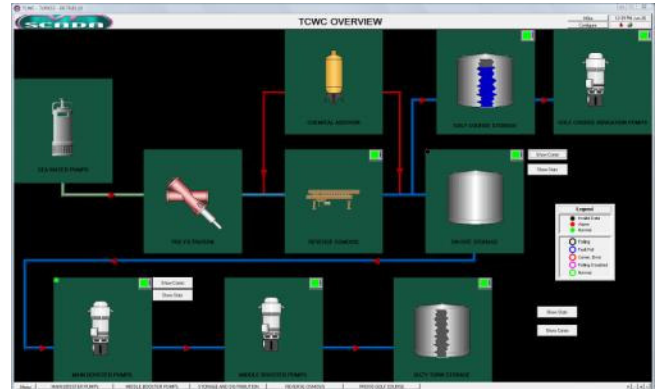




Overcoming Water Scarcity Challenges on Providenciales Island

An integrator uses historical SCADA information to help efficiently upgrade a single source water system without leaving customers high and dry.

By Richard Embry and Christopher Little



Overview page for the completed SCADA software application

Abstract

The residents and industries of Providenciales Island are completely dependent on fresh water produced by a single desalination plant. In 2007, ITT Flowtronex was hired to replace the plant's overworked pumping system and add a booster pumping station to the distribution system. One of the challenges they faced in designing controls for the system was how to maintain the public water supply while the island's undersized ground water storage tanks were removed and replaced with a large single tank in the same location, a three to four month process. During the tank replacement process, the pump stations would be operating 24/7 without backup. The main pumping station was put on-line in July 2008, and the booster station was commissioned in February of 2009. Soon after, Turks and Caicos Water Company Manager, Jared Fulton, began using their new SCADA system to closely scrutinize the pumping infrastructure to ensure that it would be able to meet system demands around the clock when the tank replacement project began.

In this article, Richard Embry of ITT Flowtronex, describes how detailed trending information from the new HMI aided in debugging the new pumping systems, as well as overcoming high friction losses in mainlines due to undersized distribution piping and adjusting operating pressures to conserve electricity during low demand periods.

Providenciales Island

Providenciales is the most populated of the Turks & Caicos Islands, located in the North Atlantic two hundred miles north of the Dominican Republic. Due to the lack of natural fresh water and negligible rainfall, nearly one hundred percent of the water used by the islands industry, tourists, and residents comes from a reverse osmosis desalination plant with an annual capacity of over three-hundred million gallons. The facility takes salt water from wells drilled into the coral beneath the island and forces it at high pressure through ten reverse osmosis membrane packages, which remove 99.9% of the salt.

The Turks & Caicos Water Company Ltd. (TCWC) owns and operates the plant, while the Provo Water Company Ltd. distributes its water to customers. The TCWC is owned and operated by the HAB Group, an investment firm which operates several upscale resorts on the island.

Since 1990, the island's population has surged to 22,500 thanks to the introduction of major casino resorts and a recent wave of retirees looking for beautiful weather and unspoiled beaches. This has put ever increasing pressure on the pipes and tanks that make up the aging distribution system.



