Case Study: Simplifying Access to Many Systems with One Interface

City of Morro Bay improves water quality and operator access to real-time data

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City of Morro Bay improves water quality and operator access to real-time data

The scenic coastal community of Morro Bay, California

It's not easy managing water and wastewater services for a city where demand doesn't just fluctuate—it surges with each weekend and summer season.

Morro Bay, a scenic coastal community of 10,000 residents, faces exactly this challenge. With its prime oceanside location, the city is a popular tourist destination. So just like the ocean tides, the population ebbs and flows, drawing in waves of visitors that put additional pressure on water supply and wastewater treatment systems.

Morro Bay's utilities division must adapt to seasonal spikes, safeguard against saltwater intrusion, and ensure access to clean, reliable water for both residents and visitors.

To manage these complexities effectively, the city's control systems must be robust, adaptable, and capable of handling the dynamic demands of a fluctuating population.

INHERITED CHALLENGES

In 2019, when Operational Technology Specialist Grant Chase went to work in Morro Bay, he found a utilities infrastructure in need of unification and stability. The city's water and wastewater control systems were a patchwork of different technologies—some dating back decades:

- Various water treatment processes at the reverse osmosis filtration facility, running on Allen-Bradley® SLC 5/05 PLCs from the 1980s
- An aging wastewater treatment plant built in the 1960s with minimal automation and absolutely no modern SCADA oversight
- Water distribution systems (tanks and pumping stations) running on Opto 22's SNAP PAC Systems™ from the 1990s
- Wastewater lift stations running on Opto 22's SNAP PAC Systems with a mix of Opto 22's Windows®-based PAC Display™ and web-based *groov* View® for visualization
- Underground wells with more SNAP PAC Systems that had been disconnected, requiring manual well control

Being right on the ocean means Morro Bay needs to safeguard against saltwater intrusion.

"Each part of the system operated independently with minimal cohesion and no standardized way to visualize data across processes," Chase says.

The system's fragmented nature meant operators had to juggle multiple platforms, often struggling to get a complete real-time view of operations.

Furthermore, the city's existing remote access solution relied on port forwarding, a risky approach that creates vulnerabilities by exposing internal networks directly to the internet. This method bypasses key security controls, making critical infrastructure an easier target for cyberattacks.

Chase recalls his initial gut reaction: "No way! We can't do that."

STEPS TOWARD THE FUTURE

"When new management arrived in 2021, they were receptive to my input. I took the opportunity to get a *groov* EPIC® [Opto 22's **E**dge **P**rogrammable **I**ndustrial **C**ontroller] and migrate some of our existing *groov* View projects from the original *groov* Boxes™ to the new hardware platform," Chase says. The *groov* View web-based HMI software comes free on all *groov* EPICs.

The added controller horsepower was great—namely a GRV-EPIC-PR1 controller with a quad-core processor—but additional features on *groov* EPIC would help take Morro Bay's water management to the next level.

"Licensing Ignition Edge® on the *groov* EPIC enabled a direct and reliable OPC UA® connection to the existing SLC 5/05 PLCs in our reverse osmosis facility. [It] turns out SLC 5/05s were the first Allen-Bradley PLC with a native Ethernet port," says Chase.

From there, he made the OPC UA connection back to *groov* View, unifying disparate controls from different brands onto a single display technicians could view on department computers and mobile devices.

"Licensing Ignition Edge on the *groov* EPIC enabled a direct and reliable OPC UA connection to the existing SLC 5/05 PLCs in our reverse osmosis facility."

- Grant Chase, Operational Technology Specialist

ANOTHER NEW FACILITY COMES ONLINE

In 2022, another major project was in the works: a brand-new wastewater treatment plant. Construction of the new facility was based on specifications that had been laid out before Chase joined the team. Most of the facility's control would be handled with Allen-Bradley PLCs, and unfortunately remote access was not part of the original specification.

The City of Morro Bay's brackish water reverse osmosis (BWRO) facility

"Weeks before startup, our operators began asking about mobile access to the new treatment facility—something they had gotten used to on the Opto 22 systems that were running *groov* View," notes Chase.

Since Chase had already proven out the *groov* EPIC's ability to leverage Ignition Edge to connect to disparate PLCs, the solution was a no-brainer.

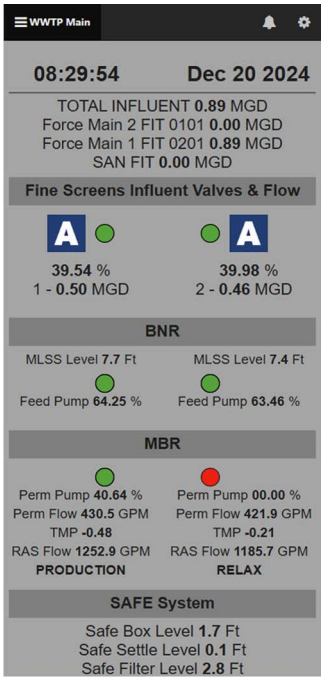
SECURE SOLUTIONS FOR REMOTE ACCESS AND MONITORING

While *groov* View provided the operators with the level of oversight and control they were looking for, Chase had to turn his attention to ensuring his operators had secure remote access to their screens.

