Application Guide

ProSoft TECHNOLOGY

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Water & Wastewater

Introduction

If you work in the water and wastewater industry, you know you're not just dealing with critical infrastructure: You're managing processes that are absolutely crucial to our lives. Communities can't operate without drinking water and wastewater treatment. Every process you support and every decision you make is vital. Without water, there's no life on earth.

As the population continues to rise—and demand for this essential service grows exponentially—equipment, needs, and service-area distance continue to change as well. To keep up, plants often have to add on, renovate, or spread out geographically to make up for insufficient infrastructure. Connecting the disparate components that arise as a result of these expansions while maintaining data integrity and high levels of plant performance is becoming a more complex endeavor.

Automated systems help today's geographically dispersed water and wastewater treatment systems operate at peak efficiency while keeping costs in line with budgets. They also allow you to detect problems (leaks, overheating of blowers, etc.) before they become major catastrophes, as well as improve efficiency and quality to save money, maintain water security, and reduce stress for employees. This 24/7 access to automation technology takes plants from reactive to proactive and predictive as the industry shifts to smart water operations and deploys emerging technology to gather and use data to solve problems.

To make automation work, however, connectivity and data integrity are essential. This application guide walks you through considerations to address connectivity needs and tactics for different parts of your water and wastewater plants.

Before You Get Started: Confirm Data Integrity and Reliability

To maximize the value of your systems and work automation to your advantage, it's important to make sure data is accurate and reliable. Data integrity is more important in these environments than nearly anywhere else: It can impact the availability of clean water.

To gauge the integrity of your data, ask yourself questions like:

- What's the condition of the equipment providing the data?
- Have instruments been out in the field for a while?
- When was the last time the sensors or devices were checked?
- Are the sensors that gather data regularly cleaned and calibrated?

While there's lots of talk about real-time data, relying on this type of information in water and wastewater treatment plants can be risky. Although it can be valuable, real-time data is only usable if connectivity is always on and functioning. The larger a plant grows, the higher the number of communication lines involved. Reliance on real-time data assumes that each one of those lines to each remote asset is always open—but they may not be. To solve that problem, DNP3 (Distributed Network Protocol) allows you to capture data at the source and put a time/date stamp on it so the information is available even if it isn't delivered in real-time. From there, it can be used and analyzed to improve productivity and efficiency—just like real-time data can.

If the system goes down—even for a few seconds—you don't have a clear picture of what happened. Because DNP3 utilizes this date and time stamp, you can go back and look at data from that time; there are no gaps or holes in the information.

DNP3 data can be prioritized and classified as well. You get to decide which pieces of data are more important than others (categorizing fault conditions as a priority). For example: If a pump doesn't turn on at the right time, that's something you want to know about right away. Classifying the data allows you to select which information takes priority and gets communicated first because it's an indicator of a problem. The other data is transmitted behind this data so you can analyze it once an hour, once a day, once a week, or whatever is required.

A Close Look at the Systems that Make Up Water & Wastewater Treatment Plants

Although they come together to form one cohesive water and wastewater entity, treatment plants, storage systems, and distribution systems have their own automation needs and requirements. Let's consider key considerations for each system.

Treatment Plants

Treatment plants operate much like small factories as they remove solids and pollutants, break down organic matter, and restore oxygen content of treated water.

Automation lessens the amount of energy and chemicals required to maintain operations and remove contaminants and impurities. It also reduces the amount of water lost during the treatment process, preserving resources and money.

To provide insight into where real-time problems are occurring, automation also connects you to valuable data from SCADA systems (flow statistics, online monitoring, dissolved oxygen (DO) measurements, etc.), as well as data from lab information systems and computerized maintenance management systems. SCADA systems have changed the way plants operate by improving how operators absorb and interact with data. The information they provide can be used to proactively address concerns before they become larger issues (a broken pump, for example).

