



# Geoinfo Services Designs 24/7 Pressurized Water Network to Provide Clean Reliable Drinking Water

OpenFlows™ Helped Save USD 1.5 Million in Annual Operating Costs and Eliminate 347 Tons of Carbon Emissions

## ESTABLISHING CITY-WIDE ACCESS TO CLEAN WATER

To provide continuous drinking water to emerging economies throughout the country, the government of India has implemented their AMRUT 2.0 program, mandating that all 3,000 utilities in 4,800 urban cities establish reliable, 24-hour water distribution and sewerage services accessible to all households. In accordance with this initiative, Ayodhya Authority commissioned Geoinfo Services to engineer an urban pressurized water supply system, eliminating Ayodhya's existing gravity-fed distribution network. As one of India's most sacred and important pilgrimage sites where the floating population has reached 24.2 million, there is an urgent need for a sustainable solution to the water and wastewater treatment, distribution, conservation, and management.

The scope of the project required Geoinfo Services to renovate the city's intermittent, leaky, and aging network, which generates a 50% nonrevenue water (NRW) rate. They had to ensure the provision of safe and dependable drinking water through functional taps to all Ayodhya homes. "The project envisaged to redesign the water supply system so that NRW can be reduced, and the existing system could be converted into a 24/7 pressurized piped water supply," said Sanjay Dahasahasra, a member of the government of India's National Task Force of 24/7 Water System. A revered, ancient destination city visited by millions every year, Ayodhya's new water supply scheme will significantly impact society and the region, establishing 24-hour access to clean water, reducing waterborne illnesses, and boosting the urban economy.

## HIGH ENERGY COSTS, EXTENSIVE NETWORK, AND VOLUMINOUS DATA

Aligned with the government's AMRUT program, Geoinfo Services needed to implement direct pumping and increase the residual nodal pressure of the Ayodhya water network. "However, conventional constant speed pumps require high energy cost," said Dahasahasra. To avoid extensive energy consumption and cost, Geoinfo Services considered adopting variable frequency drive (VFD) pumps to accommodate the varying demands and pressures of Ayodhya's new pumped network more efficiently and economically during different periods throughout the year. Given the lack of legacy information available for piped and pumped water distribution in the city, as well as the haphazard layout of the existing old pipelines, Geoinfo Services faced challenges modeling the large-scale network and digitally incorporating the new VFD technology into the hydraulic model.

Realizing that they needed a solution to model the existing large-scale network with hundreds of pipes and nodes, as well as develop scenarios to incorporate multisourced data and the pressurized VFD technology, Geoinfo Services explored various software options. Yet, these options failed to accommodate the extensive network size and voluminous associated data required to simulate and manage multiple digital distribution scenarios. "The software had a limitation of 400 pipes, and non-Bentley software does not have scenario management," said Dahasahasra. They also did not support the VFD pumps. To address these challenges, Geoinfo Services needed advanced hydraulic modeling and digital twin technology.

## PROJECT SUMMARY

### ORGANIZATION

Geoinfo Services

### SOLUTION

Water and Wastewater

### LOCATION

Ayodhya, Uttar Pradesh

### PROJECT OBJECTIVES

- ◆ To convert Ayodhya's existing water supply system into a 24/7 pressurized, piped network.
- ◆ To generate a hydraulic model and digital twin of the city's water infrastructure.

### PROJECT PLAYBOOK

OpenFlows

### FAST FACTS

- ◆ Geoinfo Services converted Ayodhya's gravity-based water distribution system into a pressurized network for uninterrupted access to clean water.
- ◆ Using OpenFlows helped evaluate design scenarios with innovative pumping technology to equalize pressure and reduce energy costs.
- ◆ Developing a digital twin facilitated real-time monitoring and predictive analysis to optimize operations and mitigate emergency situations.

### ROI

- ◆ Leveraging Bentley's OpenFlows saved 1,000 hours planning, designing, and implementing a cost-efficient water supply solution.
- ◆ OpenFlows WaterGEMS' capability to model hundreds of assets saved USD 121.75 million in energy costs.
- ◆ The digital twin optimized pipeline diameters and network operations, saving 2.5 million in material costs and USD 1.5 million in annual system operating costs.
- ◆ The 24-hour water supply network reduces waterborne illnesses, saving 50% in associated family medical expenses.

“This project removed fear of any epidemic and created confidence in people across the world.”

