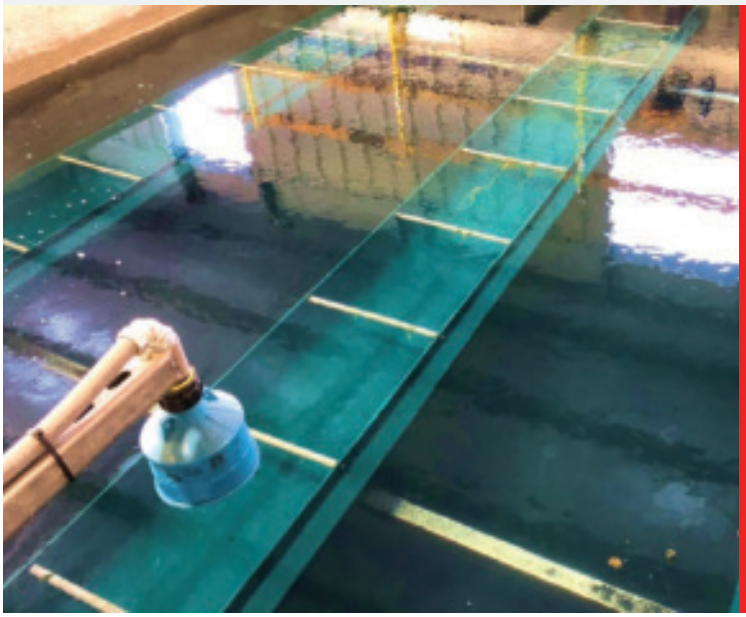
BEDROCK®
OPEN SECURE AUTOMATION

Case Study

Water Treatment Plant Upgrades to Open Secure Automation on Filter Controls

The city of Hot Springs, Arkansas projected that its antiquated filter controls would not be adequate to meet anticipated future demands. The open object-oriented system design capability of Bedrock's IDE made quick work of integrating the SCADA system across the secure Bedrock platform — improving filtration and with that, water quality, water conservation and regulatory compliance.



SUMMARY

Customer requirement: Upgrade antiquated filter controls to meet rising demand on its water treatment

Bedrock Automation Solution: Delivered PLC functionality across Bedrock Open Secure Automation (OSA) Platform, in collaboration with SCADA software supplier Inductive Automation and system integration firm Brown Engineers

Result: Dramatic improvement in automatic backwash process, helping conserve water, improve water quality, and initiate collection of filter data needed for extending regulatory run-time limits; also provided basis for cyber secure control system

The main water treatment plant in Hot Springs, Arkansas had a problem: nine filters critical to its treatment process couldn't achieve adequate flow rates necessary to meet future production goals. Also, filter flow control wasn't accurate enough and antiquated push-button operation consoles presented training challenges for new personnel.

Changes were needed, but they had to be made within the few months when water usage is low because high-demand months required the plant to operate at near capacity.

Engineering analysis determined that the filters required structural rehabilitation to address hydraulic problems and that additional instrumentation and controls would be needed to meet performance goals.

An Open Secure SCADA Solution

Although this was a rehabilitation project, from an automation standpoint it was a brand-new installation, which enabled Brown Engineers to take an integrated ap-

Upsized features; downsized space.
The three older filter consoles shown to the left are being replaced by the single new filter controller, to the right. Touchscreens mounted on the new consoles use the same Ignition interface screens as those in the control room, streamlining implementation of system-wide control screen changes.

proach in implementing everything from the PLCs to the SCADA system.

Brown Engineers had already implemented redundant gateway architecture around Inductive Automation's Ignition SCADA platform, so it was critical that the new systems interoperate with that. Since the Bedrock integrated development environment (IDE) is based on CoDeSys, an industry-leading IEC 61131 platform, an object-oriented implementation approach was possible. This methodology groups common design elements into functional units, then extends them to provide more specific functionality, virtually eliminating duplicated code throughout the application. Using that methodology, Brown programmers developed software components for analog and digital inputs and outputs. They then used these components to design analog and digital control functionality for isolation valves and other devices, from which they built elements to automate operation of entire filters.

