# Community-Level Resource Development and Management, Part 1: A Transferable Approach to the Analysis of Community Water Distribution System Expansion
# Summary Paper

Megan M. Richardson
School of Mechanical, Industrial and Manufacturing Engineering,
Humanitarian Engineering Program,
Oregon State University, Corvallis, OR, USA

Kendra V. Sharp*
School of Mechanical, Industrial and Manufacturing Engineering,
Humanitarian Engineering Program,
Oregon State University, Corvallis, OR, USA
kendra.sharp@oregonstate.edu
*corresponding author

**Keywords:** Catchment system, Pipe network, Water, Water distribution, Tanzania

## 1 TARGET AUDIENCE

Practitioners addressing water security in rural villages; volunteers implementing water-based sanitation systems; water committees within village governments managing existing infrastructure.

## 2 BACKGROUND

Globally, education initiatives and national policies have promoted higher enrollment in schools. Over 80% of African countries have abolished school fees at the primary level and several have implemented free-education at the secondary level. Eliminating part of the financial barrier to education can increase school enrollment, but unless infrastructure and resources are developed concurrently, schools can become overpopulated and under-resourced. Water security is one of many critical factors for keeping children in school because water is so essential for health, sanitation, food preparation and daily routines. Therefore, it is imperative to evaluate how school water supplies are meeting (or failing to meet) current system demands, how systems will need to be expanded to accommodate continued growth, and how systems can be reliably maintained in schools.

# 3 PURPOSE

We describe a transferable method of analyzing water piping distribution networks using an open-source software package that is intended to allow practitioners to model the increased demands on water distribution systems associated with school growth. We applied our method to the case study of a community-level water distribution system in rural Tanzania.

# 4 METHOD

The described method utilizes a freely-available open-source software package (EPANET) to evaluate the capacity of a water catchment system and its ability to supply water to a growing student population. This software models flowrate and pressure based on inputs of distance, elevation, materials, components, etc. The case study models the increase in the school's water demand with increased student enrollment to determine the extent to which the current system can be expanded, and to evaluate options for integrating secondary storage methods (e.g. tanks) into school infrastructure.

# 5 RESULTS

The method was used successfully to model the existing and expanded pipe networks. Using this model, we were able to discern that beyond the current water supply to the school, the existing built catchment is expected to meet the demand associated with five additional dormitories (or 250 additional boarding students). In addition, we modeled growth beyond the level that the current system could accommodate, and solved for the scale and height of a storage tank that could be filled during lower-demand periods of the day to meet the use needs of a sixth additional dormitory.

# 6 IMPLICATIONS FOR TARGET AUDIENCES

This article outlines a step-by-step method from system modeling to expansion capacity analysis and supplementary storage design. A major advantage of this method is it that it can be employed in a low-resource environment because it only requires basic tools (including a GPS, tape measure, bucket, stopwatch and computer with EPANET downloaded). Compared to other methods that were written for engineers designing city-water distribution systems, our approach is intended to be easier to follow and much more accessible to those either with or without a technical background or who have not worked on community water-system projects before. The results of our case study, and similar results obtained by other practitioners using our approach in the future, will help inform planning and funding requests for proposed water supply system expansions.