Municipalities and investor-owned utilities are accustomed to anticipating, preparing, and responding to weather emergencies. However, another type of storm is brewing, and it requires a different kind of preparation. Dependent on neither climate nor geography, this “storm” is just as likely to impact a facility with a capacity of half a million gallons per day (MGD) as it is one with a capacity of hundreds of MGD.

In this “storm,” several forces are colliding. Examples include an aging infrastructure and workforce that is retiring in increasing numbers, reductions in funding while energy costs are rising, security threats, and evolving regulations.

The best way for municipalities to weather this storm is by developing an integrated automation master plan. This lays the foundation for unifying operations throughout their entire service area in a phased approach over time. Replacing existing disparate islands of automation with a common, integrated platform enables municipalities to operate plants more efficiently, reduce costs, and take full advantage of advanced control technologies that facilitate information sharing throughout the organization.

Let’s take a closer look at the forces that are reshaping the industry and how their impact can be mitigated through advanced automation technologies deployed on a common platform.

**Infrastructure decay and the funding gap**

In the United States alone, billions of dollars are needed to replace aging infrastructure and support population growth. For example, aging and poorly maintained pipes equate to 240,000 water main breaks each year in the USA. While water losses average 10 to 15 percent, that number can be as high as 30 percent in older cities. In addition to the loss of a precious natural resource, there is a steep financial price to pay. The loss of 18 billion gallons of water translates into the loss of US$2.6 billion annually.

Despite this very real need to invest in infrastructure, there is a projected shortfall of $100 billion dollars in the USA for routine maintenance over the next five years alone. The US government, at one time a major funding source for capital projects in the country, has all but dried up. In 1978, the US government funded three-quarters (78 percent) of capital projects; today, that number is only about three percent.

Municipalities are increasingly searching for operational savings to fill this significant capital shortfall. With a unified automation platform, municipalities and investor-owned utilities have more visibility into their system-wide operations and are more equipped to implement advanced automation solutions that enable significant operational savings. For example, incorporating predictive maintenance software applications, intelligent field devices, and asset optimization solutions make it possible for organizations to reduce machinery operations and maintenance costs and to maximize the life of pumps, motors, and other rotating equipment. Not only do these solutions help reduce costs, but they also boost operational reliability.

**Workforce issues**

Another issue is brain drain. Over the next five years, nearly one-quarter of industry personnel, including managers and supervisors, operators and engineers, are expected to retire. Replacing these experienced employees with inexperienced workers – if funding restrictions allow replacement at all – is a concern, as operational effectiveness and efficiencies can be negatively impacted.

Advanced automation technologies can help reduce operational costs, improve efficiency, comply with regulations, and protect against cyber attacks. **Doug Johnson** of Emerson Process Management Power & Water Solutions explains.

An important aspect of security is the ability to give end users the option of a backup, off-site control center so that operations can continue in the event that the treatment plant has to be evacuated due to natural or man-made events.
affected by the loss of such expertise. As such, automation solutions such as simulation technology, which help shorten the learning curve of new employees and therefore reduce the risk of errors and regulatory violations, are becoming even more important to municipal managers.

As a training tool, simulators teach operators to more safely and effectively operate their facilities. For example, they can try new operating procedures safely without risking an environmental breach. While change can be difficult, hands-on simulation helps operators limited by autonomous PLC-based controls to confidently make the transition to the expanded capabilities of today’s more highly automated systems. This translates into enhanced operator performance and, subsequently, more efficient plant operation.

Salih Kharkar, manager of process engineering at the District of Columbia Water and Sewer Authority, knows this too well. In the late 1990s, the authority embarked on an ambitious project to upgrade operations at its Blue Plains facility to Emerson’s Ovation integrated process control system. A decade later, this project has proven to be beneficial on a number of levels. One area of improvement pertained to workforce optimization. Previously, 160 operators were needed to manually operate the plant, whereas the automated Blue Plains facility now runs smoothly with 60 operators – a reduction achieved primarily through attrition and reassignment. The new control system also makes it easier to troubleshoot and resolve equipment problems, further boosting personnel and plant efficiency.