To meet today's stringent cybersecurity standards, Chase shut down insecure network access to inbound ports (used for port forwarding), and began using ZeroTier® VPN, a virtual networking software with a number of features key to their IIoT deployment:

- Virtual network for secure, local-network-like connection to IIoT devices
- Direct, low-latency access for fast, seamless communication across the internet
- Cryptographic security for ensuring that devices, including operators' mobile phones, use unique cryptographic IDs
- Easy integration to existing systems without making major hardware changes

Now, with a simple VPN configuration on their mobile phones, Morro Bay's water operators have secure access to their systems from anywhere in the world.

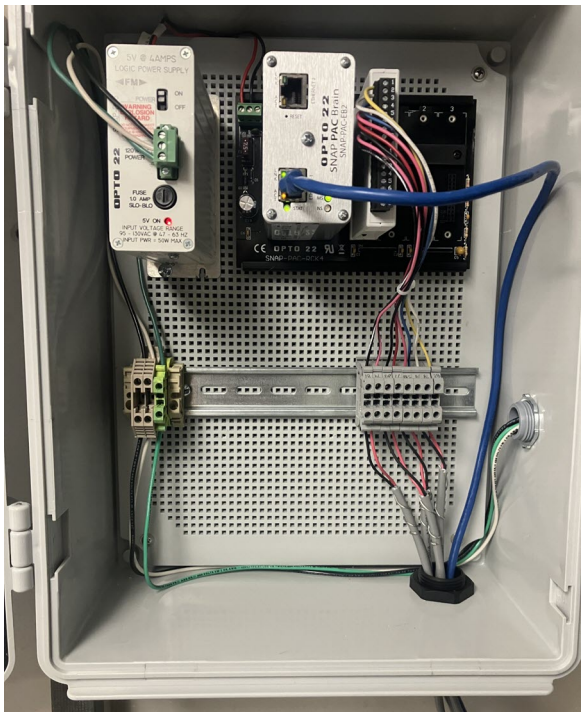


Mobile-ready *groov* View screens display live wastewater treatment data.

REVITALIZING RELIABLE TECH

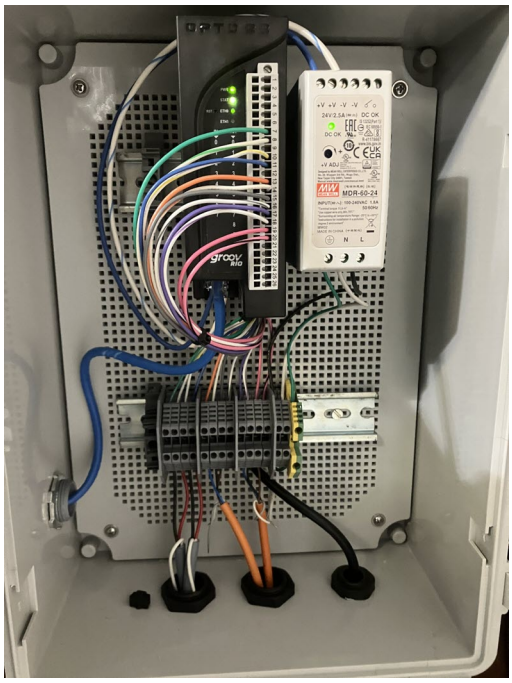
In the following months, Chase connected more systems. He turned his attention to the city's four brackish water wells. The wells were operational, but they were being run manually, with no communication or connection to central operations. Manual operation required technicians to spend time traveling to the wells and risked damage to unmonitored equipment.

Upon investigation, Chase discovered abandoned SNAP PAC controllers in place at the wells. The controllers were still functional but not in use. He began restoring the existing controllers and bridged the network gap to the remote sites using Ubiquiti® 5 GHz radios.



Abandoned SNAP PAC controllers and I/O modules were repurposed for chemical analyzers at the BWRO facility.

A savvy customer, Chase knew about Opto 22's lifetime guarantee, so at the BWRO (brackish water reverse osmosis) facility, he repurposed existing SNAP modules to expand the system without additional hardware costs. Not a bad idea, considering Opto 22—now in its 50th year—recently reaffirmed long-term support for SNAP PAC products, ensuring continued reliability and performance for decades to come.



Opto 22's *groov* RIO is used to run new chemical dosing pumps.

"This is a really big deal for the bottom line. Too often government organizations trash and replace working equipment in the name of modernization. The R1s [SNAP-PAC-R1] work perfectly, and being a public municipality, saving money for the city really means something," Chase adds.

