the huge safety challenges, the project was completed without loss or major injury, with all personnel returning safely home to their families.

1 INTRODUCTION

1.1 This chapter provides an overview of some of ACTEW's water infrastructure projects and the Bulk Water Alliance that was formed to deliver them. It also presents the audit objective, scope, criteria, approach and method.

1.2 A public interest disclosure was made under the *Public Interest Disclosure Act 2012* in relation to several issues associated with ACTEW, ACTEW Voting Shareholders and the Enlarged Cotter Dam. This performance audit examines issues raised in the public interest disclosure, including communication which is discussed in Chapter 5.

Water supply in the ACT

1.3 Icon Water Limited (Icon Water), formerly known as ACTEW Corporation Limited (ACTEW), provides water, sewerage and associated services in the ACT. Icon Water owns and operates the ACT's network of dams, water treatment plants, sewerage treatment plants, reservoirs, water and sewerage pumping stations, mains and other related infrastructure.[6] As Icon Water is a recent name change (launched on 4 May 2015) ACTEW, the name in use during the existence of the Bulk Water Alliance, is used in this report.

1.4 Between 1997 and 2009 south-eastern Australia experienced a significant drought. According to the South Eastern Australia Climate Initiative:

> Between 1997 and 2009 south-eastern Australia experienced the most persistent rainfall deficit since the start of the 20th century. Annual rainfall ... was 73 mm below average ... for the years 1997–2009 inclusive.[7]

1.5 The prolonged drought resulted in the implementation of water restrictions in the ACT for nearly eight years, from December 2002 to November 2010. Water restrictions have since been replaced by permanent water conservation measures.[8]

1.6 Notwithstanding the conservation measures that were implemented the 'Millennium Drought', as it was known, resulted in a significant decrease in water storage levels in the ACT. Figure 1-1 shows the ACT's water storage levels between 2000 and 2008.

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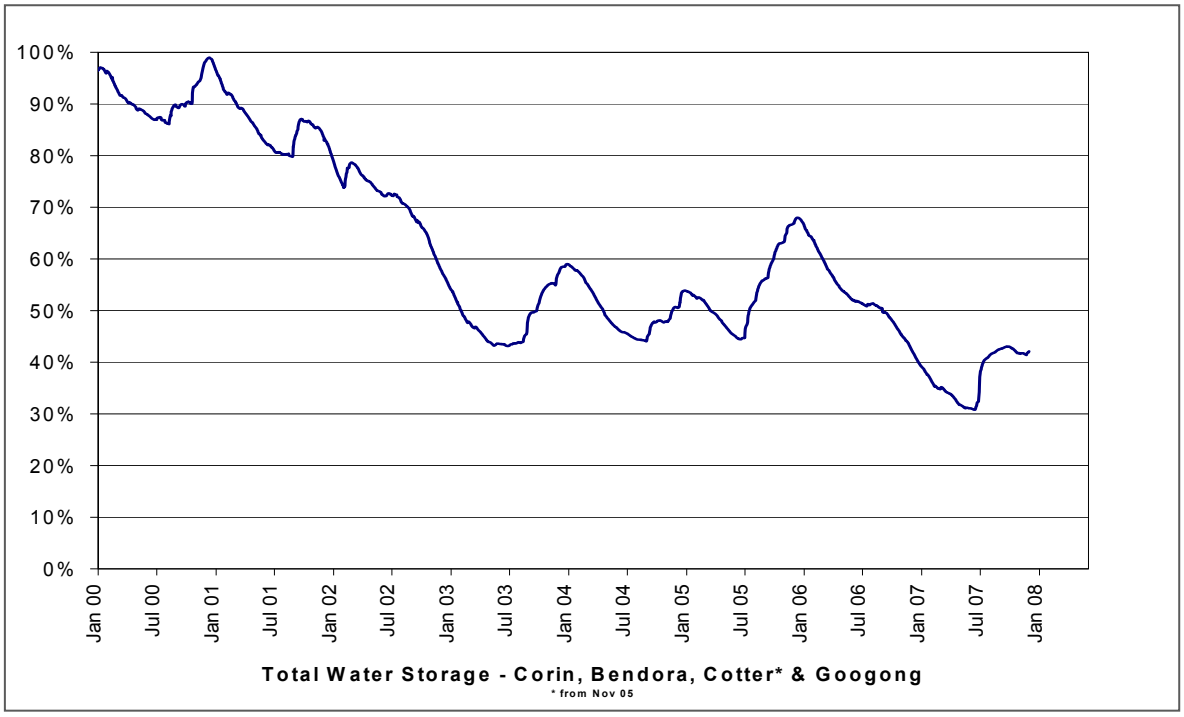
[6] Icon Water is a publicly owned, stand-alone water and sewerage utility, 50 percent owner in the energy business; ActewAGL is a publicly listed energy business (electricity and gas).

[7] South Eastern Australia Climate Initiative, The Millennium Drought and 2010/11 Floods, p 1. http://www.seaci.org/publications/documents/SEACI-2Reports/SEACI2_Factsheet2of4_WEB_110714.pdf

[8] The permanent measures allow sprinklers and other irrigation systems, including drip irrigation, to be used to water lawns and plants after 6 pm and before 9 am on any day. A hand-held hose fitted with a trigger nozzle, a bucket or a water or a watering can may be used to water lawns and plants at any time. http://www.bom.gov.au/water/restrictions/index.php?state=ACT&serviceAreaLabel=&restrictionName=&searchUsed=1 Accessed 12 December 2014

Figure 1-1 ACT water storage levels between 2000 and 2008



Source: ACTEW: BWA Presentation December 2007

1.7 In April 2004 ActewAGL, on behalf of ACTEW, released a report: *Options for the Next ACT Water Source*.[9] The report addressed 'options for a new water source for the ACT' and identified contingency planning in the event the drought continued. The report provided an initial assessment of various water supply augmentation options for the ACT, one of which was enlarging the existing Cotter Dam. Also in April 2004 the ACT Government released its *Think water, act water* strategy.[10] The strategy provided 'a framework for a partnership between the community and the government in managing, using and conserving the water resources of the region.' The strategy primarily focused on identifying measures to increase the efficiency of water usage in the ACT and also discussed possible water supply options for the ACT for the future, one of which was enlarging the existing Cotter Dam.

1.8 In 2004–2005, in order to address the ACT's access to water in the long term, ACTEW commenced the implementation of a series of measures to improve the security of the water supply. These included the development of the Mount Stromlo Water Treatment Plant and the restoration of the Cotter Pump Station. Notwithstanding the implementation of these initiatives, it was recognised that further measures were required to ensure long term water security for the ACT.

1.9 In July 2007 ACTEW published its *Water Security for the ACT and Region – Recommendations to the ACT Government* report.[11] The report made four recommendations to the ACT Government, three of which related to options for

[9] ActewAGL's Options for the Next ACT water source, April 2004
[10] Think water, act water, April 2004
[11] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation

increasing the supply of water in the ACT. These three recommendations sought the ACT Government's agreement for ACTEW to:

- commence the detailed planning and construction of an enlarged Cotter Dam;
- undertake necessary work to proceed to construction of a pumping capability near Angle Crossing (this option has since been known as the Murrumbidgee to Googong Pipeline); and
- obtain additional water from alternative water sources such as the transfer of water from the Tantangara Dam in New South Wales or from a water purification plant to be constructed in the ACT. (Further work was to be done by ACTEW in identifying which of these two options was preferred).[12]

1.10 In developing its recommendations, ACTEW reviewed ten individual supply options 'to further secure Canberra and the capital region's water supply'.[13] The proposal for enlarging the Cotter Dam was identified as 'providing the greatest economic benefit to the community'.[14]

1.11 In 2007 the ACT Government established the Water Security Taskforce and Water Security Taskforce Advisory Panel.[15] The Taskforce and its Advisory Panel were engaged by the ACT Government to provide advice on water security, specifically ACTEW's July 2007 *Water Security for the ACT and Region – Recommendations to the ACT Government* report.[16]

1.12 In September 2007 the Water Security Taskforce and Water Security Taskforce Advisory Panel produced a report, *Next Steps to Ensure Water Security for the ACT Region*, which broadly endorsed the three recommendations made by ACTEW in its *Water Security for the ACT and Region – Recommendations to the ACT Government* report. One exception related to the water purification plant; the Taskforce and Advisory Panel recommended that no further consideration be given to this option until further analysis was undertaken.

1.13 In October 2007, following the Water Security Taskforce and Water Security Taskforce Advisory Panel's review, the ACT Government announced a suite of measures aimed at providing water security for the ACT. The suite of measures announced by the ACT Government in 2007 included, among other things:

- the enlargement of the Cotter Dam from 4 gigalitres to 78 gigalitres; and
- the construction of the Murrumbidgee to Googong Pipeline.[17]

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[12] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation, p 2.
[13] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation, p 1.
[14] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation, pvii.
[15] The Auditor-General, Dr Maxine Cooper, was Chair of the Taskforce. The Taskforce, the Advisory Panel or their report have not been part of the audit and are included here as background information.
[16] Next Steps to Ensure Water Security for the ACT Region, Water Security Taskforce, Chief Minister's Department, September 2007, p iv.
[17] ACTEW, Report to ACT Government, Water Security – Major Projects, December 2008, p 2

The Bulk Water Alliance

1.14 ACTEW selected an alliance contracting arrangement, the Bulk Water Alliance, to deliver two of the water security projects. Initially the projects included were the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline. The Googong Dam Spillway was subsequently included in the Bulk Water Alliance's responsibilities.

1.15 According to the *National Alliance Contracting Guidelines: Guide to Alliance Contracting* (the Guide to Alliance Contracting):

> Alliance contracting is a method of procuring, and sometimes managing, major capital assets. Under an alliance contract, a state agency contractually works collaboratively with private sector parties to deliver the project.[18]

1.16 A key difference between an alliance contracting arrangement and a traditional procurement and contracting arrangement is the sharing of risks and opportunities. Under alliance contracting 'project risk management and outcomes are collectively shared by [project participants]'.[19] This contrasts with traditional procurement and contracting arrangements, founded on the traditional role of buyer and seller. Each '[builds] their own risk assessment into their price and stand(s) to win or lose if the risk outcome is higher or lower than predicted for each of them.'

1.17 The Bulk Water Alliance comprised:

- the owner - ACTEW; and
- Non-Owner Participants - GHD, the project designer and constructors, Abigroup and John Holland Group.

Projects

1.18 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:

- construction of two substantial earth embankment saddle dams adjacent to the main dam;
- upgrade of recreational facilities within the Cotter precinct, including Casuarina Sands and Cotter Avenue;
- construction of seven kilometres of artificial fish habitat using 52,500 tonnes of rock to provide a replacement habitat for a threatened species; and
- construction of a new walking trail and public viewing platform.

[18] Department of Treasury and Finance, Victorian Government, Alliance and traditional contracting (http://www.dtf.vic.gov.au/Infrastructure-Delivery/Alliance-and-traditional-contracting)
[19] National Alliancing Contracting Guidelines, p 10

1.19 The enlargement of the Cotter Dam, from 4 gigalitres to 78 gigalitres, increased the ACT's total water storage capacity by 35 percent.[20]

1.20 The Murrumbidgee to Googong Pipeline was intended to provide additional capacity and operational flexibility to ACTEW 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.[21]

1.21 The Googong Dam, on the Queanbeyan River in New South Wales, is one of the main water supply reservoirs for the ACT and surrounding region. After its construction in 1978 a series of relatively small flood events caused significant erosion of the rock in the unlined portion of the spillway chute. Work had been done to address the erosion and prevent further erosion but the dam's reliability with respect to flood mitigation was unknown. A flood of the significance for which it had been designed had not occurred since the work had been completed. While not increasing the available water supply this project was intended to ensure the structural integrity and functionality of the Googong Dam into the future.[22]

1.22 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 that this work was being taken to the market for tender ACTEW was planning the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects. ACTEW subsequently made a decision to include the Googong Dam Spillway project in the scope of the Bulk Water Alliance.[23]

1.23 An early part of any alliance's work is the development of a Target Outturn Cost. These are completed for each alliance project. Table 1-1 shows the development of the expected costs for the Enlarged Cotter Dam, as represented by the Target Outturn Cost (the cost associated with the Bulk Water Alliance) and Owner's costs (direct costs for ACTEW in delivering the project).

[20] Bulk Water Alliance, Value for Money report, p 4.
[21] http://www.actew.com.au/Community-and-Education/Our-projects/Murrumbidgee-to-Googong-Water-Transfer.aspx
[22] Googong Dam Spillway Project Completion Value for Money Report, Jan 2011 p5
[23] Googong Dam Spillway Project Completion Value for Money Report, Jan 2011

Table 1-1 Development of the Target Outturn Cost for the Enlarged Cotter Dam

Date	Stage	Target Outturn Cost ($ million)	Owner's costs ($ million)	Total expected cost ($ million)
April 2009	Draft Target Outturn Cost	325.0[24]	-	-
August 2009	Pre-Final Target Outturn Cost	310.9	-	-
September 2009	Final Target Outturn Cost	299.0	64.0	$363.0

Source: Audit Office analysis of ACTEW information

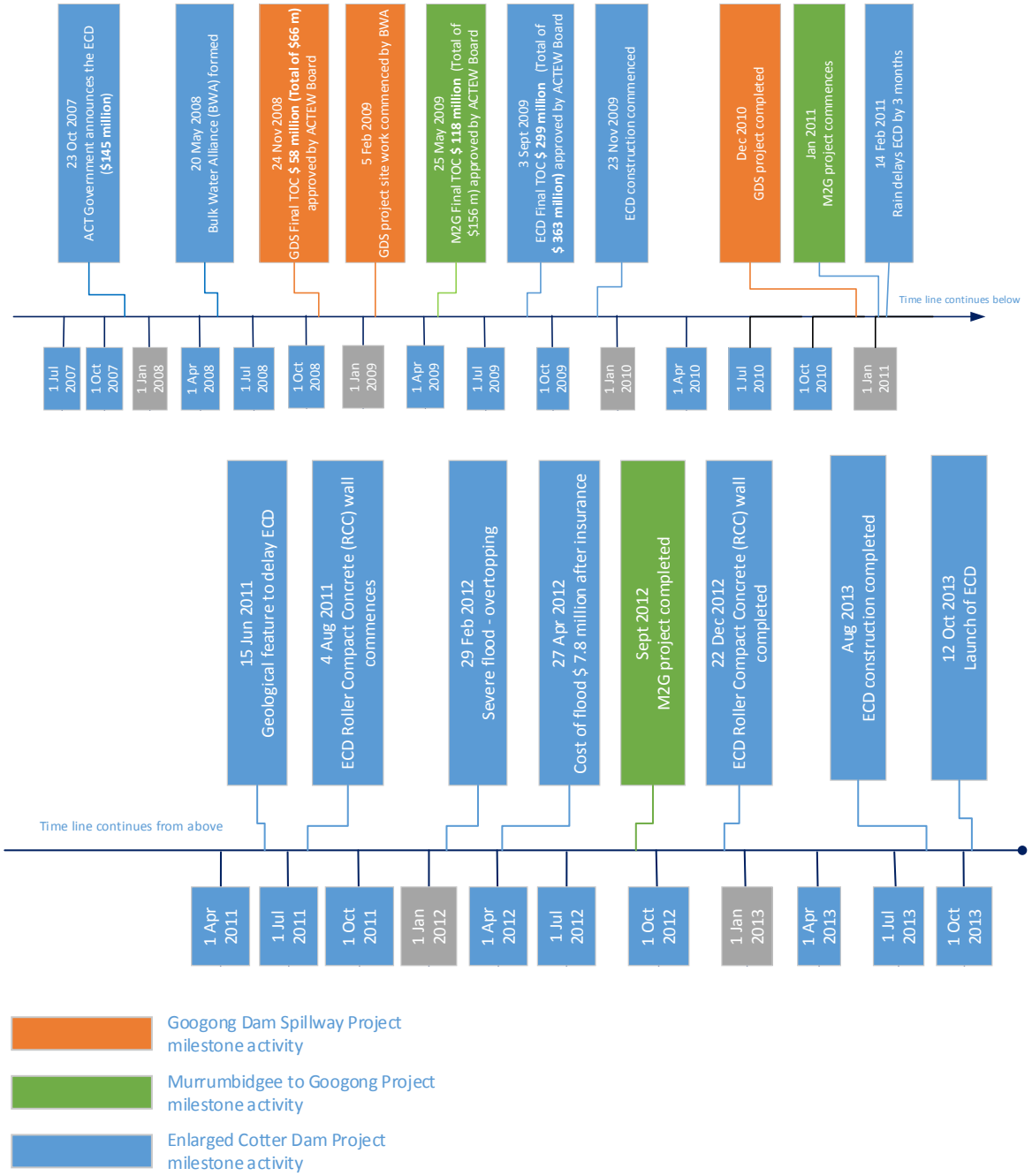
Note: Owner's costs were not estimated as part of the development of the Draft Target Outturn Cost and Pre-Final Target Outturn Cost.

1.24 The final cost of the Enlarged Cotter Dam is $410.5 million, which includes $356.2 million in Bulk Water Alliance costs and $54.3 million in ACTEW's direct costs.

1.25 Figure 1-2 shows the Enlarged Cotter Dam, Murrumbidgee to Googong Pipeline and Googong Dam Spillway milestones from July 2007 to October 2013.

[24] This included the alliance fee and excluded the quality pool.

Figure 1-2 Milestones of Bulk Water Alliance projects



Source: Audit Office analysis of ACTEW information. ECD: Enlarged Cotter Dam; GDS: Googong Dam Spillway; M2G: Murrumbidgee to Googong Pipeline; TOC: Target Outturn Cost.

Value for Money reports

1.26 The Bulk Water Alliance prepared a *Value for Money* report for each of the projects at its conclusion. The *Value for Money* reports seek to provide an assessment of the value for money achieved by the Bulk Water Alliance in delivering the projects. Each *Value for Money* report provides an overview of the project as well as information on the achievements and challenges associated with its delivery. The Value for Money Reports also seek to identify lessons learned.

Community Engagement

1.27 According to ACTEW's Annual Report ACTEW provided a community engagement program which allowed it to 'actively engage with the Canberra community on a range of water and sewerage matters'.[25] Table 1-2 shows an overview of the community engagement process undertaken by ACTEW regarding the Enlarged Cotter Dam.

Table 1-2 Community Engagement, consultation and education programs - Enlarged Cotter Dam

Consultation process	Groups or individuals consulted	Approx. Number consulted	Outcome
Community open days, site tours, community group talks, participation in conferences, stakeholders update publications, advertisements, YouTube documentaries, Twitter updates, website	ACT and Queanbeyan residents, visitors to the ACT, community groups, education institutions and online users	13,523	Raise awareness of water supply, water security, sustainability and conservation in Canberra

Source: ACTEW Annual Report 2013–14, p 17.

1.28 The *Enlarged Cotter Dam Value for Money Report* includes information on the Bulk Water Alliance's provision of information regarding the Enlarged Cotter Dam to the community through a range of community education and awareness activities that included:

- the Wonder of Water: The Cotter Dam Education Kit was provided to over 100 Canberra primary schools;
- Cotter Dam Discovery Trail educational tours were provided to engage education staff and students;
- Teacher Professional Development Workshops;
- tertiary and industry briefings;
- community open days - six open days including the official opening day;
- community presentations and briefings;
- Friends of the Cotter was established in response to community interest;
- the Heritage Archive Project - a collation of multimedia records of the ECD construction including photography, video, artworks and a book on the Cotter Heritage; and
- DamCam which provided online progress updates 24 hours a day.

[25] ACTEW Annual Report 2013–14, p 18.

Planning for the audit

Draft Performance Audit Program

1.29 An audit of ACTEW's management of capital works and infrastructure was identified in the Audit Office's 2013-14 Draft Performance Audit Program.

Public interest disclosure

1.30 In August 2013 a public interest disclosure was referred to the Audit Office from the Commissioner for Public Administration. The entity making the public interest disclosure made comments, some general and some specific, about issues associated with ACTEW and ACTEW Voting Shareholders regarding the Enlarged Cotter Dam; and communication regarding this project.

1.31 The Auditor-General considered that, by virtue of paragraph 20(g) of the *Public Interest Disclosure Act 2012*, a performance audit was the most appropriate means by which to deal with the issues raised. As an audit of ACTEW's management of capital works and infrastructure was already identified in the Draft Performance Audit Program the Auditor-General decided, on 21 August 2013, to conduct a performance audit in relation to the issues and advised the entity making the disclosure and other relevant stakeholders:

> The scope and objective of the audit is yet to be determined, however the audit, amongst other things, is likely to consider the actual cost of the project, the reasons for the increase in costs compared to budget estimates and communication of these issues.

1.32 The Audit Office sought to obtain further details of issues raised by the entity making the disclosure through discussions into early 2014. Initially, the Audit Office understood that the entity making the disclosure had specific concerns with respect to ACTEW's management of the Enlarged Cotter Dam project including ACTEW's budgeting for the project and its management of the delivery of the project. The Audit Office understood that a key concern was that the cost of the Enlarged Cotter Dam project was, therefore, higher than it should be. While concerns were raised there was a lack of detail regarding the concerns. The entity making the disclosure also indicated that they had concerns with ACTEW's management of other projects (although these concerns were not specified).

Development of objective, scope and criteria for the audit

1.33 Throughout late 2013 and early 2014 the audit objective and scope were developed. In August 2014 the audit objective, scope and criteria were finalised and communicated to ACTEW, as the auditee.

1.34 In mid October 2014 the entity making the disclosure was advised, during a meeting and via correspondence of the audit objective, scope and criteria. Noting that the scope of the audit focused on the Enlarged Cotter Dam project, the entity making the disclosure was asked to provide further information in relation to concerns about other projects managed by ACTEW. Further information in relation to these concerns was not provided.

1.35 The Audit Office was made aware by the entity making the disclosure that they were not satisfied with the coverage of the audit. In early November 2014, following further discussion with the entity making the disclosure, an additional audit criterion was added to the audit scope:

> … whether communication to stakeholders and the public, particularly on costs, was timely and reflected current estimates.

1.36 This criterion is the focus of Chapter 5 of this report.

Other issues and concerns

1.37 During a meeting in early November 2014, and in subsequent correspondence, the entity making the disclosure raised concerns with respect to other actions and activities associated with ACTEW (and ActewAGL) and its executive. In relation to some of these issues the entity making the disclosure was asked to provide further information to assist the Audit Office in identifying the issues of concern. In relation to some other issues the Audit Office offered to send relevant material to ACTEW and/or ActewAGL, without disclosing the identity of the entity making the disclosure, for the purpose of seeking further information in order to identify an appropriate way to proceed. The entity making the disclosure did not agree to this proposition.

1.38 The Audit Office has recently received correspondence (May 2015) from the legal representative of the entity making the disclosure. A response has invited details of issues to be provided so that they can be given appropriate consideration under the *Public Interest Disclosure Act 2012.*

Audit objective and scope

Objective

1.39 The objective of this audit is to provide an independent opinion to the Legislative Assembly on the effectiveness of ACTEW's management of its Bulk Water Alliance and the delivery of its associated infrastructure projects. This includes consideration of whether the governance and administrative arrangements of the Bulk Water Alliance have been appropriate and effective in assisting ACTEW to manage its financial and performance risks in the delivery of the Bulk Water Alliance projects.

Scope

1.40 The audit was focused on ACTEW's activities in participating in the Bulk Water Alliance for the delivery of the three major water infrastructure projects:

- the Enlarged Cotter Dam;
- the Murrumbidgee to Googong Pipeline; and
- the Googong Dam Spillway.

1.41 The scope of the audit included consideration of ACTEW's activities to manage and establish the alliance contracting arrangement, to manage costs and its communication with key stakeholders.

Out of scope

1.42 The audit did not include consideration of the appropriateness or otherwise of ACTEW, or ACT Government, decisions to proceed with the water infrastructure projects.

Audit criteria, approach and method

Audit criteria

1.43 The audit criteria included consideration of the:

Planning for the Bulk Water Alliance

Decision to proceed with the alliance contracting arrangement

- Decision-making roles and responsibilities:
  - with respect to deciding to proceed with the alliance contracting arrangements were clear and well-documented (ACTEW and/or the ACT Government); and
  - were appropriate and in accordance with identified governance arrangements (ACTEW and/or the ACT Government).
- Documentation associated with the decision to proceed with the alliance contracting arrangement included:
  - the preparation of sufficient information which was provided to decision-makers;
  - alternative procurement and contracting arrangements which were documented and considered; and
  - risks associated with the alliance contracting arrangements which were identified and documented.
- The decision to proceed with the alliance contracting arrangement was sound when considered against National Alliance Contracting Guidelines threshold considerations which include:
  - high project value;

  - sufficient internal resources are available within the project owner to manage the alliance contracting arrangement;
  - project risks cannot be adequately defined prior to tendering;
  - the cost of transferring risk is prohibitive in the prevailing market;
  - the project needs to start as early as possible before risks can be fully identified and/or the scope can be finalised;
  - the owner has valuable knowledge that necessitates ongoing direct involvement in the project; and
  - a collective approach to assessing and managing risk will produce a better outcome.

Establishment of the alliance contracting arrangement

- Roles and responsibilities for establishing and negotiating the alliance contracting arrangements were clear and well-documented (ACTEW); and
- There was an appropriate process for the selection of the alliance participants which included selection criteria that:
  - were appropriate for the alliance contracting arrangements; and
  - appropriately embodied cost and non-cost elements of the project, including capability and capacity.

Establishment and management of the Bulk Water Alliance

Establishment of the commercial framework and the Target Outturn Cost

- There was an appropriate process to establish the commercial framework for the alliance contracting arrangement, including the risk and reward regime which:
  - appropriately identified financial and technical risks associated with the water infrastructure projects; and
  - used these risks to develop and inform the commercial framework.
- There was an appropriate process to establish the Target Outturn Cost for the project which appropriately reflected the water infrastructure projects and was in the best interests of ACTEW and the ACT community.

ACTEW's management of the alliance contracting arrangement

- There was a clear identification of roles and responsibilities within ACTEW with respect to the management of, and interaction with, the alliance. This resulted in ACTEW effectively:
  - meeting its obligations under the alliance contracting arrangements; and
  - managing and monitoring the work of the other alliance participants through its role as the project owner.

Enlarged Cotter Dam project timing and budget

Financial performance of the alliance contracting arrangement

- Was there an appropriate process to identify and manage technical risks associated with the Enlarged Cotter Dam?
- What were the reasons for the apparent increase in the costs of the project(s), as compared to the Target Outturn Cost? Were these due to factors that:
  - were reasonably foreseeable at the commencement of the water infrastructure projects? and
  - could have reasonably been avoided?

Communication

- Communication regarding costs and timing of the project including ACTEW's provision of information with respect to cost and time to key stakeholders (including the public).

Audit approach and method

1.44 The audit adopted the Audit Office's Performance Audit Methods and Practices and related Policies, Practice Statements and Guidance Papers. These policies and practices have been designed to comply with the requirements of the *Auditor-General Act 1996* and relevant professional standards (including *ASAE 3500 – Performance Engagements*).

1.45 The audit process included:

- Interviews and discussions with key staff in:
  - ACTEW and ActewAGL;
  - Chief Minister, Treasury and Economic Development Directorate; and
  - other ACT Government agencies and stakeholders, as required.
- Interviews and discussions with key project staff in the Bulk Water Alliance, including representatives from ACTEW and the other Bulk Water Alliance participants (GHD, John Holland Group and Abigroup);
- A review of relevant documentation and project information associated with the delivery of the water infrastructure projects. This included:
  - ACTEW governance documentation such as Board papers; and
  - Bulk Water Alliance project documentation and information including financial records;
- The engagement of KPMG and Entura[26] to provide advice with respect to alliance contracting and civil engineering and construction respectively; and

[26] Entura is the trading name for the Hydro-Electric Corporation, Tasmania.

- A draft proposed report and a final proposed report was provided to the auditee (ACTEW), the Chief Minister, Treasury and Economic Development Directorate and the Chief Minister (as a Voting Shareholder and to arrange for previous ministerial Voting Shareholders to consider if necessary) for consideration and comment.

1.46 Standard APES 320 requires that an audit considers events up to the date of the report. To achieve this, when seeking comments on the draft report, the Audit Office asked Icon Water to inform it of any significant events affecting audit findings since fieldwork ceased.

Auditee and stakeholder assistance

1.47 The Audit Office acknowledges the assistance of ACTEW and the Bulk Water Alliance Non-Owner Participants in the conduct of the audit, including GHD, Abigroup and John Holland Group. This assistance included providing information, participating in interviews and discussions and facilitating site visits to the projects considered as part of the audit.

Compliance with applicable Australian Auditing Standards and professional ethical pronouncements

1.48 Applicable requirements of Australian Auditing Standards and professional ethical pronouncements, including those relating to independence, were followed in the conduct of this audit.

1.49 The following paragraph draws attention to matters that were considered in assessing the independence of the Auditor-General, Dr Maxine Cooper, in relation to the matters considered during the audit.

1.50 Dr Maxine Cooper previously chaired the Water Security Taskforce which advised the ACT Government on ACTEW's July 2007 *Water Security for the ACT and Region – Recommendations to the ACT Government* report[27] (refer to paragraphs 1.11 and 1.12). This work has not been audited and is provided as background.

1.51 As stated in paragraph 1.45 Entura was engaged to provide civil engineering and construction expertise for this audit. While Entura consultants did provide services to GHD, these were not the same consultants who provided advice for this audit. ACTEW was consulted and advised that it was 'comfortable with the appointment of Entura as [a subject matter expert] for the performance audit of water infrastructure projects'.

[27] Next Steps to Ensure Water Security for the ACT Region, Water Security Taskforce, Chief Minister's Department, September 2007, p iv.

2 PLANNING FOR THE BULK WATER ALLIANCE

2.1 This chapter discusses the effectiveness of ACTEW's planning processes that led to the selection of the alliance procurement model for the Enlarged Cotter Dam, Murrumbidgee to Googong Pipeline and Googong Dam Spillway projects.

Summary

Conclusions

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 Practioners' Guide*.

Key findings

	Paragraph
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	2.33

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.

2.36 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:

- 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.

2.49 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.

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

2.53 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.

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 2.82

design and construction, roller compacted concreting, excavation and mechanical and electrical engineering.

