

Project Summary

Organization:
Dar Al-Omran

Solution:
Water and Wastewater

Location:
Zarga, Jordan

Project Objective:

- Improve the hydraulic efficiency and performance of the water supply network
- Reduce high rates of water loss in the water supply network
- Provide greater access to potable water, particularly in areas serving impoverished population groups

Products used:
WaterCAD

Fast Facts

- The existing water supply was available to consumers on an intermittent basis only
- The project proposes to replace about 600 kilometers of water mains
- WaterCAD was used for all hydraulic modeling works

ROI

- WaterCAD's TRex functionality alone resulted in a 10 to 15 percent savings in time and resources associated with the model-building process
- Interoperability between WaterCAD and AutoCAD resulted in about 20 percent time saving, when compared to more traditional processes

Dar Al-Omran Meets Tight Deadlines for the Zarga Water Network Restructuring and Rehabilitation Project

WaterCAD's TRex Elevation Tools Reduce Water Distribution Model Building Time by 10 to 15 Percent

A Millennium Challenge Corporation-funded Project

The Zarga Governorate is located to the northeast of Amman, in the Central Region of Jordan. With an area of 4,761 square kilometers and a population of 871,600, the region is projected to grow rapidly to 1,690,000 by 2030. To meet the needs of the growing population, as well as to address limitation in the current water network, the Millennium Challenge Corporation is funding a major restructuring of the network, including the development of water supply areas (WSA), distribution areas (DA), and district metering areas (DMA), with a transition away from direct pumping into supply. The project will install and replace approximately 35 kilometers of primary and secondary trunk mains and approximately 550 kilometers of tertiary distribution mains.

The joint venture of Hazen & Sawyer and Dar Al-Omran, together with Nicholas O'Dwyer Ltd, were commissioned to progress the detailed design of the works. The team used Bentley's WaterCAD for all hydraulic modeling works, including the development of extended period simulations (over 24 hours) for a variety of hydraulic scenarios representing both intermittent and continuous supply arrangements.

Major Issues Include Intermittent Water Supply and Water Leakage

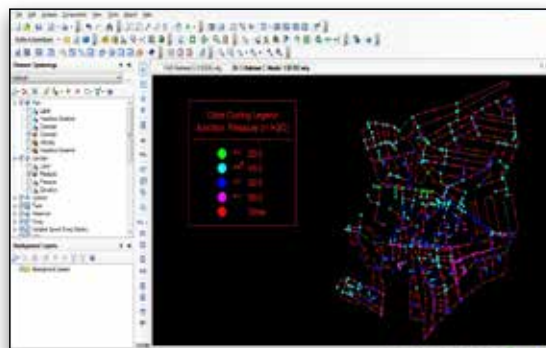
The existing water supply scheme, which consists of approximately 3,500 kilometers of water mains with associated pumping stations and reservoirs, is subject to a variety of major shortcomings. Because of inadequate water resources and high levels of leakage,

supply is available to consumers on an intermittent basis only. At present, water is supplied approximately 37 hours per week on average (i.e., 22 percent of the time). There are also high levels of water leakage, particularly in the tertiary pipe network.

Most of the network is supplied by direct pumping from low-level sources and pumping stations rather than by gravity from elevated reservoirs, which is a more efficient system. There are serious deficiencies associated with the distribution network, including pipes laid over the ground and corrosion in steel piping. Finally, there are hydraulic capacity inadequacies throughout the system, as well as supply and water pressure imbalances across the distribution system, with some areas experiencing excessively high pressure, while other areas, in the higher elevations, have minimal supply due to low pressure.

The main objective of the Zarga Governorate water system restructuring and rehabilitation project is to improve the hydraulic efficiency and performance of the water supply network, including reducing water loss, which will reduce the water that needs to be pumped. The goal is also to provide greater access to clean, potable water in areas serving impoverished population groups.

In addition, the project will reduce operation and maintenance costs for the water supply network, increase revenue due to improved availability of supplied water, and provide health benefits related to improved hygiene among populations constrained to low consumption of water.