Reliable connections to remote assets are another important step in making sure data collection happens without fail. This involves a redundant connection to your SCADA system. A completely redundant system is a called a "hot standby industrial control system." In this setup, there are two of almost everything in a facility. The redundant system acts as a backup, waiting to take over in the event of failure. Large utilities with equally large budgets may decide to build redundancy into every treatment plant system.

Others may choose to build redundancy into only certain systems.

To ensure a reliable connection from the SCADA system to your network, make sure your plant uses diagnostics that monitor not only data, but also communication links. They should verify things like:

- Are communication links up and running?
- How many successful & failed messages have occurred?

- What percentage of your data is coming through?
- What's the strength of the connection?
- Is there any interference?

Other important considerations for treatment plant automation include:

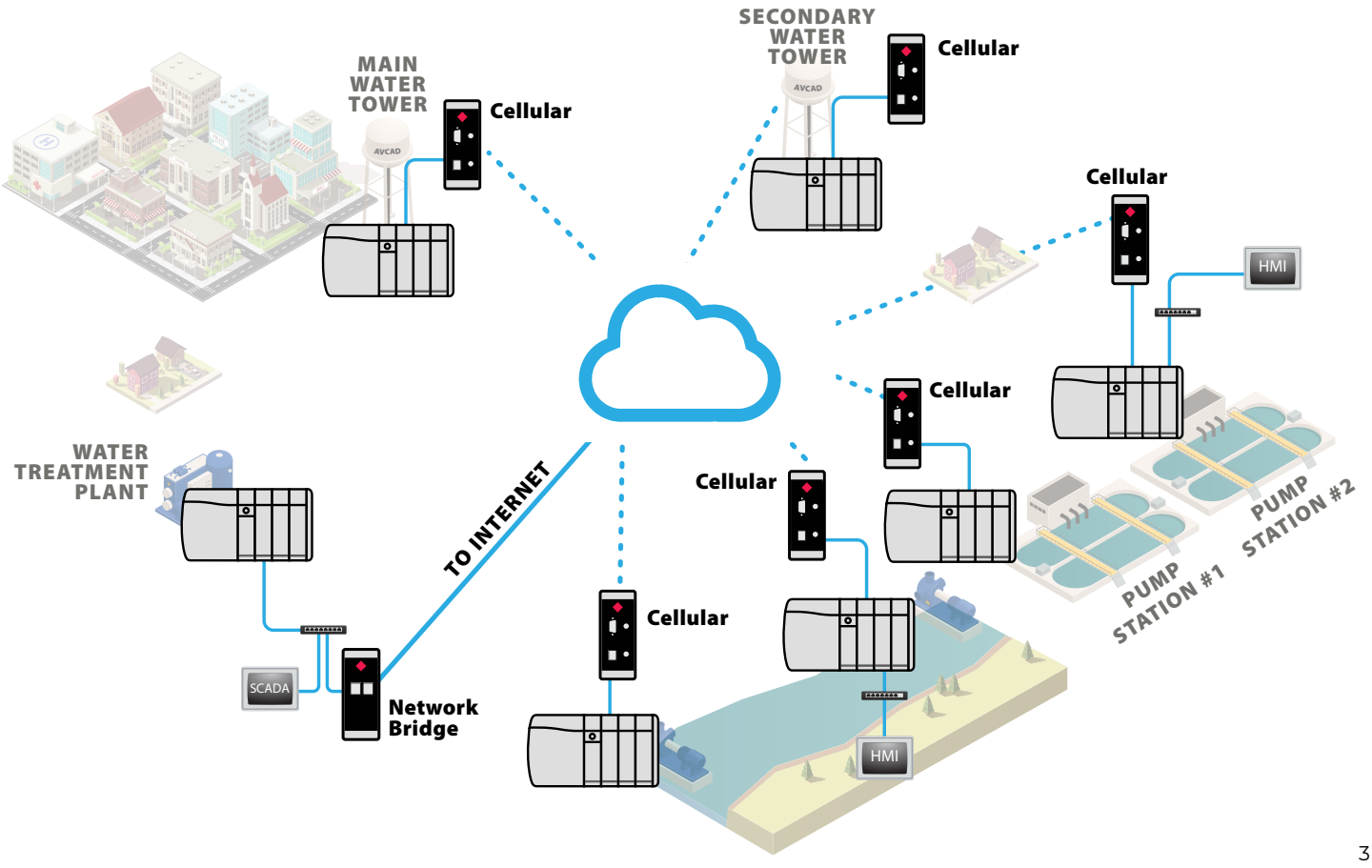
- **Network fault tolerance** (the ability to operate even when a component fails). Most water and wastewater plants make use of ring topology to create this type of redundancy.
- **Cabling infrastructure.** The majority of water and wastewater plants have a fiber plant backbone to ensure optical isolation and span network segments that need to extend beyond 100 meters (the limit of category cable). But much of the fiber in these environments is multimode (OM1) and at least two decades old, making use of much slower network technology than what's available now. Although fast speeds aren't as vital in this industry as they may be in others, it's still important to plan for what lies ahead. To futureproof, singlemode fiber (OS2) will be able to carry any data speeds we encounter for the next 50 years (or longer). What may seem like too much now will only serve you well in the future. As you decide to add devices, such as cameras or cobots, you can do so without worry or paying for upgrades.
- **Preventing IT incidents from impacting operations.** To make sure breaches or IT network issues don't affect water operations (and vice versa), plant networks should be separated from office/control room networks through VLANs and Layer 3 (inter-VLAN routing). This doesn't mean IT and OT systems can't communicate: It simply means the two networks need to be segmented while also allowing data convergence between the plant and office when needed (when production data needs to be reported to salespeople, for example).

