After-Action Report—the 2021 Earthquake

INTRODUCTION

On Saturday, 14 August 2021, Haiti's southern peninsula was hit with a magnitude 7.2 earthquake. This earthquake caused widespread devastation including over 2,000 deaths and 12,000 people injured. Both private and public infrastructure were damaged throughout the south but with a concentration in the Les Cayes-Aquin region.

Of the water systems in the South, the Les Cayes system was the most damaged. All four of the deep wells at the Charpentier site were damaged as were the transmission pipes, water tower, security wall, and even the access road.

48 hours after the earthquake, the USAID Water and Sanitation Project sent an engineer to Les Cayes and arranged for an emergency team of technicians from the Port-au-Prince water utility to join him to conduct a rapid evaluation of the situation in Les Cayes and to begin emergency repairs. At the same time, DINEPA led a rapid assessment of the other water systems in the earthquake-impacted area.

By the fifth day after the earthquake, August 19th, the technicians from the Port-au-Prince water utility, under the supervision of the Project staff, had rehabilitated the first of the four wells in Les Cayes. This well was used to fill water trucks that distributed water around Les Cayes. By the twelfth day after the earthquake, the main water system had been repaired enough to allow a limited distribution of water in Les Cayes.

In the immediate aftermath of the earthquake, the Les Cayes water utility did not charge its customers for water. However, thanks to the rapid repairs to the system, the water utility was able to return to its normal collections four months after the earthquake.

This report reviews the different efforts made by DINEPA, the OREPA, the CTE and the Project, and the lessons learned from the intervention.

Background

Previous earthquakes and disasters

Situated in the middle of the hurricane corridor and astride two tectonic plates, Haiti has suffered through numerous hurricanes, earthquakes, and floods as listed in Table 1.

Table 1. The major disasters that have impacted Haiti over the last twenty years (source: Wikipedia List of natural disasters in Haiti)

DATE	EVENT	DESCRIPTION
23–24 May 2004	Unnamed storm	Torrential rains which pounded the south-east of Haiti during the night caused 1,232 deaths, 1,443 disappearances and 31,130 displaced persons. all located in the Southeast Department.
10 September 2004	Hurricane Ivan	The hurricane struck the southern peninsula and west coast, causing serious damage in several areas due to flooding.
18–19 September 2004	Hurricane Jeanne	The hurricane crossed the western section of Haiti and the Artibonite, causing flooding which killed 1,870. In addition: 2,620 injured, 846 disappeared and 300,000 displaced. Gonaives was the most seriously affected city.

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DATE	EVENT	DESCRIPTION
6 and 7 July 2005	Hurricane Dennis	The hurricane touched the southeast coast of Haiti, causing flooding in several towns in The South Department and leaving more than 500 homeless.
26 August 2008	Hurricane Gustav	The hurricane crossed the south peninsula, including the South and Grand Anse Departments, causing approximately 77 deaths and 8 disappearances, destroying 3,000 houses, and damaging 11,458 others.
12 January 2010	Port-au-Prince earthquake	The magnitude 7.0 killed between 100,000 and 316,000 people. Its epicenter was approximately 25 km from Port-au-Prince, the capital. It was one of the deadliest earthquakes ever recorded.
20 October 2010	Cholera	A cholera epidemic hit outside of Port-au-Prince, killing at least 3,597 and sickening over 340,000.
5 November 2010	Hurricane Tomas	The hurricane killed at least 10 Haitians, causing heavy flooding and damage the many tent camps established after the earthquake.
24 October 2012	Hurricane Sandy	The hurricane passed just west of Haiti, caused heavy rainfall and left some areas with catastrophic flooding. At least 108 people were killed and 21 went missing. Around 200,000 people were left homeless.
3–4 October 20016	Hurricane Matthew	The hurricane hit Haiti with catastrophic flooding of up to 40 inches and storm surges of up to 10 feet. At least 580 people were killed and more than 35,000 left homeless by the storm.
23 AUGUST 2020	Hurricane Laura	The hurricane killed 31 people in Haiti and four in the Dominican Republic.

