

Charleston Dam Fishway Remediation Scoping Brief

1. Background

1.1 Charleston Dam

Charleston Dam was designed to provide town water to Forsyth and to Georgetown as well as creating the site for a new recreational facility at the reservoir. Charleston Dam was constructed from June 2019 through December 2020, at which time ownership was handed to Etheridge Shire Council (ESC), which included the responsibilities for operation and maintenance of the dam.

Charleston Dam consists of a zoned earthfill embankment with a clay core, general fill, upstream and downstream rock protection, and a sand filter. The dam comprises an unlined spillway channel with a buried left abutment mass concrete training wall. The dam outlet works consist of a floating offtake, with no provision for environmental releases through the dam itself. The dam has a capacity of 10,900 ML with a catchment area of 206 km².

Charleston Dam includes a fishway located on the right bank forming the full supply level of RL 387.30 m AHD. The fishway comprises a 1,045 m long (approx.) structure with an uncontrolled entrance at the Delaney River, traversing along a natural gully with excavated resting pools, two rock ramps and finally a further series of resting pools along the spillway crest before exiting into the reservoir. The available documentation on the fishway is listed in Section 4 including drawings, which is included in:

https://shepherdservices.sharepoint.com/:b:/s/Intranet/Efs49RF5XPtKkmMI1uyIBvABmDTdfi8CcDz0_y0s6Zme1w?e=dd5M6f

Charleston Dam is located on Delaney River, approximately 30 km upstream of Georgetown, which is situated on the Savannah Way approximately 385 km south-west of Cairns. The locality plan for Charleston Dam is shown in Figure 1.



Figure 1 Locality plan and catchment

1.2 Fish passage design and approval

The fish passage was designed and reviewed by a suitably qualified fish passage professional in 2017. The fish passage design was subsequently approved by the State Assessment Referral Agency (SARA) on 16 August 2017, with conditions as determined by the Department of Agriculture and Fisheries (DAF) as the assessing authority for the development. The development approval is provided in **Error! Reference source not found.** The fish passage was designed and contracted

separately to the Charleston Dam design and Charleston to Georgetown water supply works. The As Constructed Charleston Dam drawings are provided in **Error! Reference source not found.**

1.3 Construction and damage upon first filling

First filling of the dam occurred shortly after the construction contractor demobilised from site on 21 December 2020 following the installation of the piezometers, with the dam filling to FSL by around 3 January 2021. ESC advised that after this time additional rainfall in the catchment in the following days led to the reservoir reaching a peak of approximately **RL 388.8 m AHD**, 1.15 m above FSL. Daily water level data was not available at the time of preparing this inspection and the dam was reliant on manual readings at the time. The seven-day rainfall total was 316.8 mm from 31 December to 6 January 2021. This was recorded at the Bureau of Meteorology (BoM) Georgetown Airport station (030124) 27 km north of the dam site.

The Issue for Construction Drawings nominated that the spillway crest should be excavated down to moderately weathered rock or better. However, loose material was left on the surface of the spillway following blasting and excavating operations during construction. Along the centreline of the spillway crest axis, there is generally higher strength and less weathered material (where visible), which is expected based on the topography prior to construction and geotechnical borehole logs. The spillway erosion control sill was not constructed. The fish passage was relocated towards the centre of the spillway during construction.

Several deeply incised channels have eroded on the downstream side of the spillway crest following the first spillway operation. Recent survey is available, and photos showing the condition of the fishway and spillway from late 2022 are provided in **Error! Reference source not found.** Erosion channels have generally eroded to more competent material, however, the profile is variable with highly and extremely weathered rock still evident along the channels and erosion is expected to continue during future overtopping events. This pattern of erosion is typical for unlined spillways. The erosion channels generally do not present a dam safety risk, however, long-term progression of erosion may result in a reduction of full supply level.

The fishway has been undermined and collapsed during operation. The damage includes significant scour and undermining of the rock ramp sections of the spillway, as well as erosion of the natural gully and resting pools along the previous drainage line. Works are required to reinstate the fishway to its original design intent and development approval.

2. Remediation concept

An inspection of the damage to the fishway was undertaken on 8th November 2022 to assess the extent of damage to the fishway and provide input into the scope of works required to progress design, approvals and remedial construction works for the fishway.