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

Alliance contracting

2.2 Alliance contracting is a form of procurement used for the delivery of major infrastructure projects. According to the *National Alliance Contracting Guidelines: Guide to Alliance Contracting* (the Guide to Alliance Contracting[28]) alliance contracting involves 'delivering major capital assets, where a public sector agency (the Owner) works collaboratively with private sector parties (Non-Owner Participants)'. The Guide to Alliance Contracting states:

> All Participants are required to work together in good faith, acting with integrity and making best-for-project decisions. Working as an integrated, collaborative team, they make unanimous decisions on all key project delivery issues. The alliance structure capitalises on the relationships between the Participants, removes organisational barriers and encourages effective integration with the Owner. [29]

2.3 Alliances are based on the concept that all parties work together to achieve the best outcome for the project, rather than in competition, when each party works to ensure their own interests and profits.

Risk Management

2.4 A key difference between an alliance contract and a traditional contracting arrangement is the sharing of risks and opportunities. Under alliance contracting arrangements 'project risk management and outcomes are collectively shared by [project participants].'[30]Alliance agreements are therefore based on the joint management of risk and opportunity for project delivery. All participants in an alliance should jointly manage the risk within the terms of the 'alliance agreement' and share the outcomes of the project.

[28] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 9.
[29] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 9.
[30] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 10.

2.5 The Guide to Alliance Contracting states:

> … in alliancing, all project risk management and outcomes are collectively shared by the Participants. In more traditional methods of risk allocation, specific risks are allocated to Participants who are individually responsible for best managing the risk and bearing the risk outcome. This concept of collective risk sharing provides the foundation for the characteristics that underpin alliance contracting including collaboration, making best-for-project decisions and innovation. If substantial and significant risk is allocated to individual Participants, then it may not be an alliance and these characteristics may not be necessarily required or appropriate.[31]

2.6 Traditional procurement works on the principle of one party (the seller) providing a service or an asset to another party (the buyer). This is an implicitly competitive process. The requirements and terms of what the buyer is seeking are often detailed in a Request for Tender to which the seller responds with an offer of a solution (a Tender response). Each party is working to maximise their profit and minimise their risk.

2.7 In an alliance contracting arrangement '[t]he resulting contract encompasses both the requirement and the offer and allows variations to these to be made as the work progresses, as per the agreed risk allocation model and Commercial Framework.'[32]

2.8 Table 2-1 shows the key features of alliance contracting, derived from the Guide to Alliance Contracting.

[31] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 9.

[32] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 11.

Table 2-1 Key features of alliance contracting[33]

Risk and opportunity sharing.	The Owner and the Non-Owner Participants collaborate to solve problems, deliver the project successfully and so share the risks and rewards.
A commitment to 'no disputes'.	Alliance contracts generally include a no dispute mechanism whereby participants agree not to litigate, except in limited circumstances.
A best-for-project, unanimous decision-making processes.	Participants are expected to direct their decisions towards the collective vision and objectives of the alliance, rather than their own self interests or the commercial interests of their employer.
A no fault-no blame culture.	In case of errors, mistakes or poor performance under the alliance contract there is an expectation that the participants will not attempt to assign blame but will accept joint responsibility and the consequences and agree on a remedy or solution which is best-for-project.
Good faith.	Participants are expected to operate in good faith and comply with reasonable standards of conduct with regards to the interests of other participants.
Transparency expressed as open book documentation and reporting.	Participants are expected to fully document their involvement in the project and commit to an 'open book' arrangement that grants broad mutual access and audit rights, to ensure that costs that are reimbursed to the Non-Owner Participants under the remuneration framework have been actually and reasonably incurred. According to the Guide to Alliance Contracting 'each Participant should grant the Owner, and other public sector bodies, like the Auditor General's Office, full access and audit rights to any information, analysis and methodology related to the documentation prepared for the project'.
A joint management structure.	Each participant in the alliance is expected to have representation on all governance, management and administrative groups associated with the project.

Source: Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011.

ACTEW's selection of alliance contracting for the water security projects

2.9 From August to November 2007 ACTEW investigated options for, and decided upon, the contracting model for the selected water security projects.

[33] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011. p 15-22.

Transaction advice

2.10 To assist in preparing advice for the ACTEW Board with respect to the selected water security projects, ACTEW engaged a firm to be the transaction advisor. The role of the transaction advisor was to provide advice with respect to choosing and developing a procurement strategy and procurement process for the Enlarged Cotter Dam and the Murrumbidgee to Googong Pipeline in the event that the Government decided to proceed with these projects.

2.11 On 7 August 2007 ACTEW held a Procurement Strategy Workshop, facilitated by the transaction adviser, to 'identify the most suitable procurement strategy for the Enlarged Cotter Dam project'. Seven procurement strategies were identified for consideration including:

- Design.Bid.Build;
- Engineering, Procurement and Construction Management (EPCM);
- Alliance;
- Managing Contractor;
- Design.Build;
- Progressive Engagement Design Build; and
- Design, Build, Finance and Operate (DBFO).[34]

2.12 These procurement strategies were evaluated against a number of objectives and issues using a model provided by the transaction adviser - the 3DM Model. The 3DM model is a tool which facilitates the selection of a procurement method for a project by comparing the project's objectives with possible procurement strategies.[35] It assists in the selection of the most appropriate form of contract for a particular project in order to achieve the best value for money. There have been a number of versions of the model developed, including Version 4, which was specifically developed for considering the construction of dams and dam upgrades. Version 4.1 was used for the selection of the contract for the Enlarged Cotter Dam.

2.13 The 3DM Model focuses on project objectives but does not consider organisational readiness or the skills and/or competencies of an agency's staff in managing the alternative procurement strategies. Therefore, in applying it to ACTEW, the characteristics that are required to achieve collaboration in alliance contracting were not considered. This put ACTEW at risk of entering into an alliance without consideration and recognition of the necessary organisational resources that may have been required.

[34] ITN, Project Delivery Strategy for Enlarged Cotter Dam, August 2007, p 10.
[35] Davis. J, McEvoy. J, The 3DM Model – A delivery method selection methodology, http://www.aquaprojects.com.au/documents/3DMVer4.0DFeb06intro.pdf accessed March 2015.

2.14 The application of the 3DM Model process resulted in the transaction advisor recommending an alliance as the best procurement and project delivery method for the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects[36] with the following variants:

- Enlarged Cotter Dam - the conventional alliance model was recommended, using a two step tender process, where the designer would be evaluated and appointed independently of the constructor; and
- Murrumbidgee to Googong Pipeline – the conventional alliance model with a competitive Target Outturn Cost[37] (refer to Table 2-3) process was recommended.

2.15 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.

ACTEW Board decision-making

2.16 On 29 August 2007 a decision paper was presented to the ACTEW Board in relation to the various infrastructure projects. The decision paper recommended that the Board approve, among other things, the commencement of '... work on a progressive alliance for procuring the Enlarged Cotter Dam ...' The decision paper provided detail on the proposed alliance:

> … a 'conventional Project Alliance model, based on a Progressive Engagement Design-Build scope of work...to be conducted as a two-step tender process; with the dam designer being selected first, and then providing technical assistance in the subsequent selection of the construction partner'.

2.17 At this meeting the Board agreed that ACTEW commence work on a progressive alliance in relation to the Enlarged Cotter Dam. In doing so, however, the Board requested that the ACTEW Managing Director 'advise the Government that ACTEW will progress preparatory work pending the Government's decision on the recommended water security projects, stressing that this in no way pre-empts any decisions to be made by the Government.'

2.18 On 4 October 2007 the ACTEW Board was provided with another decision paper which recommended that the Board agree to commence work on 'a progressive alliance for procuring the Enlarged Cotter Dam' and 'a competitive alliance for procuring the Murrumbidgee River transfer proposal' (the Murrumbidgee to Googong Pipeline). The Board agreed to these recommendations. (It is unclear why a second recommendation was put forward in relation to progressing the Bulk Water Alliance for the Enlarged Cotter Dam following the Board's agreement to this at the meeting of 29 August 2007).

[36] The GDS was not part of the Bulk Water Alliance at that time.

[37] A competitive Target Outturn Cost may use a combination of cost and non-cost evaluation criteria. Subsequent to short listing proponents each proponent develops a TOC. The combination of cost and non-cost criteria means that the proponent with the lowest cost may not demonstrate the desired behavioural attributes and, therefore, may not be successful.

2.19 On 23 October 2007 the ACT Government announced its decision to proceed with a number of projects including the Enlarged Cotter Dam and the Murrumbidgee to Googong Pipeline 'in response to ACTEW's recommendations for securing the ACT's water supply'.[38]

2.20 On 8 November 2007 the ACTEW Board decided to:

> ... approve the combining of the Enlarged Cotter Dam and Murrumbidgee to Googong Transfer projects for delivery under a single alliance agreement, and for this alliance to also be given the responsibility for the delivery of the Googong Dam Spillway Rock Protection project [the Googong Dam Spillway].

2.21 At that meeting the Board decided on a two step tender process for the Enlarged Cotter Dam and the Murrumbidgee to Googong Pipeline rather than using a competitive Target Outturn Cost process for the Murrumbidgee to Googong Pipeline.

2.22 The Board paper identified key benefits associated with combining the projects in a single alliance as:

- market attractiveness - 'repackaging for the delivery of the 'Bulk Water Program Alliance' will improve the attractiveness of that package to potential alliance partners, which is an important risk mitigation in a market which is very constrained, particularly with respect to human resources';
- project costs - 'it is considered that there will be an overall cost savings by having a single alliance delivering the project package described above due to the reduction in procurement costs, establishment costs and projects overheads. There is also a saving in financial costs and human resources through the optimisation of ACTEW/ActewAGL resource inputs in servicing only a single alliance'; and
- timing - 'the combining of the two key Water Security Program projects [the Enlarged Cotter Dam project and the Murrumbidgee to Googong Pipeline] is estimated to allow an earlier delivery date for the [Murrumbidgee to Googong Pipeline] project by approximately 2 to 3 months without having any detrimental effect on the Enlarged Cotter Dam project.'

2.23 The Board paper noted, however, that 'the planned commencement of work on the [Googong Dam Spillway] will be delayed by about 3 months. However, any resultant delay in the completion of the project under the proposed alliance will not be material.'

[38] ACT Government Media Release, 23 October 2007, Enlarged Cotter Dam, Murrumbidgee extraction and pilot purification plant highlights of water plan. (The GDS was not included at this point.)

2.24 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.

Improving the market attractiveness of the projects

2.25 A key reason stated in the 8 November 2007 ACTEW Board paper for combining the three projects in a single program alliance was to 'improve the attractiveness of that package to potential alliance partners, which is an important risk mitigation in a market which is very constrained, particularly with respect to human resources.' This was based on advice from the transaction adviser, who had conducted industry surveys.

2.26 Other independent studies performed to assess the effectiveness of project alliances also provide insight into this issue. For example, a 2011 study similarly concluded that project alliances provide contractors with a good incentive to attract and retain good quality staff.[39]

2.27 However, the advice from the transaction advisor was inconsistent with an independent study undertaken in July 2007 by Rider Levett Bucknall, commissioned by ACTEW to conduct an assessment of the Enlarged Cotter Dam cost estimates. Rider Levett Bucknall conducted industry interviews to gauge the effect the project would have on the local, Australian and international labour markets with respect to the cost of labour. These interviews revealed that there was keen interest in the Enlarged Cotter Dam and each consortium and individual contractor interviewed

2.28 indicated that they had sufficient capacity to perform the project. This information was not included in the Board paper, notwithstanding that the Rider Levett Bucknall review had been published by ACTEW.[40]

Maximising project efficiencies and reducing overall costs

2.29 A key reason stated in the 8 November 2007 ACTEW Board paper for combining the three projects in a single program alliance was opportunities for overall cost savings, due to the reduction in procurement costs, establishment costs and projects overheads, and the optimisation of ACTEW/ActewAGL resource inputs in servicing only a single alliance. Information on the management of the Bulk Water Alliance, including governance and administrative arrangements and associated processes, is discussed in Chapter 3 of this report.

[39] Walker, D. H. T. and Lloyd-Walker, B. M. (2011), "The Ambience of Project Alliances in Australia", Hobbs B (ed), IRNOP2011 Research Conference - The Expanding Domain of Project Research, Montreal, Quebec, June 19-22, 22.
[40] ACTEW Corporation: Rider, Levett, Bucknall, Enlarged Cotter Dam – Cost Estimates Review, July 2007, p 23.

2.30 Each of the three projects was managed independently of the others with each project having its own project team and associated representatives from each of the Non-Owner Participants and ACTEW (as the Owner). This limited the opportunity for collaboration between the projects from a procurement, design and/or construction management and delivery perspective. However, at the completion of the Googong Dam Spillway in December 2010 the design manager, senior site supervisory staff, construction managers and ultimately the project manager transitioned to the Enlarged Cotter Dam (commenced in November 2009). ACTEW advised that:

> The transition of these key staff between the projects meant there was significant opportunity for collaboration and knowledge sharing in regard to design and construction management and delivery.

2.31 Stakeholders consulted during the audit advised that overall project efficiencies from the Bulk Water Alliance were gained through:

- the use of common governance arrangements, IT system and safety system;
- the use of the same geotechnical expertise for each project (one contract), one quality assurance system and one environmental management system; and
- opportunities to identify and use key personnel or experts, as well as subcontractors, where needed across the projects.

2.32 A key means by which greater efficiencies could have been achieved for the three projects was through built-in financial incentives which would have applied across the program. However, each project had its own separate Target Outturn Cost, gain-share/pain-share arrangement and quality pool. This is discussed further in Chapter 3.

2.33 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.

The Guide to Alliance Contracting

2.34 The Guide to Alliance Contracting identifies projects which are most suited to alliance contacting are those which:

- satisfy threshold issues:
  - project value: alliance projects are generally not appropriate for simple procurement projects of less than $50 million; and
  - resourcing: the Owner has sufficient internal resources to effectively represent and manage the external parties and the contract.[41]

and

- have one or more of the following characteristics:
  - the project has risks that cannot be adequately defined or dimensioned in the Business Case, nor during subsequent work, prior to tendering;
  - the cost of transferring risks is prohibitive in the prevailing market conditions;
  - the project needs to start as early as possible before the risks can be fully identified, and/or project scope can be finalised, and the owner is prepared to take the commercial risk of a suboptimal price outcome;
  - the owner has superior knowledge, skills, preference and capacity to influence or participate in the development and delivery of the project (including, for example, in the development of the design solution and construction method); and/or
  - a collective approach to assessing and managing risk will produce a better outcome, e.g. where the preservation of safety to the public/project is best served through the collaboration of an alliance. [42]

2.35 Table 2-2 shows an assessment of the suitability of the Enlarged Cotter Dam against the criteria identified in the Guide to Alliance Contracting, published as a national guide in July 2011.

[41] National Alliance Contracting Guidelines, Guidelines to Alliance Contracting July 2011, Australian Government Department of Infrastructure and Transport, p42.
[42] National Alliance Contracting Guidelines, Guidelines to Alliance Contracting July 2011, Australian Government Department of Infrastructure and Transport, p42.

Table 2-2 Assessment of the suitability of the Enlarged Cotter Dam against criteria identified in the Guide to Alliance Contracting[43]

Guide to Alliance Contracting	Bulk Water Alliance assessment
Project risks cannot be dimensioned.	The uncertainty around some risks for the Enlarged Cotter Dam were a sound reason for the choice of an alliance by ACTEW.
The cost of transferring risk is prohibitive.	The use of an alliance model by ACTEW was a sound option as the ability to share the Enlarged Cotter Dam risk between the Owner and the Non-Owner Participants, given the inherent uncertainty associated with some risks, may have resulted in a reduced cost to the Owner.
Urgent project start is required.	The choice of an alliance was not incompatible with the need for an urgent project start. While the transaction advisor had advised that alternative procurement models would have also achieved the overall program objective, the choice of an alliance as the project methodology was sound as it allowed for the commencement of the Enlarged Cotter Dam as soon as possible.
The Owner has valuable knowledge, skills and capacities.	The use of an alliance model was a sound option as ACTEW staff could be involved in the design stage, would have ongoing management of the Enlarged Cotter Dam and could manage the community consultation and education programs.

Source: KPMG analysis of ACTEW information for the Audit Office

2.36 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:

- 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.

2.37 In relation to the Enlarged Cotter Dam the Halcrow report similarly identified:

> ... the process for the selection of a project delivery methodology was systematic and rigorous. The project delivery methodologies under consideration were broad ranging and inclusive of those commonly utilised by similar agencies. Likewise, the objectives and issues used to evaluate the project delivery methodologies are those of common concern to similar agencies for the delivery of substantial infrastructure projects.[44]

[43] National Alliance Contracting Guidelines, Guidelines to Alliance Contracting July 2011, Australian Government Department of Infrastructure and Transport.

[44] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p74

Inclusion of the Googong Dam Spillway

2.38 The inclusion of the Googong Dam Spillway in the Bulk Water Alliance was agreed to by the Board at its meeting on 8 November 2007 (refer to paragraph 2.20).

2.39 The analysis developed to support the inclusion of the Googong Dam Spillway project in the Bulk Water Alliance was not comprehensive. Accordingly, the analysis presented to the Board to support its decision to include the Googong Dam Spillway was limited. A general argument was made in the Board paper that there would be overall cost savings (refer to paragraph 2.22).

2.40 At the time (8 November 2007) that the Board agreed to include the Googong Dam Spillway in the Bulk Water Alliance preliminary work for the project had been undertaken by ACTEW and expressions of interest for undertaking the project had been sought, with a closing date of 13 November 2007. Some of the expected savings in procurement and establishment costs would therefore not be achieved as it was further progressed than the other two projects. At the time it was included it was in the procurement phase; incorporating it in the Bulk Water Alliance delayed the start of construction by at least three months. The technical design was being managed by GHD (a Non-Owner Participant) and SMEC.

2.41 KPMG advised:

> ... the [Googong Dam Spillway] project had already been advertised in the market and was being procured using a 'Schedule of Rates' contracting method. The benefit of combining this project into the program alliance is unclear given that this would result in changing the project delivery method and delaying the project by an expected three months. Furthermore, the design of the project was substantially complete and ...(the two shortlisted designers for the [Bulk Water Alliance]) were both involved in the project's design. Furthermore, the benefits of including the [Googong Dam Spillway] project in the [Bulk Water Alliance] were not clearly documented. This is because:
>
> - the detailed design had been completed; and
> - the procurement activities for the project had been initiated.

2.42 There was also a higher degree of project design and construction certainty with respect to the Googong Dam Spillway compared to the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline. The Googong Dam Spillway involved remediation works including repairing eroded sections, extending the walls and improving the structural integrity of the spillway, originally constructed in 1978.

2.43 The primary reason for incorporating the Googong Dam Spillway into the Bulk Water Alliance was to improve the alliance's market attractiveness. At the time it was included it was in the procurement phase and incorporating it in the Bulk Water Alliance delayed the start of construction by at least three months. While suitable Non-Owner Participants were found, which may or may not be attributable to the inclusion of the project in the Bulk Water Alliance, there is no evidence as to whether including the Googong Dam

Spillway in the Bulk Water Alliance resulted in a better outcome for that project than if it had been delivered through a traditional form of contract.

2.44 The Enlarged Cotter Dam, Murrumbidgee to Googong Pipeline and Googong Dam Spillway were combined by ACTEW into a single program alliance delivery model in order to:

- improve the market attractiveness of the projects to potential alliance participants, particularly from a human resources perspective; and
- reduce the overall cost of delivering each project individually with the aim of:
  - maximising the efficiency of ACTEW resources to manage a number of projects collectively rather than individually;
  - improving the efficiency of project delivery through reduced administration; and
  - reducing overall construction costs through obtaining efficiencies.

Selection of Bulk Water Alliance Non-Owner Participants

2.45 Selecting Non-Owner Participants is a critical step in the formation of a successful alliance in order to realise the collaborative, performance based nature of the alliance contracting model. There is no industry standard for selecting Non-Owner Participants and the process should be tailored for each alliance based on the:

- nature of the activities to be performed and the risks associated with the project;
- preferences of the Owner taking into consideration the objectives for using an alliance model, the organisation's procurement policies and procedures and/or the Owner's risk appetite; and
- alliance model adopted.

Program versus project alliance

2.46 The Bulk Water Alliance is a program alliance, defined in the Victorian Department of Treasury and Finance Guide[45] as:

- incorporating multiple projects under a single alliance framework;
- possibly having unspecified number, scope and duration of projects;
- having the same alliance participants potentially delivering all projects;
- usually having longer terms, in the order of 5-10 years; and
- having economies of scale and resulting efficiencies.

2.47 There are differences in delivering multiple projects in a single program alliance as opposed to delivering individual projects through separate alliances.

[45] Department of Treasury and Finance, Victoria, In Pursuit of Additional Value, October 2009, Page 6.

2.48 Accordingly, the process to select the preferred participants for the Bulk Water Alliance, a single program alliance for three projects, should have taken into consideration the differences in undertaking and managing a program alliance as opposed to individual project alliances. However, KPMG advised that there was limited:

> … emphasis on the respondent's experience in delivering and/or managing program alliances (e.g. efficiency through procurement and management practices). This is highlighted in the Request for Proposal document which listed the categories of KPIs. There were none from a 'program alliance' perspective;
>
> reference in the selection criteria for assessing the individuals nominated in each respondent's bid on previous experience in program alliances; and
>
> reference in the methodology requirements for the respondents to provide their methodology for managing a program of projects. The methodology was focused on individual projects.
>
> The value of undertaking a program alliance did not appear to have been a major consideration in the formation of the Bulk Water Alliance.

2.49 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.

2.50 Through combining three projects into a single program the Bulk Water Alliance was exposed to the varied commercial and technical risks of each project. Therefore, the commercial framework for the Bulk Water Alliance had to be flexible and able to adapt to different risks associated with each individual project and provide adequate protection to the participants from a commercial and risk perspective. The process to establish the commercial framework for the Bulk Water Alliance included an assessment of risks of water infrastructure projects and the alliance contracting model.

2.51 Other matters that could have been considered when deciding on a program alliance include:

- suitability of each project for being delivered under a non-competitive alliance commercial framework: due to the distinct differences in each project it would have been expected that the risks and opportunities would have been documented for undertaking each project, using a consistent commercial framework, when previously each project was being delivered using a different procurement method. (i.e. competitive alliance versus non-competitive alliance);
- organisational control and management: additional coordination and management effort required to manage a program alliance versus the efficiencies expected to be gained;
- owner resourcing: whether the organisation had the requisite level of experience to manage a 'program' alliance versus individual project alliances;

- program/portfolio versus project management risks;
- impact on local construction industry participants: due to the increased size of the overall program local construction industry participants may not have had the technical and/or financial capacity to tender for the overall program; they may have tendered for the smaller projects which were incorporated into the program alliance;
- construction production rates and materials costs: through establishing a program of activities the cost of procuring similar materials and managing construction activities should have resulted in efficiencies;
- management control and operations: the cost of adding additional management/ control into the delivery model for each project (the additional cost associated with delivering a project using an alliance contracting model versus the reduced cost associated with managing a lump sum contract such as contractual disputes);
- innovation and collaboration: how the program alliance could provide the agency with increased control over important non-cost elements. These included Owner input and stakeholder management, innovation capture and knowledge transfer between Owner, designer and constructor; and
- knowledge transfer: there was an opportunity for the Owner to derive benefits through the transfer of knowledge and resources across the program. This would have improved:
  - contracting strategies with key suppliers to achieve economies of scale;
  - management systems for managing design and construction activities in a consistent manner to produce efficiencies; and
  - stakeholder interface management.

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

2.53 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.

Price selection processes for alliance Non-Owner Participants

2.54 There are two different pricing approaches (Table 2-3) that may be adopted when selecting Non-Owner Participants:

- a non-price selection/single Target Outturn Cost process; or
- a price selection/multiple (competitive) Target Outturn Cost process.

Table 2-3 Selection approaches for alliance Non-Owner Participants

Approach	Description
Non-price selection/ single Target Outturn Cost process	The selection of alliance partners is based on non-cost evaluation criteria. The evaluation process involves the following: • financial establishment audit to check the business systems, establish the rates for payroll on-costs and check the margins tendered against the historic financial results of the organisation; • workshops between the owner and prospective alliance partner(s) to evaluate the behavioural attributes of the team and to determine whether the nominated individuals will be able to work in a collaborative team environment; • technical evaluation of the skills and attributes of each individual nominated in key positions; • assessment of the nominated respondent's departures to the terms of the draft alliance agreement; • assessment of the nominated fees of the respondent; and • financial capacity check of the respondent.
Price selection/ multiple (competitive) Target Outturn Cost process	The selection of alliance partners may use a combination of cost and non-cost evaluation criteria. This is determined by the Owner's priority between cost and non-cost outcomes. The approach may be similar to that adopted for single Target Outturn Cost approaches (i.e. establishment audit, workshops, technical evaluation). Subsequent to short listing proponents, each proponent would then develop a Target Outturn Cost. Due to the combination of cost and non-cost criteria the proponent with the lowest cost may not demonstrate the desired behavioural attributes and therefore, may not be the successful proponent.

Source: KPMG analysis for the Audit Office

2.55 The decision to select the preferred Non-Owner Participants using a non-price selection method was agreed by the ACTEW Board in February 2008 and April 2008 as part of approving the establishment of the Bulk Water Alliance. The key reasons nominated in the Board papers for selecting a non-price selection process were consistent with published guidelines for alliance contracting. These reasons included:[46]

- technical and complex design;
- schedule risks;
- involvement of owner team in the development of the design;
- criticality of engagement with community stakeholders; and
- limited owner time and resources to manage two competing teams, required in a price evaluation process.

2.56 The method for selecting the Non-Owner Participants for an alliance should be dependent on the risks associated with the project(s), the preferred approach to developing the Target Outturn Cost and the Owner's procurement policy requirements. There were two methods identified for the projects in the Bulk Water Alliance:

- the non-price selection/single Target Outturn Cost process (Enlarged Cotter Dam project); and
- the price selection/multiple (competitive) Target Outturn Cost process (Murrumbidgee to Googong Pipeline before it was incorporated into the Bulk Water Alliance).

2.57 As noted in paragraph 2.40 the Googong Dam Spillway project was well-advanced in terms of understanding of the project and its requirements when the ACTEW Board made a decision to incorporate the project in the Bulk Water Alliance.

2.58 The non-price selection/single Target Outturn Cost process approach adopted by ACTEW to select the alliance partners for the Enlarged Cotter Dam[47] accords with guidance in the *Project Alliancing Practitioners' Guide* [48] for projects/programs that have similar characteristics to the Enlarged Cotter Dam.

2.59 The non-price selection/single Target Outturn Cost process, used for the Enlarged Cotter Dam, is based on non-cost evaluation criteria. The price selection/multiple (competitive) Target Outturn Cost process may use a combination of cost and non-cost criteria, depending on the Owner's priority, and may be similar to that adopted for the non-price selection/single Target Outturn Cost approach. Each proponent would develop a Target Outturn Cost which would then form part of the Owner's assessment in selecting potential alliance partners.

[46] QLD Government Project Assurance Framework, Alliance establishment and management, January 2010, page 10. Department of Treasury and Finance, Victoria, In the Pursuit of Additional Value, October 2009. Department of Treasury and Finance, Victoria, Project Alliancing Practitioners' Guide, April 2006.
[47] Advised by ITN, Project Delivery Strategy report, August 2007.
[48] Department of Treasury and Finance, Victoria, Project Alliancing Practitioners' Guide, April 2006, Page 16

2.60 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.

Selection of the designer prior to the constructor – two step process

2.61 In November 2007 the ACTEW Board decided on a two step process to select the designer and constructor for the Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects (the Googong Dam Spillway design had already been completed by GHD). This included progressive engagement of the designer followed by the constructor (recommended to the ACTEW Board for the Enlarged Cotter Dam). This enabled the selected designer to provide technical assistance in the subsequent selection of the construction partner.

2.62 The two step procurement method was the preferred approach for the Enlarged Cotter Dam project due to the strong technical requirement for the design of the dam and the limited industry experience in dam construction. The selection process included a series of technical reviews of the proposals produced and a number of workshops with the shortlisted proponents to evaluate their behaviours and technical ability.

2.63 The Request for Proposal evaluation criteria included 'People' and 'Relationship Readiness', worth 40 and 10 percent respectively. ACTEW advised that this provided an assessment of cultural fit of the designer and constructor teams and so mitigated the risk of an inability to work together as a team. Additionally, full day workshops, with GHD as the designer and the potential constructors, were held as part of the selection process. The workshops tested the ability of the constructors to perform as individuals in the context of the prospective alliance team.[49]

2.64 The two step procurement method was approved by the ACTEW Board (October 2007) and is consistent with the guidelines for alliance contracting published by the Victorian (2006) and Queensland (2010) Governments. The approach adopted is a common method for selecting Non-Owner Participants and has been used for similar major water infrastructure alliance projects. Entura advised that there were difficulties experienced during the clean-up of the Enlarged Cotter Dam foundation as 'the expectations of the designers were poorly understood by the constructors at [the Final Target Outturn Cost] stage'. Some Bulk Water Alliance stakeholders advised of the 'continual frustration' on the part of the constructors with the designers during this stage of the Enlarged Cotter Dam and that mediation was often needed. However, difficulties in the designer/constructor relationship were not raised as a concern once the foundation clean-up was completed.

[49] Itn advised that this was best practice alliance evaluation methodology at the time.

2.65 The August 2007 Board paper, which provided information on this process, detailed the expected benefits to be obtained through using the two step approach. However the risks of using this approach were not identified in the Board paper, nor assessed against the expected benefits, and there was no reference as to how these risks would be addressed in the selection process. The *Project Alliancing Practitioner's Guide*[50] highlights the risk associated in using this approach. It identifies that using this approach may result in the agency selecting the best individual designer and constructor but then not achieving the best team.

2.66 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.

Request for Proposal documentation

2.67 The approach for selecting the Non-Owner Participants for the Enlarged Cotter Dam, using the non-price selection/single Target Outturn Cost process, was reflected in the Request for Proposal document issued to industry. In support of the request for proposals from industry, a Request for Proposal Evaluation Manual was developed by ACTEW. The key steps stated in the Request for Proposal Evaluation Manual were:

- submissions to ACTEW in response to the Request for Proposals document;
- desktop review of submissions to determine a long-list based on the 'hurdle criteria';
- technical and commercial evaluation assessments of submissions;
- technical interviews;
- commercial meetings to identify commercial departures from the draft Alliance Agreement;
- short listing of respondents;

[50] Department of Treasury and Finance, Victoria, Project Alliancing Practitioners' Guide, April 2006, Page 71

- extended workshops with the shortlisted respondents;
- referees checked;
- financial audits conducted;
- commercial workshops to finalise the draft Alliance Agreement;
- shortlisted respondents were scored; and
- recommendation for award.

Evaluation criteria for selection of Non-Owner Participants

2.68 Evaluation criteria should be linked to the organisation's strategy for program delivery and may include a mix of qualitative (non-price) and quantitative (price) assessment criteria. They should be developed to suit the objectives for each project.