In addition, relatively minor extensions allowed the PLC functionality to simulate control inputs so the system could be extensively tested without physical I/O. Because simulation was added by extension instead of modification, there was no risk of the simulation code interfering with the production code.

During the PLC development process, Brown Engineers also created Ignition user-defined types (UDTs) and templates for each PLC element using the same object-oriented approach. UDTs are tags that leverage Ignition's object-oriented data design prin-

ciples by creating parameterized, reusable “data templates”.

The integrators then combined these basic elements into a composite control component that addressed entire filters and linked them together as data structures and visual templates that required only one unique parameter: the filter number.

This modular approach also streamlined incremental development, so that developers could add a new parameter to the object definition in the PLC, the corresponding UDT, and the corresponding template. Once changes were saved, the Bedrock IDE and the Ignition software applied them to each instance automatically, eliminating the configuration management nightmare typical of a traditional copy/paste/edit approach.

One of the most challenging aspects of this project was the requirement that each filter perform an automated backwash sequence of more than 30 steps. The integrators simulated one filter and used the basic functionality for both flow control and auto-backwash. When testing of the automatic backwash sequence with the internal simulator was

Control Panel with Bedrock PLCs

This project also demonstrates how beautifully Ignition, with its versatility, scalability and reliability, works with the ultra-performance Bedrock Open Secure Automation that provided the PLC functionality for this renovation. To date, Brown Engineers has paired Ignition with Bedrock at four Arkansas utilities. Without exception, these projects have exceeded expectations for performance, reliability, built-in security, and ease of use.

PROJECT FACT SHEET

- Filter Rehabilitation (9 Filters)
- Filter Building Enclosure
- Sodium Hypochlorite Facility
- High Service Pump Control Valves
- Extensive SCADA Integration

Integrator: Brown Engineers, LLC

HMI/SCADA: Ignition by Inductive Automation

PLC: Bedrock OSA by Bedrock Automation

Construction Cost: $3.4 million

Integration Cost: $525,000

complete, the team developed an external simulator on another Bedrock PLC, which included more realistic analog inputs and outputs with noise. They then interconnected the I/O of the two systems to perform end-to-end real-world simulation.

All testing was done with a single instance of the Bedrock PLC control and Ignition filter blocks. Each unit would control three filters, so to prepare for deployment, integrators made two copies of the filter block in the PLC and two copies of the filter UDTs and templates in Ignition.

The project stakeholders were invited to interact with the system simulation months before the equipment was delivered to the site; including full auto-backwash sequencing. Changes to the sequence were identified during simulation and implemented before deployment, resulting in no major changes to the automatic backwash sequence after deployment.

Result

The automatic backwash process is now more reliable and uses less water, which improves efficiency. Backwashes are now accomplished quickly with a touchscreen, instead of lengthy sessions at a sea-of-switches console. Flow control has been remarkably steady (see next page), improving water quality where the six upgraded filters maintained a consistent flow rate, flow rate of the legacy filters varied between 1400 and more than 2000 gpm. The City is pleased that the improved performance exceeds expectations, and that Brown's phased approach accommodated both water usage demands and a tight construction schedule.

In addition, the City is now collecting historical performance data for the purpose of requesting extended filter run times from the regulatory agency, which should result in additional cost savings and capacity improvements in the future. In this project, Brown Engineers accomplished a unique blending of the Ignition object-oriented SCADA software and the Bedrock Open Secure Automation technology. With it, Hot Springs is well-equipped to be able to scale its filter controls easily to meet growing water demand while at the same time have the beginnings of a cyber security infrastructure that will protect the area water supply.

