

FROST & SULLIVAN

NAVIGATING TROUBLED WATERS

OPTIMIZING
OPERATIONS MANAGEMENT SOLUTIONS
IN THE
WATER & WASTEWATER INDUSTRY

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BACKGROUND

This white paper was commissioned by Schneider Electric with the objective of outlining the challenges and approaches to effectively leverage operations management solutions such as HMI/SCADA and Historian in Water and Wastewater industry.

The white paper was written by analysts of the Industrial Automation Practice at Frost & Sullivan.

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As a global specialist in energy management with operations in more than 100 countries, Schneider Electric offers integrated solutions across multiple market segments, including leadership positions in energy and infrastructure, industrial processes, building automation, and data centres/networks, as well as a broad presence in residential applications. Focused on making energy safe, reliable, and efficient, the company's 114,000 employees achieved sales of more than 18.3 billion euros in 2008, through an active commitment to help individuals and organisations “Make the most of their energy™”.

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Navigating Troubled Waters

OPTIMIZING OPERATIONS MANAGEMENT SOLUTIONS IN THE WATER AND WASTEWATER INDUSTRY

TROUBLED WATERS

Water and Wastewater utilities face a growing number of challenges that relate directly to their role and their future in a rapidly changing environment and the unaddressed issues that compromise service delivery.

What are some of these key challenges?

AGEING INFRASTRUCTURE

The resilience of Water and Wastewater infrastructure is critical to safe and adequate Water and Wastewater management.

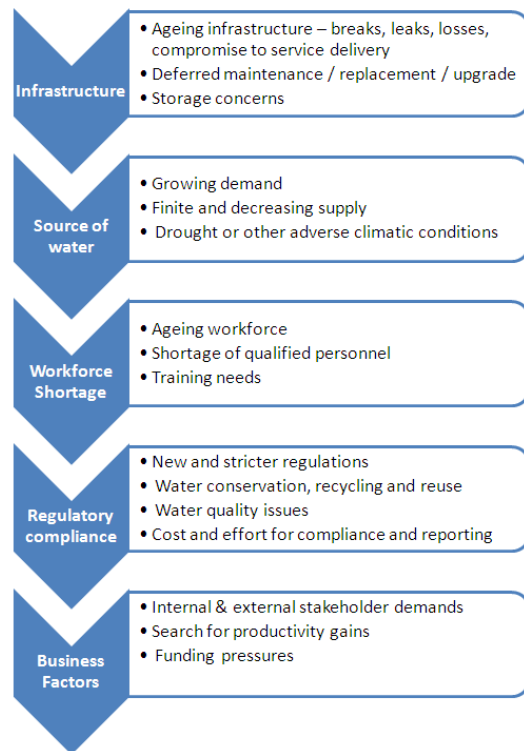
However, many networks have reached their end-of-useful-life and as a consequence there is **water loss** (through leakage) and **contamination** of water bodies (through wastewater overflows).

According to the United States Environment Protection Agency, “sewer overflows, caused by blocked or broken pipes, result in the release of as much as

10 billion gallons of raw sewage annually.”

In addition, the consequences of ageing infrastructure are more keenly felt when system maintenance is not timely and adequate.

Key Challenges: What they mean to Water and Wastewater Utilities?



Source: Frost & Sullivan

SOURCE OF WATER

According to the World Health Organization, by the year 2025, around 1.8 billion people would be living in countries or regions with absolute **water scarcity**. In that year, total world population would have crossed 8 billion (UN projections).

While most governments and utilities have to contend with population growth, they now also have to factor in new pressures on water availability. These pressures are the result of:

- Climate change – manifest in increasing variability in regional and seasonal weather conditions.
- Urban congestion – concentration of consumers in urban areas as well as the disturbance to the water balance on account of a high proportion of built-up environments (roads and roofs replacing vegetated land).
- Past excessive consumption levels without conservation or recycling.

Ensuring sustainable water supply is now an operational imperative and not a mere statement.

This often requires **investment in greater water storage, redesigned water transfer networks** or sourcing of water from **alternate sources** (such as desalination or recycling). In terms of operational demands, such a trend requires **more effective monitoring and management of infrastructure**.

WORKFORCE SHORTAGE

Intense **competition for qualified employees** across various industries is seeing the Water and Wastewater sector losing out to more high-profile industries.

Added to this difficulty in recruiting, the **ageing workforce** trend is leading to experienced personnel retiring without suitably experienced replacements being readily available to utilities.