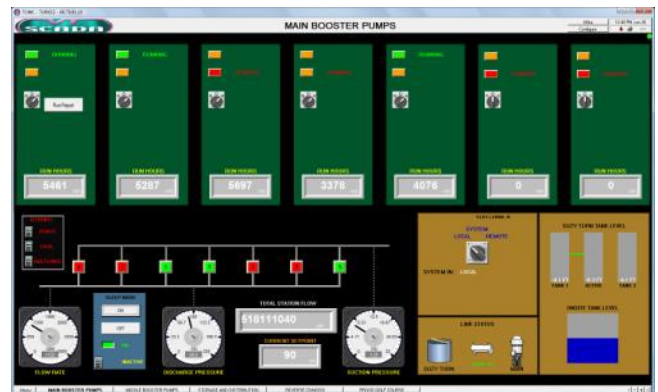
ITT Flowtronex

Richard Embry is the director of the Direct Service Group at ITT Flowtronex. This includes employees engaged in a wide variety of services, equipment commissioning, and turnkey contracting activities. In 2007, following a comprehensive engineering study projecting future water needs on Providenciales, the TCWC contacted Flowtronex about purchasing two new pumping systems to meet this demand. "The original project included two pre-fabricated pump stations--a main pump station for water coming directly from the desalinization plant, and a booster station about six miles from the plant. The client was also interested in a SCADA system, so the municipal department at the Flowtronex plant in Dallas, Texas, turned the project over to my service group for sale and implementation."

The original plan was to integrate the pump station controls with a SCADA system to allow the operator maximum flexibility in adjusting system levels to meet all demands. "The two existing elevated ground storage tanks, which supplied water to the system during low demand periods, were slated for replacement with larger tanks. Due to site limitations, however, the only place to erect the new larger tank was at the site of the existing tanks. For three months, the water supply to Providenciales Island had to be supplied from the new pump stations without any backup storage. The normal control method of basing pump output to tank level had to be supplanted with a flow based control system during the tank replacement project. Reliable operation, and quick notification of any problems with the equipment, was imperative."

An Integrated SCADA HMI

For the SCADA HMI, the project specified VTScada from Trihedral, a twenty-two year old developer of mission-critical monitoring and control software. VTScada uses a library of device drivers to speak to most major brands of remote telemetry hardware such as radios and programmable logic controllers (PLC's). "We've been using VTScada for four years. VTScada was originally recommended to us as being a very user friendly HMI by a sales rep for Control Microsystems. The ease of setup and the ability to expand and connect to a variety of equipment using drivers was very important for this project. Couple that with Trihedral's first class technical support, and it's why VTScada is our first choice on our projects."



Application page for the completed SCADA software application

When the main pumping station was put on-line, the utility of the SCADA system was immediately apparent to the customer, and TCWC began integrating other plant equipment. Site storage tanks, chlorine meters, the reverse osmosis packages, and even a golf course irrigation system were incorporated over the next few months. "The flexibility of the SCADA package is evident when you look at the different types of hardware and communications protocols employed. "The distribution system pump stations use 450 MHz licensed radios for communications, while equipment around the plant utilizes 900 MHz spread spectrum radios. Six of the RO systems are linked to the SCADA PC via fiber optic cable, and four of the units are directly connected via Ethernet. PLC's in the system include various models of Control Microsystems SCADAPack, Allen Bradley 503 and Allen Bradley 505 controllers, and GE Versamax controllers, incorporating Modbus, DF1, and Ethernet communications.

The Completed System

"We commissioned the main pumping station in May 2008, and brought the new booster station on-line in February. Trihedral employees were extremely helpful in consulting with us on some of the situations we encountered in the normal course of implementing the project. For example, when our programmer needed some help with writing script for some custom calculation tags, the Trihedral folks were quick to help and even offered some solutions of their own."

A VTScada full-development license runs on a Windows™ workstation in the plant manager's office at the pump station. System pages are displayed on four separate monitors; two for use by the manager in his office, and two for plant operators downstairs.



Application page allowing users to easily adjust system set points

www.trihedral.com info@trihedral.com

© Trihedral Engineering Limited 2009. VTS, Visual Tag System and VTScada are trademarks of Trihedral Engineering Limited.

All other brands or products mentioned herein are the property of their respective owners.

