The design and construction of an enlargement scheme for Black Esk reservoir (Scotland)

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SYNOPSIS Work started in early 2013 on a scheme for enlarging Black Esk reservoir in the Scottish Borders, and was substantially completed within twelve months. The overflow level was raised by about 2.5m, increasing the original storage volume of 2200 Ml by about 40%.

The original reservoir, built around 1962, was impounded by an embankment dam that was about 20m high, with a rolled clay core and the overflow works comprising a bellmouth shaft and tunnel spillway.

The overflow level was raised by the innovative adoption of precast piano-key (PK) weirs around the rim of the bellmouth – believed to be the first PK weir in the UK and a world first for the adoption of PK weirs at a bellmouth spillway. The new PK weirs are designed to pass the design flood of 183 m³/s with a flood surcharge of just under 1m, saving about 0.7m from the amount of dam raising that would have been required in conjunction with simple raising of the circular weir around the bellmouth rim.

This paper covers the design and construction of the dam raising, using material won from the original boulder clay shoulder to heighten the core, then replacing the shoulder excavation with relatively free-draining material, the development of the PK weir design and its adaptation to the circular rim of the bellmouth, together with the use of precast construction, and the raising and modification of the valve shaft.