Public Works
NSW Water Solutions

Dams & Civil

TWEED DISTRICT WATER SUPPLY

CLARRIE HALL DAM RAISING

COST RISK ASSESSMENT

Report No. ISR18079

June 2018

Tweed Shire Council

TWEED SHIRE COUNCIL

Document Control

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1 Introduction

This report concerns the updating of prior cost estimates to for the preferred option for water supply for Tweed District; the raising of Clarrie Hall Dam to FSL70.0m with 42,300ML storage.

Initial cost estimates for Clarrie Hall Dam was based on the July 2015 “Clarrie Hall Dam Raising and Construction of New Dam at Byrril Creek – Cost Update Report” by NSW Public Works.

Cost estimations were based upon the determination of construction items, preliminary material selection, and the substantial experience of Public Works Advisory in the design and construction of dams. Cost risk estimates were prepared based on estimated 10th percentile (P10), 50th percentile (P50) and 90th percentile (P90) costs.

The cost risk assessment was performed using Version 7 of the Palisade Decision Tools Software, @RISK. The software performs a Monte Carlo simulation with the output “Total Project Cost” generated by letting the computer recalculate our estimate worksheet over and over, each time using randomly selected sets of values for the triangular probability distributions assigned for each of the estimate items.

The maximum raising option for the Clarrie Hall Dam site incorporates FSL70.0m with a total storage of 42,300ML. Rockfill would be obtained from a new spillway excavation higher in the left abutment and the existing precast concrete parapet walls would be re-used, thus saving on the volume of raised embankment fill.

Options developed for this report satisfy NSW Dams Safety Committee (DSC) and Australian National Committee on Large Dams (ANCOLD) guidelines.

Refer to Appendix A for a summary of the results.

2 Clarrie Hall Dam Raising

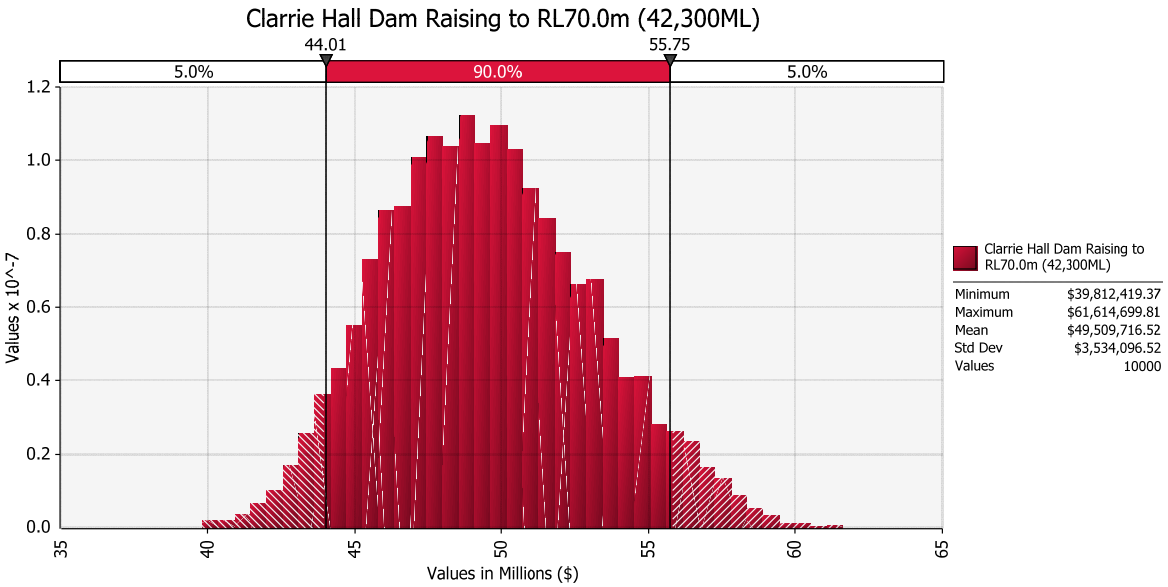
The Clarrie Hall Dam raising option cost estimates are discussed in the October 2015 NSW Public Works report "Clarrie Hall Dam Raising and Construction of New Dam at Byrril Creek – Costs Update". The estimates from this 2015 report have been reviewed and updated.

