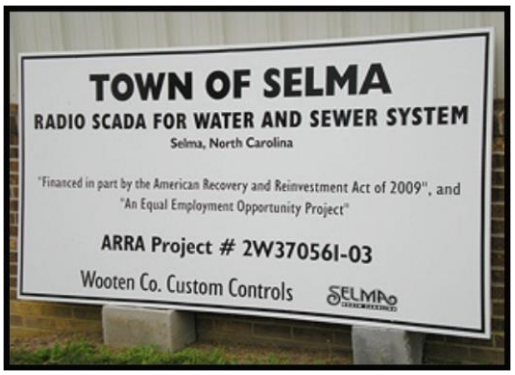
VTScada
Software for Monitoring & Control

A Municipal SCADA Project Comes in On Time, Under Budget and Exceeds Expectations

A consultant, an integrator and a vendor discuss the factors for success such as open specifications

By John Grey, Devin Carroll, and Christopher Little



In June of 2009, the Town of Selma, North Carolina commissioned a supervisory control and data acquisition (SCADA) system to monitor and control their lift stations, tanks, wells and water treatment plant. This project was made possible in part, by stimulus funding provided by Construction Grants & Loans, a state-level wastewater agency. Despite strict regulations and extensive paperwork, the project came in on-time and under-budget while still managing to surpass the customer's expectations by allowing them to identify hidden issues and optimize the efficiency of their system. In this article, project manager John Grey and system integrator Devin Carroll discuss the factors that made the project a success.

The Town of Selma, NC

Serving 7000 residents, the Town of Selma's Water and Sewer Division is responsible for administering four elevated water tanks, nineteen wastewater lift stations, eight water wells and one water treatment plant.

In 2008, the town hired Richard Douglas as their Town Manager. One of his first actions was to enter into a general services agreement with the Wooten Company, a Raleigh-based consulting firm, to oversee a new monitoring and control system for the growing town. One of his next actions was to hire Gerald Lanier as the Town's Water and Sewer Director. Both Mr. Douglas and Mr. Lanier saw the need for improvements in the water and sewer system, especially related to data acquisition and process control.

Goals for the New System

John Grey is the branch manager for the Asheboro office of The Wooten Company. As the project manager for Selma's new system, Grey was responsible for creating the specification, overseeing the bid process and assisting with the loans and construction administration. Grey outlines the following list of priorities that he and Douglas assembled for the new system.

Remote Monitoring: "State law requires that any wastewater pump station that is not connected to a SCADA system must be visited every day. Town workers had to visit each site and log the run hours from the meters on each pump. It was very important for the town to have a central system tied in through telemetry so they didn't have to visit those stations every day."

Alarming: "They needed the wastewater pump stations to be monitored so that if an alarm condition occurred, such as a pump failure, the town's staff would be notified."

Reporting: "On the water side, they had four elevated water storage tanks with no remote information. There were level gauges on the sides of each tank but that was it. There was no reporting available at all for these sites."

Control: "There were some internal controls at the plant that would start a chemical feed system when flows were sensed. Operators had no way to know what chemical was running or if it stopped working."

Spill Prevention: "The town had no way of knowing there was a spill unless somebody went out and saw it. It was partially the fear that something serious could happen that drove the town to move forward with this project."

Grey recommended that the Utility adopt a supervisory control and data acquisition (SCADA) system rather than simply using less expensive dialers at all their remote sites. "The problem with dialers is if you lose the phone lines, you may as well have no system at all. We wanted to go with something that was going to be more reliable and would let them know if it was communicating or not. With nineteen stations we felt like SCADA was the way to go."

However, a full SCADA system, consisting of remote I/O devices, a city-wide communication network and an HMI software package was an ambitious proposition for a town the size of Selma. Grey quickly discovered a way to defray the added cost. The town qualified for a grant made available through the American Recovery and Reinvestment Act of 2009. "To receive this funding, the project had to be shovel-ready and have all the permits already in place. I suggested to Richard that this would be a good project to submit since SCADA systems do not require permits."

Creating an 'Open' Specification

Stimulus funding regulations require an open bidding process. This means that multiple integrators need to be able to bid on projects competitively. Similarly, bids should not favor specific manufacturers. This open-architecture approach requires that the HMI software component of the SCADA system be capable of simultaneously handling both proprietary and non-proprietary communication protocols. "We needed to generate a specification that was as open as possible. That took some effort."