2.69 According to the Guidelines principles which should inform the design and implementation of tender selection criteria are:

> the criteria should address the proponents' capability and capacity in the context of the Owner's VfM Statement;
>
> separate criteria should be set to address each of the four interdependent components of an alliance project (i.e. project solutions, Team, Target Outturn Cost and Commercial Framework) and the key features of alliancing;
>
> the criteria should enable proponents to demonstrate points of differentiation from other proponents; and
>
> explicit guidance should be given to the selection panel on how to assess and compare cost and non-cost criteria.[51]

Evaluation panel

2.70 The evaluation panel for selecting the preferred designer and constructor Non-Owner Participants for the Bulk Water Alliance included ACTEW, ActewAGL and two representatives from ACTEW's transaction advisor. The transaction advisor representatives had previous experience in the selection of Non-Owner Participants for a number of other large water infrastructure alliance projects. The panel was also supported throughout the process by the following advisors:

- legal;
- alliance financial auditor;
- probity;
- insurance analyst; and
- other independent experts.

[51] Department of Infrastructure and Transport, National Alliance Contracting Guidelines, July 2011, p 86.

2.71 Due to the preferred constructor being selected subsequent to the appointment of the preferred Enlarged Cotter Dam designer, a representative from GHD, the selected designer, also attended the workshops and evaluation meetings (but was not a voting member) for selecting the preferred contractor. This was part of the strategy to mitigate the risk of selecting the preferred constructor independently of the preferred designer.

2.72 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.

2.73 The importance of the skills and attributes of each individual nominated (discussed further at paragraph 2.78) was reflected in the weighting of the evaluation criteria. Fifty percent of the evaluation criteria were weighted towards these elements. The criteria for assessing the individuals nominated included:

- availability;
- capability;
- experience in dam engineering/construction projects; and
- referees.

2.74 The selection criteria included an assessment of the respondent's departures to the commercial terms of the draft alliance agreement. This approach is consistent with other selection processes of large infrastructure projects using an alliance contracting model.[52] Such an approach prevents the preferred participant proposing, after the alliance agreement is agreed, commercial departures which are not acceptable to the Owner.

2.75 The assessment criteria used for each stage of the process were linked to the key objectives of the process as stated in the Request for Proposal Evaluation Manual. The weighting of each criterion was different for evaluating the designers and constructors because of the different attributes being assessed. In addition, the evaluation criteria included an assessment of the commercial departures proposed by each respondent. These departures were discussed and agreed between ACTEW and the respondents prior to the finalisation of the recommendation for award.

2.76 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).

[52] Australian National Audit Office, Developing and Managing Contracts Guide, February 2012, Page 55

2.77 The limitations were:

- a lack of emphasis on the respondent's experience in delivering and/or managing program alliances (e.g. efficiency through procurement, management etc…). This is highlighted in the Request for Proposal document which listed the categories of Key Performance Indicators (KPIs) to be included in a Quality Pool and/or Project Fee adjustment. No KPIs were nominated from a program alliance perspective;
- little reference in the selection criteria for assessing the individuals nominated in each respondent's bid against previous experience in program alliances; and
- a lack of reference in the methodology requirements for the respondents to provide their methodology for managing a program of projects. The methodology was focused on how each individual project would be undertaken.

Assessment of individuals nominated by the respondents for the Bulk Water Alliance

2.78 Alliance contracts are relationship based contracts; therefore establishing strong relationships is critical to their success. Through the collaborative nature of alliance contracting representatives from Owner and Non-Owner teams are able to focus on achieving outcomes rather than having to be concerned about protecting commercial interests or the position of their organisation. This is due to the one team approach underpinned by the no blame culture. This enables faster decisions to be made, better outcomes achieved and less time in commercial disputes and/or claim issues. This is because of the collaborative approach and financial incentives embodied in an alliance.

2.79 ACTEW adopted an integrated team model for the delivery of the alliance with key positions being shared between ACTEW and the Non-Owner Participants. It was evident during audit fieldwork that ACTEW had established a resourcing strategy for the delivery of an alliance using an integrated team approach.

2.80 In determining the resourcing approach ACTEW identified individuals from ActewAGL with previous alliance and major infrastructure project experience to assist it by occupying a number of key positions in the Bulk Water Alliance. This was critical because ACTEW had limited resources and experience in undertaking alliances and/or major infrastructure projects. Conversely, ActewAGL had previously undertaken a number of projects utilising an alliance contracting model and therefore understood the risks associated in undertaking projects utilising this model. During fieldwork it was evident that not all ActewAGL staff thought this process had been successful or productive.

2.81 A number of ActewAGL personnel were seconded to the Bulk Water Alliance and occupied a number of key positions in the alliance leadership and project management teams including:

- one Alliance Leadership Group representative;
- design / technical experts; and
- project managers.

2.82 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.

Commercial model development

2.83 The Request for Proposal included the draft commercial model and draft Program Alliance Agreement. Each respondent was required to provide a list of departures against the General Terms and Conditions of Contract and Contract Schedules; these formed the basis for compensation under the Program Alliance Agreement. Respondents to the Request for Proposal were evaluated against criteria including the completeness and quality of their response.

2.84 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.

2.85 Due to the nature of an alliance establishing a strong and robust commercial model, focused on the key risks and opportunities associated with the project, is critical for ensuring a successful project outcome. The commercial model for an alliance consists of the following elements:

- general terms and conditions of contract**:** the terms and conditions of contract provide the basis for a number of key elements of the operation alliance, including:
  - alliance strategy – the principles, behaviours, and overview of the governance structure, including the division of responsibilities between each participant;
  - scope of work: approvals of the baseline and adjusted design, pre-TOC and post TOC activities;
  - responsibilities of the Owner and risks associated with the TOC;
  - construction completion, commissioning and defect period requirements;
  - risk sharing requirements including insurance and other liabilities;
  - payment including pain/gain share against the TOC, key performance indicators, project fee and progress claims; and
  - termination and reporting.
- schedules of contract: detailed interpretation of the general terms and conditions for application to the project.

2.86 Assessments of the Bulk Water Alliance Program Alliance Agreement against industry expectations for general terms and conditions (Table 2-4) and against schedules (Table 2-5) follow. The tables detail the features identified and those that were not evident.

Table 2-4 Assessment of the Program Alliance Agreement general terms and conditions against industry practices [53]

Features in the Program Alliance Agreement against Industry practice	
Each Non-Owner participant is included as an alliance partner.	✔
Unanimous decision making required at Alliance Leadership Group.	✔
Alliance Leadership Group 'deal breaker' included in terms of contract.	✔
Roles and responsibilities between the Owner and Non-Owner Participants are defined.	✔
Profit component on pre-TOC activities is not payable until acceptance of the TOC by the Owner.	✔
Ownership of works completed and materials purchased transfers to the Owner at the time of payment.	✔
Requirement for alliance specific procurement management plan.	✔
Related entities conflict of interest procedure.	✔
Construction delivery and design risks jointly shared among the Owner and Non-Owner Participants.	✔
The Project Fee was able to be withheld if it was evident that the pain share adjustment outcome or the KPI adjustment outcome was reasonably likely to result in a reduction of Project Fee payable.	✔
Open book and audit requirements were defined.	✔
The owner was granted irrevocable, perpetual, royalty free licence to any intellectual property generated by each alliance partner for works completed by any alliance partner.	✔
Not all risks associated with the project were jointly shared – insurance risk was borne by the Owner. This was based on advice received from ACTEW's insurance advisors.	✘
The financial performance for each project in the program alliance was measured against each individual project's TOC rather than considering the cost position of each project in the program alliance against the TOC.	✘
Non-financial targets (KRAs) were not established at the program alliance level and focused on performance at an individual project level. This limited the Owner's ability to drive performance at the program level in order to generate behaviours to achieve the desired benefits contained in the Board decision paper for establishing the program alliance.	✘
KRAs were not established upfront and were implemented subsequent to the beginning of the implementation (construction) phase of the project alliance.	✘
The establishment of the TOC for the M2G project was not competitive as recommended in the delivery strategy of the project and recorded in the minutes of the Board meeting approving the project delivery method.	✘
Limited decision mechanisms and/or authority of independent financial auditor.	✘
Limited provisions in the terms and conditions for non-compliance with compliance obligations in the commercial schedules.	✘

Source: KPMG analysis for the Audit Office Key: ✔ : Expected features identified. ✘: Expected features absent.

[53] Department of Treasury and Finance, Victoria, Project Alliancing Practitioners' Guide, April 2006.
QLD Government Project Assurance Framework, Alliance establishment and management, January 2010. Department of Treasury and Finance, Victoria, In the Pursuit of Additional Value, October 2009.

Table 2-5 Assessment of the Program Alliance Agreement schedules against industry practices [54]

Features in the Program Alliance Agreement against industry practices	
Roles and responsibilities of the governance functions were defined.	✔
Target cost estimating: the risks of estimates in the TOC were clearly nominated as not being able to result in a scope change in accordance with the general terms and conditions of contract.	✔
There was an allowance in the commercial model for Owner costs to be included in the TOC and subject to the calculation of the pain/gain share adjustment.	✔
Pain/gain share adjustment mechanism was applied to each project alliance individually rather than assessing the performance against the TOC at the program level.	✔
The quality pool and KPIs were focused on individual project outcomes.	✔
A gain share cap was established in the commercial model. This included any gain share recorded against the TOC, performance against the KPIs and allocation of the quality pool.	✔
Hours worked in excess of the nominated standard hours per week required approval of the Alliance Project Management Team (APMT).	✔
No project fee applicable to subcontracts relating to related entities for both constructors.	✔
The project fee was applicable to subcontracts relating to related entities of the designer. However, the rates were subject to review prior to being allowed to be claimed.	✔
The performance against the Key Result Areas (KRAs) was not taken into consideration in calculating the pain/gain adjustment.	✕
No quality pool was established for the overall program alliance activities to generate the benefits for combining the three projects into one program alliance.	✕
The allocation of the pain/gain share adjustment between alliance partners was based on the proportion of direct costs in the TOC (the constructors share was nominated to be 50/50 of the proportion of the direct costs of both contractors in the TOC).	✕
No approval requirements for the allocation of alliance partner resources used (e.g. labour, plant and/or equipment used).	✕
The maximum daily number of hours for the designer, defined in Schedule 5, was inconsistent with the standard number of hours per day on which the in-direct cost on-cost and salary on-costs were based which may have resulted in the designer achieving additional profit.	✕
Owner costs were not included in the pain/gain share project fee adjustment. Therefore, the Non-Owner Participants were not exposed to the cost of additional scope performed by ACTEW which was either required to fulfil the scope of works of the project and/or were planned to be performed by the Non-Owner Participants.	✕

Source: KPMG analysis of ACTEW information for the Audit Office

Key: ✔ : Expected features identified. ✕: Expected features absent.

2.87 The process adopted to establish the commercial model for the Bulk Water Alliance reflected industry practice, although not all aspects were evident.

[54] Department of Treasury and Finance, Victoria, Project Alliancing Practitioners' Guide, April 2006. QLD Government Project Assurance Framework, Alliance establishment and management, January 2010. Department of Treasury and Finance, Victoria, In the Pursuit of Additional Value, October 2009.

3 ESTABLISHMENT AND MANAGEMENT OF THE ALLIANCE

3.1 This chapter discusses the establishment and management of the alliance. It specifically focuses on the processes implemented by ACTEW to establish the commercial framework for the Bulk Water Alliance projects and the processes to develop the Target Outturn Cost.

Summary

Conclusion

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.

Key findings

	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: • a gain-share/pain-share mechanism for each of the projects; and • the use of a quality pool for each of the projects.	3.15
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: • 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.	3.21
The revised gain-share/pain-share mechanism for the Enlarged Cotter Dam project provided for: • 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.	3.25
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	3.30

million. (Previously it would have only covered half of that cost.)

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 3.117

Water Alliance.

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

Commercial framework and Target Outturn Cost

3.2 Two key, linked features of an alliance model for a project are its commercial framework and Target Outturn Cost. The commercial framework establishes the arrangements by which any 'pain' or 'gain' associated with a project, i.e. cost overruns or cost savings, are shared between the parties, i.e. ACTEW and the Non-Owner Participants. The Target Outturn Cost represents the expected cost of delivering the project, and involves consideration of a range of multiple factors and identification of risks.

3.3 Following the decision to proceed with alliance contracting as the means for delivering ACTEW's water infrastructure projects it was incumbent on ACTEW to establish an appropriate alliance for the delivery of the projects through consultation and agreement with the Non-Owner Participants. Two key components of the alliance are:

- the commercial framework; and
- Target Outturn Cost.

3.4 With respect to the commercial framework and the Target Outturn Cost KPMG advised:

> The commercial framework of an alliance is based on a cost reimbursable, open book, performance incentivised contracting model. If designed and implemented effectively, the owner and non-owner participants share in the performance of the alliance from both a financial (against the Target Outturn Cost) and non-financial (against the Key Result Areas) perspective.
>
> If the commercial framework and Target Outturn Cost are established appropriately, the owner and non-owner participants are sufficiently incentivised to reduce costs, work collaboratively and be focussed on achieving non-financial outcomes aligned to the owner's objectives.

3.5 The incentives for the Owner and the Non-Owner Participants to reduce costs, work collaboratively and be focussed on achieving non-financial outcomes derive from the Owner and Non-Owner Participants' share in:

- any 'gains' achieved through:
  - procurement savings;
  - innovative solutions;

  - efficiencies through more productive labour, plant and / or performance of assets; and/or
  - the achievement of minimum conditions of satisfaction associated with non-financial result areas and / or exceptional performance against the relevant non-financial result area.
- any 'pain' as a result of:
  - poor procurement outcomes;
  - under estimation of effort required;
  - poor performance against key result areas; and/or
  - less efficient labour and / or performance of assets.

3.6 KPMG advised:

> The form and structure of the commercial framework of an alliance should be designed to align the behaviours of the Owner and Non-Owner Participants to achieve the key objectives of the alliance. The risk of misalignment between the Owner and Non-Owner Participants may result in a sub-optimal performance from a cost, time and quality perspective and the desired financial and operational benefits for adopting an alliance contracting model being obtained.

3.7 KPMG further advised:

> At the time of establishing the commercial framework for this alliance, there was no 'industry standard' unlike traditional forms of contracting whereby it is common practice for Government and non-Government organisations to establish construction contracts using an Australian standard for contracting or equivalent. However, at the time this alliance was established, there were a number of common attributes which set a 'precedent' for the model to be an effective form of contracting.

The commercial framework

3.8 According to the National Alliance Contracting Guidelines: Guide to Alliance Contracting (the Guide to Alliance Contracting):

> The commercial framework is the key mechanism of the alliance contract which:
>
> - aligns the commercial objectives of the Non-Owner Participants with the project objectives of the Owner and the investment objectives of the government;
> - should encourage and drive the Non-Owner Participants to achieve the performance levels required by the Owner's [value for money statement]; and
> - ensures the Owner is equipped to address any poor performance by the Non-Owner Participants.[55]

[55] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011, p 51.

3.9 The commercial framework essentially sets out the structure and principles that govern the Non-Owner Participants' remuneration for the project and how:

- any cost savings and other benefits achieved through the delivery of the project are to be shared between the Owner and Non-Owner Participants; and
- any cost overruns or other failures experienced through the delivery of the project are to be shared between the Owner and Non-Owner Participants .

3.10 The Guide to Alliance Contracting further notes:

> Along with the framework for joint management and collaborative decision making, developing the optimum Commercial Framework is a foundation for alliance success; it should provide all Participants with an imperative to meet their behavioural commitments, and balance both the price and non-price objectives for the project. The Owner should ensure that the Commercial Framework is structured to target the achievement of the [Value for Money] outcomes required for the specific project, and to manage the associated risks.

Non-Owner Participants' remuneration

3.11 According to the Guide to Alliance Contracting Non-Owner Participants' remuneration from an alliancing arrangement typically comprises:

- reimbursable costs - these represent the costs actually and reasonably incurred by the Non-Owner Participants in the performance of the work;
- the Non-Owner Participants' fees - this represents the Non-Owner Participants' corporate overheads and profit for the project; and
- risk or reward amount - this represents a performance-based payment to the Non-Owner Participants that increases or decreases to reflect the project's outcomes. It is designed to enable the Non-Owner Participants to share in both the upside and downside associated with delivering the project.[56]

Commercial framework components

3.12 The commercial framework for the Bulk Water Alliance had all of the key components identified in the Guide to Alliance Contracting including:

- reimbursable costs;
- Non-Owner Participants' fees; and
- risk or reward amount(s).

[56] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011, p 52.

Reimbursable costs

3.13 The Non-Owner Participants' reimbursable costs were provided for by the Program Alliance Agreement. Clause 20 of the Program Alliance Agreement provided for the reimbursement of direct costs incurred by the Non-Owner Participants in the delivery of the works.

Non-Owner Participants' fee

3.14 The Non-Owner Participants' fees represented the Non-Owner Participants' fees for participating in the Bulk Water Alliance, i.e. essentially the Non-Owner Participants' corporate overheads and profit margin. Clause 20 of the Program Alliance Agreement provided for the payment of project fees to the Non-Owner Participants.

Risk or reward amount(s)

3.15 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:

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

Gain-share/pain-share mechanism

3.16 Clause 33.2 and Schedule 5 of the Program Alliance Agreement provide for the operation of the gain-share/pain-share mechanism.

3.17 Clause 33.2 of the Program Alliance Agreement provided:

(a) Alliance has agreed the process which will be used to measure the Actual Outturn Cost for the delivery of each Project against the [Target Outturn Cost] for that Project.

(b) The [Actual Outturn Cost] for a Project may cause an adjustment to be made to the amount of the Project Fee payable to the Alliance Partners through the Gain-share/Pain-share Adjustment.

3.18 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.

Original gain-share/pain-share mechanism

3.19 The original Program Alliance Agreement (May 2008) provided for a relatively simple gain-share/pain-share mechanism that would apply to each of the Bulk Water Alliance projects.

3.20 Table 3-1 shows the original gain-share/pain-share mechanism provided for by the Program Alliance Agreement. This mechanism applied to each of the Bulk Water Alliance projects.

Table 3-1 Original gain-share/pain-share mechanism

Gain-share	
Actual Outturn Cost is less than the (Final) Target Outturn Cost - project 'under budget'	50 percent of the cost saving would be paid to the Non-Owner Participants. The other 50 percent is a 'saving' for ACTEW.
Pain-share	
Actual Outturn Cost is more than the (Final) Target Outturn Cost - project 'over budget'	50 percent of the additional costs will be borne by the Non-Owner Participants and 50 percent of the additional costs will be borne by ACTEW.

Source: National Alliance Contracting Guidelines, Guide to Alliance Contracting, July 2011.

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

- 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.

3.22 According to the Halcrow report 'in general terms this is a well used, and well understood, Alliance cost incentive mechanism, albeit with some very minor variations from contract to contract.'[57]

Revised gain-share/pain-share mechanism

3.23 In August 2009, during the development of the Final Target Outturn Cost for the Enlarged Cotter Dam project, the Alliance Leadership Group, including ACTEW, agreed to a revised gain-share/pain-share mechanism that would be applied to the Enlarged Cotter Dam project. The original gain-share/pain-share mechanism would continue to apply to the other Bulk Water Alliance projects.

[57] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd

3.24 Table 3-2 shows the revised gain-share/pain-share mechanism that would apply to the Enlarged Cotter Dam project. The development of the Target Outturn Cost is discussed in paragraphs 3.38 to 3.79.

Table 3-2 Revised gain-share/pain-share mechanism applicable to the Enlarged Cotter Dam project

Gain-share	
Actual Outturn Cost is less than the Final Target Outturn Cost - project 'under budget' - by more than $10.4 million	Non-Owner Participants to receive $10.4 million cost saving plus 50 percent of any additional cost savings (in excess of $10.4 million). 50 percent of any additional cost savings in excess of $10.4 million represent a 'saving for ACTEW'. ACTEW would essentially forego its share of the initial cost savings up to $10.4 million, but would reap 50 percent of any benefits over $10.4 million.
Actual Outturn Cost is less than the Final Target Outturn Cost - project 'under budget' - by less than $10.4 million	Non-Owner Participants to receive any cost savings achieved within $10.4 million. ACTEW would essentially forego its share of the initial cost savings up to $10.4 million.
Pain-share	
Actual Outturn Cost is more than the Final Target Outturn Cost - project 'over budget' - by less than $13.4 million	All of the additional costs will be borne by ACTEW. Non-Owner Participants would not have to bear any of the additional costs.
Actual Outturn Cost is more than the Final Target Outturn Cost - project 'over budget' - by more than $13.4 million	ACTEW would bear all of the additional costs up to $13.4 million and 50 percent of the additional costs over $13.4 million. Non-Owner Participants would bear 50 percent of the additional costs over $13.4 million.

Source: Audit Office analysis of ACTEW information.

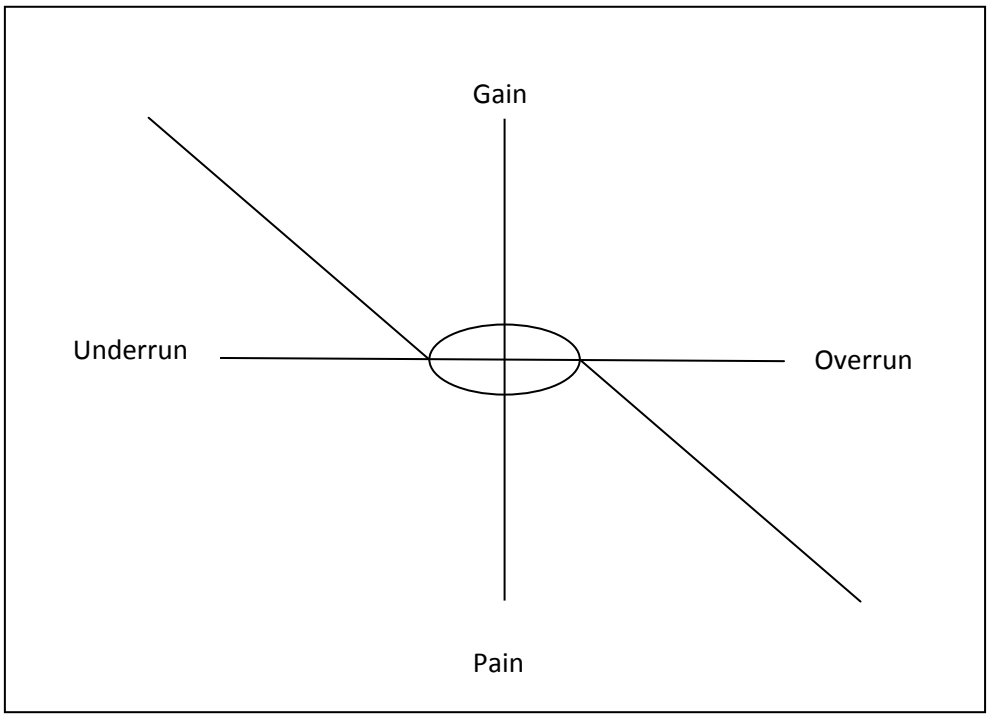
3.25 The revised gain-share/pain-share mechanism for the Enlarged Cotter Dam project provided for:

- 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.

3.26 The Halcrow report noted that this was not a common arrangement. The Halcrow report also noted 'while similar gain-share/pain-share regimes (per the original contract) have been seen by Halcrow previously, a gain-share/pain-share regime such as has been agreed by the Alliance's [Alliance Leadership Group] (and thereafter ACTEW) has not.'[58]

3.27 The revised gain-share/pain-share mechanism led to a 'flat-spot' in the operation of the mechanism where ACTEW bore all of the risks. Figure 3-1 shows the operation of the 'flat-spot' in the gain-share/pain-share mechanism.

Figure 3-1 Gain-share/pain-share model for the Enlarged Cotter Dam showing the 'flat spot'



Source: National Alliance Contracting Guidelines and KPMG for the Audit Office

3.28 In relation to the modified pain-share/gain-share mechanism, KPMG advised:

> The modification of the pain/gain share formula is commercially advantageous to the [Non-Owner Participants]. The [Non-Owner Participants] remain incentivised to complete the project at the lowest possible Actual Outturn Cost to maximise their gain share payments, however, they will receive a greater return than they would otherwise have received under the original pain/gain share model in the Project Alliance Agreement.

[58] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 82.

3.29 Similarly, the Halcrow report stated:

> ...this amended gain-share/pain-share regime is skewed in favour of the commercial participants. While it creates a greater incentive to the commercial participants to attain an [Actual Outturn Cost] much better than the [Final Target Outturn Cost] (by more than $10,431,830) it has reduced the disincentive for cost overruns because the [Final Target Outturn Cost] can be exceeded by up to $13,409,593 without penalty to the commercial participants.[59]

3.30 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.)

3.31 It is noted, however, that the revised gain-share/pain-share mechanism was agreed to in August 2009, during a period in which the Pre-Final Target Outturn Cost was being developed. The revised gain-share/pain-share mechanism was agreed to in return for a reduced Final Target Outturn Cost. This is further discussed in paragraphs 3.50 to 3.58.

Quality pool

3.32 Schedule 6 of the Program Alliance Agreement provided for the use of a quality pool for each of the Bulk Water Alliance projects. According to the Halcrow report the purpose of the quality pool was 'to incentivise the Bulk Water Alliance participants to deliver outstanding performance on non-directly cost related criteria.' The Halcrow report also noted 'the establishment of a Quality Pool or Performance Incentive Bonus Pool is common practice in Alliance frameworks/contracts.'[60]

3.33 Clause 1.1.1 of Schedule 6 of the Program Alliance Agreement provided that the 'Quality Pool model allocates a specific budget for outcomes in KPI performance, i.e. there is a maximum positive incentive and a maximum negative incentive.' Schedule 6 of the Program Alliance Agreement provided for the development of key performance indicators for the different projects and adjustments to be made to Non-Owner Participants' payments on the basis of performance against the key performance indicators.

3.34 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.

[59] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd
[60] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd

Key Result Areas

3.35 Five key result areas were established for all of the Bulk Water Alliance projects and different supporting key performance indicators were developed for each project. The five key result areas are identified in Table 3-3.

Table 3-3 Key performance indicators against the strategic key result areas – larged Cotter Dam

Key Result Area	Key Performance Indicators
Environment	E1 Biodiversity and heritage values
	E2 Emissions, pollution and waste reduction
	E3 Protection of threatened fish species
	E4 Protection of the Murrumbidgee River
Quality	Q1 System Compliance
	Q2 Concrete temperature conformance
	Q3 RCC Consistency
	Q4 Concrete surface finish
Legacy	L1 Increased local skills
	L2 Project recognition
	L3 Owner involvement
	L4 Value for money
	L5 Community education
Operability	O1 Avoid interruptions
Community engagement and stakeholder management	C1 Complaint management
	C2 Community engagement

Source: KPMG analysis of ACTEW information.

The value of the quality pools

3.36 Table 3-4 shows the budgeted value of the quality pools for the different Bulk Water Alliance projects and the payments from the quality pools for the different Bulk Water Alliance projects.

Table 3-4 Budgeted value of the Bulk Water Alliance quality pools

Bulk Water Alliance project	Budgeted value of the quality pool ($m)	Payments from the quality pool ($m)
Enlarged Cotter Dam	4.0	3.1
Murrumbidgee to Googong Pipeline	0.0	1.4
Googong Dam Spillway	0.0	0.1

Source: Audit Office, based on ACTEW data

3.37 An analysis of the quality pools of the Bulk Water Alliance projects shows:

- total payments from the quality pools for the different Bulk Water Alliance projects represented a comparatively small proportion of the actual costs of the projects; and
- only the Enlarged Cotter Dam project had an initial budgeted value identified for the quality pool.

Target Outturn Cost

3.38 A Target Outturn Cost was developed for each of the Bulk Water Alliance projects. The Target Outturn Cost represents the estimated actual cost of the design and construction component of each of the projects.

3.39 According to the Guide to Alliance Contracting the Target Outturn Cost is:

> ... a 'target' price offered by [Non-Owner Participants] where the actual costs on completion of the alliance (i.e. actual outturn costs or AOC) will be compared against this target and any differences (usually terms underruns or overruns) will be shared between [Non-Owner Participants] and the Owner in accordance with the agreed Commercial Framework.
>
> It is at this price that the [Non-Owner Participant] is prepared to share the project risks and financial performance with the Owner in accordance with the agreed Commercial Framework.[61]

3.40 With respect to the development of the Target Outturn Cost the Halcrow report stated:

> The [Target Outturn Cost] is usually a sophisticated and robust estimate compiled by the Alliance participants in parallel with the design process (i.e. prior to the commencement of construction); a process that includes early contractor involvement to assist the development of cost effective designs, and value management workshops to further refine designs and hence costs, etc.[62]

3.41 Clause 12 of the Program Alliance Agreement set out the requirements for the Bulk Water Alliance to prepare and approve the Final Target Outturn Cost for the different projects. The Program Alliance Agreement included the following requirements:

- clause 12.3(a) provides 'when the applicable time limit and expenditure limit have been agreed for a Project, the Alliance must finalise the scope of work and prepare the preliminary design to meet the Owner's requirements...and establish the [Final Target Outturn Cost] for the Project in conjunction with the [Alliance Project Management Team]...; and
- clause 12.4(a) provides 'when the [Alliance Project Management Team] is satisfied with the proposed scope of works and [Target Outturn Cost] (including the KPIs) for a Project, the [Alliance Project Management Team] will prepare a Project [Target

[61] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011

[62] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 78.

Outturn Cost] Report which contains all information relevant to enable the [Alliance Leadership Group] to assess the [Target Outturn Cost]...and will submit the Project [Target Outturn Cost] Report to the [Alliance Leadership Group] for its agreement'.

3.42 Table 4-1 shows the Final Target Outturn Cost and estimated Actual Outturn Cost (i.e. what the project eventually cost) for each of the Bulk Water Alliance projects.

3.43 The following discussion in relation to the development of the Final Target Outturn Cost primarily focuses on the costs associated with the Enlarged Cotter Dam. This is because the Enlarged Cotter Dam project represents the largest of the three Bulk Water Alliance projects and experienced the largest cost over-run of all the projects. The Enlarged Cotter Dam project has also received considerable Legislative Assembly and community attention.

Enlarged Cotter Dam Target Outturn Cost

3.44 Table 3-5 shows the Final Target Outturn Cost for the Enlarged Cotter Dam project as agreed by the Bulk Water Alliance in August 2009 and endorsed by the ACTEW Board in September 2009.