Utilities are therefore, having to contend with a reducing pool of skilled manpower for operations.

REGULATORY COMPLIANCE

Globally the Water and Wastewater industry is underpinned by strong regulations relating to **drinking water quality, wastewater treatment, effluent discharge, groundwater protection, occupational health and safety, price policy, service delivery** etc. Strict

sanctions for breaches include the loss of utility license to operate. On an ongoing basis, **‘polluter pays’** principles place the onus on utilities and industrial water users to manage effluent discharge effectively.

In the United States, for example, the industry has to deal with the Environmental Protection Agency (EPA) CFR Title 40, the Subchapter D: Water Programs Parts (100-135), the Subchapter O: Sewage Sludge (Parts 501-503), National Pollutant Discharge Elimination System (NPDES), amongst other requirements. In addition, as specified by the governmental accounting standards board's (GASB) Statement 34, asset management systems are to comply with the modified approach to GASB 34, offering an accurate inventory of infrastructure assets and a condition assessment process including the annual estimate of the dollar amount required to maintain infrastructure assets at a specified condition level.

BUSINESS FACTORS

Perhaps the most significant business factor impacting the Water and Wastewater industry is **funding pressure**. According to the American Society of

Civil Engineer's '2009 Report Card for America's Infrastructure', "drinking water systems face an annual shortfall of at least US\$11 billion in funding needed to replace ageing facilities that are near the end of their useful life and to comply with existing and future federal water regulations.

This does not account for any growth in the demand for drinking water over the next 20 years.” Aggravating the problem of funding pressure is the constraints that Water and Wastewater authorities face in raising water prices (especially since that is a politically charged issue).

To address these challenges, Water and Wastewater authorities are looking at **performance enhancement** and **cost saving solutions**.

These can take the form of **innovation in sourcing water, attracting talent** or **easing financial constraints**.

These can also take the form of **selecting and using efficient operations management tools** so that Water and Wastewater operations perform better at lower costs.

CONTROL AND AUTOMATION SOLUTIONS

Supervisory Control and Data Acquisition (SCADA) and Historian solutions have over several decades proved critical to Water and Wastewater authorities seeking improved visibility and control (24x7) over assets dispersed over large areas. Leveraging data from SCADA and Historian solutions (flow, volume, pressure levels, storage levels, pH, chemical dosage, pump operation, energy use, operator and field staff activity etc), utilities can:

- Identify equipment failure / network faults before they impact the system and customers.
- Perform timely adjustments to process or system parameters as an emergency response or to maximize efficiency of the system.
- Ensure more efficient leverage of field staff and remote interface with control centre/plant after-hours.
- Record exceptions, alarms, events and other operational data to fulfill reporting requirements.

- Improve planning and design of networks.

However, as with any tool, value is derived on the basis of what type of tool you use and how you use it. With SCADA and Historian solutions, it is often the case **of untapped opportunities, unrealized potential** and in the end, **dissatisfied water authorities.**

The reasons for this are many:

- **Ageing** and, in some cases, **unsupported SCADA and Historian systems.**
- **Disparate hardware configurations and communications protocols** resulting from a piecemeal approach to systems deployment (as opposed to an architecture reflecting overall design intent).
- **Inadequate support and training** from the SCADA and Historian solutions provider.
- **Significant re-engineering** or custom work for projects on account of limited templates and inadequate integration capabilities.

- Vast quantities of SCADA-derived data, **without reliability of storage or accessibility** at the desired levels of granularity.
- **Inflexible visualization tools** and **limited reporting capabilities**.
- **Inadequate scalability** to match growing demand.

Unfortunately, the negative consequences of not optimizing SCADA and Historian solutions can be significant. For example, utilities with outdated systems tend to find that field-crew learn of pump station malfunction in remote locations only on scheduled visits or after customers have called with complaints.

This reactive approach to problem-solving could lead to the erosion of customer confidence, increased overall operations costs and in some cases, large fines for non-compliance.

The table that follows lists some high-profile examples of SCADA-related system failure in the Water and Wastewater industry:

**SCADA-related System Failures:
High-profile Examples**

- A power failure shuts down a pumping station in Manhattan Beach resulting in a massive untreated sewage spill. One hour after the failure, operations staff find that alarm systems at 21 pumping stations were not communicating with the central control centre. – Manhattan beach, California, USA, 2006.
- Former employee installs unauthorized software on a SCADA system resulting in system damage. - Tehama Colusa Canal Authority, California, USA, 2007.