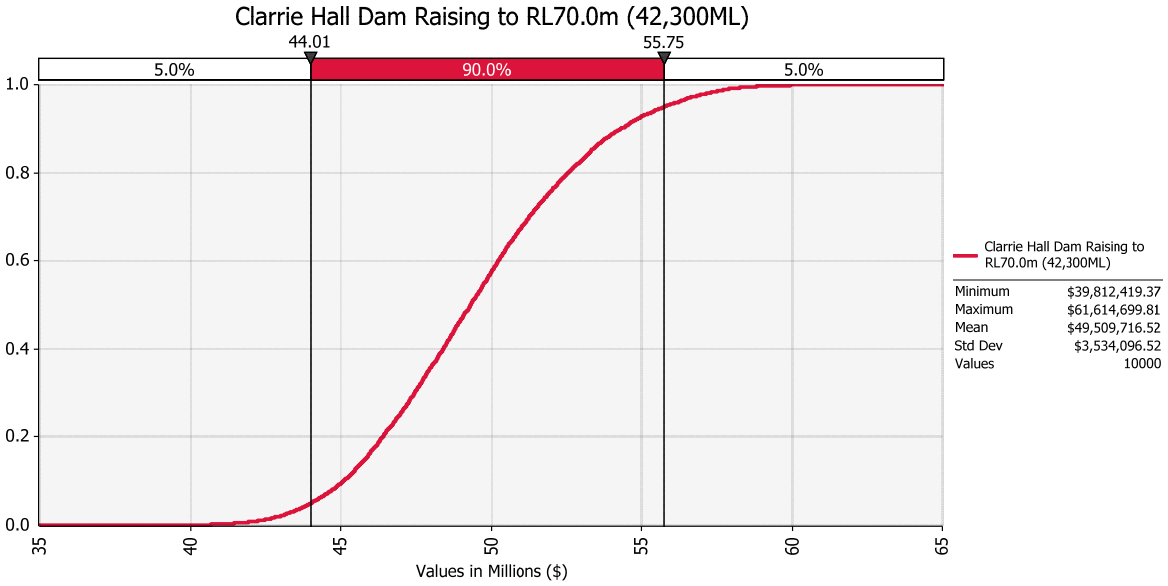
The current full supply level (FSL) of the dam is at RL61.5m with a storage capacity of 16,000ML.

Following previous investigations on dam raising, it has been determined that the dam's maximum optimum size is with FSL at RL70.0m and storage capacity of 42,300ML.

From the risk analysis, the total project cost is forecast to be in the range of $39.8M to $61.6M, with our estimate of the most likely project cost being $49.5M. The statistical analysis indicates that there is a 90% probability that the project cost will fall between $44.1M and $55.8M.

The results of the updated 2018 @RISK analysis are shown on the following page:


Clarrie Hall Dam Raising to RL70.0m (42,300ML)
44.01
55.75
5.0%
90.0%
5.0%
Values x 10^-7
Values in Millions ($)
Clarrie Hall Dam Raising to RL70.0m (42,300ML)
Minimum $39,812,419.37
Maximum $61,614,699.81
Mean $49,509,716.52
Std Dev $3,534,096.52
Values 10000


