

CANTON LAKE DAM AUXILIARY SPILLWAY EXCAVATION

Canton, OK



The North Canadian River, a tributary of the Canadian River, is a major US waterway. Spanning more than 440 miles in length, the North Canadian River runs through New Mexico, Texas and Oklahoma. In Oklahoma, it is dammed in Canton, Blaine County, where it forms the Canton Lake.

The Canton Lake is a man-made body of water located a short two miles from the town of Canton, in west Oklahoma. The lake, used primarily for recreational purposes, offers 45 miles of shoreline and almost 8,000 surface acres.

The Canton Dam was constructed in 1948 in an effort to control the lake’s waters and reduce flood risks. The dam consists of a rolled earth-filled embankment with a gate-controlled, gravity chute-type spillway, located in the right abutment.

PROJECT BACKGROUND

Owned and operated by the US Army Corps of Engineers (USACE,) the Canton Dam was originally created with a single-service spillway, 16 tainter gates and outlet works that consist of three sluices that pass through the spillway weir.

Owner:
US Army Corps of Engineers, Tulsa District

General Contractor:
Nicholson Construction Company

Technique(s):
Cut-off Wall, Diaphragm Walls, Drilled Shafts

Subsurface Conditions:
Predominantly fine sand and clay with isolated organic deposits

Approximate Key Quantities:

Cut-off Wall	43,000 square feet
Diaphragm Walls	78,000 square feet
Tieback Anchors	193



Northern diaphragm wall

The dam has been the focus of a massive, multi-phase dam safety effort designed to limit movement related to the existing spillway, to reduce seepage under the existing embankment, to ensure that the dam can pass the probable maximum flood event requirements and to meet seismic requirements.

As a result of recent changes to Engineering Regulations, it was determined that the Canton Dam was not compliant with the required base safety conditions, primarily regarding downstream hazards during floods. The dam's discharge capacity needed to be doubled in order to meet the requirements.

In order to become compliant, a supplementary or auxiliary spillway needed to be added to the dam. The design for the new, auxiliary spillway included fuse gates, rather than the tainter gates, which were used on the original spillway. Fuse gates are designed to topple in a controlled manner at the time of a flood — and need to be replaced after each flood event, whereas tainter gates open and close using electromechanical mechanisms and serve as permanent fixtures.

THE WORK

Nicholson was contracted to create a new, 21,000-foot auxiliary spillway, which would accommodate floods that exceed the current spillway's capacity. The new spillway, which would be 820 feet long and 670 feet wide, would require the excavation of 1.6 million cubic yards of material in order to create the channel.

The excavation was supported by diaphragm walls with permanent anchors. Diaphragm walls were used because they reduced the need for additional excavation and side-sloping for trench safety and stability that conventional reinforced walls require.

The auxiliary channel was made up of two, 730-foot-long diaphragm walls. Together, the north and south channel walls totaled 79,000 square feet of diaphragm wall. The creation of the wall required 6,850 cubic yards of concrete and 500 tons of steel.

More than 200 anchors were installed, on two levels, during the excavation of the channel.

In addition to the spillway, Nicholson was responsible for the creation of a 670-foot-long cut-off wall, located directly downstream from the diaphragm wall. A total of 190 drilled shafts were installed during the construction of the cut-off wall. These shafts would reduce upstream erosion should the spillway's fuse gate system release water during a probable maximum flood event.

The soil excavated to create the channel was reused to construct a toe berm on the downstream face of the existing earthen dam. A new drainage system that is 15 feet deep, seven feet wide and 11,000 feet long, designed to intercept and channel seepage to a new outfall structure, was constructed at the toe of the dam.

THE RESULT

The Canton Lake and Dam hosts an estimated 900,000 visitors annually. In addition to the Canton Dam's proximity to the town of Canton, the North Canadian River, on which the Canton Dam sits, also runs directly through downtown Oklahoma City.

The estimated population at risk due to the failure of the Canton Dam is between 17,000 and 60,000 people. Economic losses related to its failure are estimated between \$1.75 and \$2.64 billion.

The modifications made to the Canton Dam by Nicholson Construction will help to ensure the safety of those who live in close proximity to its waters and those who visit them for recreational activities.