

# Hybrid, inflatable dam system solves potential problems

Hybrid, inflatable rubber dams provide precise control of the volume of water diverted, which is particularly helpful to small communities during major rain events. **Lucius "Lu" A. Marks**, vice president of H.R. Gray, an engineering consultancy in Columbus, Ohio, USA explains why the new hybrid system was installed in a water-system upgrade project in Marysville, Ohio.

For decades, many municipalities around the world have installed inflatable rubber dams to provide water services given their advantages over traditional rigid dams, but these rubber alternatives came with their own host of potential problems. They were difficult to control precisely, and were often damaged by ice and large debris. In high-water conditions, they were subject to potentially destructive vibration due to vortex shedding as the water moved over the dam's rounded surface. The entire system had to be replaced when the dam was damaged.

A hybrid system developed by Obermeyer Hydro, Inc. of Fort Collins, Colorado, USA, solves these problems by using multiple inflatable bladders to prop up steel spillway gates. The multiple-panel gates are spanned by reinforced EPDM rubber web to help control abutment seepage. The bladders, which are reinforced in a similar way to automotive tires, are completely covered by the overhang of the spillway gates so they do not come into contact with potentially harmful debris. The bladders can be adjusted to maintain proper water flow and reservoir elevations in keeping with environmental requirements, and because they're inflated by clean, dry compressed air, there are no

potential issues with hydraulic-fluid contamination in the reservoir. Vortex shedding is eliminated because flow separation occurs only at the downstream edge of the spillway gate, allowing the system to perform flawlessly even when entirely submerged. If a section of the dam is damaged, it would not affect the rest of the system, and replacements can be made to individual components, minimizing downtime over the life of the dam.

Water-system upgrades are often time-sensitive, so ease of installation is another bonus with this type of system, as the spillway gates can conform to almost any type of existing profile. The spillway gates are attached to the foundation via anchor bolts, and the bladders are clamped over the anchor bolts and connected to an air supply. The air bladder hinge flaps are then fastened to the gate panels to connect the system. The modular design of the system eliminates the need for intermediate piers and minimizes the required lifting capacity. The lack of high-precision parts and bearings simplifies installation and helps keep maintenance costs low.

This simplicity came in handy on a recent water-system upgrade project in the US city of Marysville, Ohio. The manufacturer of the traditional inflatable dam the city

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The gate system used on the Marysville dam provides an economical way to store, control, and divert water without the expense and environmental impacts associated with more common fixed weir solutions.

Rob Eckman, Obermeyer Hydro, Inc.

had originally selected for their new reservoir could not meet the demands of the construction timeline, so construction manager H.R. Gray selected an alternate multi-bladder system from Obermeyer Hydro, Inc. The Obermeyer system was less expensive than the one originally specified, and its installation was facilitated with few minimal changes to the original spillway design. The project was completed on time and the greater control provided by the new dam enabled the city to meet

environmental standards. H.R. Gray is a management and consulting firm based in Columbus, Ohio, USA.

“The original design called for a dam that, at any particular time, would be either all inflated or all deflated,” Kristen Braden, a project manager at H.R. Gray, said. “This would limit the city's control over the diversion of the water and could prevent the city from meeting environmental requirements. The selected system allows much more precise control of the amount of water diverted,” she explained. For example, during a major rain event, the automated system lowers the dam effectively eliminating the impact of the dam on rising creek levels upstream.

The most noticeable benefit of this system over its traditional rubber-dam counterparts is its aesthetic profile. When the dam is completely deflated, the rubber bladders are covered by the curved steel gates, which sit flush with the creek bed. While the dam is inflated, a minimum water flow will be maintained, and residents downstream from the dam will still see water flow in the creek. In Marysville, the city built a walking path around the top of the new reservoir embankment.

According to Braden, the decision-maker must know the applicable regulatory requirements and restrictions, and the change in flow of the river or creek throughout the year in order to determine the most appropriate solution for a particular situation. The operating system is also important to discern in order to have the most effective dam design. For example, the pumping rate and type of system – fully automated or manual – are important to know. Finally, it is essential to invest in an efficient and effective control and communications system in order to best operate and monitor the system.

#### Author's Note

Lucius "Lu" A. Marks, vice president of H.R. Gray, is based in Columbus, Ohio, USA.



Inflatable Dam I bladder and gate slightly down



Inside the pump station, two vertical turbine pumps across piping and valves