High level review of the *Economic Costs of Inaction on Paradise Dam*

Approach, findings and implications for Building Queensland

26 February 2020

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1 Requirements of review

On 24 February 2020 the report *Economic Costs of Inaction on Paradise Dam* was released. On the 25 February Building Queensland engaged Natural Capital Economics to review the report to assess the approaches undertaken, the findings and any implications for the current Business Case. This report summarises the high-level key findings and recommendations from that review.

2 Key points and implications for Building Queensland decision-making process

Adept Economics were engaged by a consortium of regional stakeholders to assess the economic costs of a permanent lowering of the Dam by 10 metres (BQ's Option 3). Approaches used included background research, consultation, a survey of stakeholders, and economic modelling.

The Adept report includes significant contextual information that will prove useful for the Detailed Business Case (DBC). The report concludes (as expected) that there is a significant cost of a permanent reduction in the dam by 10 metres (present value range of between $1,451 and $2,426 million).

There are two key issues in the report with potential implications for the DBC:

- **Future changes in land use.** Adept's assumed growth rates of high value crops are relatively similar to those developed by NCEconomics and consistent with market trends. However, Adept's simple assumption that future development is primarily greenfield is inconsistent with historical data and trends, current trends revelled through consultation, and statements in Adept's own report. This assumption has a profound impact on water demand and could result in demand outstripping FSL yields in as little as 20 years. The assumption of greenfield development is highly questionable and should be robustly tested in the DBC.
- **Economic cost estimation.** Adept's estimates of the cost of Government inaction are effectively the benefits foregone attributable BQ's Option 3. The estimates should be treated with extreme caution. There are a number of assumptions and input parameters within the analysis that are somewhat unclear and/or questionable. Where assumptions and input parameters were clear, NCEconomics was unable to accurately replicate the estimates. Generally, the cost estimates appear to be high due to several assumptions and input parameters used.

There are a number of other issues raised in the report that will inform the DBC. Due to time limitations, they are not documented in this report, but will be incorporated into future work for the DBC.

Recommendations

No changes to the BQ analysis and recommendations are necessary.

BQ should acknowledge the report with stakeholders.

BQ should ensure the demand estimates undertaken for the DBC include detailed analysis of the likely configuration of greenfield vs. brownfield irrigation development.

3 Background and context

The report *Economic Costs of Inaction on Paradise Dam* was prepared by Adept Economics. Adept were engaged by a consortium of regional organisations[1] with a view to providing analysis to show the economic opportunities (investment and value adding) foregone if Paradise Dam was substantially lowered.

[1] The report was commission and prepared for: Bundaberg Regional Council, Wide Bay Burnett Regional Organisation of Councils, Regional Development Australia Wide Bay Burnett, Bundaberg CANEGROWERS, CANEGROWERS Isis, and Bundaberg Fruit and Vegetable Growers

This memo provides a brief summary of the approach and appropriateness of the work undertaken by Adept Economics, and assessment of any *material* issues in the analysis of interest to Building Queensland, and the identification of any implications for BQ's decision making processes.

4 Approach adopted and key findings

While a detailed outline of the study terms of reference is not outlined, the objective of the study was to "investigate the economic costs of inaction on Paradise Dam by the Queensland Government". This was undertaken through a number of approaches:

1. Literature and data research.
2. Consultation with industry in the region.
3. A survey of approximately 300 businesses in the region (primarily irrigators).
4. Based on the first 3 approaches, a discounted cashflow analysis was then conducted to assess the cost of foregone investment in agricultural development (a capital cost) and gross margins (operating producer surplus) from agricultural development.

From a reading of the document, the process undertaken was relatively consistent with standard practice. However, there are some specific assumptions and approaches that materially impact on the robustness of the analysis and the credibility of the findings. These are outlined in section 4 below.

Key findings from the analysis and the relevant to the BQ summary report are outlined in the table below. Issues with material consequences for BQ are in the shaded rows. Additional issues will be also incorporated into future work for the DBC.