Energy management
By their nature, water and wastewater treatment are energy-intensive processes. In fact, the US EPA estimates that three to four percent of energy consumption in the USA is used for water and wastewater services, which equates to roughly 45 tons of greenhouse gas. There is also a financial cost. The US Department of Energy estimates that energy costs typically account for 10 to 20 percent of a water or wastewater authority’s total operating budget. In the USA, drinking and wastewater systems spend nearly $4 billion per year on energy to pump, treat, deliver, and collect water, according to the US EPA.

Process optimization solutions deployed on a common, integrated automation platform offer a means to enhance equipment performance and deployment, resulting in decreased energy costs. Through sophisticated computer modeling, these solutions can optimize a utility’s pumping network, determining the most cost-effective mix of available pumping resources at any given time. For example, the model can determine whether it is better economically to start an additional pump during peak demand periods versus incrementally increasing the capacity of pumps already in operation. Reduced energy use makes sense from an economic and environmental perspective, as it helps municipalities reduce carbon emissions.

Security
Here’s an alarming statistic: According to the US Department of Homeland Security, growth in water industry cyber attacks from the years 2000 to 2004 and 2005 to 2009 was 367 percent – exponentially higher than other industries, including power, food and beverage, and chemical.

Certainly, a heightened interest in security is a fact of life in the water and wastewater industries today. The consequences of security breaches, including the loss of potable water and firefighting capability and death, illness and injury from contaminated water, are sobering. Additionally, there can be economic implications if the breach forces businesses and industry to shut down even briefly. Interestingly enough, the impact is nearly identical when there is only the threat of contaminated drinking water – and this threat is real.

In 2006, a water treatment SCADA (supervisory control and data acquisition) system in Pennsylvania was infected with malware and spyware through an employee’s laptop computer. Prior to that, raw sewage was spilled into a local park, hotel, and rivers in Queensland, Australia, as the result of an intentional cyber attack.

Fortunately, tougher security regulations are taking effect. Measures such as the Chemical & Water Security Act of November 2009 are driving security programs for drinking water and wastewater facilities. Many of these are likely to be modeled after the NERC CIP (North American Electricity Reliability Corporation – Critical Infrastructure Protection) requirements, which are geared specifically to the power generation industry.

Every measurement and control device or system represent a point of vulnerability, and complying with evolving security regulations can be particularly difficult for organizations using a number of different automation systems. As such, municipalities should look for automation systems delivered on a common platform and with embedded security features. Such systems enable organizations to proactively address cyber security issues, such as system hacking, and data integrity and verification. Some control system vendors also help customers address security concerns through special services, such as security patch monitoring and deployment and system security assessments.

In addition to cyber security, an integrated automation system can also augment a municipality’s existing physical security efforts. Video security monitoring, for example, can be integrated into the control system to guard against potential sabotage at the plant and remote locations, such as pumping stations. This is especially important for regional authorities that have to cover large physical areas, including many unmanned facilities.

Another important aspect of security is the ability to give end users the option of a backup, off-site control center so that operations can continue in the event that the treatment plant has to be evacuated due to natural or man-made events.

Conclusion
The use of multiple standalone controls is full of pitfalls – incompatibility among systems, difficulty maintaining aging systems from a multitude of vendors, and the inability to expand operations to meet the needs of a growing population, to name a few – that prevent municipalities from realizing the true potential of their resources and fully protecting public assets. Conversely, a planned and integrated approach to automation makes it possible for municipalities and investor-owned utilities to maximize efficiency, reduce costs, and minimize security risks. The first step down this path is developing a long-term master automation plan, which serves as a roadmap for improving district-wide performance over time while also factoring in financial and operational constraints.

It’s likely that the issues facing the water and wastewater industry will continue to evolve. Adopting integrated automation architecture will help water and wastewater organizations weather the storms of today and tomorrow by delivering operational flexibility, improved reliability, and increased operating efficiencies, while maintaining environmental and regulatory compliance.

Author’s Note
Doug Johnson is the director of business development for Emerson Process Management Power & Water Solutions. He holds a B.S. in Electrical Engineering (Magnam Cum Laude) from West Virginia University and an MBA from the University of Pittsburgh’s Katz Graduate School of Business. Doug is a member of the Water Environment Federation and the American Water Works Association. He serves on the executive committee of the Emerson Water Council.

References