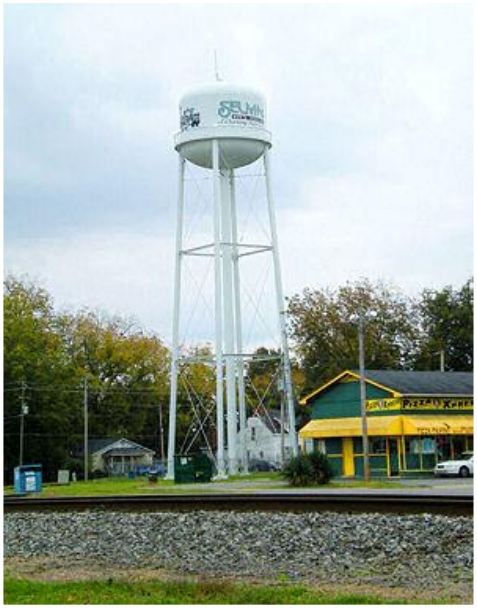
Grey had help from a local instrumentation representative named Larry Wasserman who had many years of experience creating 'open' non-proprietary systems. "I had met John Grey at some trade shows and I did a few lunch & learns at The Wooten Company offices." says Wasserman. "When this project came up, he invited me to do a presentation for the people at Selma. I showed them what an open non-proprietary system is and the kinds of products we work with."

"Basically, a closed system is one where everything is supplied by one manufacturer; the hardware, the software, the communications network, everything. It's closed and not available to the public. Any changes, modifications, service work or additional parts or equipment pretty much have to be supplied by the same manufacturer." Grey and Wasserman created a specification that listed a variety of hardware and software options that integrators could choose from when bidding the project.

Initially, the new system only included the town's nineteen wastewater pump stations. "One interesting thing about this project was that the stimulus funding came from a state-level wastewater agency called Construction Grants & Loans." says Grey. "They would only fund the wastewater portion of the project.

However, the town saw a real need to go ahead and make improvements to the water system as well, so we included the connection of the elevated tanks to the water treatment plant and the operation of the treatment plant from the tank levels. We also included control for one of the wells. Previously, someone had to drive out and turn on the pumps in the morning and then basically let it run until someone drove out and turned it off."

"The final spec didn't go into much detail." Says Grey "It simply specified that the system had to communicate with all remote sites so that the main computer at the water treatment plant would know what's going across the system and indicate if there was a problem with any of the radios. We didn't do any surveying. We developed this project very quickly to take advantage of the stimulus money while it was available."



One of the town's four elevated water tanks

Bid Process

Two local contractors submitted bids. Custom Controls Unlimited based in Raleigh, NC was the lowest bidder. Since the project was publicly funded, the lowest bidder was selected. "They had a lot of interesting conditions to work with.' says Grey "We did not provide them with any kind of layout for the pump stations or any kind of wiring diagrams for each station or anything like that. They had to go out and visit all the sites and get an idea of what it was going to take to set up the system."

The Design Process

Devin Carroll is vice-president of Custom Controls Unlimited and was the control systems engineer on this project. "The people at the Town of Selma were really great to work with. We spent a lot of time initially just talking with Gerald Lanier. Down south we call it 'chewing the fat'. In a lot of cases, customers haven't had much experience with SCADA so they are not sure what to expect. During these initial discussions, they were learning about what they could get out of this system and we were learning about what they needed and what they wanted to see."

Custom Display Screens created by CCU Inc. using VTScada

Monitoring and Control Hardware

"We used SCADAPack 314 PLCs for the sewer lift stations." says Carroll. They communicate with the HMI application at the water plant via serial 900 MHz radios. Some sites are transmitting directly to the plant while others are sending to an elevated water tank, which relays the signal to the plant." By using the tank as a radio repeater station, they were able collect information from the PLC on the tank and extend the range of the radios to reach the more remote sewer lift stations and the well sites. "Back at the water plant we used a central SCADAPack 334 PLC. That unit handles flow control and some chemical pacing at the plant itself. It also provides central polling of all the PLCs at the remote wells out in the field." The SCADAPack 334 PLC is able to communicate with the HMI software using Ethernet.

VTScada HMI Software

A central component of a SCADA system is the Human Machine Interface (HMI) software application. The HMI communicates with the remote PLCs and allows operators to see values and control the system via a series of graphic screens. The HMI also records historical data and uses it to create detailed reports on system usage.

Since the government-funded system had to be 'open', the HMI needed to be able to communicate with a variety of PLCs or RTUs. VTScada software from Trihedral comes with a library of device drivers that makes it hardware independent.

