

Innovative Partnership yields low-cost Treatment Plant Upgrade



When the City of Brevard, a western North Carolina municipality decided it was time to upgrade their water treatment operations, they turned to InstruLogic, a trusted Measurement and Control partner. Their 2.6 MGD Water Treatment Plant located just outside the city draws water from Catheys Creek, a mountain stream originating in the Pisgah National Forrest. This Conventional Treatment Plant, built in 1979 runs 7 days per week, 14

hours per day serving serving 8700 customers. Prior to the upgrade it was operated with the original manual controls.

Project objectives

Fewer steps

The layout of the plant includes multiple buildings spread out over about an acre. The main control building is a multistory structure with the control room on the second floor and a chemical feed room on the first floor. One of the primary objectives of the upgrade was to reduce the number of trips required to maintain normal operations. Prior to the upgrade, rainy days required lots of trips up and down the stairs to keep the treatment process operating within parameters. One operator, who has worked in the plant since it opened recalled making as many as 35 trips up and down the stairs in a single shift.

The Raw Water Pump Building is located approximately 150 yards from the Control Building at the inflow on Catheys Creek. In the fall leaves often clog the inlet screens. In the winter ice crystals can also clog it, requiring periodic blow off of the screen to maintain consistent inflow. Varying conditions require changes in blow off timing. In the past, plant operators had to walk all the way from the Raw Water Pump Building to the Control Building to make these adjustments.



Simplified Operation

A second objective for the upgrade was simplified operation. Start up, shut down and backwash procedures were all time-consuming multi-step processes that involved numerous pumps and valves. Careful timing and 100% attention of the operator were required. Any distractions or interruptions could result in potentially costly errors that impacted water quality.

Greater visibility

A third objective was greater visibility into their process. The plant has multiple points to control, but the 'Big Blue Panel' provided the only location that operators had any visibility into the process and primary control of operations. Any time the operator was away from the control room, there was no way to see how the plant was operating.

Creative thinking

More a requirement than an objective, creative thinking was essential. Because the water produced by this plant had been of such high quality and the plant run so reliably, obtaining budget for an upgrade had not been a priority. The old saying, "if it isn't broke don't fix it" certainly applied here. So the badly-needed upgrade had to be accomplished with a minimum amount of funds. This required some creative thinking by utilities management.



Most municipalities opt for turnkey solutions. The convenience and lower risk of this type of project make them attractive to operators. But this comes at a price. Turnkey systems usually require multiple service providers: Engineering firms to design the control strategy, a contractor to build and install the panels, electricians to do the plant wiring and a SCADA firm to program controls and HMI. Engineering firms, contractors, SCADA technicians and electricians are all valuable and essential members of any project team. But they each come with their own cost and coordinating them requires a significant project management effort.

Some municipalities consider prepackaged SCADA solutions as a cheap alternative to turnkey systems. These DIY projects are attractive because of their perceived low cost. But they are only cheap to buy. Experienced operators know that the "Y" in DIY will pay a price in terms of time, attention, frustration and unnecessary exposure to professional risk. Furthermore, the limited capability and lack of customization provided by DIY systems limit their usefulness, future expandability and user satisfaction. After all the effort required, the "Y" in DIY is often disappointed.

Brevard opted for a third and more innovative solution. Partnering with InstruLogic, a trusted and capable technical services provider, Utilities Management found a solution that provided all the benefits of a Turn-key upgrade closer to the cost of a DIY project. Leveraging their in-house strengths they brought in a partner to provide only the additional expertise they needed.

The Project

Partnership

The plant operators had a thorough understanding of their process, qualified electricians and project management capabilities. But they wanted help developing a control strategy, building the panels and programming the HMI. While they could have developed these capabilities in-house, they wanted to focus on more important things, like water production. A partnership with InstruLogic allowed the utility operator to do what they did best by having InstruLogic do the parts they didn't want to do.

Project Management

Everything about the project was structured to minimize cost and simplify communications. A large white board was used as a centralized and highly visible way to list requirements and track progress. Jeremy Cole, InstruLogic's Senior Programmer, translated these requirements into a system design, hardware and programming requirements. Control panels were built offsite. Wiring details were provided to the Utility's Maintenance Department. Wire was pulled from various parts of the plant, back to the control room. According to Dennis Richardson, Plant ORC, *"by eliminating separate contractors for Engineering, Construction and System Integration, communications were greatly improved. Nothing was lost between operator feedback and system implementation. Brevard personnel communicated directly with Jeremy and things just got done. Nothing was lost in translation though a chain of independent parties."*

Project deliverables

Touchscreen panels were installed at three critical locations in the plant- Control Room, Chemical Feed Room and at the Raw Water Pump Building. With the new system installed, the plant can be monitored and controlled from any of these locations. If a problem occurs, no one has to run back to the control room to initiate a plant shut-down any more. And with all monitoring and control functions easily accessible, no one has to run up and down the stairs just to make some adjustments.

