Bentley
Advancing Infrastructure

CASE STUDY

EPM Models Aburra Valley Sewerage System to Increase Flood Resilience and Mitigate Climate Change

Leveraging OpenFlows™ Sewer helped diagnose hydraulic issues across 2,900 kilometers of network and save 17,640 work hours

ASSESSING MEDELLÍN'S SEWERAGE NETWORK

Colombia's multiutility public services company, EPM, provides electricity, drinking water, and sanitation services to Medellín, serving more than four million people across 10 municipalities in the Aburra Valley. The rapid growth and urbanization of the area led to an increase in municipal runoff into the Medellín River, necessitating an evaluation of the sewerage system to help protect water sources, reduce environmental impact, and ensure optimal wastewater management for the community. To upgrade and optimize the sewerage infrastructure, comprised of over 56 basins and 5,155 kilometers of networks covering a 422-square kilometer area, EPM has been conducting comprehensive assessments using hydraulic modeling to understand the behavior of the water discharged into the system. "The hydraulic modeling of the sewerage system is a project for decision-making and understanding the processes of collecting and transporting wastewater for the operation, maintenance, connection of new customers, improvement, and expansion of infrastructure, design, rehabilitation and construction of networks," said Jackeline Correa, business operations professional at EPM.

The project is being executed in stages, with the first stage already complete. This second stage covers approximately 60% of the total system where EPM is modeling and calibrating 2,900 kilometers of network. Using the models, EPM will evaluate operations, assess potential network impacts in the face of extreme rainfall, and identify critical points of intervention to propose corrective or preventive maintenance actions. "Based on the results obtained, EPM aims to understand the hydraulic performance of existing networks necessary to the works inherent to the water and sanitation business," said Correa.

INTEGRATING MULTISOURCED DATA

Continuing with the work started in the first stage and incorporating changes typical of a region in constant transformation, EPM set out to model this next phase, including the 56 basins along almost 3,000 kilometers of pipeline. To comply with the project's purpose and obtain a holistic view of the network, they had to perform accurate topographic surveys of the system's elements, such as cameras, spillways, discharges, and special elements, and they had to incorporate the resulting topological data into the models. "One of the determining factors for the construction of hydraulic models, and for the reliability of the results obtained as part of the calibration, is topology, meaning that the capture of field information is essential to the entire sequence of activities," said Correa.

In addition to the captured topographic data, EPM needed to integrate the models' geospatial information, weather-related data, and data from the early warning system. This integration allowed the team to analyze critical points under predetermined rainfall scenarios and define capacity thresholds and corrective actions in the event of flooding. "In principle, capacity evaluation had only been performed in spreadsheets used for designs without a direct connection to the information contained in the information systems and without a comprehensive view of the network that make up the basins," said Correa. EPM's digitization efforts required simulating network operations under multiple scenarios to evaluate the interactions between basins and water sources, as well as calculating highly complex elements, such as spillways and tributary areas.

Ultimately, EPM realized that they needed a digital platform to visualize the system and facilitate decision-making for planning future investments,

PROJECT SUMMARY

ORGANIZATION
EPM

SOLUTION
Water and Wastewater

LOCATION
Medellín, Antioquia, Colombia

PROJECT OBJECTIVES
- To comprehensively assess the Aburra Valley sewerage system by modeling and calibrating 2,900 kilometers of network.
- To understand the hydraulic performance of the network inherent to the water and sanitation business and improve the collection system.

PROJECT PLAYBOOK
OpenFlows

FAST FACTS
- The rapid growth of Medellín's Aburra Valley led to an increase in municipal runoff into the Medellín River.
- EPM implemented hydraulic modeling to assess and improve 2,900 kilometers of sewerage network.
- They leveraged OpenFlows Sewer to integrate multisourced data, generating and calibrating hydraulic models to analyze the network over multiyear intervals for current and projected populations.

ROI
- Bentley's interoperable application improved productivity, saving 17,640 work hours.

> "Following field trips and hydraulic validations using [OpenFlows Sewer] software, nearly 1,659 elements have been diagnosed and serviced, accounting for approximately 27% of the elements referenced during the second stage."
>
> *– Jackeline Correa, Business Operations Professional, EPM*

optimizing the sewerage network, and timely addressing customer needs. They had to leverage GIS information with reliable topographic and climate-driven data in an integrated digital environment. Accomplishing their goals required an interoperable and robust hydraulic modeling solution.

OPENFLOWS FACILITATES COMPREHENSIVE HYDRAULIC MODELING

EPM selected Bentley's open and interoperable OpenFlows Sewer application to synchronize data obtained from the information system, captured in the field, and collected from meters, mobile sensors, and weather radars, then build the hydraulic models. "As part of the construction of hydraulic models, [....] Bentley's OpenFlows Sewer software is used for topology and assembly of elements, especially spillways, calculation and assignment of tributary areas, rainfall events, and residual flows," said Correa. Working in an integrated platform using the multisourced hydraulic modeling data, EPM created various digital scenarios for dry and wet weather and calibrated the models with hydrological variables for five-, 10-, and 25-year return periods, with projected population data for 10 and 30 years. Each scenario generated results to evaluate network capacity, overflow, and speed, and identify potential network issues, such as zero spills and critical components like spillways.

Using the hydraulic models, EPM can evaluate the operations of the existing network infrastructure and determine corrective and preventive actions to ensure optimal wastewater management. "The hydraulic models serve as input for operations, maintenance, replacement of networks, connections for new customers, and formulation and design of new projects," said Correa. For operations and formulation of business and city projects, the models provide insight into the condition of the network, as well as its capacity and hydraulic performance. "Particularly in the case of rainfall events, having [hydraulic models] available makes it easier to detect improvement actions, prioritizing critical points in the network and providing proposals to address them," said Correa.

DIGITIZATION SAVES TIME AND SUPPORTS SUSTAINABILITY

The interoperability of OpenFlows Sewer has facilitated synchronization with EPM's geographical database of water and sanitation. This integration provides information prior to field work and model construction for the review of the elements to be collected as part of hydraulic modeling. "By means of synchronization, the construction time of each model can be optimized by approximately 40 hours," said Correa.

With OpenFlows Sewer, EPM saved 17,640 work hours and improved the productivity and quality of deliverables, providing a digital environment to evaluate dry and wet weather scenarios and assess the network based on each individual basin. The hydraulic models contributed to saving 1.75 months in each of the 56 modeled basins, considering the model components, calibration, and generation of the scenarios.

Finally, Bentley's flexible and robust application helped advance the development of a digital viewer for consulting with internal users, aiming to present quick query results and an overview of the system for general staff and design solutions, improving workflows, corrective actions, and maintenance management. The Bentley digital hydraulic modeling solution offers a comprehensive overview to help reduce one-off discharges, playing an important role in protecting water resources and reducing the environmental impact due to sewage overflow, supporting sustainable water and sanitation practices. "This project forms part of the strategies for the adaptation and mitigation of climate change, contributing to the search for solutions to increase resilience to possible floods," said Correa.

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