

## Using SCADA to Find Hidden Problems and Solutions

How a new SCADA system is helping a popular summer tourist destination create immediate savings by identifying issues they couldn't see.

By David Kanoy and Christopher Little

Known as the 'Gem of the Brunswick Islands', Ocean Isle Beach is a small island community on the southeast coast of North Carolina. Only about five-hundred people live there year round, but during the summer months its beautiful beaches and charming downtown draw almost ten times that number. This poses unique challenges for the town's wastewater utility who must handle this extreme seasonal spike in usage. In this article, local integrator David Kanoy describes the supervisory control and data acquisition (SCADA) system he developed for the town and how it is already saving money by collecting accurate usage patterns, identifying unseen mechanical problems and freeing staff to do proactive maintenance.

David Kanoy has worked with Ocean Isle beach for over twenty years. He is president of Kanoy & Kanoy Inc., a systems integrator based in Supply, NC. "The sewer system in Ocean Isle Beach was installed about thirty years ago. It's a conventional gravity-fed system made up of thirty-seven lift stations and one major pumping station. Everything is pushed to a central collection station on the island and then forced under the inter-coastal waterway to a town-owned tertiary level treatment plant about two miles away."

In 1990, Kanoy developed the town's first monitoring system. "It was basically an overgrown burglar alarm. We ran a phone line from the central pumping station to each lift station. They used that for about fifteen years without a single spill." Though effective, this system was not designed to return any information other than critical alarms.

### Justifying the cost of SCADA

In 2008, despite concerns over the economy, Dixon Medlin, the utility's director, approached Kanoy about designing a full SCADA/HMI system. "This was the worst possible time in terms of the town's finances but he had been budgeting for it. He's a forward thinking fellow. It takes two people the better part of a day and a half to just go to each of the thirty-seven lift stations and write down their pump run hours. He knew there were better things for two people to be doing but first he would need more information and more control." Kanoy worked with the utility's staff to develop a wish list. "From that, I developed a proposal that I submitted to the town."



Site Panels designed and built by David Kanoy

### Selecting the SCADA Hardware and Software

"This is a full-blown system. We are monitoring twenty-seven different parameters for each of the thirty-seven lift stations. To do this, we installed CMI PLCs at each site and digital encrypted narrow-band UHF 460 MHz band radios to connect them to the central pumping station. There we have two identical dual-processor Dell™ desktop servers. We tried to do everything right the first time."

For the HMI software component, Kanoy planned to use a product with which he was already familiar. "Although the scripting language was robust, it was quite expensive and not particularly user-friendly." Kanoy eventually selected VTScada™ software from Trihedral. "Larry Wasseman of Johnston Inc. introduced me to VTScada. After seeing his demonstration, I camped for several days at the Trihedral website. I downloaded their examples and tutorial. The integrated device drivers allowed me to connect to equipment from many different manufacturers which would lower my learning curve and my time to complete the project. In the past I had to develop those interfaces myself."

Kanoy took a week-long VTScada training course taught by Trihedral's Doug Spurrell. "He did a very good job of instructing us. By that point, I had already spoken with him several times with questions and I was very impressed with his knowledge and customer service attitude. Then I contacted other users to get their take on the product and its reliability. I also spoke at length with several integrators that were using it before making my final decision. I was convinced that VTScada could provide me with a better return on my programming time."

Following the training course, Kanoy created a demo application for the town that used aerial maps to display each of the town's lift stations. "I simulated a lift station data with a test rig made up of a complete set of hardware. I had two radios, PLCs, the whole deal. When I presented it to the town, they accepted it with almost no changes. It addressed everything they needed."

### Finding Hidden Problems

So far, only five of the thirty-seven lift stations have been incorporated into the new system but already the utility is finding problems that had previously been invisible. "I got a call on my way back from putting in the very first lift station. They said there was a problem with the system. It was showing that a pump was only running about every third time and they knew that was not the case. The next morning, we did a pump discrepancy report and then went out and actually watched the pump. Low and behold, it had a defective alternator and was not running at all. It was the lag float pump that was coming on and pumping down the station."

"In another case, the lead float and the lag float settings were just too close together. They never really noticed that before. Just this week there was a situation where a pump didn't start every time. We caught that with a pump discrepancy report. Little things like that have already allowed them to optimize the performance of their system."

### Freeing Staff for Proactive Maintenance

"As I was creating the application I found things that I could do relatively inexpensively that didn't require additional hardware. For example, they didn't really have flow meters on any of the lift stations. We were able to use a derived flow algorithm that's built into VTScada to get an accurate estimate of their gallons per hour, gallons per day and gallons per week from each lift station. Previously, they drove out to each station about once a week and wrote down the pump run hours. Then, they would have to sit down with a calculator and approximate the total flow for the week by multiplying the gallons per minute by the total run hours."

"As you can imagine, it is a laborious process to compare the hours of Tuesday of last week to the hours from Tuesday of this week. Plus, if there is an emergency and they can't get to it until Thursday, then it's even harder to compare. Sometimes you can work really hard and still end up with numbers that don't tell you anything. The pump discrepancy and pump runtime reports that are built into VTScada provide a clear and concise picture. They were happy to put away their calculators and focus on more beneficial tasks."

Kanoy then modified the system to more easily identify those tasks. "For example, if the lead pump does not come on within a certain amount of time after it's called, we write a notice. We don't alarm it. Similarly, if the lag pump ever comes on at all, other than a debounce time of ten seconds or so, we also write a notice." These notices, which are low-level alarms, are listed in a report that is automatically printed for staff when they arrive at eight in the morning. "This shows them anything out of the ordinary that they should go and have a closer look at. I am basically giving them trouble tickets."