Table 1. Key findings and relevance to Building Queensland summary report

Key finding	Relevance to BQ process
Around 50% of irrigators have at least partially diversified from cane to other crops.	Demand assessment will need to be cognisant of this change and how it impacts on water requirements (volumes and allocation reliability).
Analysis found the growth of high value crops has historically been brownfield development – not greenfield development.	Despite their own research, Adept have then assumed most development will be greenfield. This has material implications for demand assessments (see Section 4). Growth in water demand will likely be a net change (requirements for new crops less foregone demand for cane).
Consultation and surveys indicate the role of affordable and reliance water supply as a driver of economic growth and a major loss of yield will constrain future growth. Only around 11% of irrigators started they could mitigate permanent reductions in yield from the Dam.	More in-depth analysis if demand and demand drivers will be necessary as part of the DBC. Confirms BQ's decision to eliminate of Options 3 and 5 from the DBC.
There are multiple reasons for slow uptake of water to date including exogenous factors such as market conditions and endogenous factors such as water product specification and pricing.	Demand assessment for DBC should include assessment of alternative water products and the impact of prices (allocations and tariffs) on demand.
Forward (unspecified) investments have been made or are being planned utilising water from Paradise Dam.	DBC needs to cater for future growth and/or e cognisant that investment may transfer to other regions.
Using a regional economic model, Adept estimate the cost of a permanent lowering of the Dam by 10 metres has a present value of around $2.4 billion. In effect this is the benefits of investment and gross margins foregone	While the foregone opportunities of a 10 metre lowering are acknowledged and would be captured in the DBC, Adept's approach to estimating those values is problematic, could be misleading, and this issue will need

Key finding	Relevance to BQ process
and associated social costs long-term unemployment etc.).	to be managed through the consultation phase of the DBC (see Section 4).

5 Material issues

There are two material issues stemming from this review of the Adept report that warrant further analysis:

- Adept's implicit assumptions that greenfield land use change assumptions drive very high water demand.
- The economic modelling approach appears to overstate economic costs.

These are discussed in greater detail below.

Greenfield land use change assumptions drive very high water demand

Changes in water demand are implicit in the Adept modelling. However, it is clear from their report that the basic approach of treating water as a derived demand has been used – water demand is a function of changes in land use and specific crop requirements. In an approach similar to that used by NCEconomics, Adept have used the Queensland Land Use Mapping Program (QLUMP) spatial dataset to understand changes in land use since 1999 and this is summarised in Figures 5 and 6 of their report. Their own analysis clearly shows a marginal decline in the areas under irrigation and the substitution of perennial tree crop and seasonal horticulture land uses for sugar production (i.e. high value crops are brownfield irrigation developments) and they state this is the case for their scenario development. This is entirely consistent with the findings from the NCEconomics' analysis.

However, in their actual quantitative scenarios for future land and water use, Adept have actually modelled the bulk of the growth coming from greenfield developments (see Table 14). Using tables 10 and 14 from the Adept report it is possible to estimate the change in demand for water inferred in their model. This is shown in the table below (changes in land use and allocation demand).

Table 2. Land use change assumption in the Adept Economics report

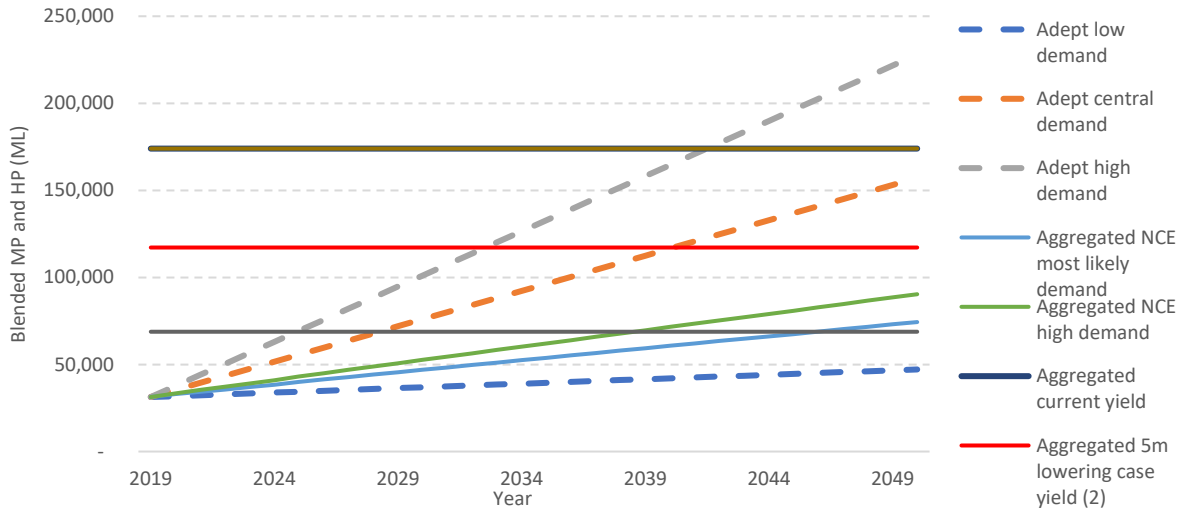
Crop	Lower bound		Central case		Upper bound	
	Area growth (ha)	Water demand growth (ML)	Area growth (ha)	Water demand growth (ML)	Area growth (ha)	Water demand growth (ML)
Macadamias	107	1,072	214	2,144	268	2,680
Avocados	56	349	113	698	141	872
Sugar	-338	-2,026	-169	-1,013	0	-
Other	159	1,116	319	2,232	399	2,791
Net aggregate change	**-15**	**511**	**477**	**4,061**	**807**	**6,343**