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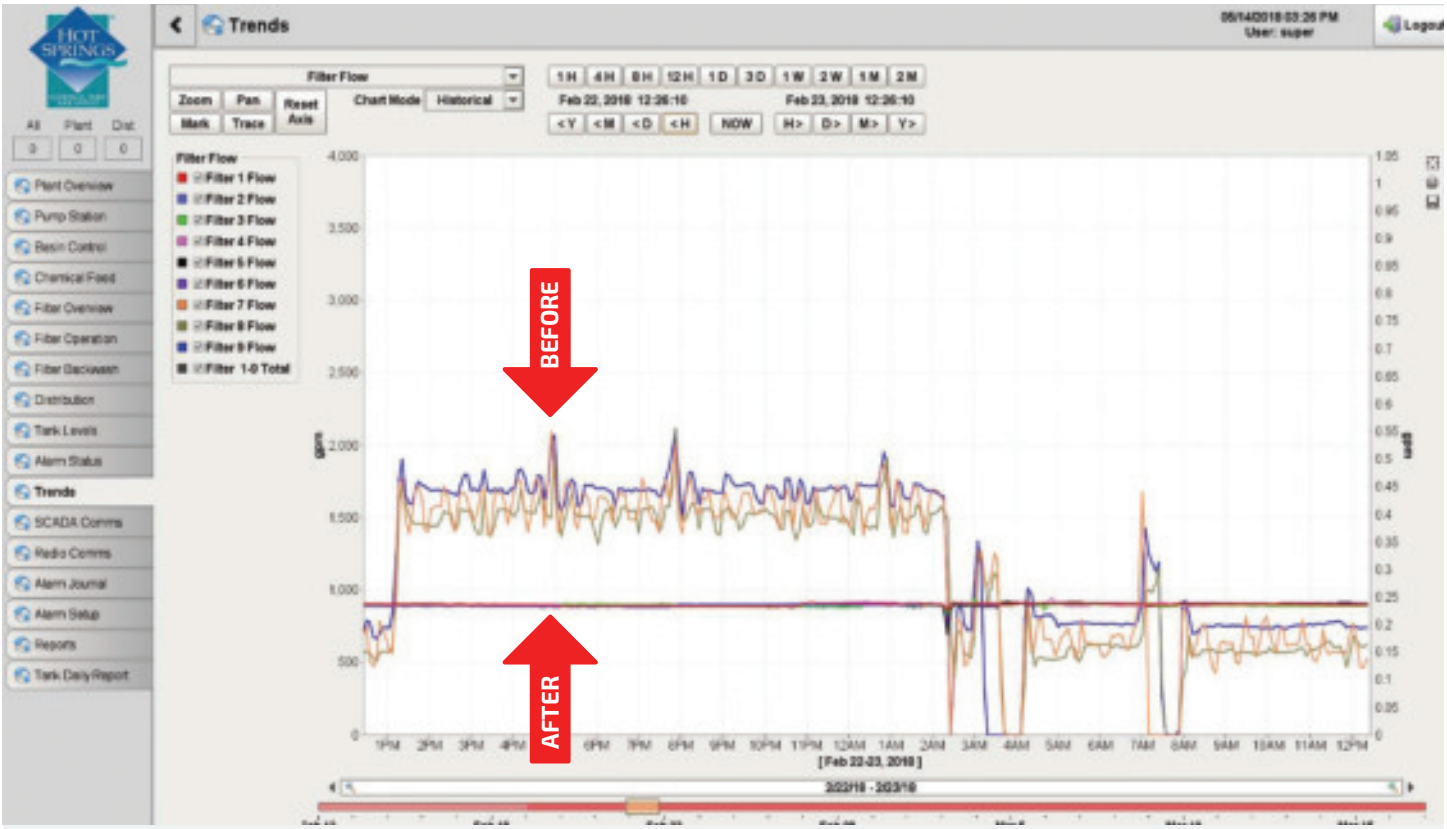

Before and after.

In this view of all nine filters, the red line represents the consistent performance of the upgraded six filters, while the wavy lines represent the legacy filters, for which flow rates vary from 1400 to more than 2000 gallons per minute.

About Bedrock Automation

Bedrock Automation, based in San Jose, California, is the maker of Bedrock® the world's most powerful and cyber secure automation platform. This Silicon Valley company has assembled the latest technologies and talents from the automation, cyber security and semiconductor industries to build an unprecedented automation solution for industrial control based on three prime directives: simplicity, scalability and security. The result is a new platform of automation called OSA®, Open Secure Automation, with a revolutionary electromagnetic backplane architecture and deeply embedded ICS cyber security to deliver the highest levels of system performance, cyber security and reliability at the lowest lifecycle cost. **Build on Bedrock.**

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