



PROJECT SUMMARY

BE AWARD NOMINEE

City of Fair Oaks Ranch Water System Analysis and Expansion

Organization:

M&S Engineering Ltd.

Category:

Innovation in Water Resources

Location:

Fair Oaks Ranch, TX

Project Objective:

Expand City of Fair Oaks Ranch's water supply while helping to safeguard limited ground water sources

Products used:

WaterCAD®

CITY EXPANDS WATER SUPPLY WITHOUT DEPLOYING ADDITIONAL WATER SOURCES

PROJECT WILL ALSO HELP SAFEGUARD LIMITED GROUND WATER SOURCES AND PRESERVE ENDANGERED SPECIES HABITATS

Fair Oaks Ranch is a city in south central Texas, just north of San Antonio. Like most Texan cities, water is always a concern. So in late 2007 when negotiations with the region's only available water supplier broke down, Fair Oaks Ranch was in a real bind. The city had not only been negotiating for enough additional water to fulfill commitments to two major subdivisions, it had also been in discussions for the maintenance of current water rates for its existing 8,500 customers.

With additional water from the only source now out of the question, Fair Oaks Ranch had to find a way to keep both pledges and do it fast – the city's promised delivery date was just six months away. Fair Oaks Ranch approached M&S Engineering Ltd., a 65-person Texas consulting firm, to analyze the situation and provide a solution.

The time frame was minimal and the scope was broad. M&S Engineering first determined the three major objectives:

- Analyze existing infrastructure and water sources to see if the proposed subdivisions could be supplied without an adverse effect on current city residents
- Based on this analysis, generate a list of options for consideration
- Evaluate combinations of the options, taking into account factors like cost, feasibility, constructability, and time to complete

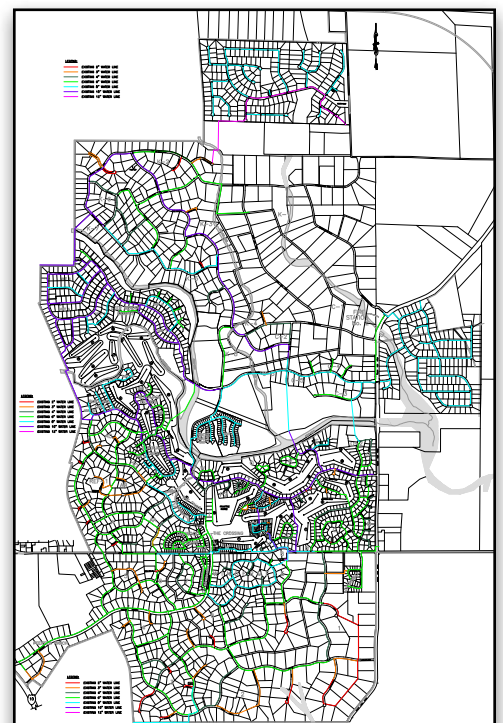
Each objective faced additional complicating factors. To analyze the existing infrastructure, for example, meant that M&S Engineering would need a schematic of the entire water system, which did not exist. The system had been built piecemeal over a 30-year period by various developers and no single plan or comprehensive CAD drawing had ever been completed. The city did have a SCADA in place, but it was of no use for calibrating a model. In fact, as in many smaller water agencies,

most of the relevant system knowledge resided between the ears of expert operators, and that knowledge had to be captured.

Generating options was also complex. In addition to expected difficulties, the larger of the two proposed developments is 50 feet higher than the greatest hydraulic grade in the city so the list of options had to contend with the possible need for additional wells and/or an elevated water tank. The alignments of any new transmission lines would have to be considered, and the city would have to make an intelligent and economically sound choice between hydropneumatic tanks – which come with additional energy and maintenance costs – or large static tanks.

FAST FACTS

- Analyzed the existing infrastructure and water sources to see if the proposed subdivisions could be supplied without an adverse effect on current city residents.
- Quickly but thoroughly evaluated a large number of options and then compared the different results.
- Provided the city with a cost-effective solution and was also able to sketch out a four-phase capital improvement program.



