Bentley
Advancing Infrastructure

Project Summary

Organization:
Manila Water Company, Inc.

Solution:
Water Networks

Location:
National Capital Region, Rizal province, Philippines

Project Objective:

- Mitigate the adverse effects of natural disasters on Manila Water customers in the National Capital Region and Rizal province.
- Ensure that there is a reliable water supply during such calamities at an economical cost.
- Prioritize resiliency measures and contingency plans for more than 100 facilities.

Products used:
WaterGEMS

Fast Facts

- WaterGEMS' criticality analysis helped to prioritize the rehabilitation of facilities.
- Hydraulic simulations helped to locate evacuation sites near secure and reliable water supplies.
- The simulations identified locations for underground emergency reservoirs near population centers.

ROI

- Initial estimates predicted it would cost USD 520 million to restore water service after a calamity.
- Estimates based on WaterGEMS simulations reduced the cost to restore reliable water service by USD 380 million.
- The masterplan saved USD 30 million in insurance costs through the end of Manila Water's concession period.

WaterGEMS® Prioritizes Manila Water Facilities for Disaster Resiliency and Contingency Plan

Utility's Masterplan Reduces Potential Losses by USD 380 Million Using WaterGEMS

Reliable Water During Disasters

Located on the Pacific Ring of Fire, the Philippines experience frequent earthquakes, volcanic eruptions, and typhoons that cause catastrophic losses. Manila Water Company, Inc., prepared a Natural Calamity Risk Resiliency and Mitigation Masterplan to ensure that there is a reliable water supply in the event of a natural disaster for the service area covering the East Zone of Metro Manila (the National Capital Region) and Rizal Province. Modeling with WaterGEMS illustrated what would happen if one or more interconnected supply systems shut down and which facilities would cause the most losses if they were operating at less than full capacity. The results helped Manila Water prioritize resiliency measures and contingency plans for more than 100 facilities, reducing potential losses by USD 380 million compared to USD 520 million without such measures.

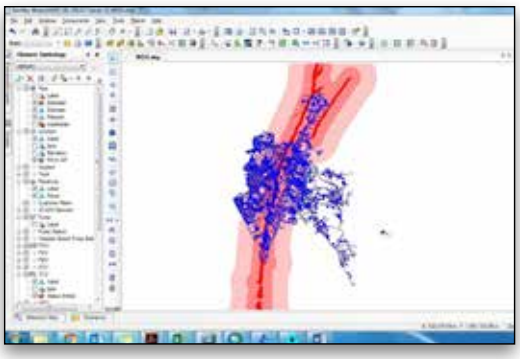
Assets at Risk

Manila Water operates the concession to provide water treatment, water distribution, sewerage, and sanitation services to the eastern side of Metropolitan Manila, where there are more than 6 million residential, commercial, and industrial customers. The concession encompasses 24 cities and municipalities in a 1,400-square-kilometer area. Manila Water has a mandate to provide customers with an uninterrupted water supply that complies with national drinking water standards. Manila Water aims to maintain reliable water service during natural disasters, when it is essential for sanitation, hygiene, and preservation of life.

The Philippines are threatened by an average of 20 typhoons every year, with 10 making landfall and five reaching superstorm proportions. In 2009, the deadliest season in decades, Typhoon Ketsana left more than 670 dead and USD 237 million in damages. The country also suffers at least one destructive earthquake each year. When the magnitude 7.6 Samar earthquake struck in 2012, it displaced more than 1 million people and destroyed extensive infrastructure, leaving critical facilities inoperable and disrupting water service. Government hazard assessments predict that the next catastrophic earthquake could cause as many as 34,000 fatalities and disrupt access to drinking water for months.

To assess preparedness for such a calamity, Manila Water conducted a Resiliency and Business Interruption (RBI) study to determine which of its facilities would be the most vulnerable. The RBI study confirmed that the utility would suffer significant damage to dams, water transmission and distribution pipelines, treatment plants, reservoirs, pump stations, and other facilities. Damage assessments indicated that it would take USD 520 million to restore service.