Table 3-5 Final Target Outturn Cost for the Enlarged Cotter Dam

Item	Cost ($)
Direct costs	224,292,261
Total direct costs	**224,292,261**
Escalation	15,404,734
Risk allocation	21,958,287
IT and management fees	1,772,844
Direct costs plus escalation and risk and IT management and fees	**263,428,126**
Fee costs	35,571,874
Final Target Outturn Cost	**299,000,000**

Source: Adapted from TOC report

3.45 The different items are:

- Direct costs. Direct costs relate to the costs incurred by the Non-Owner Participants in designing and constructing the Enlarged Cotter Dam, including foundation excavation and preparation and the construction of the dam wall and associated structures.
- Escalation. The escalation component provides for an increase or escalation of direct cost inputs due to inflation over the course of the project. The use of an escalation component recognises that the project was to be conducted over a period of time and that cost increases due to inflation were to be expected.

- Risk allocation. The risk allocation component is a contingency sum for the project. It recognises that there are risks in the delivery of the project which should be budgeted for.
- IT and management fees. This represents direct fees payable to one of the Non-Owner Participants for specific services.
- Fee costs. The fee costs component relates to project fees payable to the Non-Owner Participants.

Changes to the Enlarged Cotter Dam Target Outturn Cost

3.46 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.

3.47 The Draft Target Outturn Cost ($325 million[63]) was prepared by the Bulk Water Alliance in April 2009. With respect to the development of the Draft Target Outturn Cost figure an August 2009 ACTEW Board paper (26 August 2009) identified:

> The [(Draft) Target Outturn Cost] for the [Enlarged Cotter Dam] was first available from the [Bulk Water Alliance] in draft form in late April 2009 and was in excess of expectations. The [Bulk Water Alliance] re-examined the [(Draft) Target Outturn Cost] estimate.
>
> Over 50 items were identified as potential sources of reduction and these were thoroughly assessed and re-evaluated. The completion of the [(Pre-Final) Target Outturn Cost] was delayed until this time, to ensure the best cost was available for submission to the Board.

3.48 The ACTEW Board paper (26 August 2009) noted:

> The total project cost [Pre-Final Target Outturn Cost] that was recently considered by the [Bulk Water Alliance] was some $311 million. The Alliance has reviewed this estimate and proposed to deliver the [Enlarged Cotter Dam] for $299 million...through a proposed change to the commercial model as outlined in the BWA Program Alliance Agreement. In addition, the [Bulk Water Alliance] proposes to reduce the Quality Pool from 2% to 1.5%. The [Bulk Water Alliance] proposes to alter the commercial model such that there is additional reward payable to the [Bulk Water Alliance] partners for bringing in the [Final Target Outturn Cost] for less than [originally anticipated].

[63] This included the alliance fee and excluded the quality pool.

3.49 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:

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

Processes for the development of the Target Outturn Cost

3.50 The process undertaken to prepare, review and approve the Final Target Outturn Cost for each of the projects was important in ensuring that each project:

- demonstrated value for money; and
- provided stakeholders with certainty as to whether the value of the project recommended for approval was economically sound.

Bulk Water Alliance Target Outturn Cost Management Plan

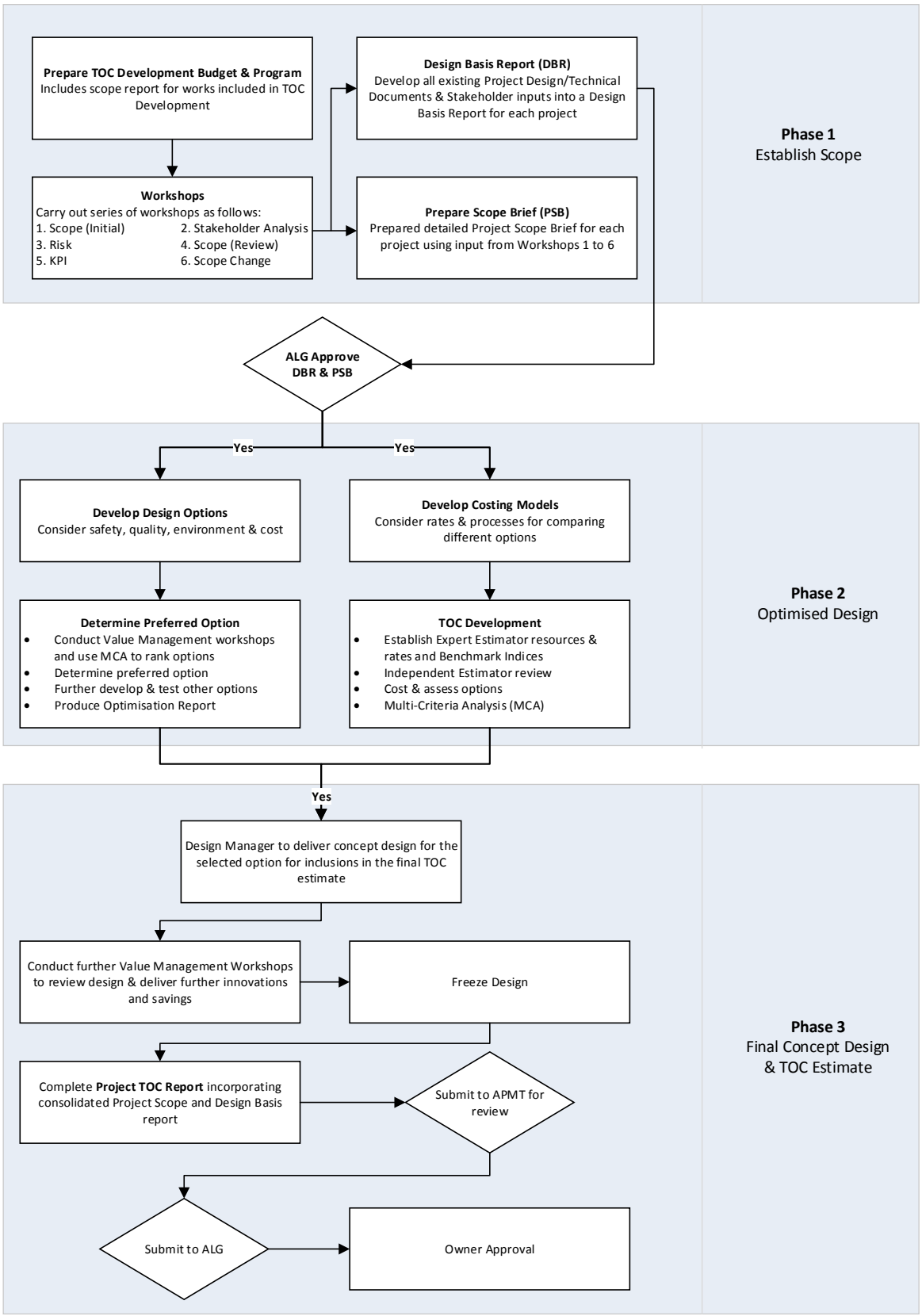
3.51 To assist in documenting and demonstrating value for money throughout the Target Outturn Cost development process ACTEW developed a Bulk Water Alliance Target Outturn Cost Management Plan.

3.52 The purpose of the Bulk Water Alliance Target Outturn Cost Management Plan was 'to provide procedures to be adopted in the development of the Project [Target Outturn Cost] Reports for each of the Projects within the overall program of works.' The Bulk Water Alliance Target Outturn Cost Management Plan detailed the processes for completing the Target Outturn Cost and allocated the key responsibilities between the Owner and Non-Owner Participants.

3.53 The final deliverable from the process was to be a (Final) Target Outturn Cost Report for each of the projects which detailed the expected costs associated with the project as well as the assumptions that underpinned the cost estimates.

3.54 Figure 3-2 provides an overview of the process associated with the development of the Final Target Outturn Cost for each of the projects.

Figure 3-2 Bulk Water Alliance Target Outturn Cost Management Plan development sequence.



Source: BWA TOC Management Plan, January 2009, p 15.

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

- 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.

Commercial pressure on Non-Owner Participants in the development of the Final Target Outturn Cost

3.56 The Halcrow report noted that the process followed by the Bulk Water Alliance for the development of the Final Target Outturn Cost for the Enlarged Cotter Dam followed normal industry practice with two exceptions:

- the development of the Final Target Outturn Cost was time and expense limited. The Non-Owner Participants were required to undertake all of the work required to develop the Final Target Outturn Cost to a predetermined budget; and
- should the Final Target Outturn Cost not have been accepted by the ACTEW Board, the Non-Owner Participants were only to be paid their costs in the development of the Final Target Outturn Cost.[64]

3.57 The Halcrow report noted 'these differences only serve to add commercial pressure to the [Target Outturn Cost] development phase of the Alliance, serving to add rigour to the [Target Outturn Cost] development and hence, theoretically, giving rise to a more competitive [Target Outturn Cost].[65]

3.58 Key aspects of the Final Target Outturn Cost, which warrant specific consideration, are the direct costs component and the risk allocation component. Specific processes in place to develop these components are detailed below.

[64] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 78.
[65] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd.

Estimation of direct costs

3.59 The Bulk Water Alliance developed a number of processes for the estimation of direct costs associated with the Enlarged Cotter Dam.

3.60 Unit rates were developed and identified for each of the relevant components of the direct costs component of the Final Target Outturn Cost. The Halcrow report noted that the unit rates for the components of the direct costs were based on:

- unit rates provided through a competitive tendering process for specific components of the Enlarged Cotter Dam works; and
- unit rates for other components (not subject to a competitive tendering process), which have been developed on the basis of the Non-Alliance Partners' experience.[66]

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

- 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.

Value for money workshops

3.62 Value for money workshops and other meetings were held throughout the concept design phase to reduce the costs of the proposed design. These meetings were attended by Owner and Non-Owner Participants.[67,68]

3.63 Workshops and meetings included:

- design coordination meetings between the Owner and Non-Owner Participants to review the concept designs to identify value for money opportunities;
- a two-day workshop in April 2009 to review design and proposed construction methodologies to identify possible cost savings and innovations; and
- a meeting between Owner and Non-Owner Participants following preparation of a Target Outturn Cost estimate in May 2009 to review the scope, design and construction methodology for the project to identify potential cost savings and ideas to improve value for money.

[66] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 64.

[67] ACTEW Corporation, Independent review of the design and estimate process for the Enlarged Cotter Dam Project (Commercial-in-confidence), 24 August 2009, Deloitte Touche Tohmatsu, p15, 34.

[68] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p67

3.64 Following the conduct of the value for money workshops a total of 57 ideas for potential cost savings were identified and documented. Each of these ideas was separately pursued and a follow up value for money workshop was held in June 2009 where each of the 57 ideas were discussed.[69,70]

3.65 With respect to the value for money workshops, the Halcrow report stated:

> Halcrow is satisfied with the value for money workshops undertaken by ACTEW and the Alliance. Halcrow is of the opinion that the value for money workshops, and the corresponding value for money outcomes reports, contributed to the Alliance ensuring that value management remained a focus throughout the development of the [Target Outturn Cost].[71]

Independent Estimator

3.66 The Halcrow report stated, regarding the independent estimator:

> [The independent estimator] reviewed the direct costs, risk allocation and escalation outlined in the July 2009 [Target Outturn Cost] estimate of $310.92 million... [The independent estimator's] final assessment resulted in a total point of difference (POD) with the Alliance's estimate of $5.91 million... This represents a point of difference of approximately 2.2 percent.[72]

3.67 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.

Estimation of risk allocation

3.68 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.

3.69 As part of the risk analysis each deliverable associated with the project was allocated a probability that the expected cost of delivery would be lower or higher than the Target Outturn Cost estimate. Lower estimates were identified as 'opportunities' and higher estimates were identified as 'risks'. As part of this process each deliverable was analysed against the following key parameters:

- the percentage under budget;
- the best case outcome;

[69] ACTEW Corporation, Independent review of the design and estimate process for the Enlarged Cotter Dam Project (Commercial-in-confidence), 24 August 2009, Deloitte Touche Tohmatsu, p15, 34.

[70] Enlarged Cotter Dam. Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p69-70

[71] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd.

[72] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 68.

- the most likely outcome;
- the percentage over budget; and
- the worst case outcome.

3.70 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.

Robustness of risk allocation

3.71 There are differences of opinion with respect to the robustness and appropriateness of the risk allocation component of the Final Target Outturn Cost for the Enlarged Cotter Dam project.

3.72 The independent estimator engaged by ACTEW identified that the risk allocation was potentially too high and that a more appropriate estimation was $20.2 million (a difference of $1.8 million). Alternatively, the Halcrow report identified that the risk allocation appeared to be too low.

3.73 The Halcrow report noted:

> The risk allocation adopted by the Bulk Water Alliance represents approximately nine percent of total direct costs. For a project of similar complexity and level of detailed design it could be reasonably expected that the risk allocation be in the order of 15 to 20 percent.[73]

3.74 In making this assessment, however, the Halcrow report noted:

> ... the process by which the risk allocation was developed, that is estimating the variability of each deliverable and inputting the outcomes into a Monte Carlo simulation, is considerably superior to the application of an arbitrary percentage. As such, Halcrow is satisfied with the process by which the Bulk Water Alliance has estimated the level of risk allocation for the [Enlarged Cotter Dam] project.[74]

3.75 The Audit Office also sought assistance from Entura to provide advice with respect to the reasons for the increase in the costs associated with the Enlarged Cotter Dam. Entura's advice is detailed in Chapter 4 of this report. In relation to risk identification Entura advised:

> [The Bulk Water Alliance] had an adequate system for identifying risks. There was considerable workshopping of risks, both before the [Target Outturn Cost] and after it to identify and manage the risks.

[73] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 79.
[74] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p 79.

3.76 Nevertheless, Entura also noted that there was a desire to reduce the Pre-Final Target Outturn Cost and that 'this drove optimistic assessments of some construction parameters'.

3.77 The Bulk Water Alliance's optimistic assessments of some of the construction parameters associated with the Enlarged Cotter Dam project were not accompanied by a recognition of their associated risks, for example:

- the production rates adopted;
  - foundation excavation production rates;
  - roller compacted concrete production and placement rates;
- the likelihood of the following risks eventuating:
  - 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 wall;
  - more time taken to complete construction after the end of roller compacted concrete placement;
- the consequences of many risks:
  - 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 Target Outturn Cost.

3.78 Entura advised:

> In regard to consequential risks, there was no scenario analysis carried out for the [Target Outturn Cost], but instead the major risks (rates of production for excavation and [roller compacted concrete] placement) were included with all the other risks in the Monte Carlo analysis. The validity of a Monte Carlo analysis like this one depends on the assumption that all risks are independent of one another. For this project many of the risks were interdependent.
>
> The result of this optimism and of the Monte Carlo analysis was a risk allocation, i.e. a contingency sum, built into the [Final Target Outturn Cost] which was low, in the context of a dam to be built at this site and the detailed design not having been done.
>
> One of the things which was negotiated during the process of reducing the [Pre-Final Target Outturn Cost] towards $300M was the allocation of the construction flood risk. It was removed from the contingency analysis, with a decision being made that ACTEW take flood risk during construction, rather than the Alliance taking this risk. In general, a risk should be borne by the party that is best placed to manage it.

3.79 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.

Managing and monitoring the water infrastructure projects

3.80 As the Owner in the Bulk Water Alliance it was incumbent on ACTEW to effectively work in and with the Bulk Water Alliance, in cooperation with the Non-Owner Participants, to achieve the intended outcomes for the projects.

3.81 The Guide to Alliance Contracting identifies that a responsibility for ACTEW (as the Owner) during the project delivery phase was ensuring:

- ongoing alignment between all participants' objectives for the projects;
- that risk management was shared equally between all participants; and
- that expenditure in relation to the projects served the public interest and met public sector prudential standards.[75]

3.82 The Guide to Alliance Contracting has identified a number of key areas of focus associated with the delivery phase of alliance projects. These include:

- implementing effective governance - internal and external to the alliance;
- ensuring effective Owner representation and resources internal and external to the alliance, including key management and leadership roles on key governance committees and access to independent advice on the activities of the alliance;
- ensuring that the fundamentals of good project management and project controls are established and maintained for the alliance;
- ensuring expenditure of public funds is prudent and appropriate, and that all cost claims and reports are reviewed and audited regularly;
- providing greater certainty for the Actual Outturn Cost by minimising the need for Target Outturn Cost adjustments;
- ensuring rigorous review of, and justification for, any proposed or potential scope changes;
- managing the alliance culture to ensure that it is healthy and productive;
- ensuring that 'no blame - no disputes' operates to optimise project delivery and does not lead to 'no accountability and no disagreements' between the Owner and Non-Owner participants; and
- ensuring monthly reports are provided to the Owner.[76]

[75] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011

[76] Australian Government Department of Infrastructure and Transport, National Alliance Contracting Guidelines: Guide to Alliance Contracting, July 2011

3.83 ACTEW's role as Owner in the Bulk Water Alliance obliged it to establish and implement appropriate management arrangements and oversight to ensure that these areas of focus were recognised and implemented effectively.

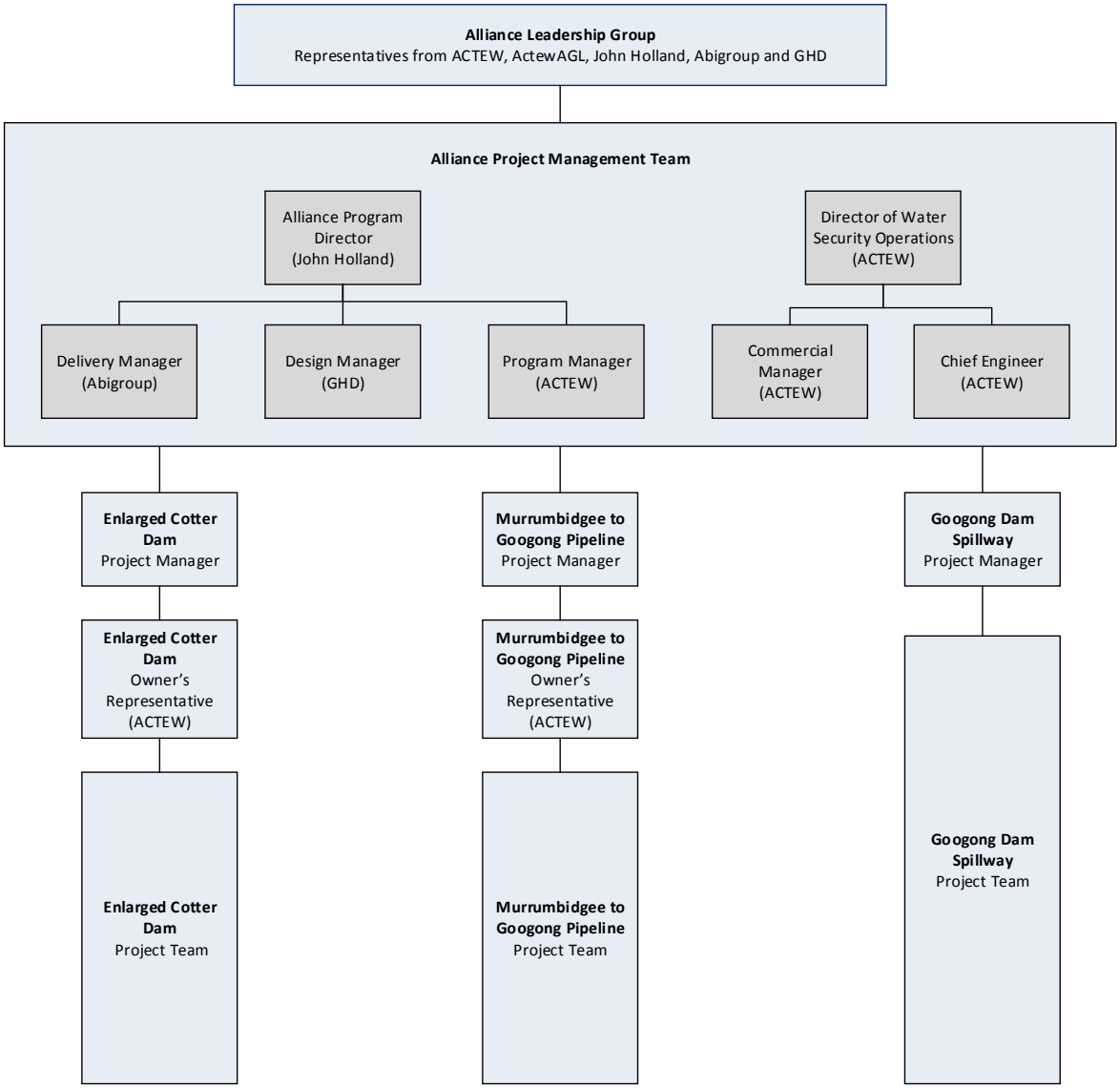
3.84 This audit has focused on the following key aspects of ACTEW's management of the Bulk Water Alliance:

- documentation of roles and responsibilities and project deliverables;
- governance and administrative arrangements including:
  - policies and procedures; and
  - management and governance committees; and
- monitoring and reporting arrangements.

Documentation of roles and responsibilities and project deliverables

3.85 The documentation of roles and responsibilities and project deliverables of the Bulk Water Alliance was primarily achieved through the Program Alliance Agreement.

Figure 3-3 Bulk Water Alliance organisational chart



Source: Audit Office analysis of ACTEW information

Program Alliance Agreement

3.86 The Program Alliance Agreement was the key contract under which the Bulk Water Alliance operated. The Program Alliance Agreement commenced on 1 May 2008.

3.87 The Program Alliance Agreement established, among other things:

- the scope of work for the Bulk Water Alliance projects and key deliverables associated with the different projects;
- the roles and responsibilities of the different parties, including ACTEW and the Non-Owner Participants;
- processes for the establishment of the Target Outturn Cost for each of the projects;

- payment arrangements including the operation of the gain-share/pain-share mechanism;
- resources and key personnel from the Non-Owner Participants; and
- management and governance groups for the Bulk Water Alliance, their role and membership.

3.88 Importantly, the Program Alliance Agreement also established protocols for ACTEW, as the Owner within the alliance arrangements, to exercise a right of refusal over key aspects of the projects. This included, for example, the Target Outturn Cost proposed by the Bulk Water Alliance.

Non-Owner Participants responsibilities

3.89 The Non-Owner Participants in the Bulk Water Alliance included:

- GHD, the project designer;
- Abigroup, constructor; and
- John Holland Group, constructor.[77]

3.90 The roles and responsibilities of the Non-Owner Participants were clearly articulated in the Program Alliance Agreement, including:

- the appointment of subcontractors;
- discharging identified safety responsibilities;
- 'ensur[ing] that the works [were] designed and constructed to the standard of a competent engineer and contractor with extensive experience in the design and construction of similar works, with due expedition' in accordance with relevant project documents and other relevant standards and requirements;[78]
- ensuring that all plant, material and equipment incorporated into or forming part of the projects were fit for purpose, new, of appropriate quality and not of an inherently dangerous or hazardous nature, and compliant with relevant requirements and standards;
- ensuring that the completed works were fit for the purpose stated in relevant project documents and other relevant standards and requirements, including legislative requirements; and
- 'do[ing] all that [was] required of the Alliance under this Agreement to enable the Projects to achieve their respective Target Dates'.

[77] John Holland Group and Abigroup formed the Surewater Alliance in preparation for the Bulk Water Alliance.
[78] These are to be constructed and designed in accordance with the Program Brief, the applicable Project Brief, the Works Delivery Documents, applicable legislation and Australian Standards, Approvals, good trade practice and the Program Alliance Agreement.

3.91 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.

Documentation of policies and procedures

3.92 The documentation of policies and procedures for the Bulk Water Alliance was primarily achieved through:

- the Bulk Water Alliance Programme Management Plan; and
- the Bulk Water Alliance Performance Management Plan.

Bulk Water Alliance Programme Management Plan

3.93 A Bulk Water Alliance Programme Management Plan was developed by the Bulk Water Alliance in July 2008. The Plan subsequently underwent a series of updates until June 2011.

3.94 The purpose of the Bulk Water Alliance Programme Management Plan was to 'establish a road map and a consistent and uniform approach to managing all aspects of the Bulk Water Alliance (BWA) Programme'. The Bulk Water Alliance Programme Management Plan noted:

> A primary objective of this [plan] is to establish a consistent and uniform approach to managing all aspects of the [Bulk Water Alliance] Programme, including:
>
> - Effective identification and compliance to legislative, statutory and regulatory requirements; and
> - Effective planning (including efficient structures and processes) and delivery of the [Bulk Water Alliance] Programme of Works.

3.95 The Programme Management Plan identified a series of subordinate programs and plans, which formed the basis of policies and procedures for the Bulk Water Alliance. Sixteen subordinate programs and plans were identified, covering a diverse range of areas such as:

- key phases and deliverables of the projects;
- workplace health and safety;
- community engagement and stakeholder management;
- procurement; and
- environmental management.

3.96 The Programme Management Plan also identified the quality management features of the Bulk Water Alliance and how this was to be incorporated and demonstrated in the delivery of the projects.

3.97 The Programme Management Plan also identified relevant controls relating to:

- key governance groups and meetings;
- risk management;
- document and records control;
- correspondence within, and external to, the Bulk Water Alliance;
- competencies and training;
- non-conformance, corrective and preventive actions;
- internal audits and assessments;
- resolution of issues and disputes;
- documentation of alliance decisions;
- reporting processes and protocols; and
- financial reporting to ACTEW (as the Owner).

Bulk Water Alliance Performance Management Plan

3.98 A Bulk Water Alliance Performance Management Plan was developed by the Bulk Water Alliance in August 2009. The Plan underwent a series of updates until March 2010.

3.99 The purpose of the Bulk Water Alliance Performance Management Plan was to 'describe the procedures for measuring and reporting performance for each project in the [Bulk Water Alliance]'. The Bulk Water Alliance Performance Management Plan stated:

> The Performance Measurement Plan has been developed to provide guidance on the desired non-cost outcomes for each project managed by the [Bulk Water Alliance]. The Owner's expectations have been further refined by defining Key Performance Indicator Measures (KPIs), applicability and desired weighting of KPIs to each project.

3.100 The Bulk Water Alliance Performance Management Plan primarily focused on the management and measurement of performance in relation to non-financial key performance indicators associated with the quality pool. The use of the quality pool for the different projects is discussed at paragraphs 3.32 to 3.34.

3.101 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.

Management and governance committees

3.102 The Program Alliance Agreement (and other relevant policy and procedural documents) provided for the establishment of three key management and governance committees:

- the Executive Committee;
- the Alliance Leadership Group; and
- the Alliance Project Management Team.

Executive Committee

3.103 Schedule 9 of the Program Alliance Agreement provided for the establishment of an Executive Committee for the Bulk Water Alliance. The purpose of the Executive Committee was to participate in the internal resolution of issues and disputes within the Bulk Water Alliance.

3.104 Table 3-6 shows the composition of the Executive Committee.

Table 3-6 Executive Committee, Program Alliance Agreement, May 2008

Organisation	Role
Owner	Managing Director
Abigroup	Managing Director
GHD	CEO
John Holland Group	CEO/Group Managing Director

Source: Bulk Water Alliance – PAA, Schedule 4, Program Alliance Principles

3.105 The Executive Committee did not meet formally for the purpose of resolving issues and disputes in the Bulk Water Alliance. Nevertheless, it is understood that the members of the Executive Committee did meet and discuss issues associated with the Bulk Water Alliance as required.

Alliance Leadership Group

3.106 Schedule 4 of the Program Alliance Agreement provided for the establishment of the Alliance Leadership Group. The role of the Alliance Leadership Group included:

- providing overall strategic guidance and direction for the Bulk Water Alliance projects and setting strategies, goals and objectives for the alliance;
- promoting and fostering the core values and principles of the alliance;
- reviewing the performance of the Bulk Water Alliance, including performance of their respective entities; and
- reviewing and approving all requests or proposals for scope changes (i.e. major changes) or any other proposals with material effect on the project deliverables, Target Outturn Cost(s) or expected timeframes.

3.107 Table 3-7 shows the composition of the Alliance Leadership Group.

Table 3-7 Alliance Leadership Group, Program Alliance Agreement, May 2008

Organisation	Representatives	Alternate
Owner	Chief Engineer (ACTEW), General Manager (ActewAGL)	Director (Water Security Projects), Manager (Water Services)
Alliance Partner (Abigroup)	General Manager (Major projects and Technical services)	State Manager Engineering
Alliance Partner (GHD)	Director	
Alliance Partner (John Holland Group)	Director	General Manager (Operations)

Source: Bulk Water Alliance – PAA, Schedule 4, Program Alliance Principles

3.108 The Alliance Leadership Group typically met on a monthly basis and met a total of 60 times over the course of the alliance.

Alliance Project Management Team

3.109 Schedule 4 of the Program Alliance Agreement provided for the establishment of the Alliance Project Management Team. The role of the Alliance Project Team included:

- managing the delivery of the Bulk Water Alliance projects;
- developing budgets, plans and schedules to manage the projects within the Target Outturn Cost and identified timeframes;
- developing and implementing processes for 'maintaining and improving the health of the Alliance'; and
- reviewing and approving any other changes (i.e. not major scope changes) to the project deliverables, Target Outturn Cost(s) or expected timeframes.

3.110 Table 3-8 shows the composition of the Alliance Project Management Team.

Table 3-8 Alliance Project Management Team membership, Program Alliance Agreement, May 2008

Organisation	Role
Owner's representative	Owner's Alliance Program Manager
Alliance Partner	Program Construction Manager
Alliance Partner (GHD)	Program Design Manager

Source: Bulk Water Alliance – PAA, Schedule 4, Program Alliance Principles

3.111 The Alliance Project Management Team typically met on a monthly basis and met a total of 82 times over the course of the alliance.

3.112 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.

Individual Project Managers

3.113 Each Bulk Water Alliance project had its own project manager. Each project manager was 'responsible for the day-to-day management of the works for each project and reported directly to the BWA Program Director with escalation, if necessary, to the ALG'. Project Manager Group (PMG) meetings were 'conducted weekly to track the progress of the individual projects against Programme budget and KPIs to ensure the successful delivery of the works.' Each Project Manager had delegation for industrial relations for the Bulk Water Alliance.

3.114 There were also ACTEW project managers for each of the three projects. They were responsible for ensuring that ACTEW's interests were considered and taken care of and ACTEW's stakeholders' expectations were met. The ACTEW project manager worked closely with the Alliance Project Managers to influence project outcomes.

Dispute resolution processes

3.115 The Alliance Project Management Team was responsible for the day to day management of the Bulk Water Alliance. If unable to reach a unanimous decision on a particular issue, the Alliance Project Management Team was to refer the matter to the Alliance Leadership Group. It was expected that the Alliance Project Management Team would make recommendations on these matters to the Alliance Leadership Group. The Alliance Project Management Team was responsible for some decisions, as per the Program Alliance Agreement.