Clarrie Hall Dam Raising to RL70.0m (42,300ML)
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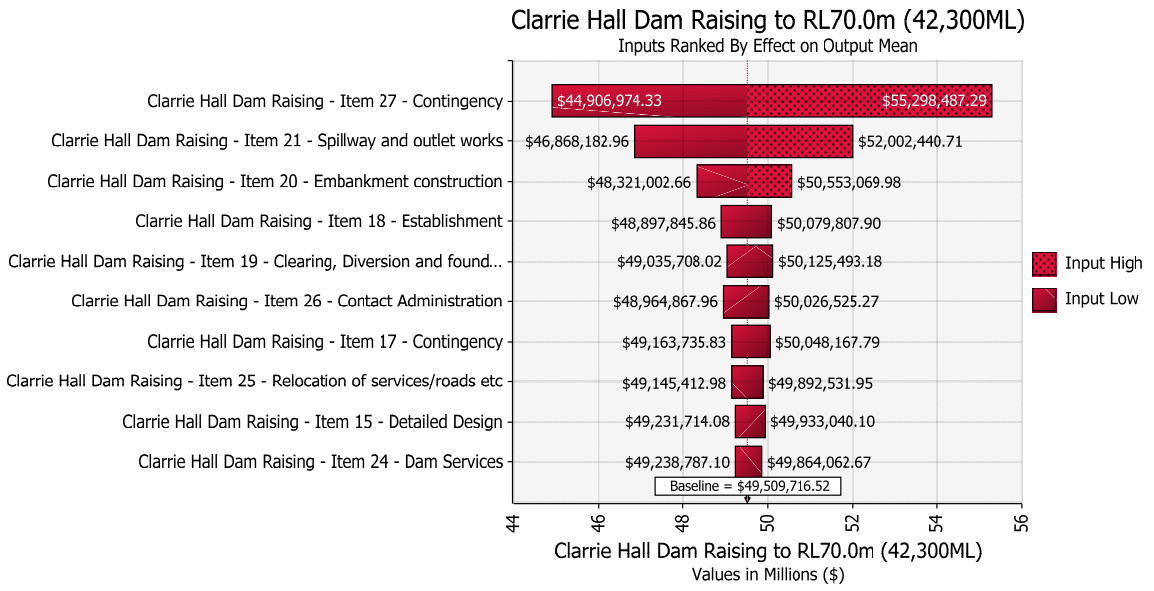
Clarrie Hall Dam Raising to RL70.0m (42,300ML)
Inputs Ranked By Effect on Output Mean
Clarrie Hall Dam Raising - Item 27 - Contingency $44,906,974.33 $55,298,487.29
Clarrie Hall Dam Raising - Item 21 - Spillway and outlet works $46,868,182.96 $52,002,440.71
Clarrie Hall Dam Raising - Item 20 - Embankment construction $48,321,002.66 $50,553,069.98
Clarrie Hall Dam Raising - Item 18 - Establishment $48,897,845.86 $50,079,807.90
Clarrie Hall Dam Raising - Item 19 - Clearing, Diversion and found... $49,035,708.02 $50,125,493.18
Clarrie Hall Dam Raising - Item 26 - Contact Administration $48,964,867.96 $50,026,525.27
Clarrie Hall Dam Raising - Item 17 - Contingency $49,163,735.83 $50,048,167.79
Clarrie Hall Dam Raising - Item 25 - Relocation of services/roads etc $49,145,412.98 $49,892,531.95
Clarrie Hall Dam Raising - Item 15 - Detailed Design $49,231,714.08 $49,933,040.10
Clarrie Hall Dam Raising - Item 24 - Dam Services $49,238,787.10 $49,864,062.67
Baseline = $49,509,716.52
Clarrie Hall Dam Raising to RL70.0m (42,300ML)
Values in Millions ($)
Input High
Input Low

3 References

1. NSW Public Works, July 2015. "Clarrie Hall Dam Raising and Construction of New Dam at Byrril Creek – Costs Update". Report Number DC15141.
2. NSW Public Works, October 2015. "Tweed District Water Supply Augmentation Options – Cost Risk Assessment". Report Number DC15193.
3. MWH, September 2010. "Tweed District Water Supply Augmentation Options Study. Stage 3 – Fine Screen Assessment of Shortlisted Options. Final Report"

Appendix A Cost Risk Estimates

Clarrie Hall Dam Raising to RL70.0m (42,300ML)