### Logging Accurate Usage Patterns

The system is also providing the town with a clearer look at usage patterns across the system. "During the winter months, the lift stations near the condos might not pump more than once a day but in the summer, some of them are filling up and pumping every two minutes."

Not all extreme fluctuations are seasonal. "Sometimes, thunder storms come by and run everybody off of the beach. All of a sudden, everybody is indoors, taking showers and the lift station gets so overwhelmed that the lag pump has to come on just to keep up with the flow. They never really knew that was happening before unless someone happened to be at that pump station and saw it happen."

"They also didn't realize that, during the summer, a couple of their lift stations regularly had to run in lag mode just to keep up when all the sunbumed people headed home at five o'clock. Without any flow meters, they didn't have any idea how much flow they were getting." This allows the utility to extend the life of their infrastructure by rotating underused motors and pumps and expanding over-worked lift stations.



VTScada Overview page showing polling of lift stations



Clicking on a site displays information about that lift station

### Protecting the Treatment Plant from Storm Water

"The tertiary treatment plant uses what I like to call 'superbugs' to treat wastewater in aerated basins. We are on the coast where hurricanes can cause significant over wash of sea water into the basins. Salt water and the super bugs definitely do not mix. If a hurricane kills off your bug population, it is a laborious and expensive process to restore it. One of the things we successfully incorporated from the wish list was to allow authorized staff members to pump down the basin and shut it off when a storm approaches."

During the Hurricane, VTScada monitors the floats to detect if saltwater is getting into the sewer system. If it has, the system is able to recover by using upset valves to pump the salt water into a holding basin until the lines are flushed and clear. In the past, this process was done manually.

### Taking the Right Tools for the Right Job

There were some unexpected benefits of the new system as well. "Before, staff only knew that there was a high-level alarm at a particular site. Now they can look at a few reports and loggers and ask, 'Why is this pump running thirty minutes when it usually runs three minutes?' They know what they are dealing with and they can bring the right equipment. For a small municipality, that is not insignificant. You just can't have every one of you service vehicles carrying everything." This saves the utility time and money every time they need to bring a lift station back online.

### Secure Remote Access

With a staff of only seven people, it was vital that each one be able to securely access the system from anywhere. "We designed it so anyone with a cell phone can call in, enter a password and then acknowledge alarms or do rudimentary control if they have the right authority."

To do this, Kanoy had to use almost every feature available in the integrated VTScada Alarm Dialer. "Currently the staff gets their alarms via text messages on their cell phones and alpha-numeric pagers. As a third level of backup, the dialer actually calls their cell phones and tells them about the alarms using the text-to-speech feature."

Kanoy used rosters to create prioritized lists of who should be called and under what circumstances. "I set it up to call one set of on-call people first. If there is no response within a certain amount of time, the next level is called and then the supervisor. Of course, they always make sure that the supervisor never gets called." In addition to providing security, and controlling access to specific features, individual passwords provides an audit trail should a problem occur.

### Training and Support

"I can't speak highly enough about the support I received from Doug and Jen and everybody at Trihedral. In the last twenty-nine years I can count on one hand the number of companies I have dealt with that offer this level of after-the-sale support. This includes companies with whom I have spent a million dollars. That's pretty impressive."

### In the Future

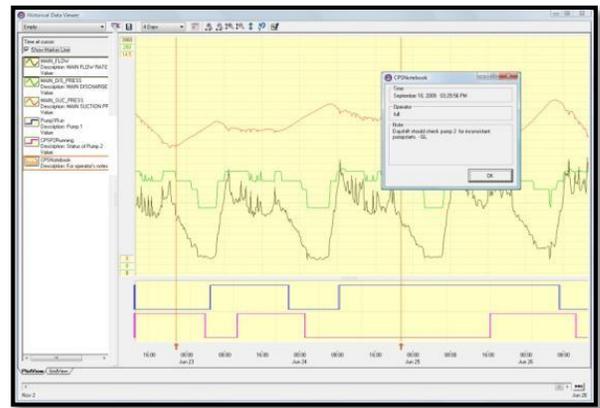
As the process of integrating the remaining lift stations continues, response from the staff has been positive. "I have gotten a lot of compliments on the layout, the functionality and the fact that it's not just a dialer. People are happy that they don't have to spend all their time driving from one lift station to another with their calculators. Now they can focus on making the system better."

"We are on track to do twelve stations a year so we should get it done in the next three years." Following that, there are plans to expand the system even further. "The percolated basins at the treatment plant use huge forty horse power compressors to create the bubbles that oxygenate the basins. We want to monitor and control the PLC that operates the compressors in the near future. I look forward to more projects like this in the future."

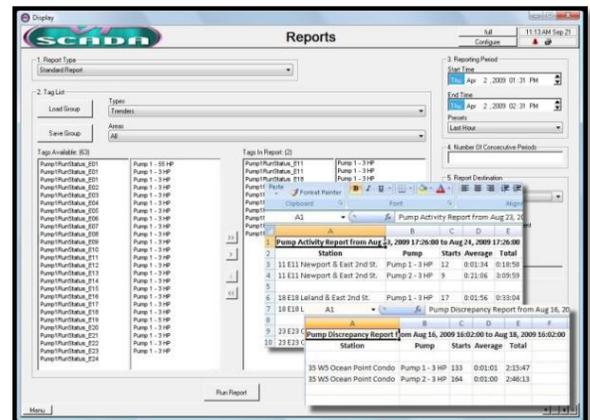
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An example of the VTScada integrated Historical Data Viewer with encrypted operator's logbook



Integrated report generator with examples in MS Excel format