3.116 If the Alliance Leadership Group was unable to reach unanimous agreement it was to refer the matter to a Technical Expert and/or to the Executive Committee for resolution. The Executive Committee was to work to resolve the matter according to the alliance principles. If unable to resolve the matter the Executive Committee[79] was to notify all parties that the matter had become a dispute, to be referred to the chief executives of each party. If the dispute was unable to be resolved the Owner and the Non-Owner Participants had the option to terminate the agreement. This was considered a drastic step and one that would reflect the irretrievable breakdown of the alliance relationship at that time.

3.117 There were effective and appropriate dispute resolution processes for the Bulk Water Alliance.

[79] The Executive Committee was generally the chief executives. However, when they were not acting as the Executive Committee they were able to act in their own corporate interests and not under the alliance principles.

Monitoring and reporting arrangements

3.118 The Bulk Water Alliance Programme Management Plan included a key control, monthly performance reporting, over the management and delivery of the projects. Each Project Manager was to prepare:

- a monthly report for the Alliance Project Management Team; and
- a monthly 'dashboard' report for the Alliance Leadership Group.

3.119 Monthly project reports typically contained information on issues including: occupational health and safety; environmental management; project scheduling; project costs; finance and commercial issues; risks and opportunities; key performance indicator progress; human resources and industrial relations.

3.120 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.

Reporting to ACTEW

3.121 In addition to progress reporting within the Bulk Water Alliance, ACTEW developed its own processes. These were to ensure that ACTEW representatives reported progress directly to ACTEW.

3.122 Table 3-9 shows the reporting from the Bulk Water Alliance to ACTEW.

Table 3-9 Minimum level of reporting on Bulk Water Alliance projects' progress and issues

Report to:	From:	Frequency	Subject
ACTEW Board	Water Security Major Program Director	Each monthly meeting	Progress of each project including safety, achievements, issues, risks, costs, schedule and community engagement and stakeholder management.
ACTEW Board's Audit and Risk Management Committee	Water Security Major Program Director; Governance and Operations Manager; and (where required) ACTEW Project representatives	Each Board / ARMC meeting	Management of program level risks and other risks which impact on ACTEW.
Owner's Reference Committee	Enlarged Cotter Dam Project Manager Murrumbidgee to Googong Project Manager Googong Dam Spillway Project Manager	Weekly meeting	Progress of each project including safety, achievements, issues, risks, costs, schedule and community engagement and stakeholder management. This forum was useful in identifying common issues or themes at a program level that may have needed addressing through the Alliance.

Source: Water Security Major Projects: Bulk Water Alliance Governance Guide, July 2009, p 23.

3.123 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.

4 ENLARGED COTTER DAM PROJECT TIMING AND BUDGET

4.1 This chapter discusses the Bulk Water Alliance's performance with respect to time and cost objectives. It specifically focuses on the Enlarged Cotter Dam project from the acceptance of the Final Target Outturn Cost of $299 million plus $64 million owner's costs in September 2009. Construction of the Enlarged Cotter Dam commenced in November 2009 and was completed in August 2013.

Summary

Conclusion

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.

Key findings

	Paragraph
An analysis of the cost and timing of the Bulk Water Alliance projects showed:	4.3
• 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.

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

- 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).

4.15 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.

4.25 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:

- 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).

4.30 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.

4.35 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.

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, 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. 4.41

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 m^3 per month with a peak monthly placement rate of 90,000 m^3 per month. The actual roller compacted concrete placement rate was less than 30,000 m^3 per month with a peak placement rate of 42,000 m^3 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.[80] 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 placement rate that could be achieved were very optimistic. 4.59

The reasons for lower roller compacted concrete placement are: 4.67

- 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. 4.84

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. 4.98

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 4.103

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

its Value for Money Report[81] 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.

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 cost and timeframe. 4.104

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).[82] 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 4.116

[81] ACTEW, Bulk Water Alliance Value for Money Report, 2014, p 41, 42

[82] 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.

five years is expected to be on a smaller scale than a flood event that might happen once every twenty years.

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.

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

- the production rates adopted;
  - foundation excavation production rates;
  - roller compacted concrete production and placement rates;
- the likelihood of the following risks eventuating:
  - 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:
  - 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.

Bulk Water Alliance Project cost increases and time delays

4.2 Table 4-1 shows, for each Bulk Water Alliance project, the final budgeted cost and final cost. The final budgeted cost is the Final Target Outturn Cost, as determined and agreed by the Bulk Water Alliance (August 2009), plus the estimated Owner's Costs. There have been a number of different cost estimates for the Enlarged Cotter Dam between 2004 and 2007. These cost estimates, their accuracy and use, are in Appendix A. Also shown in Table 4-1 is the intended completion dates and actual completion dates of each project.

Table 4-1 Bulk Water Alliance projects' Target and Actual Outturn costs

	Cost						Time	
	Final Budgeted Cost ($m) (as at 1 September 2009)			**Final Cost ($m) (May 2015)**			**Initial Completion Date**	**Actual Completion Date**
	Final Target Outturn Cost	ACTEW/ Owner Costs	Total Cost	Actual Outturn Cost	ACTEW/ Owner Costs	Total Cost		
Enlarged Cotter Dam	299.0	64.0	363.0	356.2	54.3	410.5	Dec 2011	Aug 2013
Murrumbidgee to Googong Pipeline	117.5	37.0	154.5	105.6	34.9	140.5	June 2012	Sept 2012
Googong Dam Spillway	48.0	8.0	56.0	47.0	7.0	54.0	April 2010	Dec 2010
Total	**464.5**	**109.0**	**573.5**	**508.8**	**96.2**	**605.0**		

Source: ACTEW data

4.3 An analysis of the cost and timing of the Bulk Water Alliance projects showed:

- 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.

4.4 This audit has primarily focused on the reasons for the cost increases and time delays for the Enlarged Cotter Dam following the acceptance of the Final Target Outturn Cost by the ACTEW Board on 1 September 2009. This is because this project was the largest of the three Bulk Water Alliance projects and experienced a significant cost over-run. The Enlarged Cotter Dam project also received considerable Legislative Assembly and community attention.

Enlarged Cotter Dam project cost increase and time delay (post Final Target Outturn Cost)

4.5 The Enlarged Cotter Dam accepted budgeted cost (on 1 September 2009) was $363.0 million. This comprised the Final Target Outturn Cost of $299.0 million for the Bulk Water Alliance and separate Owner's Costs for ACTEW of $64.0 million.

Enlarged Cotter Dam (Final Target Outturn Cost)

4.6 Table 4-2 shows the Final Target Outturn Cost for the Enlarged Cotter Dam project, as agreed by the Bulk Water Alliance in August 2009 and endorsed by the ACTEW Board on 1 September 2009.

Table 4-2 Enlarged Cotter Dam Final Target Outturn Cost

Item	Cost ($)
Direct costs	224,292,261
Total direct costs	**224,292,261**
Escalation	15,404,734
Risk allocation	21,958,287
IT and management fees	1,772,844
Direct costs plus escalation and risk and IT management and fees	**263,428,126**
Fee costs	35,571,874
Final Target Outturn Cost	**299,000,000**

Source: Adapted from Target Outturn Cost report (August 2009)

4.7 An explanation of the different items in Table 4-2 is as follows:

- Direct costs: the costs incurred by the Non-Owner Participants in designing and constructing the Enlarged Cotter Dam, including foundation excavation and preparation and the construction of the dam wall and associated structures.
- Escalation: provides for an increase or escalation of direct costs due to inflation over the course of the project. The use of an escalation component recognises that the project was to be conducted over a period of time and that cost increases due to inflation were to be expected.
- Risk allocation: a contingency sum for the project. It recognises that there are risks in the delivery of the project which should be budgeted for.
- IT and management fees. This represents direct fees payable to one of the Non-Owner Participants for specific services.
- Fee costs: project fees payable to the Non-Owner Participants.

4.8 The development of the Target Outturn Cost is discussed in Chapter 3.

Direct costs

4.9 Table 4-3 shows the direct costs component of the Final Target Outturn Cost and estimated actual cost of the of the Enlarged Cotter Dam project. The escalation, risk allocation and IT and management fees payable to one of the Non-Owner Participants, as identified previously in Table 4-2, have been allocated to each of the direct cost items.

Table 4-3 Enlarged Cotter Dam direct costs (target and actual)

	Target $	Actual $	Change $	Change %
Overheads	85,499,526	73,358,907	12,140,619	14.2
Design	15,145,009	22,231,510	(7,086,500)	(47.0)
Abutment and Dam	93,686,423	146,780,523	(53,094,100)	(56.7)
Saddle dam/ quarry/crushing	41,386,762	43,266,507	(1,879,745)	(4.54)
Structures	27,710,404	48,071,050	(20,360,646)	(73.4)
Direct costs subtotal	**263,428,126**	**333,708,496**	**(70,280,372)**	**(26.7)**
Flood costs	-	11,489,166	(11,489,166)	
Direct costs total	**263,428,126**	**345,197,662**	**(81,769,538)**	**(31.0)**

Source: Adapted from Bulk Water Alliance Cost statements (March 2015)

Note: There are differences in the Budget and Actual totals in the table above due to rounding differences.

4.10 Although an additional $81.8 million in direct costs were incurred for the project, this was shared between ACTEW and the Non-Owner Participants according to the 'pain-share' mechanism developed as part of the Commercial Framework for the Bulk Water Alliance.

4.11 The different elements of the direct costs are:

- Overheads: various overhead and administrative costs related to the project.
- Design: costs incurred in the design phase of the project.
- Abutment and Dam: preparing the abutments and constructing the dam wall.
- Saddle Dam/Quarry/Crushing: preparing the saddle dam and preparing material for use in the roller compacted concrete.
- Structures: the construction of structures associated with the dam, e.g. the intake tower and dam spillway.
- Flood Costs: the three flood events that were experienced during the construction of the dam. There were two minor flood events in late 2010 and a major flood event in March 2012. These costs relate directly to the construction of the Enlarged Cotter Dam and were not budgeted for as part of the Final Target Outturn Cost.

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

- 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).

4.13 Table 4-4 provides information with respect to the initial target and actual cost for the different components of the direct costs associated with the Enlarged Cotter Dam project. It also shows key budget items that experienced significant cost over-runs.

Table 4-4 Breakdown of the Enlarged Cotter Dam direct costs (budget and estimated actual) by key cost drivers

	Target ($ m)	Actual ($ m)	Change ($ m / %)	Proportion of overrun (%)	Explanation
Overheads	**85.5**	**73.4**	**(12.1) / (14.2)%**	(14.8)%	
Design	**15.1**	**22.2**	**7.1 / 47%**	8.7%	**Due to various delays, which resulted in project designers remaining on site for longer than anticipated.**
Abutment and Dam	**93.7**	**146.8**	**53.1 / 56.7%**	64.9%	
Diversion works construction	*3.1*	*6.6*	*3.5 / 112.9%*	*4.3%*	*A decision was made to provide for greater flood diversion capacity in the later stages of the project, to mitigate the risk of flooding.*
Foundation excavation and preparation	*14.8*	*18.6*	*3.8 / 25.7%*	*4.6%*	*Principally due to a less efficient and slower operation on the steep abutments than anticipated. This figure also recognises a 'fault' at the abutment of the dam, whereby unanticipated extra excavation was needed.*
Roller compacted concreting	*52.7*	*93.2*	*40.5 / 76.9%*	*49.5%*	*Significantly more time was needed to lay the roller compacted concrete for the dam, as compared to initial estimates. A variety of factors led to this, including more rain than normal and a number of compounding factors.*
Craneage	*3.7*	*9.4*	*5.7 / 154.1%*	*7.0%*	*Attributable to the delays in the roller compacted concreting placement.*
Saddle dam/ quarry/crushing	**41.4**	**43.3**	**1.9 / 4.6%**	2.3%	
Structures	**27.7**	**48.0**	**20.3 / 73.3%**	24.8%	
Intake tower	*2.8*	*1.6*	*(1.2) / (42.9)%*	*(1.5)%*	*Primarily due to overly optimistic scoping and estimating at the Final Target Outturn Cost development stage, when the design was only known at a concept or preliminary level.*
Spillways	*2.3*	*7.0*	*4.7 / 204.3%*	*5.7%*	
Stilling basin	*1.5*	*4.0*	*2.5 / 166.7%*	*3.1%*	
Reinforcing steel	*2.5*	*3.3*	*0.8 / 32%*	*1.0%*	
Structural concrete supply	*2.0*	*4.5*	*2.5 / 125%*	*3.1%*	
Direct costs subtotal	**263.4**	**333.7**	**70.3 / 26.7%**	85.9%	

	Target ($ m)	Actual ($ m)	Change ($ m / %)	Proportion of overrun (%)	Explanation
Flood costs		*11.5*	*11.5 / - %*	*14.1%*	*Several minor floods were followed by an extreme flood in March 2012.*
Direct costs total	**263.4**	**345.2**	**81.8 / 31.0%**		

Source: Audit Office analysis of Bulk Water Alliance Cost statements (March 2015)

Key: Grey shaded and italicised text in the table above represent major/significant cost items within each of the main cost driver categories.

4.14 An analysis of the Enlarged Cotter Dam's direct costs by cost drivers shows:

- almost all areas of the direct costs component of the Final Target Outturn Cost, with the exception of Overheads, have specific items that have exceeded their initial estimate; and
- the roller-compacted concrete item within the abutment and dam component experienced a significant target over-run, from $52.7 million to $93.4 million (an increase of 77 percent and 48 percent of the cost overrun).

Project time

4.15 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.

4.16 Table 4-5 shows the cumulative impact of various delays in the project.

Table 4-5 Delays in the construction of the Enlarged Cotter Dam (key phases)

Phase	Target time for completion (months)	Actual time required (months)	Difference (months)
Foundation excavation and preparation	14.5	20.5	6
Roller compacted concreting	7	17	10
Completion	4	8	4
Total	**25.5**	**45.5**	**20**

Source: Entura analysis of ACTEW material

4.17 An analysis of delays in the construction of the Enlarged Cotter Dam shows:

- there were delays at all stages of the project; and
- significant delays were experienced during the roller compacted concrete phase of the project (i.e. the placing of roller compacted concrete to construct the dam wall) which was initially forecast to take seven months and ended up taking 17 months.

Analysis of reasons for cost increases and time delays

ACTEW explanation for time delays and cost increases

4.18 In its *Bulk Water Alliance - Value for Money* report ACTEW identified that the most significant project delays resulted from:

- geological conditions at the base of the abutment to the dam 'requiring excavation to a depth of greater than 9m below the design foundation level';
- construction and maintenance of an additional water diversion for the project 'due to exceptionally high rainfall and outflow rates from the old Cotter Dam';
- '[roller compacted concrete] joint treatment considerably in excess of Final [Target Outturn Cost] allowances due to weather and other unforseen events'; and
- 'excessive wet weather, including multiple flooding events, most notably the March 2012 flood event'.

4.19 In its *Bulk Water Alliance - Value for Money* report ACTEW also noted:

> The Actual Out-turn Cost (AOC) for the Cotter Dam exceeded the Final [Target Outturn Cost], reflecting the aggressive production targets applied in the Final [Target Outturn Cost], abnormally high wet weather during construction and unforeseen geology.

4.20 With respect to the 'aggressive production targets' applied in the Final [Target Outturn Cost] ACTEW noted in its *Bulk Water Alliance - Value for Money* report that 'the Cotter Dam project significantly exceeded the target construction program developed for the Final [Target Outturn Cost], with [roller compacted concrete] placement alone almost ten months longer than target estimates. This was a consequence of a number of extraordinary events (particularly weather) and unrealistic production targets.'

Audit Office analysis

4.21 The Audit Office examined the reasons for the increase in costs and delays associated with the construction of the Enlarged Cotter Dam. In many instances the reasons and drivers for the increase in costs and the delays to the project are the same. For example, adverse weather conditions had an impact in delaying the project and causing additional expenditure to remediate the effects of the weather. Delays to the project also contributed to project costs due to, for example, idle equipment.

4.22 The Audit Office sought advice and assistance from Entura with respect to identifying the reasons for the delays in the project and the increase in costs associated with the project. In doing so, advice was sought as to whether the risks associated with the delays to the project and the increase in the costs of the project were reasonably foreseeable and could have been more effectively managed.

4.23 A number of issues that have been identified as key drivers of increases in the costs of, and delays to, the project are:

- foundation excavation and preparation activities;
- roller compacted concreting;
- flood events; and
- post-roller compacted concreting activities.

Foundation excavation and preparation

4.24 The foundation excavation and preparation activities of the Enlarged Cotter Dam project involved clearing the site in preparation for its construction.

4.25 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:

- 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).

Slow rate of progress for foundation excavation and preparation

4.26 There was a generally slower than expected rate of progress in relation to the excavation of the dam foundation and the associated clean-up of the foundation excavations. This was identified as being partially due to the steep abutments of the dam, i.e. the steeper the abutments adjoining the dam the more difficult it was to excavate and clean in preparation for construction of the dam wall.

4.27 In relation to the physical constraints of the site Entura advised:

> The steepness of the abutments, the minimal overburden and the high standard of foundation surface required make this a particularly specialised operation, with which very few construction people in Australia would be familiar. Narrow access tracks had to be carved into the rock face.

4.28 With respect to the generally slow progress in relation to foundation excavation and preparation Entura advised:

> The clean-up was overall a more difficult job than expected by the contractors because the expectations of the designers for the standard of clean-up were poorly understood by the contractors until construction started.

4.29 There was also additional excavation of the foundation rock; more than that which was initially anticipated and incorporated into the design of the dam. In this respect it is noted that it is difficult to precisely excavate the rock to the design level, i.e. what was planned, and it is also noted that the site itself, specifically the steepness of the abutment walls, presented challenges in the excavation and removal of foundation material. Nevertheless, the depth to which the foundation material was excavated was typically at a deeper level than planned. The Bulk Water Alliance Detailed Design Report March 2014 identified:

> Some degree of damage to the dam foundation typically occurred as a result of excess blast energy that was transmitted into the rock mass below the design excavation depth ... removal of blast damaged rock resulted in a dam foundation that was typically deeper than design levels.

4.30 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.

4.31 On this issue, ACTEW advised that there was a strategy to excavate further than initially planned due to a fault encountered on the excavation line. ACTEW advised that this was a risk mitigation action to minimise the need for re-commencement of excavation from the top of the abutment which would have been required if the first excavation was not deep enough. ACTEW advised that, on balance, it was considered that the cost of additional excavation was prudent given the potential cost of re-excavation.

Was this reasonably foreseeable and could it have been managed more effectively?

4.32 With respect to the generally slow progress in relation to foundation excavation and preparation Entura advised:

> The low efficiency and slower-than-target progress on the excavation and foundation clean-up of the steep valley sides was foreseeable. The geology of the site was well understood thanks to an effective geotechnical investigation programme. However for the construction planning, it is evident that there was inadequate experience with this very specialised type of work brought to bear on this task at Cotter. The target rate of progress was very ambitious.

4.33 Entura further advised:

> The slow production rate for the abutment excavation and clean-up should have been foreseeable to experienced dam builders. The 'worst case' input to the Monte Carlo analysis of a 4 month delay bears this out. As events unfolded, including some delays as a result of flooding in the riverbed, the delay is considered to have been unavoidable.

4.34 In summary, Entura further advised:

> 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. For dam construction this is a common problem. At this dam, unusually high for Australia at 85m, the clean-up requirements were stringent, and the gap in expectations was troublesome. The Alliance method of project delivery could have been exploited to bridge this gap to a greater extent.

4.35 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.

Diversion works construction

4.36 In early 2011 the Bulk Water Alliance agreed to undertake works to construct an additional river diversion to be in place during the construction of the Enlarged Cotter Dam. A river diversion typically involves the construction of a tunnel or conduit, through which the river could be diverted during the construction of a dam. This would allow the dam foundation area to be de-watered and the dam to be constructed in the dry. A river diversion generally consists of an upstream cofferdam, a river diversion conduit or tunnel, and a downstream cofferdam.

4.37 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.

Was this reasonably foreseeable and could it have been managed more effectively?

4.38 With respect to the construction of the river diversion, Entura advised:

> The decision, during the foundation preparation phase, to spend more on the diversion works and delay the foundation work, in order to provide a greater diversion capacity and thus mitigate the flood risk, was a sensible one.

4.39 Entura further advised:

> To have retained the diversion arrangements that were included in the Final [Target Outturn Cost] would have led to much more delay and net cost. The extent of the increase in delay and cost is difficult to estimate, but it can be stated that there would have been at least one additional overtopping event, other than the one in March 2012; also it is likely that the March 2012 event would have incurred a delay of at least one month longer than actually occurred.

4.40 However, Entura also advised:

> The modified Stage 2 diversion should probably have been planned from the beginning, as this finished up being a better solution. If this had been planned from the beginning the lost time in foundation excavation as a result of this revised diversion arrangement may have been reduced.

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

4.42 The March 2012 flood event is discussed in further detail at paragraph 4.106.

Geological fault

4.43 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.

Was this reasonably foreseeable and could it have been managed more effectively?

4.44 Major dam construction projects inevitably carry a level of geotechnical risk, relating to the latent conditions of the site. Geotechnical risks should be mitigated through careful investigation and planning.

4.45 ACTEW commenced geotechnical investigations for the Enlarged Cotter Dam site in 2007, prior to the formation of the Bulk Water Alliance. Geotechnical investigation included:

- investigations of the main dam site, saddle dams, quarry and borrow area prior to the development of the Target Outturn Cost;
- investigations undertaken after the development of the Final Target Outturn Cost to further confirm the geological model and further reduce uncertainties;
- investigations undertaken after the commencement of the construction in order to further investigate the tower crane foundations, intake foundation and saddle dam grouting; and
- additional investigations of the main dam grouting following the completion of the main dam drainage gallery.

4.46 The results of these investigations are well described in the Bulk Water Alliance's *Enlarged Cotter Dam: Geotechnical Assessment Report for TOC Design* which noted that no 'show-stoppers' were identified in terms of foundation faults, leakage through the foundations or reservoir rim or large scale landslides. The report identified:

- the main dam geotechnical issues as:
  - stripping depth and shape (i.e. amount of foundations excavation required);

  - excavation stability and construction implications (i.e. amount of clean up and stabilisation of the abutments);
  - kinematic behaviour of the foundation excavation (i.e. weak zones in the foundation);
  - grouting requirements (i.e. amount of grouting of the rock to reduce leakage);
  - post construction geological hazards (i.e. landslides or rock falls that may be safety risks).

- saddle dam geotechnical issues identified as:
  - stripping depth and foundation strength (i.e. amount of excavation required);
  - cut off of seepage under the dams (i.e. amount of grouting required);
  - foundation stability due to presence of the quarry (i.e. stability of the saddle dams).

4.47 Notwithstanding these investigations, in May 2011 the geological fault at the right abutment of the dam was discovered. Entura advised that this geological fault was not identified during geotechnical investigations because:

> It occurred between two boreholes, and was therefore unexpected, and was unpredictable due to the sudden and unexpected dip of the joint set No 1 at that point.

4.48 With respect to the adequacy of the geotechnical investigations undertaken for the Enlarged Cotter Dam, Entura advised:

> The geotechnical investigations prior to the development of the [Final Target Outturn Cost] were detailed and appropriate. The major features of the geology were understood and there were 'no surprises' with the exception of the right abutment foundation feature which was undetected until late in the excavation of the foundations. Whilst the feature may have been discovered with additional investigations this is not certain and the overall impact on the construction cost over-run and delays would not justify significant additional expenditure on investigations and it is better managed through an appropriate contingency sum.

4.49 While the geological fault at the right abutment wall was a factor in the project's overall time delay and cost, Entura advised:

> The more important factor for the foundation stripping and clean-up was the inadequate understanding of the difficulty of this task on the very steep abutments at the dam site at the time of the [Final Target Outturn Cost]. This is a reasonably foreseeable risk, however the Alliance worked diligently to minimise the cost and delay to the program. Whilst the actual cost was not significantly over budget, the delays were significant and with greater understanding of the construction challenges, a more realistic assessment at the time taken to complete the task may have been developed pre-TOC.

4.50 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.

Roller compacted concreting

4.51 The roller compacted concreting phase of the Enlarged Cotter Dam project involved preparing on-site rock material for incorporation into a concrete mixture for placement as the dam wall.

4.52 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:

- 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).

4.53 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.

4.54 Table 4-6 shows a breakdown of costs associated with the roller compacted concrete phase of the Enlarged Cotter Dam project.

Table 4-6 Analysis of roller compacted concrete cost (labour, material, plant and machinery)

	Target ($ m)	Actual ($ m)	Change ($ m / %)	Explanation
RCC Batch Plant	18.5	25.8	7.0 /39.5%	Significantly more time was needed to lay the roller compacted concrete for the dam, as compared to initial estimates. Many factors led to this, including more rain than normal and a number of compounding factors.
RCC material	12.6	9.9	(2.7) / 21.4%	
Placement of RCC	21.6	57.5	36.0 / 166.2%	
Total RCC cost	**52.7**	**93.2**	**40.5 / 77%**	

Source: Audit Office analysis of Bulk Water Alliance Cost Statements

4.55 An analysis of costs associated with the roller compacted concrete shows that:

- there was a small saving in the direct costs of the roller compacted concrete material, with an estimated actual cost of $9.9 million, as compared to a budgeted cost of $12.6 million; and
- there was a significant increase in the costs associated with placing the roller compacted concrete, with an estimated actual cost of $57.5 million, as compared to a budgeted cost of $21.6 million.

Placement of the roller compacted concrete

4.56 The placement of the roller compacted concrete at the Enlarged Cotter Dam varied significantly from the estimates identified in the Final Target Outturn Cost.

4.57 The Final Target Outturn Cost identified an average roller compacted concrete placement rate of approximately 54,000 m^3 per month with a peak monthly placement rate of 90,000 m^3 per month. The actual roller compacted concrete placement rate was less than 30,000 m^3 per month with a peak placement rate of 42,000 m^3 per month.

4.58 In 2010 the Halcrow report identified that 'the proposed [roller compacted concrete] average placement rate of 50,000 cubic metres per month is at the high end of benchmark rates but should be achievable.'[83]

4.59 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.[84] 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 placement rate that could be achieved were very optimistic.

4.60 Entura advised, based on their experience of roller compacted concrete dams constructed in Australia[85], that 'a peak monthly placement rate of around 60,000 to 79,000 m^3 was probably more realistic, and an average monthly placement rate of around 35,000 to 40,000 m^3 was probably a more realistic target at the time of the [Final Target Outturn Cost] development.'

Roller compacted concrete placement rate risks

4.61 Roller compacted concrete placement rates depend, initially, on production rates. Production rates depend on the set-up of the production facility, the equipment delivering the roller compacted concrete to the dam and the rate of placement of the roller compacted concrete.

4.62 After production the placement rate particularly depends on the level within the dam where placement is occurring: the more room available on the surface the higher the placement rate and vice versa. It is expected that placement rates will be lower in the riverbed (where it is narrow) and near the crest of the dam (due to the restricted room) and may be half of the rates achieved where there is plenty of room. Placement rates can

[83] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd, p32.
[84] The Bulk Water Alliance Enlarged Cotter Dam Value for Money Report (2014), page 39.

[85] Entura has been involved in three Australian roller compacted concrete dam projects (Paradise, Meander and Wyaralong dams).

also be affected by embedded items within the dam structure or an awkwardly shaped placement area.

4.63 Roller compacted concrete production and placement rates are impacted by many factors including:

- supply of raw materials such as aggregate, cement, flyash, admixtures, cooling and water;
- capacity and number of RCC batching plant(s);
- delivery method and equipment (conveyor, truck or hybrid) including the capacity of any conveyor system and the number of trucks;
- reliability of the production and delivery systems;
- topography: the narrower the valley the more congested the placement activities, the lower the placement rates;
- formwork methodology (arrangement of formwork for the downstream steps and flow of work raising formwork, which should be arranged for minimum disruption);
- constraints including the usual learning curve, thermal issues and time involved in the gallery;
- wet weather;
- non-work days; and
- work roster (whether there is/are one, two or continuous shifts).

4.64 The Bulk Water Alliance had full control of the supply of the roller compacted concrete aggregate. This is because the material was crushed on the site and there was adequate storage on site for all the raw materials. Accordingly, shortcomings in the supply of the roller compacted concrete did not constrain the rate of production. Similarly, there was sufficient production capacity, i.e. through higher batching and supply capacity, than the best daily rate of production that was planned. The Bulk Water Alliance had a dedicated mixer for roller compacted concrete and a theoretical maximum supply rate of 400 m^3 per hour. The batching and supply of the roller compacted concrete was rarely an issue with the Enlarged Cotter Dam.

4.65 ACTEW advised that the Bulk Water Alliance sought to mitigate the risk of low placement rates by engaging an expert international team (from the United States) to lead and undertake roller compacted concrete placement.

Reasons for lower roller compacted concrete placement

4.66 Notwithstanding the sufficient production and storage capacity for the supply of the roller compacted concrete, the actual rate of placement did not match what was proposed in the Final Target Outturn Cost.

4.67 The reasons for lower roller compacted concrete placement are:

- 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.

March 2012 flood event

4.68 Issues associated with the March 2012 flood event are discussed at paragraph 4.106.

Gallery construction issues

4.69 With respect to the gallery construction issues Entura advised:

> The main elements of the method were to maintain higher production by placing [roller compacted concrete] at the top of the gallery level, then excavating the gallery with a trenching machine, and finally placing precast roof panels over the excavated gallery opening, cleaning up lift surface and commencing [roller compacted concrete] placement again.
>
> ... For some reasons the construction team decided that they wanted a flat [roller compacted concrete] surface and therefore decided to rebate the precast panel into the lift surface. The result of this ... was that a second excavation activity was required for the rebate, which in turn damaged the [roller compacted concrete] edge, requiring a form and grout to repair. The result was that this exercise caused about a month of delay, rather than 10 days.

Rain delays and cold joints

4.70 With respect to rain delays and the issue of cold joints Entura advised:

> The average placement rate at Cotter Dam was dramatically impacted by the number of rain days, and the shifts due to "cold" joints. Cold joints occur when too much time passes between the placement of a [roller compacted concrete] layer and the following layer coming over the top. Normal practice is to develop a [roller compacted concrete] mix to have sufficient life, by retarding the set time with a retarding additive, to achieve the placement of [roller compacted concrete] layers without getting cold joints. An appropriate mix design was developed for the Enlarged Cotter Dam and the retardation adopted gave around 20 hours life for the [roller compacted concrete], which should have been adequate. At Cotter 36-48 hours needed to pass before a [roller compacted concrete] lift surface became a "cold joint". Of course one will always have some cold joints due to either rain stoppages, plant breakdown, or planned stoppages, however, this should be the exception.