The utility concluded that it could not afford to lose these critical facilities and that it would take too long to restore them to full operational capacity. The RBI study suggested high-priority facilities that would need to be made more resilient to minimize damage. Lower priority facilities would require contingency plans in case of their loss. The objective was to mitigate the adverse effects of a natural disaster, ensure a reliable water supply during such calamities, and accomplish these objectives for the most economical cost. Savings would not only benefit the private utility and its public partners but also be passed on to customers in the form of lower tariffs.



WaterGEMS was used to create a model that overlaid pressure and flow profiles on a GIS-based map, which helped the project team find the areas that have reliable water supplies.

"Mitigation of the adverse effects of a natural calamity is a race against time. Bentley's WaterGEMS helped Manila Water minimize the amount of its investment while maximizing the resiliency and contingency of its facilities. Both were highly beneficial to the customers it serves. Without this capability, the masterplan would be completed and optimized later rather than sooner."

— Diogenes Adelbert Voltaire B. Evangelista, Water System Analysis and Planning Engineer, Manila Water Company, Inc.

Masterplan for Resiliency

Manila Water undertook a rigorous process to optimize the masterplan for improving resiliency and mitigating risk at its more than 100 facilities. WaterGEMS, Bentley's water distribution analysis and design software, was used to build a model and simulate operations of the entire water supply system. The model incorporated data from internal and external sources, including ground elevations, demand loading and patterns, pipe profiles, and other parameters. Various WaterGEMS capabilities used for model building, such as automated elevation and demand allocation, helped Manila Water create an accurate hydraulic model efficiently.

Simulating operations under various scenarios revealed the effects of losing one or more components of the water system, illustrating how interconnected systems would react if one or more systems shut down. The what-if scenarios included assessing options for evacuation center locations, network segmentation, water storage capacities, and other variables. The results allowed Manila Water to identify and prioritize critical facilities with confidence. For example, if damage to a primary water main would cause loss of pressure, WaterGEMS calculated how much water could be supplied from alternate sources and for how long. This indicated which facilities would have the highest impact on water availability and so required resiliency measures.

The modeling also helped the utility to make contingency plans in case of catastrophic losses. The simulations identified the best locations for underground emergency reservoirs to supply evacuation centers and other population centers, if connecting systems were damaged. The masterplan also prioritized facilities whose failure would cause further damage, such as a dam that would cause a catastrophic release of water if it failed.

Public Private Collaboration

Throughout the study and planning process, Manila Water collaborated with local government units and the National Disaster Risk Reduction and Management Council. This ensured that the utility's masterplan was aligned with each government agency's plan for emergency response. The WaterGEMS model helped the agencies select the most suitable location for evacuation sites: the visuals created by an overlay of pressure and flow profiles generated by WaterGEMS on a GIS-based map helped to envision the water supply in relation to population centers.

Then, Manila Water used WaterGEMS to ensure these sites would have a secure and reliable water supply in case of a catastrophic event. WaterGEMS produced project cost calculations, supporting documentation, and detailed reports for review by all stakeholders. The plans made clear the risk associated with taking no action, and the rewards of taking measures to ensure access to potable water under different contingencies. The model not only prioritized capital expenditures by criticality of facilities, but also prevented unnecessary expenditures on non-critical facilities. In short, the study helped to determine where to expend resources most economically for the greatest benefit. These were results that stakeholders could embrace.

Affordable Risk Reduction

According to final RBI study projections, applying the resiliency and contingency measures to the prioritized facilities would decrease damages during a catastrophic event by USD 380 million. The WaterGEMS simulations demonstrated that the proposed measures would significantly reduce property damage and business interruption in metro Manila and Rizal province. More importantly, the plan would ensure a stable water supply for Manila Water's customers.

Rather than settle for the initial projections, which estimated a recovery cost of USD 520 million paid largely through tariffs, Manila Water found a viable, economical way to minimize damages and provide reliable water service during a calamity. The RBI study and master planning process provided Manila Water with the information required to make prudent decisions. The masterplan's financial viability gave the utility's partners and stakeholders confidence that, for a minimal investment, life-saving results could be achieved.

Bentley® *Advancing* Infrastructure