

DoD provides unique and critical support to Puerto Rico

Story and photos by

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Hurricane Maria struck Puerto Rico on September 20 as a Category 4 storm with maximum sustained winds over 150 mph. The storm dropped over 20 inches of rain, causing at least 49 deaths on the island and crippled virtually all the island's infrastructure systems.

On September 30, New England District team members joined the Jacksonville District, Mobile District and other DoD personnel on the Island to help stabilize a dam in danger of breaching and to provide clean drinking water to residents.

The Guajataca Dam was constructed in the 1920's to create Lake Guajataca. The lake is used as a water source to produce drinking water for 250,000 people in three different municipalities. The 1,000-foot-wide earthen dam is owned and operated by the Puerto Rico Electrical and Power Agency (PREPA). After the storm, the water level in the lake quickly rose to flood stage and water started to flow over an emergency spillway. The massive volume of flow over the spillway spared damage to the earthen dam but exceeded the capacity of the concrete lined spillway and it began eroding and crumbling.

The erosion and undermining began at the leading edge of the spillway and was progressing back towards the dam. Complete failure of the dam was imminent if the erosion continued. The damage at the spillway also severed the water connections to all three water treatment plants downstream of the dam leaving over 250,000 residents without clean water.

The dam is located in the mountainous jungle typical of the Island's interior region with approximately 200 homes that lie within the downstream flood plain. The storm downed trees and power lines, crippled cell towers and caused landslides and flooding on roads all around the dam. One landslide also blocked the 96-inch outlet pipe of the dam that restricted the normal flow of water out of the lake to the Guajataca River. When local officials became aware of the deteriorating conditions at the dam, a flash flood warning was posted and all residents were evacuated from vulnerable homes downstream of the dam. Without any electrical power or functional communication systems, local police and fire personnel had to go door-to-door to warn residents.

Personnel working for PREPA did what they could to get the gates in the outlet pipes open in an effort to lower the water level in the lake. Water flowing over the spillway continued to undermine and destroy sections of the concrete spillway, threatening the integrity of the entire dam. Realizing that the work required at the dam exceeded their capabilities, PREPA reached out to the Puerto Rico Emergency Management Agency and FEMA for help. FEMA tasked the Corps of Engineers to provide subject matter expertise and management to advise PREPA on potential means and methods to stabilize the Guajataca Dam. The USACE Recovery Field Office, established to respond to Hurricane Maria, and an engineering team from Jacksonville District quickly conceived a plan that would be executed in phases. Phase 1 included immediate measures to lower the water level in Lake Guajataca to a level below the spillway crest and stabilize the eroding spillway. Phase 2 included work to further stabilize and anchor the remaining sections of the damaged spillway to make it functional if weather conditions caused the lake's water level to rise again and start spilling. Phase 3 of the plan would require a large construction project to build a new and improved emergency spillway and repair all of the known damage to the dam.

Phase 1 began with work to remove landslide material in the river channel that was obstructing the discharge from the 96-inch outlet works pipe. Maximizing discharge from the existing outlet pipe was important to lower the water level in the lake. Jacksonville District quickly awarded an emergency contract to have ten large pumps transported and set up at the dam. Each 18-inch pump in the contract had a capacity to discharge up to 25 cubic feet per second. To expedite pump installation, the first two of the 18"

pumps were flown to Puerto Rico on military aircraft with the rest arriving via barges. The next task of Phase 1 was to place some type of hard material into the active erosion area to dissipate the energy of water that continued to flow over the spillway. Based on availability, concrete Jersey barriers were selected as the material to be placed at the leading edge of the damaged spillway. The method of placing the barriers, however, presented a challenge, as the area was out of reach of any excavator or crane that could make it to the dam. DoD quickly stepped up with a solution for placement. Marines from the 26th Marine Expedition Unit used CH53 Sea Stallion helicopters to lift and deliver the concrete barriers. The barriers were trucked to the crest of the dam, sling loaded below the helicopters and released into the eroding area of the spillway. The marines placed a total of 505 barriers over several days of flying helicopters mobilized off of the Naval ship Kearsarge.

With the concrete barriers in place, the next task was to further minimize the active erosion by constructing a check dam across the spillway area downstream of the concrete barriers. The purpose of the check dam was to create a plunge pool that would slow the velocity of any water that flowed over the spillway. Super-size sand bags with integrated lifting straps which could each hold one cubic yard of sand were selected as the material to construct the check dam. FEMA was able to quickly deliver 1,800 of the sand bags to the Island via military aircraft. Placement of the sand bags was again another challenge where the DoD stepped up with a solution. CH-47 Chinook tandem-rotor, heavy-lift helicopters flown by Army National Guard units from Pennsylvania and Georgia were used to lift and place 1,338 of the sand bags at the dam. Precise placement of the sand bags was important to ensure the dam would hold a pool of water so USACE personnel on the ground directed locations for the bags. The loaded sand bags were hooked up to the helicopters at a small airfield about 20 minutes from the dam and flown to the dam to be placed. The CH47's delivered the sand bags in groups of four and eight at a time.

Roads in the vicinity of the dam were narrow with numerous trees, debris and downed power lines. After some debris removal on local roads, the dam owner, PREPA, was able to mobilize an excavator to the site and arrange for delivery of rock materials from a local quarry. Traversing the roads, particularly with large trucks, was a challenge. The main access road to the dam had one section that remained flooded for weeks after the hurricane's landfall. Getting rock materials to the dam was critical to reinforce and harden the side slopes of the eroding area. PREPA and FEMA again reached out to the DoD for support in getting rock materials delivered to the dam. Most local trucks were fully engaged in other recovery work to remove debris or distribute food, water or other essential supplies. The 130th Engineer Battalion of Puerto Rico's Army National Guard (130th EN BN) with support from the 44th Infantry Brigade Combat Team (44th IBCT) were tasked with hauling stone from a local quarry. Soldiers using 10-ton dump trucks travelling in convoys delivered over 100 tons of rock material per day to the dam. The 130th EN BN with support from 44th IBCT also worked alongside PREPA civilian work crews to clear obstructions and landslide material from a canal that was necessary to re-establish the flow of water from the lake to downstream treatment plants.

To help with short term water distribution, the Army's 3rd Expeditionary Sustainment Command (3rd ESC) mobilized Reverse Osmosis Water Purifying Units (ROWPU's) to a location adjacent to Lake Guajataca. Soldiers from 3rd ESC pumped water from the lake and filtered it through the ROWPU to produce clean water. Local residents in the remote communities near the dam picked up the clean water in improvised bulk containers and smaller containers that were made available from FEMA.

The emergency stabilization work at Guajataca Dam was a unified effort performed by municipal, government and non-governmental organizations. The work performed by DoD demonstrates the unique capabilities that well-trained and prepared troops can offer FEMA during Defense Support to Civil Authorities (DSCA) events.

The New England District personnel that supported work at the dam as part of the Joint Forces Land Component Command (JFLCC) includes Col. William Conde, Mark Anderson, Capt. Steve Kraus, John MacPherson, Maj. Sonny Avichal and Joe Mazzola.