> ... the [Final Target Outturn Cost] had budgeted for 30 shifts lost due to lift surface treatment due to "cold" joints, while the actual shifts that were lost was 192... This is extraordinarily high, and would suggest a very high number of "cold" [roller compacted concrete] joints.

4.71 The Final Target Outturn Cost had budgeted for 30 shifts lost due to treatment for cold joints. The actual number of shifts lost due to the need to treat cold joints was 192. This caused almost three months cumulative delay to the project.

4.72 Entura advised that most of the cold joints were attributed to rainfall. Entura further advised that 'there is no doubt that that the rainfall for the 5 months prior to the March 2012 flood was high, with our independent check showing that this was the wettest period between November to March on record ... Therefore it is not surprising that a high number of cold joints eventuated.'

4.73 Notwithstanding this Entura advised:

> However, after the March 2012 flood the rainfall that occurred was not unusual, and this period was equivalent to around the 45% rainfall, that is 55% of the years on record had a higher rainfall...Therefore the rainfall that occurred in this period is similar to what they would have expected during the development of the [Final Target Outturn Cost]. However, even in this period of [roller compacted concrete] placement the [roller compacted concrete] placement rates did not improve.

4.74 Compounding the issue of the cold joints was the time taken to green-cut and clean the cold joints. To overcome the cold joints, which presented a risk to the bonding of the different concrete layers and the structural integrity of the dam, a process of green cutting was adopted which involved 'cutting' the surface of the concrete with a jet of water, to expose the fresher concrete that was underneath, in order to enhance the bond with the next layer of concrete. Entura advised:

> The average time of 7 shifts to green cut and clean up a "cold" lift surface is extremely high, and is very unusual. Typically this should not have taken more than 2 days, which is equal to 4 shifts.

4.75 In relation to this process Entura further advised:

> ... the high level of retardation to the [roller compacted concrete] mix meant that the "cold" lifts were still relatively green (soft) and delicate to green-cut. Therefore, if the construction team were too aggressive with the green-cutting it would result in a large amount of clean up. This, along with the congested nature of the lift surface and work OHS issues, meant that this process was extremely slow.

4.76 Entura advised that 'overall, 136 shifts were lost on account of joint treatment, compared with an allowance in the [Final Target Outturn Cost] of 30 shifts lost. In addition, 52 shifts were lost due to the weather, compared with the allowance in the [Final Target Outturn Cost] of 23 shifts lost.'

Congestion of the roller compacted concrete surface

4.77 Entura advised:

> Even when the [roller compacted concrete] level rose and the valley width increased the placement rates did not increase, which is unusual ... a significant reason for this was the congestion of the [roller compacted concrete] lift surface. This congestion was a result of the two tower cranes, the drainage gallery entrances and the gallery up the abutments, and the amount of equipment on the lift surface. The equipment on the lift surface was placed on the surface at the start of the [roller compacted concrete] placement in the bottom of the riverbed and this equipment had to stay on the dam surface as it went up until it got to the top. This congestion can really slow down the placement of [roller compacted concrete], which clearly happened.

Secondary spillway return walls

4.78 The secondary spillway return walls were against the downstream rock surface to protect it from erosion when the secondary spillway was operating.

4.79 Entura advised:

> Originally, during the [Target Outturn Cost design] these return walls were going to be placed with conventional vibrated concrete (CVC), however, as part of the value engineering process this was replaced with [roller compacted concrete] placement based on the material cost. This proved to be a poor decision, with the [roller compacted concrete] placement being extremely restrictive with the narrowness of this return wall to the excavated foundation, as a result placement in these areas was extremely slow.

4.80 The decision was made during planning to replace conventional vibrated concrete with roller compacted concrete. While this may have been a cheaper option, it also extended the time of the roller compacted concrete placement, on the basis of a restrictive environment in which to work.

Formwork

4.81 Entura advised that fourteen shifts were lost as a result of delays to the placement when moving formwork, compared with an allowance in the Final Target Outturn Cost of six.

Christmas shut down period

4.82 In the Final Target Outturn Cost the only breaks identified in the placement program related to Easter. Delays in the placement of the roller compacted concrete, due to factors identified previously, meant that the placement of the roller compacted concrete was interrupted by the Christmas period as well as the following Easter period. A total of 25 shifts were lost, compared with an allowance of eight in the Final Target Outturn Cost.

Was this reasonably foreseeable and could it have been managed more effectively?

4.83 Entura advised 'it is clear that given the optimistic [roller compacted concrete] placement rates at the [Final Target Outturn Cost] stage that achieving these placement rates was a foreseeable risk.'

Risk identification and management

4.84 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.

4.85 In November 2011 the risk of not achieving roller compacted concrete placement rates was identified by the Bulk Water Alliance and recorded in the Enlarged Cotter Dam Risk Register as a low risk. The control for this risk was identified as 'Daily costings and accurate quantity measurement to enable early identification and corrective action of costs. Trial 400mm placement layer.' Entura has advised 'this set of control measures is considered a flimsy one, insufficient to warrant a "low" risk level.'

4.86 This risk was replaced in the Enlarged Cotter Dam Risk Register with the following risk: 'Time and cost risks for RCC placement resulting from delayed start and/or production targets not achieved'. This risk was identified as an extreme risk. The controls identified for this risk primarily related to thermal requirements: the need to ensure that the temperature of the roller compacted concrete was maintained appropriately, including the need for an additional ice plant to keep the roller compacted concrete cool.

4.87 Entura advised that a significant amount of effort was undertaken to manage and minimise the impact of thermal requirements but that 'the key risk that eventuated was both rainfall causing cold joints, and a highly congested work surface causing production to be impacted.'

Cold joints

4.88 The number of cold joints that occurred exceeded the number assumed during planning.

4.89 In relation to managing and mitigating the risks of cold joints, Entura advised:

> ... an alternative placement method, such as the slope layer method should have been trialled to see if this could have improved the "cold" joint issue. With this the [roller compacted concrete] layer is sloped rather than horizontal, thus reduce the surface area that [roller compacted concrete] is being placed on and reducing the time taken to cover it with the next layer. This is normally done in say 5m lifts, with a slope up to 1 in 10 depending on the space available. The advantage of this would have been:
>
> - a smaller area to green-cut and clean up when a cold joint occurred.

- less retarder needed, due to the shorter time until the following layer is placed, thus enabling the sloped surface to be less fragile with the green-cutting process than was the case with horizontal surfaces.
- having planned green-cutting at the top of the lifts; the top of the lifts would be fairly old and therefore one could be fairly aggressive with the high pressure water without causing damage.

4.90 Entura advised that these options were suggested by the roller compacted concrete expert in the Alliance and the roller compacted concrete expert on the Technical Review Panel. However, these options were not adopted because:

> ... the current formwork system was certified for the [roller compacted concrete] placement method used, and there was reluctance to get it certified for a different method. Also the paving machine would not have been able to be used for the downstream steps, which was considered by the contractor to be safer, less manually intensive and provided a higher quality finish than the more traditional approach.

4.91 Notwithstanding this Entura advised:

> ... we consider losing the benefit of machine paving, by using a more traditional approach for the downstream steps, would have been more than outweighed by the reduction in the net time lost from cold joints, should the slope layer method have been adopted.
>
> ...
>
> We consider that the difficulties in implementing a trial of an alternative placement method like the slope layer method could have, and should have, been overcome.

4.92 ACTEW disagreed with the suggestion that the benefit of machine paving would have been more than outweighed by the reduction in the net time lost from cold joints. ACTEW advised that there were aesthetic benefits associated with using machine paving:

> Noting that the dam is situated within a public recreation space, the design sought to ensure the downstream face presented an aesthetically pleasing result. [Roller compacted concreting] construction does not typically produce the neat horizontal lines which result from other concrete construction methods. Previous [roller compacted concreting] dam constructions worldwide had used a vibrating hand screen and vast amounts of manual labour to finish the downstream steps. The use of a paver to carry out this work:
>
> - offered safety benefits, minimising the number of manual labour injuries;
> - sped up production; and
> - improved the quality of the finished step surface.

4.93 ACTEW also advised that 'this technology had never been utilised before to construct the horizontal downstream steps and is currently a unique and original concept developed by the Alliance' and that the finish on the Enlarged Cotter Dam has generated international interest'.

Highly congested work surface

4.94 In relation to managing and mitigating the risks associated with the work surface of the dam Entura advised:

> Based on the topography, the design and the plant and equipment used this should have been foreseeable, and adequate planning should have been done around this. The net result of this planning would have been a lower expectation of the placement rates that could be achieved, and a desire to remove as much plant and equipment as possible from the lift surface.

4.95 Entura further advised that better planning associated with the work surface could have led to:

- an acceptance that the average production rate was going to be lower and therefore planning plant and equipment around a lower production rate. This could have reduced the plant and equipment on the lift surface, actually improving production in some areas due to less congestion;
- better placement of the tower cranes to improve the roller compacted concrete placement constrictions;
- replacement of some equipment with simpler hand methods, e.g. replacing the backhoe with gang vibrators with a manual vibration for the Grout Enriched Roller Compacted Concrete; and
- development of an alternative method for downstream step finishing rather than the introduction of another piece of plant (the paving machine) on the work surface.

4.96 ACTEW advised that it did:

> ...not agree that construction planning in relation to the work surface was not adequate. Detailed planning and analysis was conducted to develop the construction methodology… (and) on the [roller compacted concrete] placement cycles and production shifts. Detailed analysis was also conducted on the [roller compacted concrete] supply chain and treatment of interruptions to placement in terms of surface preparation (i.e. cold joints), how long each discrete task would take and sequencing. [Roller compacted concrete] placement layout sketches were also developed. The concrete placement planning took into account the plant that would be on the surface of the dam and their relative positions during operations in order to maximise efficiency of placement and ensure the safety of personnel'.

4.97 However, the work surface was highly congested; as Entura advised '(t)his congestion can really slow down the placement of RCC, which clearly happened.'

Planning for roller compacted concrete placement

4.98 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.

4.99 In summary, Entura advised:

> The very aggressive forecast of production rate at [Final Target Outturn Cost] was not accompanied by an aggressive push to plan the job so as to keep the placement operation as simple as possible. If, for instance, the returns on the abutments for the secondary spillway had been planned from the start to be built with conventional concrete, and the planned equipment and methods had contemplated the 'slope layer' method of placement as an option, then the actual time taken would likely have been nearer 10-11 months than 14.5 months (actual). Therefore the slower-than-target progress on the placement of [roller compacted concrete] in the dam is considered to be foreseeable.

4.100 Entura further advised:

> Once the slower placement rate became evident a lot of effort was put into finding remedies; the lack of success with these efforts is largely due to the constraints on the operation which had effectively been built in at planning stage. Wetter than normal conditions during the placement period did not help. Therefore it is considered that the slower-than-target placement rate was only partially avoidable.

4.101 ACTEW advised:

> The [Bulk Water Alliance] conducted a range of trials to test the quality of the roller compacted concrete and identify the optimal method for efficient placement. Historically, roller compacted concrete dams have been constructed using a lift thickness of 300mm or less. As a means of potentially increasing the placement rate the option of placing the roller compacted concrete in 400mm lifts was trialled. The construction team concluded that it would be more efficient to place in 400mm lifts than the traditional 300mm lifts, with a reduction in placement time of approximately 50 shifts.

4.102 Roller compacted concrete placement commenced in August 2011. The trials of 400 mm layers were identified as a mitigation for the (low risk) of roller compacted concrete placement rates being below Target Outturn Cost estimate in November 2011, three months after the placement of roller compacted concrete had commenced. The use of 400 mm layers was not part of roller compacted concrete planning.

4.103 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 Report[86] 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.

[86] ACTEW, Bulk Water Alliance Value for Money Report, 2014, p 41, 42

4.104 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 cost and timeframe.

4.105 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).[87] 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.

Flood events

4.106 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.

4.107 In relation to the March 2012 event, according to the ACTEW Value for Money report[88], heavy rain began falling on the afternoon of 28 February 2012 and continued through the night. Early on 29 February 2012 the Alliance Flood Management Plan was activated and various measures were undertaken including:

- removal of equipment and formwork where possible; and
- removal of non-essential personnel from the site. Non-essential personnel were removed by 9:30 am and all personnel were removed by 11:00 am.

4.108 Water levels continued to rise throughout the day before overtopping the dam at approximately 8:00 pm on 29 February 2012. Water continued to flow over the dam wall until 12 March 2012. Full roller compacted concrete placement work did not re-commence until 5 May 2012. The February/March 2012 flood event resulted in considerable damage to the construction site.

4.109 The direct cost of all flooding is estimated at $11.5 million. The estimated costs do not take into account indirect costs, e.g. the delays to the roller compacted concrete placement. ACTEW has since recovered $7.3 million in insurance associated with the flood event.

4.110 For the purpose of this report most of the discussion focuses on the February/March 2012 flood event.

[87] 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.
[88] ACTEW, Bulk Water Alliance Value for Money Report, p 183

Were the flood events reasonably foreseeable and could they have been managed more effectively?

4.111 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.

4.112 As noted in paragraph 4.36, following the December 2010 flood events an additional diversion was constructed leading to an additional $3.5 million in costs for the project and approximately 1.5 months delay. This ultimately proved to be ineffective in managing the full extent of the February/March 2012 flood event. However, Entura advised that without the increased diversion capacity it is likely that at least one additional overtopping would have occurred and the March 2012 flood event would have incurred a delay of at least one month longer.

4.113 Entura advised:

> The decision on the design capacity for a river diversion for dam construction is a 'risk based' decision. Traditionally the design capacity has been selected based on an annual exceedence probability (AEP), and AEPs in the order of 1:10 AEP to 1:20 AEP are not uncommon. However, where the contractor is taking the construction flood risk, it is not uncommon to make a 'higher risk' decision. Clearly the choice is either to spend more time and money on the diversion works upfront therefore providing a higher level of flood protection during construction; or to spend less and accept a lower level of protection and the additional risk (cost and delay) associated with an overtopping event during construction.

4.114 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.

4.115 According to Entura:

> At this point it moved towards a higher risk on the diversion capacity, with the assessment undertaken indicating a reduced diversion capacity of around the 1 in 5 AEP flood, and potentially as low as the 1 in 2 AEP flood depending on the draw down behind the existing Cotter Dam.[89]

4.116 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

[89] 'In principle, the arrangements discussed at the previous meeting (January 2009) were homing in on a minimum height upstream coffer dam with a tunnel or conduit to provide protection up to the 1 in 20 AEP flood'.

expected to be on a smaller scale than a flood event that might happen once every twenty years.

4.117 The Technical Review Panel , Report No 4, April 2009, commented:

> It would be timely for the owner to decide if a set diversion capacity, such as the 1 in 10 AEP flood, or as stated by the Bulk Water Alliance at our last meeting, the 1 in 20 AEP flood, should be defined. There is clearly a cost implication here as the peaks of these floods are relatively high, but the risk posed opting for a smaller design diversion flood could be the pollution of the Murrumbidgee River...
>
> and … (i)t was clear … that there is limited space in the valley floor for the construction of a lot of facilities. For example, the proposed three metre temporary corrugated pipe would take up a lot of the excavated river bed just to see it constructed. This restricted area is always going to be a problem in coming up with a final diversion layout.

4.118 The Technical Review Panel Report No 5 discussed 'obvious precautions' that could be taken to prevent overtopping of the Enlarged Cotter Dam including 'adding designed flash boards to the existing dam and drawing down the storage behind the existing dam to its permitted maximum at any time during the year'. hese measures were adopted and resulted in the Bulk Water Alliance estimating that it 'would be protected for floods up to the 1 in 5 AEP flood'.

4.119 The Technical Review Panel Report No 7 endorsed this higher risk diversion strategy in accepting the above measures. It stated it considered 'strongly that the [Bulk Water Alliance had] done an excellent job at assessing the flood overtopping risk' and had 'no hesitation at all in supporting the [Bulk Water Alliance's] proposal for the diversion of the river during the construction of the main dam'.

Flood cost estimates

4.120 In May 2009 it was estimated that the most likely cost of flooding was $8.2 million, based on the then construction schedule, with three overtopping events and 60 days delay. In July 2009 this had been revised to a cost of $1.42 million with one overtopping event and 21 days delay. The main differences in these analyses were:

- the May 2009 figures were based on the (then) current construction schedule and reservoir draw down;
- the July 2009 figures were based on:
  - an updated construction program with RCC placement starting later;
  - the existing 0.9 meter diameter water supply pipe being maintained throughout the construction period to provide some diversion capacity even when the 3 metre conduit was removed (the early analysis had a period of a month without any diversion capacity); and
  - changes in the reservoir drawdown restrictions.

4.121 Table 4-7 shows the changes in the Bulk Water Alliance's estimates of the cost of flooding.

Table 4-7 Bulk Water Alliance's estimates of most likely cost of flooding

Date	Most likely cost of flood ($m)	Number of overtopping events	Days delay
21 May 2009	8.2	3	60
22 July 2009	1.42	1	21

Source: Entura analysis of Bulk Water Alliance documentation.

4.122 The significant change in the estimated cost of flooding between the two analyses indicates the sensitivity of this risk based assessment to the construction program, reservoir drawdown and small changes to the diversion strategy.

4.123 The construction flood risk cost analysis was based on the Final Target Outturn Cost program and fixed costs for overtopping. As the program was much longer than originally proposed the exposure time was significantly longer. This meant that the risk-based cost of flooding would have been higher than that calculated. If both a longer construction program (longer exposure time) for the Enlarged Cotter Dam had been assumed and a higher cost per overtopping event this would have encouraged the adoption of a higher diversion capacity, based on a risk cost analysis. Although the analysis performed was a reasonable basis for deciding on the appropriate balance between capital cost and the risk-based cost of flooding it was impacted by the assumptions made.

Flood risk ownership

4.124 According to Entura:

> In the [Target Outturn Cost] development phase, rather than develop a diversion strategy to pass a flood with an annual exceedence probability of 5-10%, which is a typical level of protection for a dam of this type and size, a detailed assessment of the risk was undertaken ... the estimate of most likely cost of flooding was $1.42M, with 1 overtopping event and 21 days delay, the Alliance considered that there was a strong justification for spending less time and money on the diversion works and take an increased construction flood risk. It was likely that the dam site would be flooded at least once during the construction period, and there was a 10% chance that it would be flooded at least 3 times causing up to 70 days delay an over $4M of additional cost. In this assessment it was estimated that clean up after the overtopping event would only take 7 days prior to construction re-commencing. The validity of this estimate depends on what stage construction has reached when the event occurs, and the consequent damage, but overall it is considered optimistic.
>
> It was unusual that the flood risk, over and above $1.42M was taken up by ACTEW rather than the Alliance (i.e. it was excluded from the [Final Target Outturn Cost]).
>
> What actually occurred were 3 overtopping events, two during the foundation excavation period and one larger overtopping event during the [roller compacted concrete] placement period.

4.125 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:

- 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.

4.126 As a result the following were not included in the Final Target Outturn Cost:

- increasing the capacity of the diversion works above 1:2 average recurrent interval; and
- costs associated with major flooding events over and above $1.42 million and over and above any amount recovered from insurance.

4.127 ACTEW advised that, as a result of flood risk analysis, the Bulk Water Alliance bore the flood risk up to $1.42 million (paragraph 4.126) where it was under its control through the construction of a diversion. ACTEW bore the flood risk associated with managing the upstream dam level which was within its control from a whole of catchment perspective.

4.128 The allocation of the construction flood risk was negotiated during the process of reducing the Final Target Outturn Cost to $299 million. This resulted in this risk being removed from the contingency analysis and the decision made that ACTEW would bear the flood risk, above $1.42 million, during construction rather than the Bulk Water Alliance.

4.129 ACTEW partially mitigated the risk of the cost of flood events by taking out insurance. However not all non-consequential costs were covered by insurance.

Managing the flood events

4.130 On the basis that the Bulk Water Alliance recognised that there would be a high likelihood that the dam would be overtopped during construction it was important that appropriate measures were implemented to manage this eventuality. The Bulk Water Alliance undertook a number of activities to manage this eventuality including:

- monitoring of rainfalls and floods (using some predictive tools); and
- the development of Bulk Water Alliance Flood Management Plan.

4.131 Entura advised 'appropriate systems were in place to try to minimise the flood impacts should an overtopping event occur.' However it is noted that the removal of all of the equipment from the dam surface was not possible during the March 2012 overtopping due to the steep topography and resulting lack of access. Furthermore the equipment removal was limited by the capacity of the tower cranes.

4.132 Entura advised:

> Although the Alliance had a Flood Management Plan, the plan was based on the assumption that the overtopping would only occur through the central portion where the formwork system was removed, with equipment being moved to behind the intake structure at the right-hand abutment. In fact the flood event that occurred in March 2012 overtopped the completed dam by more than 2m.

> ... it was recognised that most things that could have been done prior to the overtopping occurring did occur. Due to the catchment being saturated from the very wet 5 month period leading up to the flood, the runoff from the 72 hour storm that commenced at the end of February 2012 was significant and sudden. Also safety became an issue with the operation of cranes in the rain.

4.133 There were appropriate systems in place to try to minimise the flood impacts should an overtopping event occur.

Flood management conclusion

4.134 Entura advised:

> Construction flood risk is always a key risk for any dam project. Flood estimates were calculated based on historical data and the [Bulk Water] Alliance had a good understanding of the construction flood risk. Flood capacity for the river diversion depends on the specific project conditions, the length of exposure and the resulting consequence of an overtopping event. Typically the flood capacity for the river diversion for large dam engineering projects would have been a flood with an annual exceedence probability of 5-10%, which over a planned two year construction program would still have had a reasonable chance of overtopping. However, on the basis of a risked based decision, a higher risk decision was taken to reduce the diversion capacity and take on increased flooding risk. The [Bulk Water] Alliance taking on additional flood risk would not be unreasonable if the consequence of that decision was also borne by the [Bulk Water] Alliance; however, in this case, the flood risk was borne by ACTEW and not the [Bulk Water] Alliance.
>
> In the risk assessment undertaken to justify the decrease in the diversion flood capacity, the optimistic [roller compacted concrete] placement program of 7 months placement was adopted. If a more realistic estimate of the [roller compacted concrete] placement rate was adopted (say 10 or 11 months) the exposure time would have been greater and the risk cost higher. This would have likely led to a higher optimum diversion capacity. In addition to this the assumptions made in regards to the cost and delay of an overtopping event, was proven to be inadequate. Once again if higher cost and delays assumptions assumptions were adopted in this analysis it would have resulted in a higher risk cost, which would have likely led to a decision for a greater diversion capacity.
>
> ...
>
> The net result was that a higher construction flood risk was taken than was identified. However, even if a higher capacity diversion was provided, a capacity equal to the 1 in 20 [annual exceedence probability] would have required a significantly different approach to the diversion strategy. The only way this would have been achieved would have been with a large diameter diversion tunnel, with a high cofferdam. This would have been costly to construct, in excess of the $10M. This would have been greater than the actual flooding cost that the Alliance experienced; and the time it would have taken to construct this tunnel would have been extensive. This would also not have protected the dam site from the 1:100 [annual exceedence probability] flood that occurred in March 2012, and therefore damages and lost time would still have occurred due to this event.

> It was recognised ... that a higher risk was being taken and that the [roller compacted concrete] dam would likely overtop, and this was accepted due to the fact that a concrete dam can withstand overtopping.
>
> In taking the high-risk decision on construction flooding, the most likely scenario was that the dam site would be overtopped at least once but possibly up to 3 times. As a result it was critical that the appropriate actions be taken to limit the cost and delay of an overtopping event, given the high likelihood of it occurring. The Alliance Flood Management Plan had the necessary actions that would be expected. The ideal would have been to be able to remove everything off the dam prior to the flood event. However, this was not possible due to the access at the site. Therefore the larger plant and equipment on the [roller compacted concrete] lift surface could not be removed. Providing greater access was considered but due to the terrain and the fact that the slopes were all rock the cost of providing adequate access to the dam at a range of [roller compacted concrete] levels was just not practical and would have been very costly - more costly than the risk cost associated with losing this equipment to flooding.
>
> The Alliance was not expecting a 1 in 100 [annual exceedence probability] flood (and this size flood although possible during the construction of a dam is not likely and it would be unusual to plan for this), and therefore would not have been expecting this degree of overtopping. With this degree of overtopping the damage was much greater than expected and the sequence of events required to get production going again was significant. Once again the critical element was the tower cranes, so in retrospect some protection around the cranes may have reduced the time taken to get started with [roller compacted concrete] placement again. Once again this may have been tested with a worst case scenario testing, such as 'what if we are overtopped by 2m?'

4.135 In summary, according to Entura:

> It was unlucky that a flood of magnitude 1:100 occurred during the dam construction period. Overtopping of the dam was reasonably foreseeable, but it was reasonable to have not expected such a severe event, and it was certainly not avoidable. Management of the event and the recovery was generally done well.

4.136 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.

Completion

4.137 The completion phase of the Enlarged Cotter Dam, following roller compacted concrete completion, involved the:

- placement of conventional concrete on the crest of the dam;
- construction of the spillway training walls;
- construction of the stilling basin;
- removal of the second stage diversion conduit; and
- removal of the tower cranes and backfilling their positions with concrete.

4.138 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.

4.139 Key features of the dam completion phase and their challenges are:

- construction of the spillway training wall was delayed by water running down the face from the roller compacted concrete placement above, to a greater extent than envisaged;
- the presence of a large mobile crane set up to service the construction of the spillway training walls delayed the construction of the central portion of the stilling basin until the crane could be removed;
- in light of the February / March 2012 flood resulting in overtopping the second stage diversion conduit was left in place until the roller compacted concrete placement was complete. This meant the left hand part of the stilling basin was built much later than planned at the Final Target Outturn Cost stage; and
- the tower cranes were left in place longer than planned to service the various concreting activities. Once disassembled and removed the block-outs in the stepped dam face for the tower crane foundations were able to be backfilled with concrete.

4.140 Entura has advised:

> The overall result for these post-[roller compacted concrete] activities was a more linear and inflexible programme than had been envisaged at [Final Target Outturn Cost] stage.

Was this reasonably foreseeable and could it have been managed more effectively?

4.141 According to Entura:

> Extra time and cost for the post-[roller compacted concrete] construction of the various structures is foreseeable with the benefit of hindsight. However, at the time of the [Target Outturn Cost] development, a simple diversion strategy was in place, so the problem with the left hand side of the stilling basin was probably not foreseeable. It could only have been avoided with a much more costly diversion arrangement, and we do not consider that this would have been justified. Also detailed designs had not been done for the structures, such as the spillway, and the extra complications with the design led indirectly to the delay with the central part of the stilling basin. So the extra time and cost are considered not foreseeable to the extent that actually occurred, though it would have been prudent to have allowed some weeks contingency in the program on account of the incomplete design at [Final Target Outturn Cost] stage. Given the events which preceded these activities, particularly the experience with the March 2012 overtopping, these factors were largely unavoidable.

4.142 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.

Identification of technical risks for the Enlarged Cotter Dam

4.143 The Bulk Water Alliance had the necessary processes in place to identify, allocate and manage risks.

4.144 In relation to risk identification, Entura advised:

> [The Bulk Water Alliance] had an adequate system for identifying risks. There was considerable workshopping of risks, both before the [Final Target Outturn Cost] and after it to identify and manage the risks.

4.145 Effective management of risks is integral to managing cost and timing. At a minimum, effective risk management processes include:

- the development of a risk register;
- the identification of the higher risks and the development of appropriate risk mitigation strategies;
- taking into account the risk and opportunities at the time of the Target Outturn Cost development when determining an appropriate contingency sum for inclusion in the Final Target Outturn Cost; and
- the review and updating of the risk register throughout the project, along with assessing the effectiveness of any risk mitigation strategies, particularly at key phases in the project when the risks are likely to have changed.

4.146 Entura advised:

> As part of the [Target Outturn Cost] development a detailed risk and opportunity register was developed, which was populated through a number of risk and value for money workshops ...
>
> The risk register at the time of the [Final Target Outturn Cost] had not allocated them to a specific person to champion at the mitigation strategies. There was a column headed 'Project Risk Owner' but for almost all the risks listed this column was blank. However, after [Final Target Outturn Cost], as the risk registers and the mitigation strategies were better developed, the appropriate person to champion each risk was identified.
>
> There is a gap between the risk register developed leading up to the [Final Target Outturn Cost] and the "Monte Carlo" probability analysis which was used to develop an appropriate risk cost estimate (contingency) for inclusion in the [Final Target Outturn Cost].

4.147 However, Entura also advised:

> The notable exception to this was in the [roller compacted concrete] placement area, where the factors behind the risk of a poor placement rate were not well identified, until the work was well advanced.

4.148 In relation to geotechnical risks Entura advised 'the main geotechnical risk, with the consequence that more foundation excavation and preparation work would be needed than allowed for, was well identified at the [Final Target Outturn Cost] stage.

4.149 Entura advised:

> It is clear that in the [Final Target Outturn Cost] development stage of the project there was a cost hurdle: early estimates by the Alliance of the project's cost were well in excess of $300M, however it was understood by the Alliance participants that if the dam project was going to cost any more than $300M, it was unlikely to proceed. This drove optimistic assessments of some construction parameters.

4.150 With respect to the Bulk Water Alliance's assessment of risk there were optimistic assessments of some construction parameters:

- the production rates adopted;
  - foundation excavation production rates;
  - roller compacted concrete production and placement rates;
- the likelihood of the following risks eventuating:
  - 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:
  - 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.

4.151 Entura advised:

> In regard to consequential risks, there was no scenario analysis carried out for the [Final Target Outturn Cost], but instead the major risks (rates of production for excavation and [roller compacted concrete] placement) were included with all the other risks in the Monte Carlo analysis. The validity of a Monte Carlo analysis like this one depends on the assumption that all risks are independent of one another. For this project many of the risks were interdependent.
>
> The result of this optimism and of the Monte Carlo analysis was a risk allocation, i.e. a contingency sum, built into the [Final Target Outturn Cost] which was low, in the context of a dam to be built at this site and the detailed design not having been done.
>
> One of the things which was negotiated during the process of reducing the [Final Target Outturn Cost] towards $300M was the allocation of the construction flood risk. It was removed from the contingency analysis, with a decision being made that ACTEW take flood risk during construction, rather than the Alliance taking this risk. In general, a risk should be borne by the party that is best placed to manage it.

5 COMMUNICATION

5.1 This chapter focuses on ACTEW's communication of the cost and timing of the Enlarged Cotter Dam project with the Chief Minister and Deputy Chief Minister, as the Voting Shareholders, and the broader community. It examines issues raised in a public interest disclosure (refer to paragraphs 1.30 to 1.38). Some other issues in the public interest disclosure have been considered elsewhere.

