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OpenFlows WaterGEMS Saves Sabesp BRL 365,000 per Month on Diadema's Water Treated Volume Costs

Hydraulic Modeling and Simulation Study Yields Total Distribution Loss Rate Descrease of 90 Liters Per Connection Per Day

Project Summary

Organization
Sabesp – Companhia de Saneamento Básico do Estado de São Paulo

Solution
Water, Wastewater, and Stormwater Networks

Location
Diadema, São Paulo, Brazil

Project Objectives
- To enhance customer satisfaction by limiting water supply outages in the city of Diadema, Brazil.
- To ensure consistent water supply at high points in the sector and disadvantaged supply points in the water network.

Products Used:
OpenFlows™ WaterGEMS®

Fast Facts

- The Regional Management Unit at Sabesp Metropolitana Sul sought to use hydraulic modeling, high precision meters, and process integration on this project.
- Hydraulic modeling and simulation were conducted in OpenFlows WaterGEMS, which identified and corrected network inconsistencies.

ROI

- Sabesp reduced water loss from 41% to 32% by utilizing hydraulic models.
- The return on investment will be recovered for the organization within 14 months as a result of the optimized network and consistent supply.
- Approximately BRL 365,000 will be recovered per month due to the reduction in water loss and recovery of lost volume.

Sabesp Seeks to Update Diadema Water Network with New Modeling Technology

Within the São Paulo metropolitan area, the city of Diadema in Brazil comprises 400,000 residents. Supplying water to 28.8 million people and treating and collecting sewage for 23.2 million people, Sabesp – Companhia de Saneamento Básico do Estado de São Paulo provides water and collects and treats sewage for 366 cities in the state of São Paulo, Brazil.

The Regional Management Unit at Sabesp Metropolitana Sul (MS) took on a project to highlight the significance of using process integration and new technologies, including hydraulic modeling and high precision meters. The BRL 5.12 billion project involved enhancing the water supply network to limit supply outages and improve customer satisfaction in the region. Updating the network to improve operating pressures within the entire sector would ensure continual water supply to all residents in this thriving metropolitan area of Brazil.

Older System Presents Operational Challenges

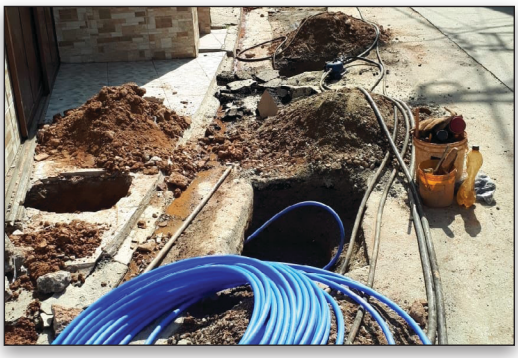
Before this project began, the city of Diadema was dependent on a single pipeline that supplied water to the main reservoir of the water system. From the main reservoir, another pipeline branched out to supply a second reservoir, and a pipeline then branched out from the second reservoir and connected to a third reservoir. This tiered configuration of reservoirs posed a problem for the water network because it caused supply outages. Furthermore, when there was an issue in the pipeline that prompted a water supply outage, recovery time was extremely slow, leading to consumer dissatisfaction.

In 2016, Sabesp invested money into setting up new pipeline connections, with each reservoir being fed by its own independent pipeline. Because of this new design setup, the old pipelines that connected the reservoirs became obsolete and were no longer used. At the same time, however, the configuration of the distribution system was still unreliable. Due to high volumes of consumption, the output of water to supply approximately 49,000 connections included the use of a single 500-milimeter loop and pipes that were subjected to critical operating loads at high speeds. Consequently, there were high loss loads in the distribution system that prompted supply outages, mostly at the highest points in the sector, which are portions of the system that are located at disadvantaged supply points or on areas of elevated ground.

Developing a New Solution

To overcome these challenges, Sabesp engineers analyzed the system layout and sought to resolve the flow limitation issue. The engineers decided to construct another 800-milimeter diameter output loop that was capable of supplying the required volume of water for consumption in the sector; this would resolve supply issues. Yet, there were significant challenges when implementing this solution, including the high expense due to the size of the undertaking, which included labor and materials. Additionally, it was difficult for the engineers to identify the optimal route and location for such a wide pipe.

