

Texas Flood Control Dam Performing Under Pressure

By Dee Ann Littlefield, NRCS, Temple, Texas

The soggy day of May 27, 2015 is a day many Ellis County, Texas residents will not soon forget. Over the course of the month over 15 inches of rain had fallen in the 6,000-acre watershed that drains into Padera Lake, just upstream from the Dallas suburb communities of Midlothian and Grand Prairie. An additional four inches had fallen overnight on already saturated land, creating widespread flooding. The floodwaters would test the strength and design of any lake dam, but this particular dam was under construction and in a more vulnerable condition.

The cofferdam, built during the rehabilitation phase at Padera Lake, was put to the test as storm waters pressed forcefully against it. Television crews from CNN and Dallas news stations hovered overhead in helicopters, providing live coverage of the storm water surging over the top of the cofferdam. The threat was that the floodwaters would erode the dam's soil to the point it would fail.



Pumping flood waters over the Cofferd dam: Flooding during rehabilitation work threatened to break the temporary cofferdam.

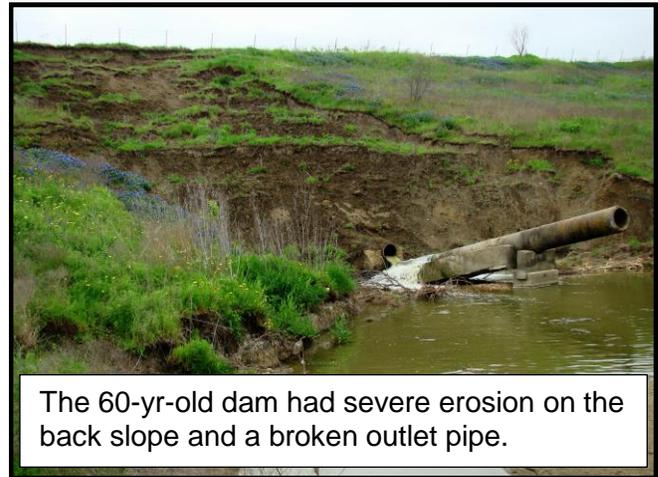
“The dam was designed according to state and federal criteria to address extensive rainfall events, but the repeated nature of the flooding that occurred was a test for the structure, especially with the cofferdam in place,” says John Mueller, state conservation engineer with the USDA’s Natural Resources Conservation Service (NRCS).

Emergency management crews sprang into action and alerted residents downstream in the event the dam gave way. Nearby State Highway 287 was partially closed due to impending floods. City officials from Midlothian and Grand Prairie watched the issue with great concern as their city water supply in Joe Pool Lake was just four miles downstream.

Officials monitored the situation closely and in the end, the cofferdam held, and construction was resumed. Everyone breathed a sigh of relief, but the event did serve to highlight the importance of having floodwater retaining structures in place to protect downstream communities.

While Padera Lake appears to be simply a nice recreational lake, it is officially called Mountain Creek #10, and it is actually a flood prevention structure designed in 1956 by engineers with the NRCS.

In 2006, the dam was upgraded to high hazard status and was no longer meeting specifications, due in part to age and downstream urbanization. The NRCS state office in Texas had been submitting funding proposals for rehabilitating the dam to the national office for several years, but with so much competition for federal funds, the proposal was not funded.



The 60-yr-old dam had severe erosion on the back slope and a broken outlet pipe.

The federal agency's state partner, the Texas State Soil and Water Conservation Board (TSSWCB), was keenly aware of the issue as one of their districts, the Dalworth Soil and Water Conservation District (SWCD), based in Arlington, was responsible for the operation and maintenance of the dam since its original construction. With no federal funds available and the dam continuing to age while downstream populations increased, the partners sought a different avenue.

The Dalworth SWCD gathered up some sponsors for the rehab project which included the cities of Grand Prairie, Midlothian, Venus, Trinity River Authority, Tarrant County, Ellis-Prairie Soil and Water Conservation District, Ellis County, and Johnson County. The sponsors agreed they could come up with five percent of the estimated \$6 million needed to fund the project.

"We knew this was a high hazard structure with some huge issues with soil erosion and sliding on the dam," says Dalworth SWCD Board Chairman Bobby Waddle. "We knew it was just a matter of time until it gave way. And it sits just off of highway 287 so it would have really caused some havoc with infrastructure there."

"But even knowing all that, five percent of a \$6 million project is still a lot for a District," Waddle continues. "The District couldn't have done it without the partnership. We presented a need and each partner was willing to make the contributions needed to get it repaired."

The Dalworth District approached their state partner, TSSWCB, about help coming up with the remaining \$5.7 needed to complete the rehab. Recognizing the safety of many Texans was at risk, the TSSWCB approved funds appropriated by State Legislature for the project through their Flood Control Dam and Structural Repair Grant Program.

“This specific dam was on our radar from the very beginning,” says John Foster, TSSWCB statewide programs officer. “When, at the time, there was not a good chance of getting federal funding under the rehabilitation program, the State Soil and Water Conservation Board chose to allocate its limited funding to this project. This was the dam that was keeping the engineers up at night.”

Rehabilitation construction broke ground on July 1, 2014. The project was designed by NRCS engineers who take the watershed size, state and national criteria and other factors into consideration in their dam designs.

“The main issue was the back slope of the dam was sliding because of the erodible nature of the soil,” says Tom Beach, NRCS project engineer for the project. “The soil in the new dam was treated with lime to reduce shrinking and swelling, and the exterior of the whole dam was treated with lime.

Over 6,000 tons of rock riprap was placed on the dam’s slope for reinforcement. While the dam height remained at approximately 50 feet, the biggest changes were in the outlet pipe and spillway design. The outlet pipe more than doubled in size going from 19” to 42”. The earthen spillway was replaced with a roller-compacted concrete (RCC) spillway. These measures were necessary to meet the criteria associated with a high hazard structure.

“We used RCC based on design criteria of soil erodibility,” Beach explains. “This will prevent erosion in the spillway and reduce sedimentation in reservoirs downstream.”

Almost 12,000 cubic yards of concrete went into the new spillway. The rehabilitation project was officially completed on December 23, 2016.

“This project speaks well for the partnership and the use of state and local funds while working with a federal agency,” Waddle says. “This dam has now gone from a high hazard dam to a nice amenity for the area now.”



Padera Lake is just one of over 2,000 such structures in Texas the NRCS designed through its Watershed Protection and Flood Prevention program. The majority of these lie in central to north central Texas, with most of them within 100 miles of I-35 roughly extending from San Antonio to beyond the Dallas-Fort Worth Metroplex. Many of the dams were designed in the 1950s and 60s and are now in need of rehabilitation. NRCS cites there are currently 450 high hazard watershed dams in Texas, with at least 340 of those dams that, like Padera Lake, need to be upgraded to meet high hazard criteria at an estimated cost of \$260 million.

These floodwater retarding dams play an important role in successfully protecting many Texas communities from catastrophic damage during flooding events. According to the NRCS, Texas watershed projects provide over \$151 million in annual benefits. Besides flood protection, 6,200 bridges are protected, as well as numerous county, state, and federal highways. Over 11 million tons of sediment is stored annually, preserving over 10,000 ac-ft of storage in downstream reservoirs and community water supplies. These dams also provide wildlife habitat, including an additional 60,000 acres of wetlands.

“Based on upstream flood loss data for Texas, there is a real need to continue watershed projects to provide flood control and preserve water quality for communities,” Mueller states. “Our hope is that more partners will come to the table to help us address the issue and provide Texas citizens with successful outcomes like our Padera Lake project.”

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