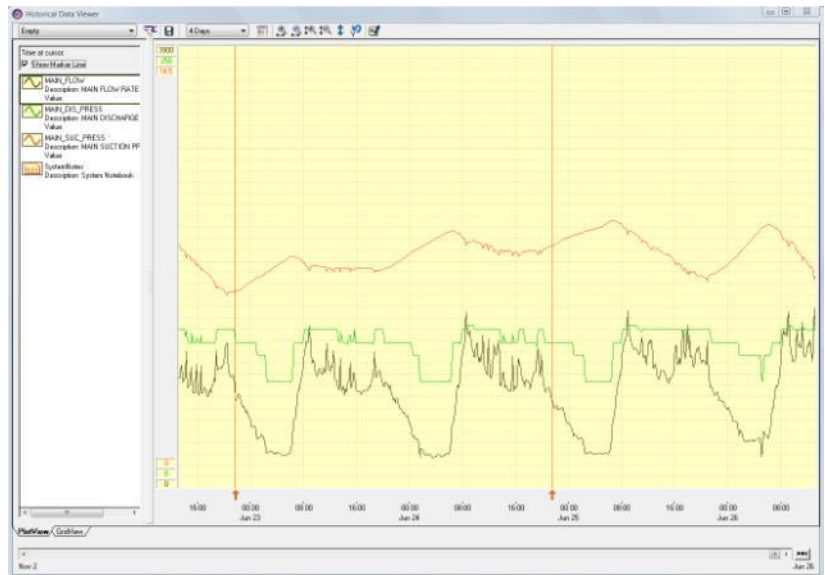
The application also includes an integrated Internet server that allows the manager access to the application from anywhere in the world from a Windows computer with an internet connection.

Two Control Modes

Developers with ITT Flowtronex created a VTScada application that could seamlessly switch back and forth between the temporary tanks and pump stations and the completed infrastructure. "We use a 'Tank Level' mode when the storage tanks are on-line in the distribution system. A 'Local' mode is used during the conversion process, or in the event of a radio outage, to control pump station output and adjust discharge pressure based on flow in the system. The VTScada program enables the operator to seamlessly switch back and forth between the two modes, and even permits the operator to adjust set points for each mode from his office.

Historical Data Viewer

Following the handover, Embry continued to work closely with TCWC staff. "You can use the trending capabilities in VTScada to observe pressure in the system and make adjustments.



A VTScada trending screen plotting discharge pressure, suction pressure, and flow rate over a four day period.

During the first few weeks of operation, we monitored the system's operation on a daily basis, and were able to suggest ways to 'fine tune' the operating programs and parameters." The ITT Flowtronex team was able to use historical and real-time data to achieve the following kinds of efficiencies:

Maintaining Pressure Tolerances – "The distribution piping on Providenciales is marginal at best requiring careful consideration of operating pressures during high flow periods." This includes tank levels and booster pump inlet pressure in relation to output pressure. "VTScada's trending capabilities in particular are very useful in this regard."

Overcoming Friction Loss - "The programming to vary pump pressure based on system flow resides in the pump station PLC's. However, the HMI's window into the distribution system makes it possible to view line pressures and tank levels across the island in real time. Coupled with historical data for virtually any time period utilizing VTScada's trending capabilities, the operator has the information he needs to change pumping pressures and pump sequencing with the click of a computer mouse.

Reducing Energy Costs - "Power on the island is supplied by diesel generators, and it is expensive. By studying trend charts in VTScada, we were able to employ a PLC routine to significantly reduce system pressure during periods of low usage late at night to save energy, yet be able to quickly ramp back up to normal in the event of unexpected need, such as a fire.

Going Forward:

"When we were first contacted, the original scope for the SCADA system was to simply monitor levels at the two new pump stations and the ground water storage tanks, and utilize that data for simple pump control and monitoring. Once the HAB Group realized the versatility of the new SCADA system, they began requesting that more equipment and more functionality be added. Long range plans for Providenciales call for a new desalinization plant to be built on the west side of the island as demand for water continues to increase along with new development. We believe that the Turks and Caicos Water Company has full confidence that their new SCADA system will be the right tool for integrating the new infrastructure into their present system."

"Our recommendation to clients interested in SCADA is that they do not paint themselves into a corner by purchasing proprietary equipment or so-called "configurable" systems which may be very limited in flexibility. Select a user-friendly, non-proprietary system which is readily adaptable to all types and brands of control and communications equipment, and which can be easily expanded to meet future needs."