– Sanjay Dahasahasra, Member of National Task Force of 24x7 Water System, Government of India

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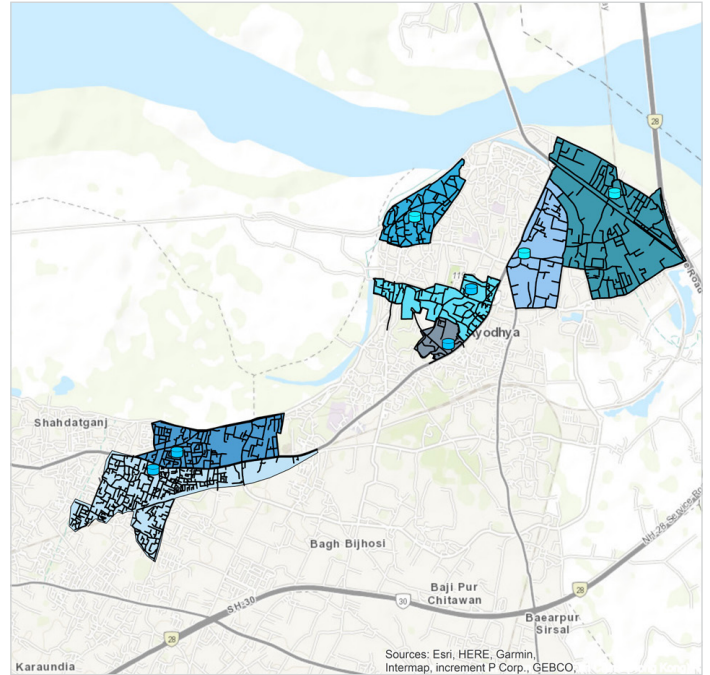
## GENERATING A HYDRAULIC MODEL AND DIGITAL TWIN

To transform Ayodhya's existing system into a dependable and energy-efficient network, Geoinfo Services turned to OpenFlows. They created 3D models of the city's 24-hour supply system, introducing variable frequency control pumps to generate the required pressure at the nodes. OpenFlows WaterGEMS® allowed hydraulic network modeling with an unlimited number of pipes and automated data integration within the model, enabling Geoinfo Services to easily generate digital analysis scenarios to obtain equal residual pressures at the tanks using the VFD pumps. “OpenFlows WaterGEMS has the capability of modeling VFD pumps. Using this, we would [see energy savings] of 1,082 million kilowatts per hour,” said Dahasahasra.

Using OpenFlows™ WaterSight®, Geoinfo Services integrated data from the hydraulic model and Internet of Things (IoT) devices, as well as geospatial and consumer information, into a digital twin to provide real-time, cost-effective operations strategies. The performance data of the real-world Ayodhya water supply system is transferred into a digitized virtual reality, which is processed and made available to the network managers. With Bentley's open, interoperable software, Geoinfo Services consolidated multisourced, real-time critical information in an open, connected data environment, facilitating predictive analysis and actionable insight to optimize water management. “The digital twin of Ayodhya city is a virtual representation of its water supply system that spans its lifecycle. It is updated from real-time data, and uses simulation, machine learning, and reasoning to help decision-making,” said Dahasahasra. Having access to the digital twin allows Ayodhya's utility engineers to observe measurements and analytically derive results, optimizing asset performance and reliability for safe and continuous water distribution.

## SMART WATER SOLUTIONS DELIVER SAVINGS AND SUSTAINABILITY

Bentley's hydraulic modeling technology provided Geoinfo Services with the capability to model the innovative VFD pumps and design the transmission network to maintain equal and optimal pressures at each service tank. Working in a connected data environment reduced design time by 75% and optimized pipe diameters, saving USD 2.5 million. The network with the VFD pumps is saving USD 1.5 million in annual operating expenses and USD 46,025 in annual energy costs. It also minimized the amount of land required for tank construction to save an additional USD 5.45 million in costs. At the same time, water losses will be reduced by 35%. “Before the start of the project, the NRW level was 50%, which will be brought down to 15%,” said Dahasahasra.



Geoinfo Services converted Ayodhya's gravity-based water distribution system into a pressurized network for uninterrupted access to clean water. Image courtesy of Geoinfo Services.

Generating a hydraulic model and digital twin, Geoinfo Services effectively converted Ayodhya's water supply system into a 24/7 pumped distribution network, providing every city household with continuous access to clean drinking water, while reducing carbon emissions by 347 metric tons. Through smart water solutions, Geoinfo Services has eliminated the intermittent water supply and resulting negative social impact, addressing health concerns caused by leakages and poor quality water. “With this project converted to 24/7 system, health risks are averted,” said Dahasahasra. Moreover, the digital twin facilitates virtual network monitoring with 95% confidence to improve decision-making and crisis management, mitigating emergency situations based on real-time data and analytics. Embracing intelligent digital engineering and urban water management workflows, Geoinfo Services has supplied millions of people in Ayodhya with the basic human need of clean water access, delivering a pressurized water system, built efficiently and sustainably.