Summary

Conclusion

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

	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 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. 5.58

The then Chief Minister stated 'the government was advised of the final cost last 5.59

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.

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

ACTEW's communication regarding costs and timing of the Enlarged Cotter Dam

5.2 As mentioned in Chapter 1 the entity making the public interest disclosure identified concerns with information that had been communicated to the ACT community with respect to the increase in the cost of the Enlarged Cotter Dam. The entity identified that they had specific concerns associated with media reports in 2009 referring to an expected cost of the Enlarged Cotter Dam (varying between $145 million and $200 million) that were not corrected by either ACTEW or the ACT Government 'given that at the time the cost blowout of $363 million was known by both parties'.

5.3 The following section provides a brief overview of cost estimates of the Enlarged Cotter Dam project.

Changes in expected costs of the Enlarged Cotter Dam

5.4 There have been at least three significant cost estimate milestones (and a final Target Outturn Cost) for the Enlarged Cotter Dam since 2004. These were:

- April 2004 - *Options for the Next ACT Water Source* report by ActewAGL on behalf of ACTEW - $102.6 million;
- April 2005 - GHD provided an engineering cost estimate to ACTEW - $120 million;
- July 2007 - *Water Security for the ACT and Region - Recommendations to the ACT Government* report from ACTEW with cost estimates informed by work from GHD and Rider Levett Bucknall - $145 million; and
- August 2009 - figure developed and informed by the Bulk Water Alliance and agreed to by the ACTEW Board on 1 September 2009 - $363 million.

5.5 It is also noted that, as part of the ICRC's 2008 water and sewerage services price determination, the ICRC engaged Halcrow Pacific Pty Ltd to assist in reviewing the forecast expenditure associated with ACTEW's water security projects, including the Enlarged Cotter Dam. In relation to ACTEW's forecast capital expenditure in relation to the Enlarged Cotter Dam, the ICRC's *Water and Wastewater Price Review: Final Report and Price Determination* identified:

> Halcrow has reviewed ACTEW's proposed capital expenditure on Cotter Dam and reported that:
>
> ... A final estimate of the costs of the project will be prepared by the Bulk Water Alliance in late 2008 or early 2009 and could result in a final cost of up to 30% greater than the current estimate.
>
> The process used to estimate the capital expenditure for the project is deemed robust.

5.6 Appendix A of this report discusses the various estimates of the expected cost of the Enlarged Cotter Dam which were developed and published between 2004 and 2007. It also cites reports from the ICRC and Halcrow Pacific Pty Ltd (on behalf of the ICRC) which discuss the appropriateness of the different figures and their use.

ACTEW's Options for the Next Water Source report (2004)

5.7 In April 2004 ActewAGL, on behalf of ACTEW, released: *Options for the Next ACT Water Source*. The report provided an initial assessment of various water supply augmentation options for the ACT, one of which was enlarging the Cotter Dam.

5.8 The report identified that the expected capital cost of the Enlarged Cotter Dam was $102.6 million.

5.9 In providing this figure the report noted:

> These estimates have the status of "pre-feasibility" estimates. They are based on studies of the options, and 2003 estimates of the costs of pipelines, excavation etc. They do not include comprehensive environmental, social and economic cost:benefit analysis. This will require significantly more work, including independent assessment, before a final option can be recommended.

GHD preliminary cost estimate (2005)

5.10 In April 2005 GHD was engaged by ACTEW to provide preliminary engineering costs for a range of projects, including an enlargement to the Cotter Dam. GHD estimated that a 78 gigalitre, roller compacted concrete dam would cost approximately $98 million in 2005-06 dollars. The GHD estimate did not include 'the Cotter Pumping Station upgrade, owner's costs, land purchase costs, permitting costs, financing costs, and costs associated with government liaison'.

5.11 GHD also estimated that the inclusion of 'clearing, pipelines, power and pumping stations' costs would result in a total cost of $120 million.

ACTEW's Water Security for the ACT and Region - Recommendations to ACT Government report (2007)

5.12 In July 2007 ACTEW published its *Water Security for the ACT and Region – Recommendations to the ACT Government* report.[90] The report made four recommendations to the ACT Government one of which related to a proposed enlargement of the Cotter Dam.

5.13 In relation to the expected costs of the project the report stated:

> The cost of the dam was estimated in 2005 and again, by two consultants, in 2007. The 2007 cost estimate is approximately $119 million for the dam and associated works. Allowances of $4 million have been made for clearing and site preparation, $2 million for pipelines, $15 million for the pump station and $5 million for miscellaneous works, giving a total cost of approximately $145 million.

5.14 The Halcrow report identified that 'there were, however, a number of significant issues relating to the cost estimate communicated to the ACT Government.' These included:

- no allowance being made for ACTEW's owner costs; and
- the GHD review being limited to a review and update of the unit rates from 2005.[91]

[90] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation
[91] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd.

5.15 The Halcrow report further noted that the contingency sum included in the 2007 cost estimate was $29.2 million, approximately 33 percent of the proposed direct costs. The Halcrow report noted:

> ... the generally accepted guidance for contingencies at this stage of estimate development is a range of 30 to 50 percent, with the adoption of the 50 percent value (or more if a lack of detail warrants) more likely in this case given the nature of the project and lack of detail in the work breakdown structure.[92]

5.16 The Halcrow report, prepared on behalf of the ICRC, clearly identified the shortcomings associated with the estimate of $145 million that was presented to the ACT Government for its consideration in July 2007. In its June 2010 report the ICRC identified its concerns with respect to decision-making that was based on that figure. The ICRC report stated:

> It is clear to the Commission that the $145 million estimate was deficient for the purposes of approving the [Enlarged Cotter Dam] project due to the preliminary nature of the estimates as well as an absence of market testing of the costs assumed in 2007. Additional feasibility studies were required to ensure that the costs were tested and the design of the dam refined. The Commission is concerned that the $145 million estimate was used in the decision to recommend the dam in 2007 to the ACT Government. As a consequence, ACTEW at that time made decisions which favoured the [Enlarged Cotter Dam], and the favouring of this one option influenced the process for considering other options. The Commission is concerned that the 2007 recommendation ultimately led to the decision to proceed with the [Enlarged Cotter Dam] in 2009 despite the economic returns associated with meeting the water needs of the community being maximised by not proceeding with the [Enlarged Cotter Dam] project once the full cost of the project was known.[93]

Development of the Target Outturn Cost

5.17 Chapter 3 of this report discusses the development of the Final Target Outturn Cost for the Enlarged Cotter Dam by the Bulk Water Alliance.

5.18 Chapter 3 notes that the Bulk Water Alliance worked on preparation of the Target Outturn Cost for the Enlarged Cotter Dam (and the 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 estimates as necessary.

[92] Enlarged Cotter Dam Water Security Project Investigation – Final Report, March 2010, Halcrow Pacific Pty Ltd, p 52.
[93] ICRC Final Report, ECD Water Security Project Report 9 of 2010, June 2010

5.19 The first estimate of the Target Outturn Cost (i.e. the Draft Target Outturn Cost, $325 million[94]) was prepared by the Bulk Water Alliance in April 2009. With respect to this figure a 26 August 2009 ACTEW Board paper identified:

> The [Target Outturn Cost] for the [Enlarged Cotter Dam] was first available from the [Bulk Water Alliance] in draft form in late April 2009 and was in excess of expectations. The [Bulk Water Alliance] re-examined the [Target Outturn Cost] estimate.
>
> Over 50 items were identified as potential sources of reduction and these were thoroughly assessed and re-evaluated. The completion of the [Target Outturn Cost] was delayed until this time, to ensure the best cost was available for submission to the Board.

5.20 The 26 August 2009 ACTEW Board paper noted:

> The total project cost that was recently considered by the [Bulk Water Alliance] was some $311 million. The Alliance has reviewed this estimate and proposed to deliver the [Enlarged Cotter Dam] for $299 million ... through a proposed change to the commercial model as outlined in the BWA Program Alliance Agreement. In addition, the [Bulk Water Alliance] proposes to reduce the Quality Pool from 2% to 1.5%. The [Bulk Water Alliance] proposes to alter the commercial model such that there is additional reward payable to the [Bulk Water Alliance] partners for bringing in the [Target Outturn Cost] for less than [originally anticipated].

5.21 The Final Target Outturn Cost was agreed to by the ACTEW Board on 1 September 2009.

ACTEW's communication of the cost of the Enlarged Cotter Dam to the Voting Shareholders

April 2008 to August 2009

5.22 On 11 April 2008 the then Managing Director, ACTEW, wrote to the then Chief Minister and Deputy Chief Minister advising that ACTEW had:

> ... foreshadowed increases in the cost of the delivery of our infrastructure projects. This is something I have previously stressed publicly, and emphatically outlined at Assembly Committees on 11 December 2007 … Over the coming months we will be working with the designers and constructors to firm up the cost for each project. We will advise you further once these costs are known.

5.23 On 5 November 2008 the then Managing Director, ACTEW, advised the then Chief Minister and Deputy Chief Minister that there were significant cost pressures being experienced as a result of increases in the cost of concrete, steel and labour and that final costings for the Enlarged Cotter Dam were still being determined. The then Managing Director, ACTEW, advised that he expected the final costings (i.e. the Target Outturn Cost) to have been determined by early to mid 2009.

5.24 In December 2008 ACTEW provided a report to the ACT Government which outlined ACTEW's progress in relation to its water security projects. The report stated:

[94] This included the alliance fee and excluded the quality pool.

> ACTEW advised the Government that the expected cost of the dam was $145 million in 2006/07 dollars. The ICRC in its determination stated that it expected these costs to rise by 30%. It is now expected that the cost increase in the order of 50 – 70% (in constant dollar terms) due to the significant increases in the cost of labour, concrete and other materials and also due to additional concrete required in the foundations due to the nature of the rock found. However, there is still considerable uncertainty in this rise due to impacts on labour and materials from the global financial crisis and the substantial level of the construction within the Australian water industry.

5.25 A 50 to 70 percent increase in the original cost of $145 million would have meant an upper cost of approximately $247 million.

5.26 The then Managing Director, ACTEW, in a letter which accompanied the December 2008 progress report, dated 24 December 2008, further informed the then Chief Minister and Deputy Chief Minister:

> One factor of note that is having a significant impact on ACTEW's work is the increase in the cost of construction across Australia. In the past three years the price of labour has increased 15% and the price of consumables increased between 8% and 97%. Increases are likely to continue, having an inevitable impact on the final prices for the Enlarged Cotter Dam and the [Murrumbidgee to Googong Pipeline project].

5.27 The then Treasurer (Deputy Chief Minister, a Voting Shareholder) met with the then Chairman and Managing Director, ACTEW, on 7 January 2009. In a response to a question taken on notice in the Legislative Assembly the then Treasurer stated, in August 2010, that she was aware from that January meeting 'that the costs of the Enlarged Cotter Dam were expected to increase substantially due to a range of factors beyond the control of ACTEW'.

5.28 On 29 April 2009, prior to the Target Outturn Cost being finalised, the then Chief Minister and Deputy Chief Minister were advised by ACTEW that the Target Outturn Cost would be available by July 2009 and that the costs would be reconciled with ACTEW's 2007 report to the ACT Government.[95] A risk identified in that advice from ACTEW was that the cost 'may increase significantly over the price advised in 2007, and this is being addressed in the current pre-[Target Outturn Cost] design phase'.

5.29 The 13 May 2009 ACTEW Board meeting papers, provided to the then Chief Minister and Deputy Chief Minister, included an attachment to an information paper on the Enlarged Cotter Dam which noted the 'cost to complete the Enlarged Cotter Dam is being developed' as a high risk. The paper noted 'considerable price escalation has occurred and design issues with the abutments and foundations are being clarified. The current Pre-[Target Outturn Cost] design phase will address these issues to contain costs at the lowest level possible'.

5.30 The 1 July 2009 ACTEW Board meeting papers, provided to the then Chief Minister and Deputy Chief Minister, included a paper which stated:

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[95] ACTEW: Water security recommendations to ACT Government July 2007

> The preliminary [Target Outturn Cost] estimate for the construction of the [Enlarged Cotter Dam] is significantly over expectations and the [Bulk Water Alliance] is now challenging its design and costs estimates to bring the total project cost within $300m.
>
> ...
>
> These critical review activities will be finalised in early August and the final [Target Outturn Cost] submitted to the Board Meeting on 26 August 2009.

August 2009 to September 2009

5.31 The 26 August 2009 ACTEW Board meeting papers, provided to the then Chief Minister and Deputy Chief Minister, included a decision paper on the Enlarged Cotter Dam which sought the Board's approval of the construction of the Enlarged Cotter Dam. The paper advised that:

> Based on the [Bulk Water Alliance] design and estimating work the estimated cost for the delivery of the [Enlarged Cotter Dam] is now as follows:
>
> - [Target Outturn Cost] of $261,655,282
> - [Target Outturn Cost] project fee of $37,344,718
> - Quality Pool up to $4,000,000
> - Mitigation measures (Cotter Precinct and Fish Management Plan) - total cost of $13,128,234; and
> - Owner's costs to complete construction of the [Enlarged Cotter Dam] - a total cost of $10,415,000 ...

5.32 Adding these costs together gives a figure of approximately $326.5 million. It is noted that this paper did not identify the full direct costs of the Enlarged Cotter Dam project for ACTEW, e.g. costs incurred to date were not included. The Board deferred its decision until after the ACT Government considered the costs.

5.33 According to information tabled in the Legislative Assembly on 17 September 2009, prepared by ACTEW, these Board papers were provided to the departmental representatives on Friday 21 August 2009. Furthermore, according to information tabled in the Legislative Assembly on 17 September 2009, prepared by ACTEW, the then Managing Director met with the then heads of the Chief Minister's Department and the Treasury 'to discuss the proposed costings provided in the Board papers.' It is not clear as to when these meetings occurred.

5.34 The ACTEW Board met on the afternoon of Wednesday 26 August 2009. The Board meeting commenced at 1:15 pm and concluded at 5:20 pm. The minutes of the Board meeting state:

> Mr Sullivan provided an overview of the process for developing the target outturn cost (TOC) and advised that the total project cost for the Enlarged Cotter Dam (ECD) was $362.3m.

5.35 The then ACTEW Managing Director and Chair of the ACTEW Board provided a briefing to Cabinet on 31 August 2009. The then ACTEW Managing Director and Chair of the Board informed Cabinet that the expected total cost of the Enlarged Cotter Dam project would be $363 million. This reflected a $299 million Final Target Outturn Cost for the Bulk Water Alliance and $64 million in direct costs for ACTEW. ACTEW explained the cost increase (from $145 million) as being due to 'geological conditions, lack of clay, intake tower, precinct works, environmental and inclusion of all costs and complete scope of work'.

5.36 The ACTEW Board met on 1 September 2009 and approved the Final Target Outturn Cost figure of $299 million, and total budget of $327 million, for the Enlarged Cotter Dam. The then Managing Director of ACTEW wrote to the Chief Minister and Deputy Chief Minister on 1 September 2009 informing them that the ACTEW Board had 'resolved to approve a budget of $327 million for the project' and that 'this will bring the total costs for the dam to $363 million, inclusive of owner's costs'.

5.37 On 2 September 2009 the then Chief Minister and Deputy Chief Minister wrote to the Chair of the ACTEW Board noting:

> ... surprise and serious concern at the significant increase in the previously advised figure of $145 million, with a possible upside cost of 50 – 70 % [approximately $250 m] subject to detailed investigation of costings. The Voting Shareholders have been operating on the understanding that this was the upper limit of the total cost of the project … we remain at a loss as to why the contractor costs were not included in earlier advice to Government. We note your explanations in this regard as well as your undertakings that the costs will not increase further'.

5.38 The then Chief Minister and Deputy Chief Minister 'endorse[d] the continued progress [of the Enlarged Cotter Dam] as an important step towards water security' while noting his 'concern at the cost increase to the public'.

ACTEW's communication of the cost of the Enlarged Cotter Dam to the Legislative Assembly

5.39 The then Managing Director, ACTEW, provided information to the Public Accounts Committee hearings on 11 December 2007 regarding the cost estimates for future water projects. The Managing Director noted:

> … extremely overheated construction market [and that the cost estimates provided to the Government had] an error margin of plus or minus 30 percent. [He added that] [i]n the four months since the estimates were prepared, there has been a further acceleration in construction activities in the water sector … prices in the construction sector have risen significantly in both material and labour … in particular in the water sector over the past two to three year period with the growing impact of the national drought … very preliminary indications … are that prices for the delivery of major projects are likely to rise approximately 25 – 30 percent over the next three years.

5.40 During the Select Committee on Estimates hearings on 19 May 2008 the then Managing Director, ACTEW, stated with reference to the Enlarged Cotter Dam that '(a)t this stage it is a proposal' and that '(w)ith respect to the dam project, the Chief Minister will have some announcements to make today or tomorrow on progress on that. It is well and truly on schedule'.

5.41 The then Managing Director, ACTEW, also referred to the construction business in Australia being subject to skills and price pressures that would flow through to ACTEW's costs.

5.42 On 18 May 2009, during the Select Committee on Estimates hearings, the then Managing Director, ACTEW, referred to the Target Outturn Cost which was being determined at that time for the Enlarged Cotter Dam. The Managing Director continued:

> … in benchmarking ourselves against others, we do pretty well in terms of initial lack of detailed design estimate versus final estimates versus final costs. We tend to always have a low estimate at starts, despite people trying to encourage it to be as reasonable as possible. We have a peer review to have it confirmed. Then, by the time we get to this target outturn cost, the TOC, we generally see a fairly large increase.[96]

5.43 The then ACTEW Managing Director also stated:

> In early 2008, the ICRC accepted an estimated cost of 145. We are working on an estimate of costs that we warned in that report could be 30 per cent higher than that again.

5.44 The then Managing Director advised the Committee that ACTEW planned to work out, once the Enlarged Cotter Dam Target Outturn Cost was finalised, where movement in costs had occurred and, if there were deficiencies, where they were in terms of the planning process.[97]

ACTEW's communication of the cost of the Enlarged Cotter Dam to the community

5.45 On 25 March 2009 ACTEW issued a media release which provided a brief update of progress in relation to the water security projects. The media release stated:

> Other work in coming months includes ... finalisation of cost estimates for all projects, which are expected to have increased significantly from the early estimates in 2007 due to national escalations in cost of labour and materials.

[96] May 2009 Estimates Hearings, Managing Director, ACTEW, 18 May 2009.

[97] The ACTEW Managing Director's evidence in relation to the M2G TOC was referred to a Select Committee on Privileges. This did not include the evidence regarding the ECD TOC. See Report, Select Committee on Privileges, Evidence of [the then ACTEW Managing Director] to the Select Committee on Estimates 2009-10.

Summary of stakeholder communication

5.46 Table 5-1 shows an analysis of communication in relation to the Enlarged Cotter Dam project and its costs including communication to the ACTEW Board, the ACT Government (including the Voting Shareholders) and the community.

Table 5-1 Analysis of information available on the cost of the Enlarged Cotter Dam to the ACTEW Board, the ACT Government and the ACT community

Date	ACTEW Board	ACT Government	Community*
July 2007 **$145 million**		ACTEW Water Security Recommendations report: approximate capital cost of $145 million; and details of the 'cost estimate of $145 m'.	
August 2007 **$145 million**	Board Meeting: no specific information on cost. Preliminary studies completed including costs.		ACTEW PR: Enlarged Cotter Dam, capital costs of $145 million.
23 October 2007 **$145 million**			ACT Government PR: Chief Minister announces Enlarged Cotter Dam, $145million capital cost.
8 November 2007 **$145 million**	ACTEW Board information paper included mention of the Enlarged Cotter Dam 'at a capital cost of $145 m'.		
11 December 2007 *Cost increase of up to 30 percent*			Public Accounts Committee: then ACTEW Managing Director: costs up 30 percent and more for major water projects.
April 2008 **Increase above $145 million**		Chief Minister and Deputy Chief Minister advised that there were significant cost pressures being experienced as a result of the increased cost of concrete, steel and labour; final costings for the ECD still being determined.	
May 2008 **$150 million**			Estimates hearings, the then Chief Minister: 'Propose to build a $150 million dam at the Cotter'. Managing Director, ACTEW: 'At this stage it is a proposal'. And: construction business in Australia was being subject to tremendous skills and price pressures that would flow on to their prices.
June 2008			ACTEW PR: Early estimates

Date	ACTEW Board	ACT Government	Community*
$145 million			of Enlarged Cotter Dam: $145 million (cf Tennent Dam $292 million)
October 2008 *Cost increases due to increases in the cost of construction materials and resources.*		Chief Minister and Deputy Chief Minister 'advised that a report and final recommendations in relation to the Water Security Major Projects would be presented to the Government in December…whilst costs had not been finalised, estimates confirm that there will be cost increases for the project due to significant increases in the cost of construction materials and resources'. (Minutes from 24 September 2008 ACTEW AGM minutes).	
November 2008 *Cost increases due to increases in the cost of construction materials and resources.*	Chief Minister and Deputy Chief Minister advised by then ACTEW Managing Director (letter re 28 October 2008 ACTEW Board Meeting) 'significant cost pressures … being experienced as a result of increases in the cost of concrete, steel and labour and that final costings for the projects were still being determined and were expected to be available in early to mid 2009'.		
December 2008 **Significant increase above $145 million: ($188 - $247 million approximately)**	17 December Board Meeting: Risk identified that the cost to complete the Enlarged Cotter Dam may increase significantly over the price advised in 2007 – considerable price escalation and design issues (abutments and foundations).	Chief Minister and Deputy Chief Minister informed that there had been an increase in construction costs in Australia over the last three years and this would impact the cost of the Enlarged Cotter Dam. ACTEW Report to Government: increase in cost of 50 – 70 percent.	
January 2009 **Cost to increase substantially above $145 million**		Meeting between Treasurer (Voting Shareholder) and Chair and Managing Director, ACTEW: Treasurer informed that 'the costs of the Enlarged Cotter Dam were expected to increase substantially due to a range of factors beyond the control	

Date	ACTEW Board	ACT Government	Community*
		of ACTEW'.	
5 February 2009 *Range of cost variants*	Board Meeting: Important issues with dam design and construction methodology and range of possible cost variants (saddle dams, dam wall, endangered fish, intake tower, abutment stripping, suitability of on-site rock for roller compacted concrete, precinct, spillway, foundations. Risk identified as for December 2008. Then ACTEW Chairman briefed then Treasurer: 'indicative costs increases are between 15% and 79% depending on the project'.		
March 2009 **Cost may exceed $250 million**	23 March 2009: Then ACTEW Managing Director briefed Cabinet on progress of each of the Water Security Major Projects. 25 March Board Meeting: Cost of dam may exceed $250 million; construction methodology under review. Risk identified as for December 2008.		ACTEW PR: Cost estimates being finalised; expected significant increase from early estimates in 2007 due to national escalations in cost of labour and materials.
April 2009 **Cost may significantly increase over $145 million**		The cost of the Enlarged Cotter Dam 'may increase significantly over the price advised in 2007, and this is being addressed in the current pre-Target Outturn Cost design phase'.	
May 2009 *Considerable price escalation; generally a fairly large increase.*	ACTEW Board meeting papers (provided to Chief Minister and Deputy Chief Minister) included an attachment (to an information paper) on the Enlarged Cotter Dam which notes as a high risk that the '(c)ost to complete the Enlarged Cotter Dam is being developed and that considerable price escalation has occurred and design issues with the abutments and foundations are being clarified.' (As for December 2008)		Estimates hearings: then Managing Director, ACTEW: referred to the Target Outturn Cost, being determined at that time, and that by the time it is finalised they 'generally see a fairly large increase'. 27 May 2009: The then Treasure to Question on Notice: It is now expected that the cost could increase in the order of 50 – 70 percent due to significant increases in costs of labour' etc; and Response to Question on Notice by then Treasurer: '…the cost of the projects is expected to be in the vicinity of $400 million'. (Note: this is the three projects together).
30 June 2009		Treasury brief to then Chief Minister	

Date	ACTEW Board	ACT Government	Community*
		and Acting Treasurer: 'final costs for the Water Security Major Projects have also yet to be determined and are now expected to be available in August 2009'.	
1 July 2009 Preliminary TOC estimate significantly over expectations **Within $300 million**	ACTEW Board meeting papers (provided to Chief Minister and Deputy Chief Minister) included a paper, which identified 'the preliminary [Target Outturn Cost] estimate for the [Enlarged Cotter Dam] is significantly over expectations and the [Bulk Water Alliance] is now challenging its design and costs estimates to bring the total project cost within $300m.		
6 July 2009	Then Chief Minister responds to then ACTEW Managing Director: 'have noted your advice regarding the potential uncertainty associated with …costs…also keen to receive regular reports on the progress of ACTEW's various …Projects, similar to previous years'.		
9 July 2009	ACTEW wrote to then Chief Minister and Deputy Chief Minister: '(t)he complexity of the final detailed cost estimate for the Enlarged Cotter Dam means that it will now be submitted to the ACTEW Board in August'.		
14 and 17 July 2009	Then ACTEW Managing Director briefed the then Chief Executive of the Chief Minister's Department and the Under Treasurer respectively: significant cost increase for the Enlarged Cotter Dam and independent advice being sought about the validity of the costs.		
16 July 2009	Then ACTEW Managing Director briefed the then Treasurer's Chief of Staff: significant cost increase for the Enlarged Cotter Dam and costs still being reviewed and subject to final verification.		
21 August 2009 **$299 million Final Target Outturn Cost**	ACTEW Board meeting papers (26 August 2009) (provided to Chief Minister and Deputy Chief Minister and their departments) included a decision paper on the Enlarged Cotter Dam, seeking the Board's approval of construction of the Enlarged Cotter Dam with a total project (Total Outturn) cost of $299 million. ACTEW asked (24 August 2009) to provide a presentation to Cabinet.		
26 August 2009 **$299 million Final Target Outturn Cost, Total cost of $363 million**	ACTEW Board noted 'previous estimates did not take account of a number of factors including change to scope, increasing design costs, fees, profit		

Date	ACTEW Board	ACT Government	Community*
	margins, escalation of costs and owner's fees.		
31 August 2009 **$299 million Final Target Outturn Cost, Total cost of $363 million**		ACTEW provided a presentation to Cabinet on the total cost including the Final Target Outturn Cost ($299 million) plus the $64 million for which ACTEW was solely responsible (total cost of $363).	
1 September 2009		Letter from the then Managing Director, ACTEW, to the then Chief Minister and Deputy Chief Minister, advising that the ACTEW Board had met that day and resolved to approve the budget for the Enlarged Cotter Dam, total of $363 million.	Press Release: Cost of Enlarged Cotter Dam will be $363 million.
8 September 2009		Then ACTEW Chairman letter to then Chief Minister and Deputy Chief Minister: the then Managing Director 'informed the Board…on 1 July 2009 of his intention to engage an independent external organisation to undertake a review of the preliminary deisgn and estimating processes…he would inform your advisers and departmental officers of a steep increase in costs and the independent review. I understand this occurred in mid July 2009.'	
17 September 2009			ACTEW report in response to Legislative Assembly motion (16 September 2009): 'the experience of increases from initial cost estimates to final projected costs is very much the norm for projects of this size and degree of complexity.

Source: Audit Office analysis of ACTEW information.

Note: *Legislative Assembly hearings and ACTEW press releases.

Conclusion

5.47 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).

5.48 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'.

5.49 The Audit Office notes that a Draft Target Outturn Cost estimate (approximately $325 million[98]) was produced by the Bulk Water Alliance in April 2009. A July 2009 ACTEW Board paper noted that this figure 'is significantly over expectations'. This figure was subsequently subject to further and additional review processes, including Value for Money workshops and Challenge workshops, to achieve further reductions. It was not until August 2009 that a comprehensive Pre-Final Target Outturn Cost figure was decided on by the Alliance Leadership Group. This figure was then subject to further negotiation.

5.50 In a letter to ACTEW on 2 September 2009, the then Chief Minister and Deputy Chief Minister advised that 'Cabinet was surprised and seriously concerned at the significant increases in the previously advised figure of $145 million, with a possible upside cost of 50-70% subject to detailed investigation of costings'.

5.51 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.

[98] This included the alliance fee and excluded the quality pool.

Chief Minister's statement with respect to expected cost increases

5.52 The entity making the public interest disclosure stated 'it would appear the Chief Minister has deceived the public in the statement made during the ... radio interview on 3 September 2009'. During a radio interview on Thursday 3 September 2009 the Chief Minister was asked whether the ACT Government was aware of the 'cost blow-out' when the then Minister for Planning announced his decision to use call-in powers to consider the Enlarged Cotter Dam development application on 26 August 2009. The Chief Minister stated:

> No, we weren't. The government was first advised of the final cost last week. And as a result of that, indeed, we asked the chairman of the board ... and the chief executive officer ... to present to cabinet. I think we were advised somewhere around - I'm guessing - perhaps last Thursday of last week. As a result of that I asked for [the then Chair of the Board and Managing Director] ... to make a presentation to cabinet to explain the cost ...

5.53 The then Planning Minister announced the use of call-in powers for the Enlarged Cotter Dam project on the morning of 26 August 2009.

5.54 In support of this assertion, the entity identified communication (15 September 2009) from the then Treasurer to the Legislative Assembly. On 15 September 2009, in response to a question during a sitting of the Legislative Assembly, the then Treasurer advised:

> As to the final cost, though, the actual dollar figure, the $363 million, that was not confirmed by the Actew board until, I think, about 21 or 22 August. I will check that date. Certainly that final figure was made aware to me on 24 August. We were in regular discussion and contact and I was aware that Actew had instigated their own review of their cost structures. They had that independently evaluated and Treasury had certainly briefed me on that. I think I was kept briefed at regular intervals but the final cost, as you know, was made public pretty much as soon as the government was made aware of it.

5.55 In relation to the assertion that the then Chief Minister had deceived the public on 3 September 2009, it is noted:

- general information had been communicated by ACTEW to the then Chief Minister and Deputy Chief Minister, as the Voting Shareholders, through Board papers and other correspondence, throughout 2008 and 2009, with respect to the expected increase in costs associated with the project;
- a July 2009 ACTEW Board paper discussed the April 2009 Draft Target Outturn Cost figure, how this was significantly over expectations, and how ACTEW was 'challenging its design and costs estimates to bring the total project cost within $300m';
- information tabled in the Legislative Assembly on 17 September 2009, prepared by ACTEW, advised that ACTEW Board papers for the meeting on 26 August 2009 had been delivered to departmental representatives on Friday 21 August 2009 and that the ACTEW Managing Director had 'met with the heads of both Chief Minister's

Department and Treasury to discuss the proposed costings provided in the Board papers.' (It is not clear as to when these meetings occurred);

- the 26 August ACTEW Board paper, made available to the Chief Minister and Deputy Chief Minister through departmental representatives, did not convey the full final estimated cost for the project as it did not include costs that had been incurred to date. The ACTEW Board paper identified costs associated with the Enlarged Cotter Dam of approximately $326.5 million, which included a Final Target Outturn Cost of $299.0 million and other costs for ACTEW of approximately $27.5 million. This included costs associated with fish studies and habitat precinct works and other activities;
- minutes of the ACTEW Board meeting on 26 August 2009 note that the then Managing Director of ACTEW advised the Board that 'the total project cost for the Enlarged Cotter Dam (ECD) was $362.3m'; and
- the 31 August 2009 presentation to Cabinet referenced an expected total cost of $363 million for the project. This figure was again referenced in a letter from the ACTEW Managing Director to the Voting Shareholders on 1 September 2009, advising that the ACTEW Board had 'met today and resolved to approve a budget of $327 million for the project' and that 'this will bring the total costs for the dam to $363 million, inclusive of owner's costs.'

