

Bedford Dam: Ingula Pumped Storage Scheme

Bedford Dam is a 49 m-high concrete-faced rockfill dam (CFRD) with an 810 m crest length, and forms the upper reservoir of the Ingula Pumped Storage Scheme (IPSS). The IPSS borders on the Free State and KwaZulu-Natal provinces and is situated north-east of Van Reenen in the Little Drakensberg.

Bedford Dam is located in a sensitive wetland area in the upper reaches of the Wilge River. The design of the dam was divided into three phases.

Phase I was the basic design, in which detailed geotechnical investigations were conducted, a dam type selection study was performed and the dam layout was optimised and finalised.

Phase II comprised the tender and construction designs, and Phase III, construction supervision. The Braamhoek Consultants Joint Venture (BCJV) was successful in its bid for Phase I and a contract was signed in May 2004. The BCJV was later also awarded the remaining Phases II and III of the project. Owing to the sensitive wetland at Bedford, environmental matters were taken very seriously and the dam design was very much 'nature driven'.

The wetland provides a continuous water supply to the Wilge River throughout the year, thanks to the excellent water retention properties of its peat soil.

The white-winged flufftail bird breeds in only three wetland sites in the central highlands of Ethiopia and migrates regularly to a few sites in South Africa, one of which is at Bedford. The wetland is also home to the critically endangered wattled crane and numerous animals, including the threatened oribi, the grey rhebok and the steenbok.

Detailed studies were therefore carried out by Eskom supplemented by additional research by specialists, which formed the basis for compiling an encompassing environmental management plan (EMP), as well as informing ensuing processes in terms of the unique project design, stakeholder and landowner relations, land management, job creation (450 temporary and 10 permanent) and long term conservation.

The construction of the CFRD was undertaken using state-of-the-art techniques developed worldwide for this type of dam including an innovative kerb system which entailed placing a kerb using a modified road kerb machine.

The concrete face slab was slip formed. As the face slab acts as a relatively thin concrete membrane (only 300 mm thick), it is essential that good-quality concrete is produced.

Other factors that were taken into account when the face slab concrete mix was designed included the sub-zero ambient temperatures experienced in winter, strong winds of up to 120 km/h that could easily result in concrete drying shrinkage cracks and harsh crushed concrete sand.

Workability of the concrete is of the utmost importance as concrete that is too dry will block the discharge chutes down the face and concrete that is too wet will result in sagging behind the slip form screed and potentially weak concrete.

The above measures resulted in a face slab concrete mix that achieved the design strength at 28 days with minimal cracking.

The project was exceptionally well planned and executed. Close co-operation between client, consultant and contractor, combined with the high expertise and professional attitude of the contractor, resulted in Bedford Dam being completed on time and well within budget. ●



Professional team

- Project manager: Eskom
- Name of company entering: SSI
- Braamhoek Consultants Joint Venture (BCJV) comprises: Arcus GIBB, Knight Plésold and SSI Engineers & Environmental Consultants.
- Civil engineer: BCJV
- Electrical engineer: BCJV
- Structural engineer: BCJV
- Geotechnical engineer: BCJV
- Quantity surveying: BCJV
- CFD modelling: Aerotherm
- Landscape architect: Cave Klapwijk and Associates
- Site supervision: BCJV
- Health & safety: Eskom
- Environmental: Nature Conservation Corporation
- Main contractor: Braamhoek Dams Joint Venture (BDJV), comprising WBHO, Concor, Edwin Construction and Silver Rock Construction