

# Commission of Inquiry

## PARADISE DAM

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### KEY ISSUES

Practice Guideline No 2, paragraph 7

Revised 4 March 2020

#### 1. Structural and stability issues (Terms of Reference para 3(a))

- 1.1 Paradise Dam's (**the Dam's**) sliding stability. In **GHD.005.0001**, the sliding stability is assessed as not meeting the Australian Committee on Large Dams (**ANCOLD**) factors of safety for different flood scenarios.
- 1.2 The adequacy of downstream protection immediately below the Dam, principally;
  - a. the adequacy of the primary spillway apron's dimensions;
  - b. the capacity of the materials from which the primary spillway apron was constructed (and the way in which it was constructed) to resist the erosive force of water.
- 1.3 The strength of the Dam's foundations. (Exploratory boreholes taken in 2019 (see **IGE.017.0001**, p. **0014**) are said to show areas of open contact between the RCC and bedrock at the foundation of some parts of the Dam. See also Section 2.4 of the second report of the Tranche 2 TRP (**IGE.051.0001**)).

#### 2. The 'engineering and technical studies' material to the issues stated above are, for the purposes of paragraph 3(a) of the Terms of Reference

- 2.1 Technical Review Panel ('Tranche 1') Reports:
  - a. No 1 dated October 2013 **IGE.017.0001**
  - b. No 2 dated January 2014 **IGE.018.0001**
  - c. No 3 dated November 2014 **IGE.019.0001**
  - d. No 4 dated 15 December 2015 **IGE.020.0001**

- 2.2 Technical Review Panel ('Tranche 2') Reports:
- a. No 1 dated 29 May 2019 **SUN.009.003.0613**
  - b. No 2 dated 23 September 2019 **IGE.051.0001**
  - c. Although outside the date range in the Terms of Reference, No 3 dated 9 December 2019 **SUN.009.002.0001**, but relevant because it deals with many of the matters dealt with in TRP Report No 2.
- 2.3 Report of Tatro Hinds 'Shear Strength Evaluation Comments' dated 25 November 2019 **IGE.028.0001**.
- 2.4 Memoranda from GHD (Mr James Willey) dated 5 September 2019 **DNR.001.2363** and 25 November 2019 **GHD.005.0001**.
- 2.5 Draft Inspection Report of the Dam Safety Regulator in April 2013 **DNR.012.9331**.
- 2.6 SunWater, Dam Safety Review, Revised Report, in 2016 **DNR.002.3132**.

### 3. Key issues

- 3.1 In terms of sliding stability:
- a. adequacy of the bond between the roller-compacted concrete (**RCC**) lifts;
  - b. whether the consequences of using the particular 'lean' RCC mix adopted for the Dam limited the practicability of verifying shear strength parameters by *in situ* testing and, for that reason, necessitated greater reliance on quality management systems that recorded whether and to what extent specified construction methodologies and practices were adhered to than for mixes with higher cementitious content;



- c. whether the specified construction methodologies and practices were:
  - i. appropriate according to accepted practices and guidelines at the time the dam was constructed;
  - ii. sufficient to verify that the Dam achieved the design parameters for shear strength;
  - iii. adhered to, including, in particular, with respect to the laying of RCC and the treatment of lift joints (including 'cold joints') with bedding mix;
- d. the adequacy of testing and checking (and the standards against which such testing was undertaken) reliably to verify that the lift joints were of a quality likely to result in a dam about which there could be reasonable satisfaction of stability and structural integrity;
- e. adequacy of remediation of non-conformances and quality short-falls identified during the Dam's construction;
- f. whether the Dam, as designed, 'essentially achieves stability with current friction values alone' (see, for example, **SUN.010.002.0047**) and the reliance placed upon this statement in making decisions about the design and construction of the Dam.
- g. what standards are properly to be applied in assessing the Dam's sliding stability.

3.2 In terms of the downstream protection:

- a. the adequacy of the dimensions, structure and quality of construction of the apron downstream of the primary spillway;
- b. whether the primary spillway apron was constructed of sufficiently strong material to withstand the erosive forces of water and abrasion;
- c. the design process and the accuracy and adequacy of the hydraulic modelling, including as to the energy dissipation effects that tailwater



would offer, and whether the complexity of anticipated flood flows had been properly accounted for in the apron's design;

- d. the appropriateness and sufficiency of geological investigations prior to and during construction of the Dam and the availability of them to the Dam's designers;
- e. the effect of damage from flooding in 2010/11 and how it may have influenced (if it did influence):
  - i. the damage sustained immediately downstream of the Dam in 2013;
  - ii. the hydraulic jump.

3.3 In terms of the Dam's foundations, the adequacy of contact between the Dam wall and the rock beneath it.

3.4 In terms of governance and reporting arrangements:

- a. whether the use of a special purpose vehicle (Burnett Water Pty Ltd) was attended with weaknesses in terms of separating the design and build from the ultimate owner and operator of the Dam (SunWater);
- b. whether an alliance arrangement was the appropriate delivery model for the design, construction and commissioning of the Dam in the sense of having contributed to the structural and stability issues identified in paragraph 1 above;
- c. whether a 'declaration' made by some or all members of the Alliance that they would use, or seek to use, less conventional concrete was desirable and the consequences for the project of such a stance;
- d. whether the use of an independent review panel during the design and construction of the Dam would likely have improved governance and provided a wider lens across design and construction activities, including the avoidance of excessive reliance upon one, or a small number, of advisors;



- e. whether the Dam Safety Regulator adequately discharged his statutory functions, including in properly conditioning the development permit for the Dam and ensuring those conditions were met;
- f. whether the conditions of the development permit for the Dam were met;
- g. the adequacy of peer review of the Dam's design, and of changes and adjustments to that design;
- h. the circumstances which contribute to a situation where there exists uncertainty among technical experts and engineers as to the Dam's structural integrity and stability and how this might be avoided in the future.

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4 March 2020