



MILLENNIUM
CHALLENGE CORPORATION
UNITED STATES OF AMERICA

EVALUATION BRIEF | FEBRUARY 2023

IMPROVING WATER SUPPLY TO THE WATER UTILITY IN LIBERIA

The pipeline underperformed as the utility struggled to deliver water

Program Overview

MCC's \$238 million [Liberia Compact](#) (2016-2021) funded the \$18 million Water Pipeline Sub-Activity, which was part of the Energy Project, to construct a raw water transmission pipeline to upgrade and replace the pre-war pipeline infrastructure. The sub-activity was based on the [theory](#) that the pipeline's larger capacity, upstream inlet location, and gravity-fed design would increase the supply of raw water, protect against salt-water intrusion, and reduce electricity costs for the water utility. This would help meet the growing demand for water in Monrovia and improve the quality and consistency of water supplied to the utility's service areas.

MCC commissioned Mathematica to conduct an independent final performance evaluation of the Liberia Water Pipeline Sub-activity. Full report results and learning: <https://mcc.icpsr.umich.edu/evaluations/index.php/catalog/277>.

Key Findings



Pipeline Implementation

- › The pipeline was successfully completed and has been transmitting raw water from the Mt. Coffee Hydropower Plant to the Liberia Water and Sewer Corporation's (LWSC) water treatment plant since December 2020.



Water Supply Outcomes

- › Overall, the pipeline did not improve the quantity or quality of the treated water supply.
- › The pipeline increased the reliability of raw water flow, but not the supply of raw water because LWSC limits water intake due to resource constraints.
- › In addition, the pipeline did not reduce raw water salinity or turbidity (clarity of the water).
- › LWSC staff reported reduced electricity use and costs given the gravity-fed design replaced an expensive system that pumped the water.



Pipeline Maintenance

- › LWSC is not conducting pipeline maintenance, risking long-term sustainability. LWSC staff said there was a shortage of spare parts and insufficient management support for maintenance.

Evaluation Questions

This final performance evaluation was designed to assess whether or not the pipeline:

1. Implementation went according to plan?
2. Increased the supply, reliability, and quality of water?
3. Reduced electricity costs for the water utility?
4. Existing water network can it accommodate the increased supply?
5. Cost-benefit analysis met the MCC threshold rate of return?
6. Asset is being maintained?

And whether the:

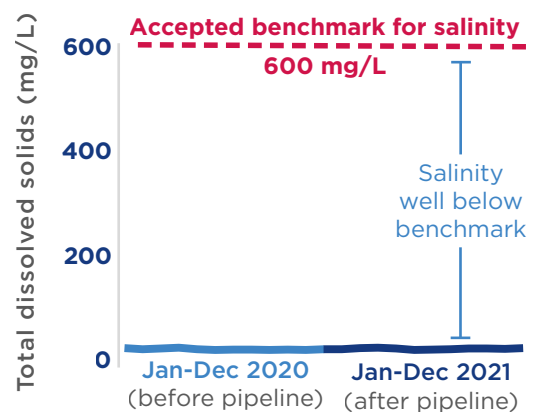
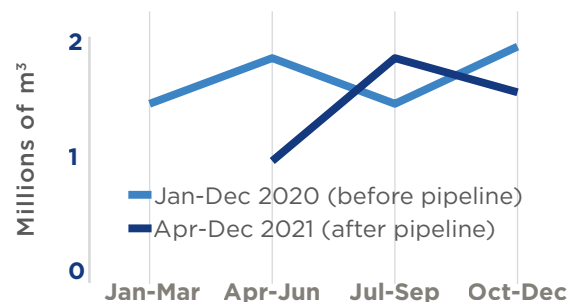
Detailed Findings

Pipeline Implementation

The 1,200-millimeter pipeline and other key program outputs, including the provision of spare parts and maintenance equipment, construction and rehabilitation of community wells, development of an operations and maintenance plan, and training of the Liberia Water and Sewer Corporation (LWSC) staff on operations and maintenance, were completed successfully. Stakeholders note that the pipeline was built using high-quality materials and sound construction practices. Implementation work was delayed about five months due to the lengthy pipeline design process, challenges in resettlement activities, COVID-related delays, and construction issues.