Source: Frost & Sullivan

In response to the perceived risks (as highlighted by the high-profile examples just listed) and the untapped opportunities to optimize their systems, utilities are seeking to get more out of their SCADA and Historian solutions by increasing focus on some or all of the areas listed below:

Focus Areas for SCADA and Historian Users in the Water and Wastewater Industry

- **Modernization** and upgrade of ageing SCADA and Historian systems (especially unsupported solutions).
 - **Security enhancements** to existing SCADA infrastructure as a key risk-mitigation approach (including interface with motion detectors, intrusion sensors, keypad entry devices and video surveillance, as well as more
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Focus Areas for SCADA and Historian Users in the Water and Wastewater Industry

robust diagnostic and alarm functions for shorter response times).

- Move towards **standardization** of automation and control solutions and interfaces across the entire system / plant / organization.
- Increased need for **expandable/modular solutions** to keep pace with changing demand and consequently larger operations.
- Increased focus on **user configurable solutions** with intuitive, easy-to-use graphic interfaces.
- Increased leverage of real-time data from SCADA and Historian systems to **improve effluent quality.**
- Increased leverage of real-time data from SCADA and Historian systems to **reduce energy consumption.**
- Increased leverage of SCADA and Historian to **support business processes.**

Source: Frost & Sullivan

To progress on each of the above focus areas, it is critical that utilities partner with **solutions providers** who have **flexible**, but **robust solutions** and **demonstrable experience** in such projects.

It is very much a case of knowing clearly what is needed from a system design perspective and assessing the providers’

ability to bring value to each specific requirement.

For example, **SCADA solutions from Schneider Electric** have **built-in redundancy** to protect data and to ensure continued monitoring in case of hardware downtime.

With **comprehensive alarm notification, high data integrity and rapid data transfer rates**, enabling faster response times, these SCADA and Historian solutions can help operators identify and correct malfunction before it snowballs into a significant problem.

In addition, the use of the **‘Process Analyst’** (available in Schneider Electric’s SCADA as well as Historian solution) helps operators analyze the cause of malfunctions through a single integrated display overlaying trend and alarm data.

“Using Schneider Electric’s SCADA solution for monitoring has saved us a half million dollars a year in chemical usage.”

- Robert Falor, I&E Supervisor, Brunswick County, North Carolina, USA

In fact, overall **intuitive and standardized graphic visualization** reduces training time and costs for operators.

With **open architecture**, such solutions integrate seamlessly with existing legacy systems and their **scalability** ensures expansion without wholesale re-engineering. Industry standard **OPC DA client**, offered as standard by Schneider Electric’s Historian solution, ensures consistent data access and connectivity to any third-party SCADA systems.

“The Schneider Electric SCADA solution has supplied Fishwater Flats (treatment works) with meaningful information and has proven to be very reliable. Our process operators are now effectively using the system to gain better productivity.”

- *Mike Clinghan, Acting Works Manager, Nelson Mandela Metropolitan Municipality, Eastern Cape region, South Africa*

Powerful **reporting tools** also aid utilities to ensure that the desired flow of operational data to business systems and users across the organization is in **user-friendly formats** (100% Microsoft SQL Server 2005) and (with hierarchical tag

grouping) at the appropriate level of granularity. Preconfigured and ready-to-use **Energy reports** can help facilitate comprehensive energy consumption and / or potential savings assessment by equipment, plant or area.

The **option to integrate with Microsoft Windows security** also helps centralize the management of user accounts (across both operational and business systems) and thus provide additional assurance of security.

Finally, the **option to interface with Manufacturing Execution Systems (MES)** helps bridge a vital gap between the plant operational environment and the management of the business (the option of the OPC HDA server can facilitate connectivity with MES systems such as Schneider Electric’s Ampla).

Partnering with a single service provider, capable of offering and supporting solutions from device level through to SCADA, Historian and MES level, helps utilities to more effectively leverage the benefits of **an integrated solution approach** - An approach that makes possible system-wide standardization, seamless integration and comprehensive

support across control systems and along the eventual upgrade path.

CONCLUSION

Given that Water and Wastewater utilities are ‘critical infrastructure systems’, secure, reliable and flexible operations management solutions go a long way in raising the performance of operations and meeting stakeholder expectations.

Utilities will need to focus on harnessing SCADA and Historian solutions more effectively to help make them smarter and more proactive as they navigate the troubled waters of a changing business, regulatory and consumer environment moving forward.