



## **Gate House Repairs Under Pressure (Literally)**

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Indian Lake dam is a cyclopean concrete and masonry dam constructed circa 1898. During rehabilitation to address stability, seepage, and general upgrades, a dive inspection into the gatehouse revealed extensive damage. Although minor repairs were always expected, the condition was much worse than anticipated and long-term performance of the structure was in question. The gatehouse is roughly 40 ft below water and the structure's issues complicated the repair solution. The challenges included 5-foot-diameter low level outlet conduits that would not shut completely making access dangerous/difficult, masonry construction with severe mortar loss that rendered the structural capacity extremely limited, and some portions of the support walls that were completely inaccessible making them very difficult to address. Because the condition was discovered during construction, developing a repair solution was a priority. Different alternatives were brainstormed and evaluated, and an independent structural facing placed outside of the existing walls was ultimately chosen as the preferred alternative. There was no cofferdam included in the rehabilitation project prior to discovery of the gatehouse issues and cost estimates of the planned work for the gatehouse indicated that the cofferdam option would add significant cost. The design team developed plans to repair the structure using a three-sided reinforced concrete facing constructed with tremie concrete & divers. An early design modification was to use precast concrete panels in lieu of conventional formwork which had several benefits. First, the thimbles for exterior sluice gates could be cast into the precast allowing the divers to more easily align the thimble with the existing opening. The exterior layer of reinforcing could be cast within the panel and formwork for the corners and vertical joints between the panel could be easily placed against the panels. The design team worked through the details which included room for lap lengths at vertical panel joints, room for standard hooks at the corners, and tolerance to allow for dimensional variations in the bedrock and existing dam. The structural design and construction of the improvements were complicated by several factors which required creative thinking as each challenge presented itself. The resulting design incorporated the external panels, internal bracing, several lifts of tremie concrete with cleaning between each lift, a grouting program to seal inaccessible areas and several innovative details relating to bracing anchorage & support, formwork support & placement of reinforcement. This is a story of engineers meeting each challenge of a complex design.