Storage Systems

Unlike treatment facilities, storage systems are often remote or standalone storage tanks and reservoirs. While other parts of a water or wastewater treatment plant may require onsite workers, these systems can typically operate without lots of hands-on work. This makes remote connectivity necessary.

Not only does remote connectivity make it possible to monitor SCADA data and performance from afar (instead of having someone drive around, write things down, and enter the data into an Excel spreadsheet), but it also accurately monitors and records data that complies with U.S. Environmental Protection Agency (EPA) and National Primary Drinking Water Regulations.

In addition, it allows third parties with service-level agreements to access the network and verify telemetry data. We've seen water treatment plants set up their networks like VPNs to allow these third parties to check data as needed; however, problems arise when that access isn't



controlled. In one recent situation, a third party was granted access to the entire plant network instead of solely the data they needed. Later, when a cybersecurity company came in to conduct a penetration test, the plant failed because no steps were taken to secure or restrict access to only the data needed
(and making sure that access was read-only).

Instead of taking a VPN-like approach, the plant could've implemented required layers of approval before someone from a remote location could connect and read or make changes to device values. The plant could have additionally made sure access was recorded so they knew who was logged in, for how long, and when.

In storage systems, remote connectivity also lets you respond faster to potential problems instead of driving across town to see what's happening. If you discover that you need to be on-site, you won't be starting from scratch when you arrive: You'll be better prepared to resolve the issue quickly because you'll know exactly what's happening and which piece of equipment needs attention.

There's also another benefit to reliable remote connectivity: It makes it simple for retired workers to weigh in when needed. Many professionals in the water and wastewater industry have worked at the same plant for decades. As new workers take over and get up to speed, you may occasionally need to reach out to retired workers. Getting their input and advice is much easier if they can connect remotely and tell you what they think (from wherever they are) vs. driving to the plant.

Distribution Systems

To bring safe drinking water and fire protection to communities, distribution systems consist of a series of connected pumps and valves that move water from treatment plants to consumers — or directly from the source to the consumer if treatment isn't needed. In other words: Distribution systems move water to where it's needed most.