Water Supply Outcomes

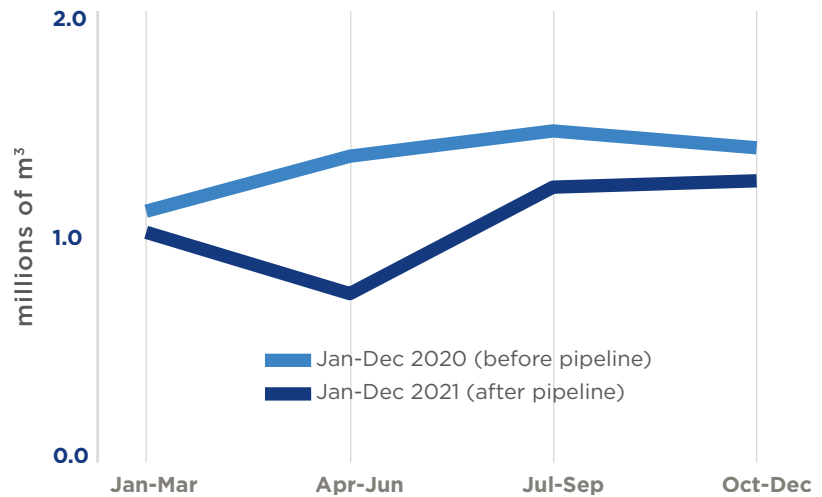
Despite having a larger capacity than the pre-existing system, the pipeline did not substantively increase raw water supply. This is because LWSC limits water intake due to resource constraints that restrict processing of additional raw water at the treatment plant. There were no changes observed in raw water salinity during the study period, and raw water turbidity increased after the pipeline due to rainy season storms and floods and pipeline maintenance issues. The pipeline improved the reliability of raw water supply, with the number of outages in water transmission falling from about seven per month to zero.



Reliability, quantity, and salinity of raw water supply, before and after the pipeline

The pipeline led to a reduction in electricity costs for LWSC (estimated at \$780,000 in savings annually) as raw water is supplied to the treatment plant through gravitational flow.

The pipeline has not increased the quantity or improved the consistency of treated water supply to LWSC service areas. This is primarily due to the significant resource challenges at the treatment plant that hinder the production and supply of treated water. Moreover, large segments of Liberia’s water network are old, requiring upgrades to improve water services. The data showed a decrease in treated water turbidity and increase in water salinity after the pipeline, although this is likely due to operational factors at the treatment plant.



Production of treated water at the treatment plant, before and after the pipeline

 Pipeline Maintenance

LWSC staff are not maintaining the pipeline system and have not conducted regular inspections, tests, and other maintenance activities as described in the operations and maintenance plan. Stakeholders report that the access road to the pipeline has overgrown vegetation, which impedes inspection of the pipeline and makes it challenging to conduct leak detection tests. Many sections of the pipeline’s perimeter fencing have been stolen for use as building material and the bridge component of the pipeline has been vandalized.

Lack of support from LWSC’s senior management and financial constraints are the key impediments to implementing the operations and maintenance plan and procuring parts for repairs. This risks the sub-activity’s ability to sustain and achieve outcomes related to the quantity, quality, and reliability of water supply.

Economic Rate of Return

MCC considers a 10% economic rate of return (ERR) as the threshold to proceed with investment.

17%
Original ERR

-18%
Evaluation-Based ERR

The pipeline had a net present value (NPV) of negative \$12,216,505 and an economic rate of return of negative 18 percent because the primary benefit stream of increased water consumption did not materialize. The benefit of eliminating costs of pumping raw water into the treatment plant was small relative to the costs of the overall investment. Finally, the cost of the project was 25 percent higher than expected.

MCC Learning

Activities added late in the compact process should be carefully analyzed before moving forward with the works.

The ex-ante cost-benefit analysis should be sequenced after the project due diligence is complete and be in alignment with both the findings from due diligence and the program logic.

When programs are implemented in a situation where maintenance is unlikely, the program should be designed to withstand low levels of maintenance.

Evaluation Methods

This performance evaluation consists of a retrospective thematic analysis of qualitative data to study project implementation and a pre-post evaluation methodology to assess project outcomes. There was a one-year exposure period given that the pipeline became operational in December 2020 and administrative data on water supply outcomes was collected for the period spanning January 2020 to December 2021. This evaluation also used data from site visits conducted in November 2019 and April 2022, a review of program documents, news articles and relevant literature collected from late 2019 to May 2022, and 18 key informant interviews conducted from May 2021 to May 2022.