Source: NCEconomics estimates based on Adept Economics (2020) Economic Costs of Inaction on Paradise Dam

While the general assumption of growth in high value crops is relatively consistent with the NCEconomics analysis, the simple (and questionable) assumption that future development is primarily greenfield has a profound impact on water demand. Adept's implicit demand is shown by the dashed lines in the figure below. In effect, under Adept's high growth scenario, all water available from the

current FSL would be utilised in approximately 20 years. To put this in perspective, this is a net growth rate in water demand that is approximately 4 times the historical rate since the dam's establishment and around 8 times the rate of annual demand growth from the Dam's establishment up until the heavily discounted water sales in 2019.

Figure 1. The implicit impact of assuming greenfield development – significantly higher net growth in water demand



Source: NCEconomics estimates based on Adept Economics (2020) Economic Costs of Inaction on Paradise Dam and NCEconomics (2020)

The inconsistencies between Adept's statements regarding crop substitution and the parameters used to develop their scenarios (that indicate very low levels of substitution) are not resolved in their report.

Key points

Adept's assumed growth rates of high value crops are relatively similar to those developed by NCEconomics and consistent with market trends.

Adept's simple assumption that future development is primarily greenfield is inconsistent with recent history, current trends, and statements in their own report. This assumption has a profound impact on water demand and could result in demand outstripping FSL yields in as little as 20 years

Economic modelling approach overstates economic costs

Chapter 6 of the Adept report is where the economic benefits foregone attributable to a 10 metre lowering of the dam are estimated. In effect, the benefits foregone are treated as the costs of 'Government inaction'. Present value estimates range from $1.4 - $2.4 billion. While a number of key assumptions and parameters are documented, it is often not clear how the calculations were undertaken, and the results were not replicable.

The key costs are outlined in the table below including commentary.

Table 3. Economic benefits foregone attributable to a 10 metre lowering of the spillway

Benefits	Commentary
Gross margin forgone due to lower investment and irrigated agricultural production (estimated range $1,633 to $2,769 million).	On a first read, the general approach is reasonably sound. While NCE attempted to replicate the analysis, estimates as high as Adept's could not be obtained. Observations regarding assumptions include: • It would appear that Adept have estimated gross margins using changes in land use similar to NCE's estimates in Table 2 (i.e. primarily greenfield

Benefits	Commentary
	developments). The impact of this assumption is that economic costs will be much higher as margins from cane production foregone are not included. • Tomatoes are used as the representative vegetable crop. This is an unrealistic assumption, and given the very high gross margins used for tomatoes, overall costs are overstated.
Capex reduction (estimated range -$571 to -$861 million).	This is a negative cost (i.e. a benefit) reflecting the fact that investment to establish irrigation areas is precluded due to a lack of water. The rationale is generally sound, however, the exact basis of the estimate is not entirely clear.
Lower productivity across economy as a result of lower regional investment (estimated range $288 to $378 million).	It is not clear exactly how this was calculated. The report eludes to a simple % reduction in Bundaberg's Gross Regional Product, however, we were unable to achieve a similar result when attempting to replicate the estimates.
Social costs (i.e. long-term unemployment, mental health, alcohol abuse, family violence) (estimated range $103 to $143 million).	While the report briefly outlines the key issues and potential costs, assumptions and data used are unclear or incomplete, and there are no references to substantiate the causality between constraints in the growth of irrigation and numerous social costs.
Offsetting environmental benefit from reduced dissolved nitrogen and sediment (estimated range $2 to $3 million).	This reduction in diffuse water pollutants attributable to less agriculture is treated as a negative cost. The general rational for this is sound, and appropriate sources of information have been used. While improvements to the estimates could be made, they are imperial to the overall assessment.

Source: NCEconomics analysis based on Adept Economics (2020) Economic Costs of Inaction on Paradise Dam

Basic sensitivity analysis was also undertaken using Monte Carlo simulations. While this is encouraging, only partial results of the sensitivity analysis were presented, and it is not possible to elicit insight on which input parameters drive the variability on the cost estimates. Furthermore, he range of estimates is relatively narrow given the paucity and variability of input data presented. This reinforces the need to treat the estimates with extreme caution.

Key points

Adept's estimates of the cost of Government inaction are effectively the benefits foregone attributable to a10 metre lowering of the Dam (Option 3).

The estimates should be treated with extreme care. There are a number of assumptions and input parameters within the analysis that are somewhat unclear and/or questionable.