5.56 Furthermore, in response to a Standing Committee on Public Accounts supplementary question on notice on 6 April 2010, the then Treasurer advised:

> [The letter of 2 September 2009 from the then Chief Minister and Deputy Chief Minister] referred to a "total cost" of $326.5 million. ...
>
> Although ACTEW alerted Government officials in July 2009 that there had been a significant escalation in costs, it was not until 21 August 2009 that the final actual total cost became known.
>
> This was subsequently discussed by the Government on 24 August 2009. ACTEW was then called on to make a presentation to Cabinet on the following Monday, 31 August 2009 which was the first formal notification to Government of the increase in the cost of the Enlarged Cotter Dam to $363 million.

5.57 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].'

5.58 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 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.

5.59 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.

ACTEW's explanation of cost increases

5.60 The entity making the public interest disclosure identified that they had concerns with ACTEW's public explanation for the increases in the costs of the Enlarged Cotter Dam project. These concerns related to:

- ACTEW's reference to the cost of reinforced steel, in a September 2009 report to the Legislative Assembly, as a reason for increased costs associated with the project; and
- a quote from the then Managing Director of ACTEW in a newspaper article on 3 September 2009, referring to geological conditions on the site.

Report to the Legislative Assembly

5.61 On 16 September 2009 the Legislative Assembly passed a motion that requested ACTEW provide to the then Minister for the Environment, Climate Change and Water, for presentation in the Assembly, information relating to: 'a detailed accounting of the factors leading to the increase in costs of the [Enlarged Cotter Dam and Murrumbidgee to Googong Pipeline projects]'; and 'a chronology of when ACTEW advised the Government, Voting Shareholders and Ministers of the variation in costs and details thereof in relation to the projects.'

5.62 The then Managing Director, ACTEW, wrote to the Minister for the Environment, Climate Change and Water on 17 September 2009, providing a report with the requested information.

5.63 The report stated:

> As evidenced by the evolution of cost estimates for these projects, the experience of increases from initial cost estimates to final projected costs is very much the norm for projects of this size and degree of complexity. Far from representing a 'cost blowout', this increase in estimated cost reflect[s] project and necessary investigation of the various geotechnical, engineering, hydraulic and resourcing requirements of such projects, and an assessment of the likely design and cost implications of each of those factors in the prevailing market.

> It follows from that explanation that it was not until ACTEW had completed a thorough site investigation for each project and taken into account environmental and planning requirements that it was able to accurately quantify the costs.

5.64 The report continued:

> The initial estimate of $145 million to enlarge the Cotter Dam provided by ACTEW in July 2007 was based on the preliminary information that was available at the time, and included a range of assumptions about the extent of the works required. It was acknowledged at the time that the costs were best estimates and subject to change…(quoting from ACTEW's report 'Water Security for the ACT and Region-Recommendations to ACT Government, July 2007') *This report provides the best estimates of costs available at this time…The current construction boom is possibly the largest since the gold rush era and as a result, demand is driving large cost increases across Australia. Some of these increases are very large for equipment, like water pipes. While there is potential for cost increases they are unlikely to significantly affect the ranking of the projects to be undertaken.*

5.65 The report then discussed investigations undertaken during the pre-Target Outturn Cost phase to arrive at an 'accurate and fixed cost'. It continued '(i)n summary the key changes to cost are the additional material due to increased foundation work and a better understanding of the local geology, additional functionality and safety issues, refinement of spillway and saddle dams as well as inclusion of indirect costs, fees and escalation'.

5.66 ACTEW's report, *Water Security for the ACT and Region – Progress Report and Recommendations to ACT Government, December 2008*[99], is referenced in the 2009 report regarding general factors that would affect the Enlarged Cotter Dam's Target Outturn Cost including:

> ... possible movement in the rate of various construction inputs which will have a follow-on impact on the construction estimate. Since 2005 many construction material inputs have increased in cost to have a follow-on impact on construction activities including concrete (30%), plant hire (30%), rebar [steel reinforcement] (100%), fuel (90%) and labour (15%).

5.67 This information generally accords with Australian Bureau of Statistics data available on the cost of steel reinforcement, as conveyed in the 20 July 2009 Australian Bureau of Statistics Producer Price Indexes release (Series 6427.0). According to this release, the weighted average cost index for reinforced steel across six capital cities increased incrementally between the December 2004 and March 2008 quarters, from 134.3 to 139.3, before increasing significantly to 238.1 by the December 2008 quarter. By the June 2009 quarter the index had reduced to 213.7. While the information conveyed through the July 2009 Australian Bureau of Statistics publication is an index (and the quote from the then Managing Director refers to a percentage increase) it is apparent that the price of reinforcing steel (as represented by the weighted average cost index for the six capital cities) had increased significantly to December 2008, before falling throughout 2009. This

[99] ACTEW Water Security for the ACT and Region – Progress Report and Recommendations to ACT Government, December 2008

means that, at the time of providing the report to the Legislative Assembly in September 2009, the price of steel reinforcement had fallen.

Conclusion

5.68 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.

5.69 Reinforced steel was cited as one of five different construction inputs that had experienced an increase in cost. The point was made in the report to the Legislative Assembly that 'since 2005 many construction material inputs have increased in cost' thereby having an impact on the cost of construction more generally.

Newspaper article

5.70 A newspaper article dated from 3 September 2009 stated:

> Mr Sullivan said a major cause of the cost increase had been that rock on the site was not nearly as solid as had been expected.
>
> "So we are going down about another 9m on what we anticipated for the foundations."

5.71 The Audit Office notes that, in the report provided to the Legislative Assembly on 17 September 2009 in relation to increased costs associated with the Enlarged Cotter Dam, the then ACTEW Managing Director stated:

> In summary the key changes to cost are the additional material due to increased foundation work and a better understanding of the local geology, additional functionality and safety issues, refinement of spillway and saddle dams as well as inclusion of indirect costs, fees and escalation. The details are:
>
> Site Geology: The largest construction cost difference and one which influences many other quantities and schedules is foundation excavation. In 2005 little was known about the proposed dam site foundation conditions. A preliminary geological investigation program commenced in late 2007. The detailed site geotechnical investigations and foundation geological mapping of the dam site commenced in 2008. This work was finalised in April 2009 with the development of an accurate dam site geological model which now forms the basis of the current design. The impact of the increase in accuracy of geotechnical knowledge of the site has led to an approximate five fold increase in the foundation excavation volume and an increase in volume of roller compacted concrete required.
>
> In addition there was a lack of clay in the construction area for use in the saddle dams. This information in combination with a better understanding of the geological

> conditions where the saddle dams are to be sited meant the earth and rock saddle dams increased in size, shape and volumes and the lack of suitable clay within the construction footprint will require importation of clay (bentonite) and additional onsite processing of material for the core of these structures.

5.72 Geological testing of the site was undertaken between 2007 and September 2009. Findings associated with the geological testing that was conducted for the Enlarged Cotter Dam project are discussed in Chapter 4. With respect to the adequacy of the geotechnical investigations undertaken for the Enlarged Cotter Dam Entura advised 'the geotechnical investigations prior to the development of the [Final Target Outturn Cost] were detailed and appropriate.'

5.73 An April 2009 *Geotechnical Assessment Report for TOC Design*, produced by the Bulk Water Alliance, identified, on the basis of borehole testing as part of geotechnical investigations, initial stripping depths for various part of the Enlarged Cotter Dam site. The stripping depths varied between 1.4 metres and 8.2 metres. The report stated:

> It is expected that initial stripping will be required to these depths, whereupon an assessment of the need for any further stripping will be made by on-site geotechnical personnel, based upon a range of factors ...

5.74 It is noted, however, that on 24 August 2009 the *ECD TOC Design Report Addendum No. 1* report was prepared, which stated 'Prior to the initial design freeze, however, the Bulk Water Alliance decided 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.'

5.75 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.

APPENDIX A: DECISION TO PROCEED WITH THE WATER INFRASTRUCTURE PROJECTS

The decision to proceed with the water infrastructure projects, either on the part of ACTEW or the ACT Government, has not been considered as part of this audit. Nevertheless, two previous reviews have considered the decision-making processes associated with proceeding with the Enlarged Cotter Dam:

- Enlarged Cotter Dam Water Security Project Investigation Final Report - Halcrow Pacific Pty Ltd (on behalf of the Independent Competition and Regulatory Commission) (March 2010); and
- Enlarged Cotter Dam Water Security Project Final Report - Independent Competition and Regulatory Commission (June 2010).

Halcrow report[100] (March 2010)

In April 2004 ActewAGL, on behalf of ACTEW, released a report: *Options for the Next ACT Water Source*. The report addressed 'options for a new water source for the ACT' and identified contingency planning in the event that the drought continued. The report provided an initial assessment of various water supply augmentation options for the ACT, one of which was enlarging the existing Cotter Dam.

In providing this the report provided a summary of the expected capital costs of the shortlisted options. The expected capital cost of the Enlarged Cotter Dam was $102.6 million.

In providing this figure, the report noted:

> These estimates have the status of "pre-feasibility" estimates. They are based on studies of the options, and 2003 estimates of the costs of pipelines, excavation etc. They do not include comprehensive environmental, social and economic cost:benefit analysis. This will require significantly more work, including independent assessment, before a final option can be recommended.

The Halcrow report commissioned by the ICRC noted:

> In April 2005, in order to allow a cost comparison of different water security measures being considered for the ACT, ACTEW engaged GHD to provide preliminary engineering cost estimates for the variety of measures.

GHD estimated that a 78 gigalitre roller compacted concrete dam would cost approximately $98 million in 2005-06 dollars. The GHD estimate did not include 'the Cotter Pumping Station upgrade, owner's costs, land purchase costs, permitting costs, financing costs, and costs associated with government liaison'.

[100] Enlarged Cotter Dam Water Security Project Investigation – Final Report" March 2010, Halcrow Pacific Pty Ltd.

GHD also estimated that the inclusion of 'clearing, pipelines, power and pumping stations' costs would result in a total cost of $120 million.

According to the Halcrow report the 2005 GHD estimate 'was deemed to have an error factor of plus or minus 30 percent'. The Halcrow report also noted:

> It is important to note that the 2005 GHD options study for the Enlarged Cotter Dam was presented as being "*a preliminary cost estimate*" for comparison between options. It was clearly stated that these estimates should be used for "*the purposes of preliminary budgeting*" and not be used "*for any other purpose*". It also stated that "*a functional design is recommended for budget setting purposes*".

In relation to whether the decision to proceed with the Enlarged Cotter Dam project was prudent, the Halcrow report stated:

> Based on our investigations for this review, it has not been possible to definitively determine whether selection of the Enlarged Cotter Dam, as part of a suite of works that together comprise the adopted Water Security Program, was (or remains) prudent, particularly given the significant increase in its estimated cost in comparison to estimates used in the original decision making process.
>
> This review has identified a number of inadequacies in the decision making process, the impacts of which are not entirely apparent. These include:
>
> - the assumptions underlying the net economic benefit analysis, which was used as a key element of the decision making process;
> - the extent to which the hydrological performance of alternative options/combinations of options has been analysed; and
> - the limited additional costing of alternative options/combinations of options in light of the significant increase in estimated project cost.

In July 2007 ACTEW published its *Water Security for the ACT and Region* – Recommendations *to the ACT Government* report.[101] The report made four recommendations to the ACT Government, one of which related to a proposed enlargement of the Cotter Dam.

In relation to the expected costs of the project, the report stated:

> The cost of the dam was estimated in 2005 and again, by two consultants, in 2007. The 2007 cost estimate is approximately $119 million for the dam and associated works. Allowances of $4 million have been made for clearing and site preparation, $2 million for pipelines, $15 million for the pump station and $5 million for miscellaneous works, giving a total cost of approximately $145 million.

This figure was based on further work undertaken by GHD. In relation to this estimate, the Halcrow report, commissioned by the ICRC, stated:

> In July 2007, ACTEW engaged GHD to review and update the [Enlarged Cotter Dam] estimates and options comparison. The review only involved a re-evaluation by GHD of the unit rates used in the 2005 estimates. The dam concept or quantities were not reconsidered. The revised estimate was $124 million... It should be noted that the

[101] Water Security for the ACT and Region – Recommendations to the ACT Government, July 2007, ACTEW Corporation

> GHD review focused on the dam construction costs; related costs were not re-estimated.

The Halcrow report also stated:

> ACTEW commissioned Rider Levett Bucknall to review the GHD 2005 cost estimates and also review the preliminary scope provided by GHD. Based on the review of rates adopted by GHD, Rider Levett Bucknall estimated the cost of the [Enlarged Cotter Dam] project at $107 million. ($124 million after escalation to expected completion date December 2011).

The Halcrow report also stated 'a comparison of the common items in the GHD and Rider Levett Bucknall estimates led to a best estimate of $119 million for the [Enlarged Cotter Dam] project'. This figure, as well as an additional $26 million relating to other costs, was the figure put forward by ACTEW in its July 2007 report to the ACT Government, *Water Security for the ACT and Regions - Recommendations to ACT Government*.

The Halcrow report stated 'there were, however, a number of significant issues relating to the cost estimate communicated to the ACT Government.' These included:

- no allowance being made for ACTEW's owner costs;
- the GHD review being limited to a review and update of the unit rates from 2005.

In relation to the GHD review, the Halcrow report noted:

> The 2007 GHD review, which was used to derive the ACTEW July 2007 estimate, was limited to a review only of the unit rates from 2005 and was clear in stating that "*no reviews of the concepts or quantities has been undertaken in this (further 2007) study*". It went further in again stipulating that the "*preliminary cost estimates presented*" were for the "*purposes of comparing options only*" and "*may be used for preliminary budgeting*". The accuracy was stated as "*about ± 30%*" and "*a functional design is recommended for more definitive budget setting purposes*".

The Halcrow report further noted that the contingency sum included in the 2007 cost estimates was $29.2 million, which was approximately 33 percent of the proposed direct costs. The Halcrow report noted:

> ... the generally accepted guidance for contingencies at this stage of estimate development is a range of 30 to 50 percent, with the adoption of the 50 percent value (or more if a lack of detail warrants) more likely in this case given the nature of the project and lack of detail in the work breakdown structure.

The Halcrow report stated:

> On the basis of information now available, Halcrow considers that the July 2007 estimate prepared by ACTEW, while sufficient for comparative purposes, was not suitable as a formal recommendation to Government for anything other than the presentation of the process for selecting the preferred option.

ICRC Report (June 2010)

In relation to 'whether the projected costs of the enlarged Cotter Dam water security project are prudent and efficient in meeting the water security standards required of ACTEW' the ICRC report stated:

> From its review of ACTEW's assessment processes and advice to the Board in August 2009, the Commission cannot find that the decision to proceed with the [Enlarged Cotter Dam] as an independent project was prudent in terms of meeting the standard principles and tests...The Commission has a number of concerns with the supporting analysis that was provided to the Board. The two major concerns of the Commission were that the analysis:
>
> - was based on extreme estimates of the willingness to pay to avoid water restrictions and of the likely occurrence of dry periods requiring water restrictions in the future (that is, climate change outcomes at the extreme end of the CSIRO estimated range)
> - identified other possible options that were potentially more appropriate in terms of maximising the [net economic benefit] available to the community rather than proceeding with the [Enlarged Cotter Dam] option.[102]

With respect to the costing process for the Enlarged Cotter project the ICRC report states:

> The Commission notes that there were four cost estimates between 2005 and 2009. The first two cost estimates were inadequate for use as the basis for final approval of the [Enlarged Cotter Dam] project. Significantly, these estimates explicitly excluded costs which would have been reasonably expected to be included at the time the decision to proceed with the [Enlarged Cotter Dam] was being taken. These costs were:
>
> - owner costs - subsequently revealed to be $64 million or a little over 50% of the direct construction costs which were being considered at the time the decision was taken to proceed with the [Enlarged Cotter Dam]
> - contractor margins and fees - subsequently revealed to be a significant percentage of the direct construction costs.
>
> It is clear to the Commission that the $145 million estimate was deficient for the purposes of approving the [Enlarged Cotter Dam] project due to the preliminary nature of the estimates as well as an absence of market testing of the costs assumed in 2007. Additional feasibility studies were required to ensure that the costs were tested and the design of the dam refined. The Commission is concerned that the $145 million estimate was used in the decision to recommend the dam in 2007 to the ACT Government. As a consequence, ACTEW at that time made decisions which favoured the [Enlarged Cotter Dam], and the favouring of this one option influenced the process for considering other options. The Commission is concerned that the 2007 recommendation ultimately led to the decision to proceed with the [Enlarged Cotter Dam] in 2009 despite the economic returns associated with meeting the water

[102] ICRC Final Report, ECD Water Security Project Report 9 of 2010, June 2010

> needs of the community being maximised by not proceeding with the [Enlarged Cotter Dam] project once the full cost of the project were known. [103]

The ICRC review has not been investigated by the Audit Office. The ICRC has provided an analysis which, among other things, presents inadequacies in some of ACTEW's decision making processes. The ICRC report is publically available.[104]

[103] ICRC Final Report, ECD Water Security Project Report 9 of 2010, June 2010

[104] http://www.icrc.act.gov.au/wp-content/uploads/2013/03/Report_9_of_2010_June_2010.pdf

APPENDIX B: ALLIANCE CONTRACTING

In July 2011, the Australian Government Department of Infrastructure and Transport published the *National Alliance Contracting Guidelines: Guide to Alliance Contracting* (the Guide to Alliance Contracting). The Guide to Alliance Contracting is approximately 170 pages in length.

The purpose of the Guide to Alliance Contracting is to 'provide consistent and leading practice guidance on alliance contracting to public sector agencies that develop and own infrastructure projects'.

The following selected information is taken from the Guide to Alliance Contracting.

Alliance contracting

According to the Guide to Alliance Contracting 'alliance contracting is delivering major capital assets, where a public sector agency (the Owner) works collaboratively with private sector parties (Non-Owner Participants or NOPs)'. The Guide to Alliance Contracting provides:

> All Participants are required to work together in good faith, acting with integrity and making best-for-project decisions. Working as an integrated, collaborative team, they make unanimous decisions on all key project delivery issues. The alliance structure capitalises on the relationships between the Participants, removes organisational barriers and encourages effective integration with the Owner.

Risk sharing versus risk allocation

A key difference between an alliance contract and a traditional contract arrangement is the sharing of risks and opportunities. According to the Guide to Alliance Contracting:

> The most significant difference between traditional contracting methods and alliance contracting is that in alliancing, all project risk management and outcomes are collectively shared by the Participants. In more traditional methods of risk allocation, specific risks are allocated to Participants who are individually responsible for best managing the risk and bearing the risk outcome. This concept of collective risk sharing provides the foundation for the characteristics that underpin alliance contracting including collaboration, making best-for-project decisions and innovation. If substantial and significant risk is allocated to individual Participants, then it may not be an alliance and these characteristics may not be necessarily required or appropriate.

The Guide to Alliance Contracting further states:

> Alliance agreements are premised on joint management of risk an opportunity for project delivery. All Participants jointly manage that risk within the terms of an 'alliance agreement', and share the outcomes of the project.

Alliance contracting versus traditional contracting

According to the Guide to Alliance Contracting:

> Traditional contracts are founded on the traditional role of buyer and seller. The buyer wants an asset delivered at a fair cost or better and the seller wants to deliver the asset for a fair return or better. The buyer describes its requirements and terms, often in the form of an Request for Tender and the seller proposes a solution, terms and price to deliver that requirement, in the form of a Tender response. This means that both parties build their own risk assessment into their price and stand to win or lose if the risk outcome is higher or lower than predicted for each of them. The resulting contract encompasses both the requirement and the offer and allows variations to these to be made as the work progresses, as per the agreed risk allocation model and Commercial Framework.
>
> This approach works well where the project has few unknowns and the outcome is predictable. Whilst the buyer and seller are aligned on delivering the project, the buyer's motivation is to minimise the cost and the seller's motivation is to maximise the profit. The only moderator to this behaviour is the parties' desire to maintain a sustainable position (i.e. they will be concerned about reputation and staying in business) beyond the life of this project.
>
> Where projects are more complex, with more unknowns, and the parties have less ability to confidently predict the outcome using traditional contracting, the parties will allow for higher levels of risk which will mean a higher tendered price, and/or they will have significant variations as the work progresses. This can lead to highly complex risk-allocation models and commercial frameworks with significant time and effort spent negotiating variations to the original agreement. Resolving these variations can be time consuming and costly.
>
> Alliance contracting provides an alternative approach where the buyer and seller collaborate to develop the requirements and the proposal, combining their knowledge and experience to address the complexities and unknowns, with an objective of increasing their shared confidence in the outcome. They share exposure to the project outcome, which forms the basis of the Commercial Framework. The buyer and seller are aligned as minimising actual cost to the buyer and increasing profit to the seller. Time otherwise spent negotiating variations under a traditional contract becomes time spent finding the best solution to resolve issues and problems through the life of the project. The time and energy of the leadership team is spent on value-adding activities rather than contractual disputes; solving the overall project outcome is the objective and this aligns to each party's individual commercial objectives.

Key factors for alliance contracting

According to the Guide to Alliance Contracting, the key features of alliance contracting are:

1. risk and opportunity sharing: the Owner and the NOPs are expected to collaborate to solve problems and deliver the project successfully and in the process share the risks and rewards;

2. commitment to 'no disputes': alliance contracts generally include a no dispute mechanism, whereby Participants agree not to litigate, except in limited circumstances;

3. best-for-project unanimous decision-making processes: Participants are expected to direct their decisions towards the collective vision and objectives of the alliance, rather than their own self interests or the commercial interests of their employer;

4. no fault-no blame culture: in case of errors, mistakes or poor performance under the alliance contract, the Participants are expected not to attempt to assign blame but will accept joint responsibility and its consequences and agree on a remedy or solution which is best-for-project;

5. good faith: Participants are expected to operate in good faith and comply with reasonable standards of conduct with regards to the interest of other Participants;

6. transparency expressed as open book documentation and reporting: Participants are expected to fully document their involvement in the project and commit to an 'open book' arrangement that grants broad mutual access and audit rights, to ensure that costs that are reimbursed to the NOPs under the remuneration framework have been actually and reasonably incurred. According to the Guide to Alliance Contracting 'each Participant should grant the Owner, and other public sector bodies, like the Auditor General's Office full access and audit rights to any information, analysis and methodology related to the documentation prepared for the project'; and

7. a joint management structure: each Participant in the alliance is expected to have representation on all governance, management and administrative groups associated with the project.

According to the Guide to Alliance Contracting, there are four critical success factors in an alliance contracting arrangement:

> An integrated collaborative team
>
> The combined team for an alliance project includes personnel from both the NOP and Owner organisations. These personnel will be allocated as members of both the leadership team and the management team. The affinity between members of the team and resulting project culture has a significant impact on the effectiveness of the key features of alliancing...and the project outcomes. The Alliance Leadership Team (ALT) establishes and sustains the project's culture.
>
> Project solution
>
> The project solution comprises the design solution, construction methodology and project delivery arrangements. The commercial agreements and the TOC will be developed and agreed to reflect the unique project solution.
>
> Commercial arrangements
>
> The commercial arrangements, or the Commercial Framework, are agreed as part of the Project Alliance Agreement (PAA) and are intended to drive the alignment between the Participants. The commercial arrangements should reflect the unique

> project solution to ensure that the appropriate level of risk sharing and reward are achieved, and to drive the desired team behaviours and project outcomes.
>
> Target Outturn Cost (TOC)
>
> The Target Outturn Cost (TOC) is the estimated actual costs of designing and constructing the assets. It should reflect the project solution and the commercial arrangements.

When to use alliance contracting

According to the Guide to Alliance Contracting, it is necessary to understand the 'threshold issues' that should be satisfied before an alliance contracting is considered as an appropriate option, including:

> project value - alliance contracting is generally not appropriate for simple procurement projects valued under $50 million; and
>
> resourcing - the Owner needs to have sufficient internal resources, including senior executives with experience and knowledge, to effectively represent and manage its interests in relation to external parties and the alliance contract.

The Guide to Alliance Contracting further states:

> After taking into account these threshold issues, an alliance may be considered as a suitable project delivery method when the relevant project has one or more of the following characteristics:

- the project has risks that cannot be adequately defined or dimensioned in the Business Case nor during subsequent work prior to tendering;
- the cost of transferring risk is prohibitive in the prevailing market conditions;
- the project needs to start as early as possible before the risks can be fully identified and/or project scope can be finalised, and the Owner is prepared to take the commercial risk of a suboptimal price outcome;
- the Owner has superior knowledge, skills, preference and capacity to influence or participate in the development and delivery of the project (including for example, in the development of the design solution and construction method); and/or
- a collective approach to assessing and managing risk will produce a better outcome, e.g., where the preservation of safety to the public/project is best served through the collaborative process of an alliance.

The commercial framework

According to the Guide to Alliance Contracting:

> The Commercial Framework is the key mechanism of the alliance contract which:

- aligns the commercial objectives of the NOPs with the project objectives of the Owner and the investment objectives of the government;
- should encourage and drive the NOPs to achieve the performance levels required by the Owner's [value for money statement]; and
- ensures the Owner is equipped to address any poor performance by the NOPs.
- The Commercial Framework sets out the structure and principles that govern the NOPs' remuneration for the project. The Commercial Framework under an alliance contract provides for the NOP's remuneration which typically comprises:
- reimbursable costs - the direct project costs and indirect project specific overhead costs actually and reasonably incurred by the NOPs (and the Owner if applicable) in the performance of the work;
- the NOPs' fee - this comprises both Corporate Overhead and Profit, that is, the respective NOPs' agreed profit margin and a contribution towards recovery of non-project specific (or corporate) overhead costs; and
- risk or reward amount - a performance-based payment to the NOPs that increases or decreases to reflect the project's outcomes. It is designed to enable the NOPs to share in both the upside and downside associated with delivering the project.

Key benefits, risks and trade-offs in alliance contracts

According to the Guide to Alliance Contracting, the expected benefits of alliance contracting are:

- performance enhancement - Participants take calculated and agreed risks and opportunities to pursue cost savings and enhance project performance, without fear of legal liability if they fail;
- focus on solutions - Participants focus on solutions, rather than blame, when problems arise during the project lifecycle;
- reduced disputes - the risk of disputes is reduced and the threat of litigation is minimised;
- enhanced cooperation - Participants are able to cooperate in an honest and transparent manner;
- collective decisions - the alliance's decision-making processes are directed towards the shared, collective vision and objectives of the alliance, rather than serving the self interest of each alliance Participant;
- risk management - the project's risk can be better managed through a collaborative effort, where each party's knowledge, skills and resources are shared;
- flexibility - there is flexibility to adapt to scope changes, risks and opportunities;
- early commencement - the project may commence earlier than it could have under a traditional contracting environment; and

- innovation - innovation is encouraged, which may result in cost savings and better Value for Money for the Owner.

According to the Guide to Alliance Contracting, the risks of alliance contracting are:

- capability - the Owner's team may not be sufficiently capable to deal with the complexity of the project and alliance delivery method;
- 'soft' TOC - an approach to the selection of NOPs, which does not evaluate price elements combined with any imbalance between the commercial capabilities of the NOPs and the Owner, may result in a 'soft' TOC which inflates the Owner's cost of delivering the project;
- pricing - because the NOPs are generally less exposed to the same risk under the alliance model (due to capping and sharing provisions), this should be reflected in a lower price paid by the Owner than for a traditional contract with a higher risk profile (for the same project risks);
- Owner's exposure to risk - under an alliance, NOPs' pain share will sometimes be limited, unlike the traditional contract where it is 100 percent. This means that under an alliance contract the NOPs face much lower exposure to the consequences of poor project delivery. This may result in NOPs not providing their best team for the life of the alliance project, because they have allocated internal resources to other projects where the risk exposure is much greater;
- use of subcontractors - the NOPs may use subcontractors, rather than their own staff, to deliver the project and this would attract an additional layer of fees;
- risk allocation - the risk or reward regime may not reflect, and deliver the intended benefits of, the risk and opportunity-sharing approach;
- additional costs - the remuneration framework may inadvertently incentivise the NOPs to exceed the original scope and business case requirements, and the Owner may incur additional and unnecessary costs;
- no legal recourse - Owners may be limited in terms of legal recourse if participants are negligent and careless in their conduct; and
- senior personnel required - alliance contracting may require more involvement by senior representatives from the Owner in the early project stages than the traditional forms of contracting; and
- cost overruns - given that all agreed NOP Participant costs will be reimbursed to the NOP Participants, there is potential for significant cost overruns to arise under the risk or reward regime.

APPENDIX C: GEOTECHNICAL INVESTIGATIONS FOR THE ENLARGED COTTER DAM

Details of the geotechnical investigations for the Enlarged Cotter Dam covered the main dam site, both saddle dam sites, a quarry and a clay borrow area and included:

- 352 metres of diamond core drilling;
- 15 test pits; and
- 1528 metres of geophysical investigations.

The Bulk Water Alliance (formed in May 2008) undertook the following investigations:

- Stage 1, prior to the finalisation of the Target Outturn Cost, of the main dam site, saddle dams, quarry and borrow area including:
  - 38 core drill holes with a total length of over 2200 metres;
  - 104 percussion drilled holes, each 21 metres deep;
  - 56 test pits; and
  - 2840 metres of geophysical investigations; and mapping of 2598 rock mass features.
- Stage 2, to further confirm the geological model and reduce uncertainties prior to construction commencing (a provisional item post Target Outturn Cost) including:
  - 383 metres more core drilling;
  - 626 metres percussion drilling;
  - 68 test pits; and
  - 230 metres of geophysical investigations.
- Stage 3, after commencement of construction, to further investigate: the tower crane foundations; intake tower foundation; and saddle dam grouting.
- Stage 4, following completion of the main dam drainage gallery, of the main dam grouting.

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