# Development of an Open Source Web GIS to Improve Water Supply in Zambia

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**SUMMARY**

The Zambian water company Lukanga Water Supply & Sanitation Company (LgWSC), GELSENWASSER AG and Emschergenossenschaft/Lippeverband have been in a Water Operator Partnership (WOP), funded by Germany's Federal Ministry for Economic Cooperation and Development (BMZ), for more than three years. The overall goal of the WOPs is Know-how transfer at working level as water supply and sanitation (SDG 6) are key factors for sustainable urban development.

One specific goal within the partnership is the reduction of water losses and the associated enhancement of the current Geographic Information System (GIS) at LgWSC for documentation and maintenance of the supply infrastructure. Regarding the further development of the GIS, the current work is focused on three main areas:

Increasing the completeness of GIS data to ensure a reliable basis for asset management and supporting decision-making. Different data collection processes already started, such as digitizing analogue plans, which had been scanned by Gelsenwasser's geomatics trainees in Germany. Additionally, the collection of new GIS datasets for incomplete areas took place during the last visit to Zambia with specialists from LgWSC and Gelsenwasser.

Enhancing and ensuring the quality of GIS data in terms of topology (connected networks) and attribute accuracy (e.g. diameter, material) further enables hydraulic modelling in the future, facilitating the simulation of operational incidents – such as pump failures – and the development of effective response measures.

Thirdly, establishing an environment that enables the employees to access georeferenced GIS data

on personal computers and mobile devices. Therefore, a webmap was developed, as the mobile internet generally works well in Zambia. The webmap empowers LgWSC with company-wide visibility of the water distribution network and its corresponding assets, ultimately leading to enhanced operational efficiency and more sustainable and reliable water management. Alongside HTML and Cascading Style Sheets (CSS), open-source software such as the free and comprehensive desktop-GIS QGIS and Leaflet, a JavaScript library primarily used to control interactive behaviour in web pages, helped to create a customized webmap that met the company's requirements. Another important component is a hosting service like GitHub Pages, on which the webmap can be published and operated free of charge. Being able to view the georeferenced webmap on a mobile phone or PC at any time is already a real added value for LgWSC, e.g. when repairing pipe damage, as staff in the field can effectively identify and locate assets or address other operational challenges.

In the future, surveying using global navigation satellite system (GNSS) may also become an issue. Specialists from both companies are currently working on the use of this technology and are conducting test in GNSS correction services and methods, as well as Real-time kinematic positioning (RTK), with the goal of achieving accuracies of a few centimetres.