Color-coded map showing pressure and pipe diameters

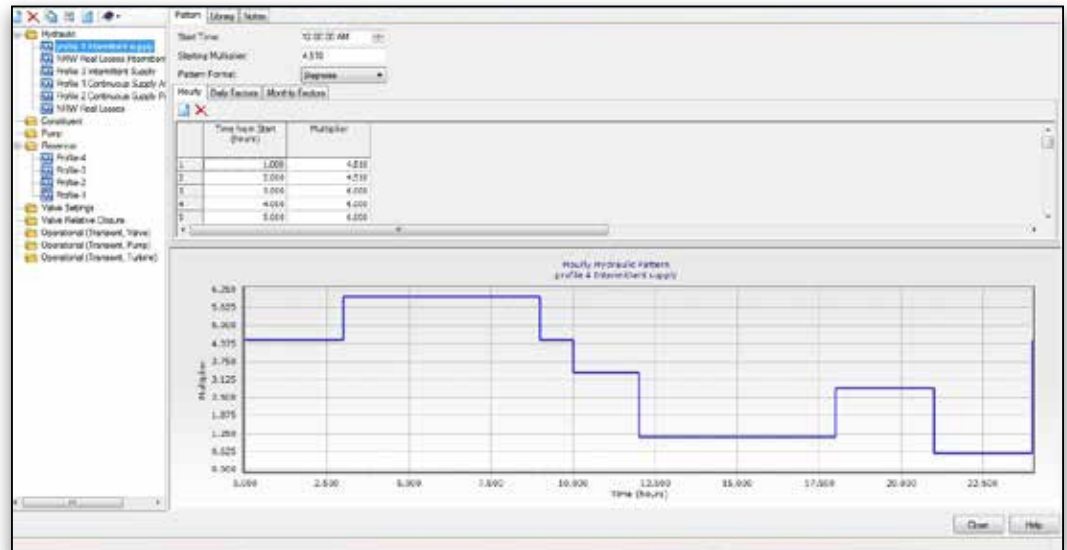
“WaterCAD was instrumental in ensuring that extremely tight deadlines and project milestones were met by the project team.”

*Emran Hammoudeh,
Head of Water &
Wastewater Design,
Dar Al-Omran*

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Hourly pattern for intermittent supply, shown in WaterCAD's pattern management

WaterCAD Facilitates Meeting the Design Deadlines

A fast-track project strategy was adopted to enable the completion of all construction and commissioning works before December 2016, an immovable client deadline. Emran Hammoudeh, head of the Water & Wastewater Design section at Dar Al-Omran, explained: "WaterCAD was instrumental in ensuring that extremely tight deadlines and project milestones were met by the project team and facilitated the development of cost-efficient solutions for a very complex water supply system."

WaterCAD helped Dar Al-Omran meet the project design deadline in a number of ways:

- Interoperability between WaterCAD, AutoCAD, and ArcGIS allowed the efficient transfer of existing GIS and network data into the model, as part of the model-building phase.
- WaterCAD's TRex functionality allowed the efficient integration of survey data and the allocation of elevations to specified nodes based on data from a digital elevation model (DEM), which was developed from site survey work. Furthermore, the combined use of DEM and TRex ensured that there was no discrepancy between the individual sub-models being progressed by the modeling teams. WaterCAD's TRex functionality was used extensively for this project and it is estimated that this feature alone resulted in a 10 to 15 percent savings in time and resources associated with the model-building process.
- The Thiessen Polygon Creator in WaterCAD's LoadBuilder module facilitated the efficient allocation of demands across the nodes in all models.
- Extended period simulations (over 24 hours) were required for both the continuous and intermittent supply

arrangements and for both average day demand and average day peak week demands. As such, four scenarios with two additional child scenarios were developed so as to ensure robust hydraulic design of the works. WaterCAD allowed the efficient development, management, update, and recall of these scenarios within the same overall model framework using WaterCAD's Scenario and Alternative tools.

Overall, one WaterCAD model was developed for the primary and secondary networks, and 32 models for the tertiary network.

Streamlined Tender Drawing Development

Given that this project involved the design of approximately 600 kilometers of new and replaced pipeline, the development of detailed design and tender drawings was a major challenge. For example, the preparation of tender documents for five network contracts included the production of 1,371 drawings and five sets of specifications. WaterCAD facilitated the migration of designs from the models to the detailed design and tender drawings.

The interoperability between WaterCAD and AutoCAD was an important benefit as it enabled efficient generation of drawings based on the water model, and minimized the possibility of data transfer-related issues, resulting in about a 20 percent time savings, when compared to more traditional processes.

Hammoudeh concluded: "In overall terms, WaterCAD is a key factor in the achievement of the project and program goals, which will result in a sustainable improvement in the Zarqa water supply scheme for the benefit of the local community."