The exposed foundations on the spillway currently comprise a combination of extremely to highly weathered rock, soils and some areas of moderately weathered rock or better. The foundations in the vicinity of the spillway are erodible in sections of the spillway crest, spillway chute and natural channel. Further excavation and potential realignment of the fishway rock ramps and exit is required to provide competent foundations for reinstatement of the previous fishway design. Strict supervision during construction by a suitably qualified geotechnical engineer or engineering geologist will likely be required for the remediation works to confirm foundation conditions are suitable for the final remedial works design.

At the fishway entrance (downstream end) there is a section of high to very high strength, fresh to slightly weathered granite outcrops which has low erosion potential and may be modified to provide a robust fish passage attraction point and allow fish to traverse up the fishway, to the natural gully, newly constructed rock ramps and fish passage exit on the spillway crest.

Rock ramps are recommended to be reconstructed along the steep section of the fishway between the spillway crest and the natural gully sections. The rock ramp will be required to be a more robust structure than originally designed, with close construction supervision by a suitably qualified fish passage professional and Registered Professional Engineer of Queensland (RPEQ) fishway engineer. The rock ramp may be further engineered using a combination of reinforced concrete and mass concrete, cast in-situ and/or pre-cast concrete sections to form the rock ramp. The rock ramp will be required to have head drops of no greater than 0.125 m in accordance with the approved fishway design, however consideration should be given to reducing the head drop to 0.1 m based on pre-lodgement engagement and correspondence with SARA and DAF (**Error! Reference source not found.**). The final location of the fishway entrance, rock ramps and exit should be confirmed as part of the detailed design and in consultation with DAF with consideration of hydraulic conditions suitable for fish passage, foundations and ongoing maintenance considerations.

The erosion control sill shown on the Charleston Dam Issue for Construction Design Drawings should be reviewed and incorporated into the design, and modified as necessary to suit the as-constructed dimensions. The erosion control sill will control the fish passage exit conditions and reduce the potential for back erosion along the spillway, potentially leading to bypass of the fishway.

In summary, the remediation concept broadly comprises:

- **Fishway entrance:** Construct engineered rock ramps at the fishway entrance on non-erodible rock to the natural gully.
- **Natural gully and resting pools:** No works due to likelihood of deep, ongoing erosion and conditions potentially suitable for fish passage.
- **Rock ramps:** Reconstruct engineered rock ramps between the natural gully to the spillway crest, in line with the design intent providing:
 - Suitable foundation conditions are specified and confirmed during construction
 - Adequate robustness is incorporated into the design
 - The rock ramp will likely comprise suitably engineered sections to control hydraulic conditions constructed from mass concrete, reinforced concrete or grouted rock protection (as determined by the design engineer) including baffles nominally to the same dimensions as per the approved design
 - Resting pools shall be incorporated into the spillway crest and rock ramp sections at same change in vertical elevation as the approved design
 - Selection of the most appropriate location of the fish passage rock ramps and exit is selected and agreed with DAF.
- **Exit:** Construct an erosion control sill and incorporate this into the fishway exit to prevent bypassing of the fish passage and maintain the 300 mm deep operating range in the fish passage rock ramp section before the spillway is activated.

The concept is further described in the meeting minutes (**Error! Reference source not found.**).

3. Scope of works

The scope of works for the detailed design of the rock ramp is subject to consultation with SARA and DAF as part of the approvals process. As such, the scope of works may vary depending on the design and advice from agencies. Notwithstanding, the scope of works should include at a minimum:

1. All project management related activities, including one site visit, quality assurance and health, safety and environment activities required to undertake the works. At a minimum, monthly progress meetings.
2. Develop concept design drawings and basis of design document for submission to SARA and DAF for technical feedback prior to meeting.
3. Prepare estimated construction cost based on concept design (project is externally funded under Disaster Recovery Funding Arrangements, keeping the Queensland Reconstruction Authority informed on estimated cost is important).
4. Prepare an agenda and presentation to present the concept design (as a proposed minor change) to SARA and DAF during a formal pre-lodgement meeting.
 - a. Hold point: Confirmation of design concept and scope of works required to progress to detailed design and approval.
5. Prepare detailed design documentation, Planning Act Form 5 Change Application Form and supporting information report including Assessment against State Code 18 and submit to SARA and DAF via MyDAS2. As the works are considered to be remediation in line with the design intent and development approval, the change is expected to be Minor.
6. Prepare an estimate of construction costs based on final design.
7. OPTIONAL: Preparation of full tender documentation for tendering the construction of the works using FNQROC template documents.
8. Provide an hourly rate to assist with any technical enquiries from potential construction contractors during the tender period.
9. OPTIONAL: Provide an hourly rate to provide assistance with tender assessment.
10. OPTIONAL: Completion of DA related construction forms as required to meet notification and reporting requirements
11. OPTIONAL: Undertake technical inspections during construction, respond to technical queries from the contractor and certify the construction.

