



## Dam upgrades & remedial works – Design & Construction

### Identify the need

Dams are critical infrastructure which provide significant benefits to communities in many ways including providing water supply, flood mitigation, power generation or irrigation. These structures may require upgrades or remedial works because of a need for increased storage or as a result of deterioration due to age, changes in design standards or inadequate original design. The need for these works can be identified in a number of ways including:

- Routine surveillance
- Safety evaluation of dams and appurtenant structures
- Failure of an element of the dam infrastructure
- Evaluation of original design and construction against modern design and construction practices
- Portfolio or detailed risk assessment process
- Revised yield or demand assessment

### Respond to the need

GHD has experienced dams engineering professionals who are able to respond to any need identified, whether in an emergency situation or as part of a formal dam improvement program.

In a formal dam improvement program, the process which would normally be followed would consist of the following:

- Identify deficiencies in the dam design or performance
- Undertake field investigations to establish the material properties of the foundations and structures (if required, e.g. embankment soil properties)
- Develop concept designs to upgrade relevant dam components
- Agree an appropriate upgrade option with Client

- Prepare detailed designs for upgrade works
- Construct upgrade works

Once the upgrade has been completed the dam is returned to full service and the dam owner monitors the performance of the dam.

### Service offering

GHD offers the following services in support of dam upgrade or remedial works:

- Safety evaluation of embankment and concrete dams, spillways, outlet works, gates, valves, etc.
- Options studies and concept design for upgrades and remedial works
- Geotechnical investigations and design
- Hydrological analysis
- Detail design and tender documentation
- Hydraulic design and modeling
- Structural analysis and design
- Construction phase support
- Preparation of Operation and Maintenance Manuals and Dam Safety Emergency Plans
- Dam safety inspections and monitoring and surveillance analysis

### Experience

GHD has one of the largest dedicated dams engineering teams across the globe.

GHD has worked closely with clients to respond to their needs for dam strengthening and upgrades. We have been involved in providing solutions to a number of challenging requirements on various projects. Examples of dam upgrade or remedial works projects are described below.



### **Upgrade of Googong Dam Spillway – New South Wales, Australia**

GHD was engaged in 2006 to undertake a review of the historical performance and prediction of future performance of the structure. The project included an increase in the capacity of the spillway to discharge the required spillway design flood. Work under this engagement included a review and assessment of previous work, the development and comparison of options and ultimately the detailed design of the preferred arrangement. A scale physical model was constructed to validate the detailed design. GHD had a full-time site role and provided design support throughout construction which was completed in 2010.



### **Eildon Dam Upgrade – Victoria, Australia**

The upgrade of Eildon Dam included increasing the spillway capacity to pass extreme flood events and a safety upgrade to address concerns in regard to the existing embankment. Embankment upgrade works involved raising the embankment crest by about 4 m to a total height of about 85 m and the construction of a 1.2 m high parapet wall. Spillway upgrade works involved the anchor installation to stabilize concrete structures, replacement of mechanical gate actuation system and modifications to an existing bridge over the spillway. The intake tower was also strengthened.



### **Safety Upgrade of Quipolly Dam – New South Wales, Australia**

GHD was engaged in 2009 to undertake concept and detailed design for the safety upgrade of Quipolly Dam on behalf of the Liverpool Plains Shire Council. The appointment included hydrology review, geotechnical investigations, upgrade to improve spillway capacity and reduce the risk of piping through the embankment and along the spillway retaining wall, OHS upgrade of intake tower top platform and replacement of intake tower access bridge piers. The client also required an increase in the storage capacity. Construction was successfully completed in 2013.



### **Upgrade of Wellington Dam – Western Australia, Australia**

Wellington Dam is a 34 m high concrete gravity dam on the Collie River south of Perth impounding a storage of 180 GL. GHD was appointed by Water Corporation of Western Australia to carry out the detailed design then to provide construction advice for risk reducing remedial works. The design included approximately 40 anchors of up to 91 strands to counter uplift pressures on the dam. The remedial works also included a new bridge for improved access, new downstream toe drainage and new access through the dam between galleries. Significant concrete cutting tasks were required and architectural finishes were designed for the bridge and public access zones.



### **Upgrade of Jindabyne Dam – New South Wales, Australia**

Jindabyne Dam is a 71 m high zoned earth and rockfill dam. GHD was engaged to undertake the concept and detailed design and tender documentation for an upgrade to allow for environmental releases and to increase the flood discharge capacity. GHD also provided design support during construction. The project included upgrading the existing spillway structure by retrofitting a concrete-lined chute, flip bucket and plunge pool, constructing a new 93.8 m wide auxiliary spillway controlled by 7.6 m high Hydroplus Fusegates and constructing a new 30 m high intake tower, tunnel and twin cone valves.



### **Awoonga Dam Valve Refurbishment – Queensland, Australia**

In 2009 Gladstone Area Water Board commissioned GHD to develop a strategy to refurbish all the Intake Tower and River Outlet valves up to 2.2 m diameter, limiting shutdowns to 12 hours. The strategy included a detail programme for each valve removal/installation shutdown period as well as an overall project program. Subsequently, GHD was engaged to develop the tender documents, evaluate the offers and direct the construction risk management process. GHD was appointed as Superintendent and technical advisor for the contract. Duties included contract administration, attendance during site work and Factory Acceptance Testing.



### **Ross River Dam Upgrade – Queensland, Australia**

The Ross River Dam was completed in the 1970s as a combined water supply and flood retention project. The dam was 24 m high and 7700 m long with a combined central core rockfill section transitioning to a zoned earthfill embankment and free overflow spillway weir section with downstream energy dissipator. The dam was upgraded using a risk-based design justification by the provision of downstream filters, raising the embankment crest by 0.7 m and installation of three 3.6 m high radial gates for increasing the storage capacity and improving the flood mitigation.

To contact our dams service line professionals, visit [www.ghd.com/dams](http://www.ghd.com/dams)