InstruLogic programmed **automatic sequences** for plant startup, mid-day shut down, end-of-day shutdown and filter backwash. At the touch of a single button each of these sequences proceed automatically with limited operator interaction. The mid-day shutdown enables Brevard to idle the plant for an hour or so when demand is low. It differs from end-of-day shutdown in that flocculators continue to operate while the rest of the plant is idle. Keeping the flocculators running during shut down prevents a slug of turbidity from entering the process after restart. This level of automation has sped up these sequences and eliminated opportunities for operator error.



Flow-pacing was introduced for raw water flow and chemical feed pumps. In the past, chemical feed pumps and water flow rates operated independently. Now, flow rates can be precisely controlled and matched to chemical feed rates.

During filter backwash sequences, chemical feed pumps had to be manually cycled on and off to prevent over treatment when the plant was running on a single filter. Now, chemical pumps adjust themselves according to flow rate. This results in better resource utilization and the more consistent water quality.

Project Components

InstruLogic, Brevard's project engineer and technology partner, selected proven, reliable and cost-effective system components that satisfied immediate requirements while positioning the water treatment plant for future potential.

WAGO PLCs



Low cost, reliable and flexible, WAGO provides a wide range of I/O connectivity. WAGO's unique system architecture provides independent Controller and I/O modules. In the future, should Brevard desire a higher performance or more feature-rich Controller module, it can simply be replaced while retaining all of the existing I/O. Virtually all other PLC vendors require I/O modules be replaced when Controller modules are upgraded. This will keep costs and complexity of future upgrades to a minimum.

Ignition by Inductive Automation

InstruLogic selected Ignition by Inductive Automation, the industry-leading toolset for for Supervisory Control and Data Acquisition (SCADA). Ignition combines SCADA, Alarming and Reporting all into one integrated platform that provides templates and object-oriented design tools. This saved Brevard time and money in the project developments stage. Ignition also saves money through its unique licensing model- unlimited tags, clients, screens and connections. Typically the introduction of automation to a manually-run plant begins with simply automating existing processes. But soon, the value of advanced measurement & control becomes more apparent, additional capabilities such as trend analysis, intelligent alarming, process optimization etc... become desirable. Adding these capabilities is simply a matter of programming them. Initial and future system functionality are only limited by the team's imagination, not licensing costs.



Ignition is also web-based. Although Brevard has not yet added remote monitoring and control to this plant, it is easy to add this functionality to any internet-connected device such as a remote PC, smartphone or tablet. No additional programming is required.

Built on industry standards- SQL, Java, Python and OPC UA, Ignition is reliable, robust and supportable for the life of the project and beyond.

Fiber-Optic Networks



VFD pumps and other heavy industrial equipment generate electrical noise that can interfere with sensitive electronics including computers and networking. Fiber-optic networks provide reliable, high-performance communications in electrically noisy environments like water plants.

Dual Redundant Servers

InstruLogic implemented dual-redundant servers to run the SCADA system. In the past high-availability computing was only considered for large mission-critical financial systems in banking, securities trading and retail transaction processing. But what could be more mission-critical than supplying safe and high quality water to the people of your community? Computer hardware has become so inexpensive, it is easier than ever to obtain highly reliable systems by simply building systems with two of everything and integrating them in a high-availability configuration. If any primary system component fails, a back-up component automatically takes over operations with no interruption in service or loss of data.



Panel-PC Displays



Panel PC's are fully functional PCs, packaged as touch screen devices. They provide full access to plant monitoring and control requiring only AC power and a network connection. Ignition allows an unlimited number of these devices with the server license.

Project success

Partnering with InstruLogic, Brevard obtained a modern, full-featured measurement and control system customized for their needs for about half the cost of a traditional turnkey project. The project delivered on time and the unique partnership resulted in a substantial savings, about half the cost of a similar project involving multiple contractors. For anyone considering a similar project Dennis suggests, "Just call Jeremy at InstruLogic. They will get it done for you."

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