3.1 Exclusions

The following activities are considered outside of scope based on the existing development approval and advice to date, however dependent on advice from SARA and DAF as the design is progressed:

1. Assessment of alternative fishways or a fishway options assessment
2. Major amendment requiring additional design work or planning applications.
3. Hydraulic modelling of the fish passage or fishway internal hydraulics
4. Geotechnical investigations
5. Ecological investigations
6. Further information requests from SARA/DAF during the change application process
7. Application fees (these shall all be paid by ESC).

4. Available documentation

4.1 General

The following table contains the available documents related to the dam and fishway. This includes technical reports, inspection reports, survey, and other relevant documentation related to the fishway.

Table 1 Charleston Dam available documentation

Document Name	Document Type	Date	Revision
2022 Survey: Dam DTM and Imagery	Survey	December 2022	0
Charleston Dam Fishway Meeting Minutes	Meeting Minutes	December 2022	0
Charleston Dam As-Constructed Drawings	Drawings	September 2021	1
Charleston Dam Design Report	Drawings	May 2019	0
Application for Water License	Letter	November 2018	0
Decision Notice – Etheridge Shire Council	Letter	August 2017	0
Charleston Dam – Delaney River Fish Community Review	Report	May 2017	0
Design Review – Detailed Design	Checklist	May 2017	0
Charleston Dam – Fish-way Design Notes	Report	May 2017	0
Constructing or Raising waterway barrier works in fish habitats state code	Report	May 2017	0
Review Charleston Dam – Waterway Barrier Works	Letter	May 2017	0
Fishway and Rock Ramps General Arrangement	Drawings	April 2017	2
Charleston Dam – Dam Safety Condition Schedule	Letter		

5. Deliverables

The deliverables required include:

1. Detailed design drawings
 - a. 30% design (concept design and construction estimate) for DAF review (**HOLD POINT**)
 - b. 85% design (Council Review)
 - c. 100% design including design model (Issue for Approval by assessing agency and construction estimate)) (**HOLD POINT**)
 - d. Issue for Construction
2. Technical Specifications
3. Schedule of Quantities
4. Safety in Design Assessment
5. Fish Passage Remediation Design Report (including certification)
6. SARA/DAF pre-lodgement presentation
7. Planning Act Form 5 Change Application Form and supporting information report.

8. OPTIONAL: Full Tender Documentation
9. OPTIONAL: Planning construction notification forms
10. OPTIONAL: Certification of Construction

6. Timeline

The following timeline is suggested based on the Scope of Works and exclusions in Section 4:

1. Engage consultant to undertake remediation design: 21 November 2023
2. Prepare concept design package: 12 January 2024
3. Approval in principal of concept by SARA/DAF: 19 January 2024
4. Detailed design: 13 February 2024
5. Submission of Approval change notification: 20 February 2024
6. Approval: 30 March 2024
7. Tender Advertised: 1 April 2024
8. Tender Award: 10 May 2024
9. Construction: May to August 2024

7. Mandatory requirements

1. All stages of design shall include oversight and advice from a suitably qualified and experienced fish passage professional in accordance with **SDAP Guideline State Code 18: Constructing or raising waterway barrier works in fish habitats**
2. All stages of design shall include oversight from a Registered Professional Engineer of Queensland (RPEQ).
3. Any modifications to the dam (including spillway) shall be certified by an experienced dam engineer who is RPEQ in accordance with the Queensland Dam Safety Management Guidelines and Dam Safety Condition Schedule for Charleston Dam.
4. The design shall be in accordance with the development approval, and/or as otherwise approved by the assessing agency.

8. Proposal

Suppliers are asked to provide a proposal outlining their understanding of the project, proposed methodology including risk identification and management approach, team (including experience), program and price for the nominated scope including details of resource time allocation and hourly rates.

9. Assessment Criteria