To resolve this problem, the project team decided to extend the 400-milimeter network by 150 meters at the beginning of 2017. Then, a pressure-reducing valve was installed to facilitate the automated remote control of supply. After the work was completed, the water supply was monitored, and checks were performed to ensure that intermittent water supply problems at high elevations were eliminated. Lastly, the original pipeline network was included within the distribution network to fully resolve water outages.



All updates implemented during the first phase of construction improved the water supply to the residents of Diadema.

"Integrated action and the systemic vision obtained using the hydraulic scenarios modeled in OpenFlows WaterGEMS are the distinguishing factors when it comes to securing a high-quality water supply for future generations and economic sustainability for sanitation companies."

– Gabriela de Almeida Moura, Supervisor, Sabesp MS

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New Water Network Designed with OpenFlows WaterGEMS

Sabesp used OpenFlows WaterGEMS, to simulate water supply alternatives using pipes that were not currently in operation. Investigating this alternative in the hydraulic model enabled the project team to simulate field conditions. As a result, the team proposed the idea of creating a branch from this unused pipeline to feed directly to the new supply line. This proposal supplied the water flow that was necessary for consumption, making this new design more valuable than the original proposal.

To create the model, network registration data was first imported using OpenFlows WaterGEMS' ModelBuilder capability. Then, the amount of consumption used by the nodes was calculated by the application's LoadBuilder feature. The project team also incorporated consumption, amounts, pressure, flow patterns, and pump curves into the OpenFlows WaterGEMS application, which in turn identified inconsistencies. Sabesp used the application to verify consistency and search for nonstandard results.

"Using in-the-field flooding conditions, we ran studies on reducing pressure, defining the size of the PRV area of influence, and defining the booster installation," Gabriela de Almeida Moura, Sabesp MS supervisor, said. "The results of hydraulic modeling were then broken down and forwarded for implementation."

Enhancements Began After First Phase was Finalized, and More Are Expected

After the first stage of the project was completed, the regularity of the water supply improved, raising customer satisfaction and reducing customer complaints about lack of water by 53 percent between 2016 and 2017. Areas of intermittent supply were eliminated, especially at critical and low-pressure points in the water supply network.

In the second phase of this project, Sabesp will set up 8,814 meters of network to reinforce the water supply and expand the network. The organization will implement two miniature pumps to service areas located at high altitudes and 11 automated pressure-reducing valves to enhance pressure management. The system meters will also be renovated, and 21,489 meters will be replaced. The estimated return will be more than 70,000 cubic meters of water per month in total measured volume.

After the second phase of work is complete, the sector will be divided into small measurement and control areas. In these areas, pressure management will be perfected with automated reducing valves to ensure that necessary operating pressures are met among the varying topography in the region. Once the entirety of the project is complete, Sabesp estimates that distribution loss rates will decrease by 9 percent and the total distribution loss rate will decrease by 90 liters per connection per day. Approximately BRL 365,000 will be recovered per month due to the reduction of water loss and the recovery of lost volume. Additionally, gains during the project are expected to surpass the amount invested 14 months after the project is complete and all actions defined in the hydraulic models calculated using OpenFlows WaterGEMS are implemented.

Modeling Optimizes Network to Enhance Customer Satisfaction

Sanitation companies are seeking out operating efficiencies, consistent supply, cost reductions, lower water loss rates, and increased customer satisfaction to meet economic sustainability. This project has reduced water loss, saved water resources, and returned the measured value on this project as a result of process integration and new technologies. Modeling and simulation were at the cornerstone of Sabesp's preliminary design work on the water system. Hydraulic modeling simulated simple, beneficial solutions to the organization, replacing costly, complex alternatives. Using OpenFlows WaterGEMS ensured that there would be water security for the system for at least a decade.

Currently in the construction phase, the interventions implemented during the first phase have already improved supply to the population of Diadema, enhancing customer satisfaction and bettering small-scale metering. Using Bentley software also eliminated the critical factors that were stopping adequate pressure management within the pipes of the distribution network. In the beginning, the water pressures were always at the maximum amounts to compensate for the load loss. However, after the new system was put into place, the water pressures in the pipes were adequately managed by the automated reducing valves, which now operate within 100 percent of the water network in Diadema.

In the end, the changes to the network significantly contributed to the improvement of the system's infrastructure, which enhanced the functionality of the entire water system. As a result, all customers in the sector are consistently being supplied water. Sabesp saved water losses and energy, preserved water resources, and secured water supply for future generations.

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