"M&S Engineering was able to meet what appeared to be an unmanageable project schedule almost exclusively due to WaterCAD"

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And last but not least, M&S Engineering would have to attach costs and benefits to each option and come up with a phased capital improvement plan that met immediate needs and prepared the city for future development. "There were a myriad of major challenges, and the aggressive time frame forced us to rely heavily on automation and time-saving capabilities," explained M&S Engineering Project Manager Daniel Konstanski. "M&S Engineering was able to meet what appeared to be an unmanageable project schedule almost exclusively due to WaterCAD."

Preparation of the system model was a good example of the time-saving ability of WaterCAD. Because there were no existing electronic drawings, M&S Engineering engineers built a system schematic from scratch working from multiple sets of developer drawings assembled over 30 years. "This presented a major problem. We would have to draw everything by hand and then draw it by hand again to enter it into the modeling software," continued Konstanski. "Fortunately, Bentley support staff and instructors guided us on how to use the extracting capabilities of WaterCAD to take the drawings we made and create a working water model automatically. This saved us hours of repeat work."

But the model needed substantial refinement and calibration based on actual operations data, and this data did not exist in digital form – M&S Engineering would have to figure out how to extract it from Fair Oak Ranch's expert personnel. This was done by physically sitting down M&S Engineering experts and city operators at computers running the model. Small changes were made to the model and then analyzed, and by doing this repeatedly, accurate solutions were arrived at iteratively.

"WaterCAD was an invaluable tool for facilitating coordination through its simple yet detailed outputs and multiple visualization options," said Konstanski, "Graphic displays, tables, and graphs were essential in facilitating communication between the different parties and allowing them to cooperatively achieve an outstanding result."

With an accurate model in place, M&S Engineering could turn its attention to evaluation of different options. Konstanski added, "We were able to quickly but thoroughly evaluate a large number of options and then compare the different results through output and report functions. Through the use of linked scenarios, each with different small

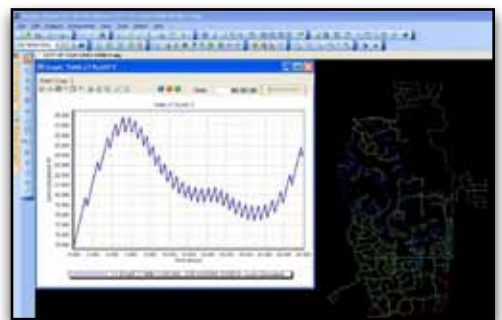
changes, we were able to quickly progress through the options without having to create different water models for each potential solution."

As a result, M&S Engineering was able to provide the city with a cost-effective solution and was also able to sketch out a four-phase capital improvement program that will not only create a fully interconnected and much more efficient water system, but position Fair Oaks Ranch as a more pervasive water provider to the region.

Use of WaterCAD resulted in immediate and substantial benefits for Fair Oaks Ranch. Konstanski estimated that 800 man-hours were saved by WaterCAD's automated extraction alone and that another 900 hours were saved by the iterative analysis of solutions and linked scenarios. "This translates to a savings for our client of over \$120,000 for engineering services alone," he noted.

Since Fair Oaks Ranch can now think in terms of providing water to customers outside city boundaries, the work done by M&S Engineering may also end up benefitting the region's environment. Water infrastructure in this part of Texas is rare, and most rural customers use well water, which depletes existing aquifers. Since the city's system makes effective use of surface supplies, an expanding city system may well reduce aquifer depletion.

By effective use of technology, M&S Engineering was able to substantially expand a city's water supply without adding additional water sources. In drought-threatened south central Texas – and in an increasingly water-thirsty world – this kind of innovation will always be needed. Konstanski concluded, "This will go a long way in safeguarding the limited ground water sources and preserving the unique habitats that they provide to a number of endangered species in this area."



Variation of the calculated level of one of the city's tanks over time.