The August 14 Earthquake

On the morning of 14 August 2021, a magnitude 7.2 earthquake struck the Tiburon Peninsula in the south of Haiti. It had a 10-kilometre-deep (6.2 mi) hypocenter near Petit-Trou-des-Nippes, approximately 150 kilometers (93 mi) west of the capital, Port-au-Prince. An estimated 2,248 people were confirmed killed and more than 12,200 injured, mostly in the South Department. At least 137,500 buildings were damaged or destroyed. It was the deadliest earthquake and deadliest natural disaster of 2021, and the worst disaster to strike Haiti since the 2010 earthquake. The economic loss from this earthquake was estimated at over 1.5 billion US dollars, nearly 10% of the country's annual gross domestic product.

The Project's Response

Overall goals of the response

Shortly after the earthquake, the Project team met with USAID to determine how project funds could be used in the response to the earthquake. USAID stressed that the goal of the USAID Water and Sanitation Project is to build sustainable water and sanitation systems, not to provide emergency assistance. Therefore, the Project was able to provide assistance that resulted in improving the long-term sustainability of the water systems, but it could not provide humanitarian assistance.

The Project's activities

DINEPA and the Project immediately began organizing their response to the earthquake. The CTE in Les Cayes quickly compiled an overview of the extensive impact of the earthquake on the Les Cayes system. The Jeremie CTE reported no damage to their water system but that their office had been damaged. DINEPA's office of monitoring (ONEPA) quickly put together an assessment and monitoring page on the online platform, mWater, to gather information on the other water systems in the earthquake impacted area.

The day after the earthquake, the DCOP, [redacted], travelled to Port-au-Prince and arrived in Les Cayes the following morning (Monday, August 16th). Upon arrival, he met with the CTE and OREPA staff and arranged for a team of technicians from the Port-au-Prince water utility (RMPP) to travel to Les Cayes to assist with the preliminary evaluation and the emergency repairs. The team consisted of an

electrical-mechanical engineer, a hydraulic engineer, a water system manager, and several plumbers and other specialized workers. He also put together a preliminary list of required materials.

On Tuesday, August 17th, the RMPP team and the Project team began working together on the evaluation of the power generation and the water pumping, transmission, chlorination, and storage systems in Les Cayes with the goal of establishing a prioritized list of the work to be done.

The main findings of the rapid evaluation were the following:

- The power generators, solar panels, and the electrical installation were undamaged.
- While the pump houses were damaged and the pumps themselves all worked, the water from the wells was turbid and therefore untreatable.
- The diagonal supports to the meter water reservoir had deformed.
- The transmission lines had been displaced but few had been broken.
- The transmission line leading up to the water tower was leaking.
- The perimeter security fence was damaged.
- The concrete pavement on the access road had been displaced and was cracked.

The team decided to focus first on clearing the water in the wells and repairing the transmission lines. The team began pumping water out of the F2 well and allowing the water to drain away. They brought in a backhoe to assist in restoring the Charpentier wellfield.

By Thursday, August 18th, the water from the F2 well was no longer turbid. The team built an elevated piped connection from the well to outside the wellhouse, so the well could be used to fill the water cistern trucks that were being used for distribution.

By Saturday, August 20th—one week after the earthquake—three of the four wells were operational and enough of the transmission lines were repaired that the CTE was able to begin testing water distribution in the area immediately around the wellfield.

USAID sent a team of structural engineers from Miyamoto International to evaluate the two water towers in Les Cayes and the office building in Jeremie. The engineers found that the steel reservoir at the Charpentier wellfield was repairable, that the reservoir at La Savanne appeared undamaged from the earthquake, and that the damage to the Jeremie office was superficial.

As the reports came in from the other water systems, DINEPA found that none of the other systems had been seriously damaged.

Over the following week, the team focused on repairing the remaining leaks in the transmission lines in Les Cayes and getting the final pump to produce acceptable water. By the end of this second week, the water system was functional enough that it could continue to provide water for the water trucks and was able to provide a limited distribution in the Charpentier area. The emergency response team left Les Cayes at the end of the second week.

The Les Cayes pumps became a primary source of water for the humanitarian relief. DINEPA played an active role in coordinating the repairs to the other water systems and in supervising the sanitation support for the camps.

During the subsequent weeks, the Project team continued working with the Les Cayes CTE as they gradually expanded the water distribution until they were able to distribute water in all four of its

sectors. However, the CTE's nonrevenue water losses had significantly increased due to pipes displaced by the earthquake.