Item	Description	P10	P50	P90	Risk Distribution	Expected Price	Comments
	Preconstruction						
1	Flood Hydrology	$48,620	$48,620	$48,620	Pert	$48,620	Completed
2	Survey	$70,103	$70,103	$70,103	Pert	$70,103	Completed
3	Flora and Fauna Studies	$190,000	$190,000	$190,000	Pert	$190,000	Engagement
4	Cultural Heritage	$128,000	$160,000	$240,000	Pert	$168,000	Engagement but will be subject to additional costs
5	Environmental Flows	$152,000	$190,000	$210,000	Pert	$187,000	Engagement of K Bishop, P Cloke and EcoLogical. May go to $210,000
6	Concept Design	$794,000	$794,000	$794,000	Pert	$794,000	NSW PW engagement
7	Preliminary Environmental Assessment	$80,000	$100,000	$100,000	Pert	$96,667	To be done internally. Cost not expected to exceed $100,000
8	Application for SEARS	$16,000	$20,000	$20,000	Pert	$19,333	To be done internally. Cost not expected to exceed $20,000
9	Agency Consultation	$16,000	$20,000	$20,000	Pert	$19,333	To be done internally. Cost not expected to exceed $20,000
10	EIS Consultant	$640,000	$800,000	$1,200,000	Pert	$840,000	Engagement of consultant to do the EIS incl of further studies beyond those above if needed
11	Exhibition and Workshops	$16,000	$20,000	$30,000	Pert	$21,000	Public advertisement, produciotn of documents etc
12	Response to Submissions Report	$48,000	$60,000	$90,000	Pert	$63,000	Engagement of consultant to prepare the Response to Subissions
13	Determination	$16,000	$20,000	$30,000	Pert	$21,000	Admin costs for sending to Minister etc
14	Planning Approvals	$32,000	$40,000	$60,000	Pert	$42,000	To be completed by Designer
15	Detailed Design	$960,000	$1,200,000	$1,800,000	Pert	$1,260,000	PWA Assessment (would include some further geoech) Guess. NSW PA can provide estimates
16	Project Management	$320,672	$373,272	$490,272	Pert	$384,006	Assume 10%
17	Contingency	$320,672	$746,545	$1,470,817	Pert	$796,278	Range of contingency assumed; 10% - 20% - 30%
	Total Pre Construction	**$3,848,068**	**$4,852,540**	**$6,863,812**		**$5,020,340**	
	Construction						
18	Establishment	$725,000	$1,450,000	$2,900,000	Pert	$1,570,833	Includes Site Estab, disestablishment, flood protection, dewatering, Env mngt during construction
19	Clearing, Diversion and foundations	$500,000	$1,000,000	$2,000,000	Pert	$1,083,333	included in items 42 and 43 based on PWA estimate
20	Embankment construction	$5,600,250	$7,467,000	$8,960,400	Pert	$7,404,775	from PWA estimate
21	Spillway and outlet works	$12,000,000	$16,400,000	$20,000,000	Pert	$16,266,667	$16,400,000 (spillway) + $1,800,000 (intake tower) from PWA estimate
22	Intake Tower	$1,600,000	$1,800,000	$2,200,000	Pert	$1,833,333	from PWA estimate
23	Fish Elevator	$0	$0	$0	N/A	$0	As per page 18 of the Fine Screen Report, it is assumed that is is unlikely that a fishway would be required.
24	Dam Services	$400,000	$600,000	$1,000,000	Pert	$633,333	Ok. This cost may include any ajustment to current outlet valves operation and power requirements
25	Relocation of services/roads etc	$1,200,000	$1,600,000	$2,000,000	Pert	$1,600,000	Suggest allow new right abutment road cost $1,400,000 from PWA estimate + say $200,000 for general services relocation
26	Contact Administration	$2,202,525	$3,031,700	$3,906,040	Pert	$3,039,228	from PWA estimate (10%)
27	Contingency	$4,845,555	$10,004,610	$21,483,220	Pert	$11,057,869	Range of contingency assumed; 20% - 30% - 50%
	Total Construction	**$29,073,330**	**$43,353,310**	**$64,449,660**		**$44,489,372**	
	Total Project	**$32,921,398**	**$48,205,850**	**$71,313,472**		**$49,509,712**	