As with treatment plants and storage systems discussed earlier, distribution systems also heavily rely on remote connectivity for operation. Pumping stations are key to moving water to all locations — despite poor pressure or flow. The ability to monitor these stations remotely can provide immediate, real-time insight into friction loss, flow rate, water viscosity, flow direction, and possible leaks.

Protocol conversion is also an important consideration to help connect disparate equipment and the protocols they rely on: DF1, HART, DNP3, Modbus Serial, and Modbus TCP/IP, for example. In-chassis and gateway modules can convert one data protocol to another to allow communication between devices that otherwise wouldn't be able share information.

This allows older devices using protocols like DF1 to connect and communicate with newer devices that use updated protocols. This lets you take a phased approach to modernizing equipment; instead of upgrading everything all at once, you can swap out equipment over time and in accordance with budgets without downtime or losing functionality.

If you're undertaking a pump-station overhaul, for example, and you can't replace everything all at once, protocol conversion can help make the transition much smoother. Instead of building separate networks, a single network can be created. From there, several virtual networks can simulate having different switches and cables. While there seem to be multiple networks, the network really only has to be built once. Over time, it can be adapted as devices and equipment are modernized.

Improving Cybersecurity Posture

Cybersecurity isn't a destination—it's a journey. It's not as simple as providing secure remote access or applying software patches, and there's no silver bullet that can solve all security problems. Guidelines and recommendations vary based on things like water capacity, system convergence, and infrastructure age.

Over the past few years, attacks on water and wastewater treatment plants have increased and been heavily talked about, which is shining a spotlight on the vulnerability of utilities. Although publicized events were largely IT issues (vs. OT issues), it's still a good reminder of what can happen to a plant's network. Recent incidents have involved attacks on remote-access systems (allowing bad actors access to the chemical composition of water treatment), as well as exploitation of outdated computer systems, billing systems, and leaked credentials.

Improving cyber hygiene in your plant is a continuous process that can be approached in phases over time.

A good first step involves visibility: making sure you can "see" and are aware of all your network assets. If you don't know what you have, then you won't know how to protect those things.

After ensuring visibility, make sure you can also see asset configurations (IP addresses, MAC addresses, OEM info, software versions, firmware versions, etc.). From there, you'll want to look at other areas of CDE (common desktop environment) vulnerabilities. Do you have automated, continuously monitored systems to detect changes in these areas, as well as OT-specific solutions that detect and prioritize critical vulnerabilities? Finally, consider security policies and/or regulations that apply to your network environment. How are you detecting change, alerting, and reporting on policies and regulations?

Cybersecurity is a big task. If you're not sure where to start, the Center for Internet Security (CIS) is a great free resource. It offers 18 CIS Controls: a recommended set of actions for cyber defense that provide actionable ways to prevent attacks. They cover everything from inventory and control of enterprise assets (knowing what you have) to incident response management and penetration testing (verifying the security of your infrastructure). Once you make your way through these 18 CIS Controls, you can be confident that you've created a robust security posture.

Your Automation & Connectivity Partner: ProSoft Technology

ProSoft Technology can help you reliably connect your equipment to ensure dependable communication, monitor devices, perform predictive maintenance to increase productivity, and limit time spent on-site. Modernization can be done according to your timeline and budget, minimizing downtime during the upgrade process.

Offering many combinations of real-time protocol conversion, ProSoft helps connect your incompatible systems. We bring real-time data directly into your control systems to show measurable results from IIoT-connected equipment. We can also help integrate remote connectivity with built-in security and safety to reduce your travel and maintenance costs.

Whether you're just getting started and have no security professionals on staff or already have several solid policies in place, we can help you find and deploy real-world solutions that maintain compliance and performance while streamlining operations and costs. Our globally dispersed networking experts are always nearby to answer questions and offer technical support virtually or in person.

Learn more about ProSoft's solutions for water and wastewater applications: psft.com/DE2

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