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Buckeye Lake, part of the Ohio public parks system, is located approximately 30 miles east of Columbus. The lake has a five-square-mile surface area which is impounded by a 15 foot maximum height earthfill embankment originally constructed in the early 1800s. Since late 2015, a new replacement dam has been under construction involving the innovative and one-of-a-kind use of deep soil mixing technology.

Buckeye Lake Dam is unique from a dam safety perspective in many ways in that:

- The dam embankment extends for over 4.1 miles;
- A complex system of natural drainages and canal systems contribute to lake inflows;
- Two non-standard spillway structures provide hydraulic conveyance; and,
- Approximately 370 homes are located at the downstream embankment slope.

Buckeye Lake Dam is a great case study in complex hydraulics due to multiple factors including the limited channel capacity of the contributing canal, complex flow patterns at the upstream and downstream reaches of the lake, backwater impacts, and the presence of numerous hydraulic structures. Because of the complexity and scale of this project, a technical approach was developed that included state-of-the-art fine resolution two-dimensional and three-dimensional computational-fluid-dynamics (CFD) flow modeling in order to best simulate the system hydraulics and to assess embankment overtopping potential.

This paper presents the technical approach developed using currently available advanced tools, and the benefits of those tools in obtaining an in-depth understanding of complex hydraulic conditions. The presentation will include video simulations of model findings. Lessons learned from the hydraulic modeling will be shared to help designers find solutions for similar complex projects.