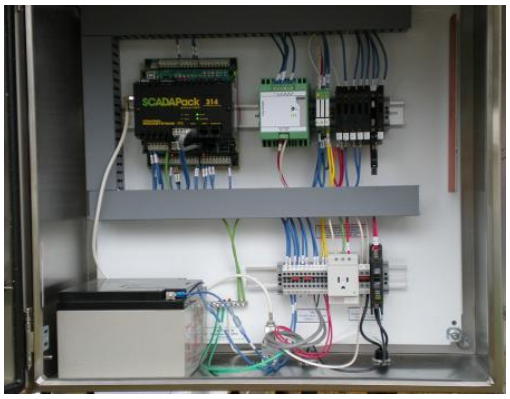
Carroll was already familiar with VTScada. "In my early days, I did maintenance on a system that communicated with VTScada using a proprietary protocol. I determined that if this software could deal with open protocols and at the same time manage this proprietary one, then it was a better choice than some of the other names that we had worked with, at least in applications where the communication protocols are not your standard big names."

The Installation Process

"The installation was wonderful." says Grey. "It was evident from the very beginning that Custom Controls was more interested in doing a good job than just getting it done. They were very professional to work with and the quality of their installation was very high. If there was a concern raised, they would jump right on it."

"They did a complete project. They never came back to us complaining about surprises that they found or extra things that they needed. For example, a few of the pump stations didn't have the right kind of contacts that would allow them to connect their pump control panels. They modify their panels to make the system work."

For Carroll, these issues are all part of the process. "When we add SCADA systems to old pump stations, we often find that control hardware such as motor starters and HOAs do not have the necessary auxiliary contacts that allow us to connect and monitor this equipment. In these situations we have a few choices: search antique automation warehouses for spare parts, add interposing relays to convert the control voltage to a signal that can be monitored by the RTU, or just upgrade the hardware. In Selma we used a combination of each choice depending on the layout and configuration of the individual control panels."



A PLC panel created by CCU Inc.

The town was so pleased with the progress of the installation that they decided to tie-in the remaining seven wells to the SCADA system. These wells had direct lines to the water plant so staff could turn the pumps on and off from there. However, they could not see if they were actually running. By installing SCADA at all of the wells the complete water supply system could be controlled through the SCADA system.

The other work at the Water Treatment Plant allowed the plant to start and stop based on the elevation of water in the elevated water storage tanks. "I wanted to get those improvements into the project." says Grey. "I knew that it would be beneficial to the town to be able to see those tank levels and to have more automation in the plant so they wouldn't have to have someone sit there and turn it on and off over the weekends."

Finding Hidden Problems and Increasing Efficiency

The town also decided to tie in the chlorine analyzer at the water treatment plant. "Once it was linked in they were able to track the chlorine levels in real time instead of seeing samples every two hours. They found that the levels were periodically spiking high and low. They didn't realize it was doing that. Based on this information, they started adjusting the system to get a more consistent chlorine level."

Once the system was completed, they saw even more benefits. "They quickly started experimenting with some of the reporting features." says Grey. "They suddenly were able to track the run times for each of the pumps and see which ones were turning off and on a lot and which ones were not. Then they started asking why. This allowed them to find hidden problems and increase the efficiency of the whole system."

During the installation process Carroll had anticipated these needs as much as possible. "The customer often doesn't know what they are going to need because they have never had a SCADA system before. We found ourselves adding features here and there because we knew that once the customer learned what was possible, there would be a few other things they would want."

"For example, levels from their water tanks provide control to the water treatment plant. Normally, it makes more sense hydraulically for a particular tank to handle that control. What happens when you need to do maintenance on that tank? You don't want to have to run everything in manual mode. We gave them the flexibility, with a few keystrokes in VTScada to move control to one of the other three tanks. We don't nit-pick over things that may not have been part of the original spec. It's easier for us to add things in the beginning than later when the customer realizes what a SCADA system can do. That's what happened in Selma."

Reasons for Success

Grey credits Devin Carroll and Custom Controls Unlimited for much of the success of the project. "If we had ended up with a bad integrator it would have been a mess. He bid it and then did a good job. I think that was key."

"Sometimes the permitting process can be complicated. However, this project did not require a permit. Construction Grants & Loans (State) were only involved to make sure that stimulus requirements were followed. It was a fairly straight forward project."

Carroll gives credit to the technical support he received from Trihedral. "Their support is phenomenal. It was great to be able to just call and get a person. There were not a lot of hoops to jump through. They have a front line of support people but they can also pull in their engineers when they need the answer to a specific question. That helped to push us towards using VTScada."

Advice

Carroll offers this advice to utilities evaluating monitoring & control systems for their water and waste water systems. "Go ahead and spend a little bit more money up front and invest in a full SCADA system, if you can. It gives you a lot more information that can help you operate your system. It also gives you much more flexibility in the future if you want to add something later.