By November, the distribution was consistent enough that the CTE began insisting its customers to pay. In December, the CTE organized a door-to-door campaign to encourage payment and had record high revenues—a testament to how its customers appreciated the rapid restoration of service.

In January 2022, USAID granted a six-month cost extension to the USAID Water and Sanitation Project to allow it work on repairing the Les Cayes water system and continuing to strengthen the water utilities in the South. By August 2022, the Project has largely completed the emergency repairs to the system and has helped the CTE to design an expansion of the distribution network that would significantly increase its customer base.

For its part, DINEPA created a disaster response unit based on the model of the team that was sent to Les Cayes. This team is designated to immediately respond to emergencies like the August earthquake.

What worked and what didn't work

Successes

Within days of the earthquake, the Les Cayes water system was able to produce water for distribution through water trucks. Within a week of the earthquake, they were able to begin a limited distribution of piped water. Within a couple months of the earthquake, water service was largely restored. This is a remarkably fast turnaround considering the damage to the pumping station and distribution network. Some of the main factors that contributed to this success were:

1. The CTE and OREPA had very capable staff that were able to quickly intervene in the system and identify their needs. Their leadership was critical in rapidly restoring service.
2. The RMPP had well trained engineers, technicians, and specialized laborers that it was willing to mobilize to help repair the system in Les Cayes. They also had a small supply of pipes and other materials that were required for the emergency repairs, and they were willing to provide this to Les Cayes and be provided with replacements later.
3. USAID was able to quickly provide guidance as to what Project resources could and could not be used for so that the Project was able to quickly respond.
4. The Project had strong relations with the different actors and was able to quickly bring them together and provide the funding for the travel and materials required to repair the water system.

Challenges

While the response went remarkably well, there were a few challenges that could have been better managed. The main issues were the following:

1. While the CTE and OREPA teams were critical in responding to the disaster, they were themselves victims of the disaster. Many had their houses damaged and were forced to sleep in temporary shelters, and all knew people who had died. It was, therefore, difficult for them to focus on the water system needs when they had to deal with their personal and family needs. This was also true for the Project staff based in Les Cayes.
2. The RMPP team was not adequately prepared or equipped for the work that they were asked to do. All members of the team had volunteered and been quickly mobilized, bringing with them what they could. As a result, the repairs they made were temporary fixes that had to be properly repaired later.

Recommendations

Given Haiti's vulnerability to earthquake, hurricanes, and floods; it is likely that these types of emergency repairs to a water system will be required again. To ensure a rapid response, the following recommendations are offered:

1. DINEPA should commit to quickly restoring paid water service following a major disaster as part of its commitment to providing quality service to its customers. It should therefore put in place a plan for how it would quickly respond.
2. DINEPA should identify a source of funding for the emergency repairs. In this case, USAID had in place a mechanism that allowed for funding the rapid response. Without that funding, the response would have been much slower. This could be donor-established commitment, or a fund generated from the CTE revenues.
3. DINEPA should identify the potential members of an emergency response team: To facilitate the mobilization of the emergency response team, DINEPA should identify well qualified technicians who could be part of a future emergency response team and identify the tools and materials they are likely to need. This team should include a logistician who would organize the travel and transportation of materials.

Conclusions

While the local water utilities in Haiti have made great progress over the last few years in improving their service level, management, and revenue collection; they remain vulnerable to the natural shocks that hit Haiti so frequently. Not only is continuity of service and/or rapid recovery after an unexpected interruption a fundamental element in a process of building trust and customer loyalty in any company, but access to water is a fundamental need. Therefore, it is critically important that piped water system service be restored as quickly as possible following an interruption.

The best way to ensure rapid recovery is to build resilient systems and develop response plans for different situations. Because the Les Cayes water system had strong management, cash reserves, USAID support, and strong connections to other support in DINEPA, it could move quickly. By relying on Haitian expertise and materials already in the country, the water system could be rapidly restored—possibly the first time a governmental system was brought back online so quickly after a major disaster. The partial restoration of water service a week after the earthquake was a strong message to the customers of the Les Cayes system of the CTE's commitment to service.

Once the CTE restarted collections, their customers were quick to pay allowing the CTE to reach a record level of collections four months after the earthquake. This showed the customers' appreciation of the rapid restoration of the water system. To further celebrate this success, the CTE organized a special celebration as part of World Water Day on March 22, 2022.