Where he needed additional I/O points to run two new chemical dosing pumps, Chase added some *groov* RIO®s, Opto 22's compact, IIoT-ready remote I/O devices. With the wells now fully automated, operational, and networked back to his central servers, it was simple to add well-site screens onto his *groov* View project for secure operator access.

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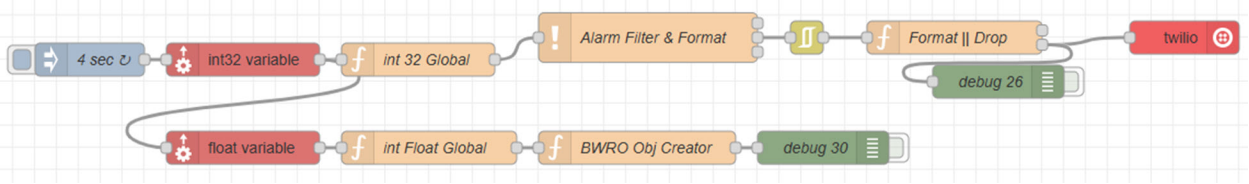
Grafana dashboards power Morro Bay water system monitoring.

MODERN HARDWARE ENABLES MODERN SOFTWARE

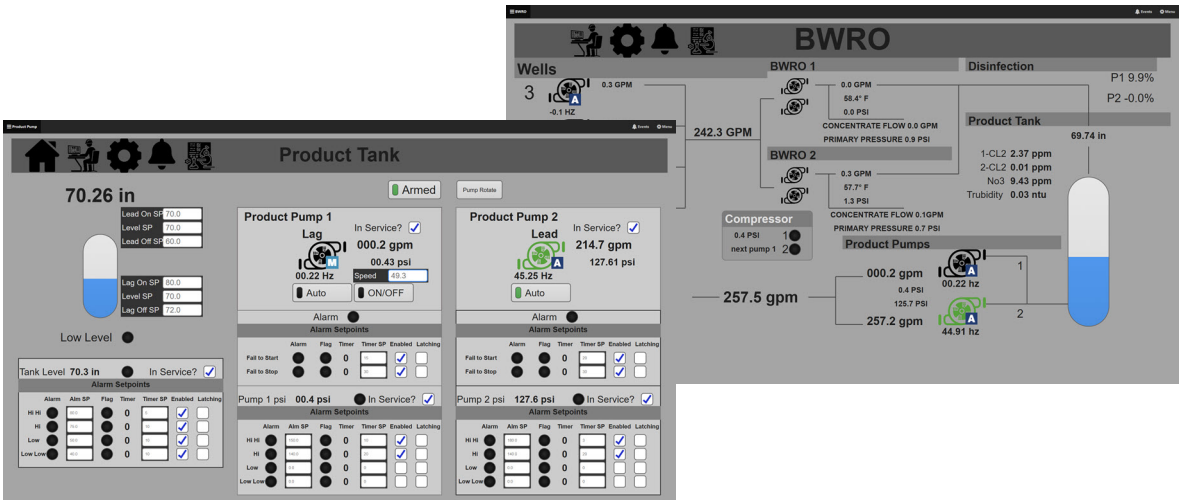
Morro Bay's control system overhaul didn't stop there. With *groov* EPIC at the core, Chase leveraged a suite of modern tools to enhance data collection, analysis, alarming, and visualization:

- Node-RED® provides real-time data filtering and processing. PAC Read nodes grab relevant tags and SQL nodes efficiently transfer data to databases.
- Twilio® functions inside of Node-RED to make bidirectional SMS text messages, alerting staff of critical alarm conditions and allowing inbound requests for pertinent data.
- Ignition's MQTT Transmission Module enables Sparkplug®-compliant, report-by-exception data transmission, reducing network traffic and ensuring that only critical data updates are transmitted.
- InfluxDB® with Telegraf® provides a robust data pipeline. Telegraf subscribes to select MQTT topics on the broker, which are then stored in InfluxDB as time-series data for historical analysis.
- Grafana®, running on a Linux® Ubuntu® server, provides operators intuitive visual insights into system performance and historical trends.

These tools provide Morro Bay's utilities team with the real-time data and streamlined processes they need to efficiently manage their systems and respond effectively to changing demands.



Twilio functions in Node-RED to enable bidirectional SMS for alarms and data requests.



Live tank level and pump monitoring in *groov* View

RESULTS AS CLEAR AS WATER

The implementation of Opto 22's *groov* systems has delivered measurable benefits for Morro Bay, both operationally and financially:

- **Significant cost savings**—By leveraging Opto 22's flexible and user-friendly technology, the city has avoided the need for costly external integrators. Chase estimates that automating the new facility and upgrading existing systems in-house saved hundreds of thousands of dollars in engineering and design fees—not to mention the huge cost savings from repurposing older equipment still under warranty.
- **Enhanced water purity**—"Our ability to monitor everything remotely has significantly improved water purity," says Chase. With real-time data on tank levels and chemical balances, operators can make immediate adjustments to ensure clean, safe water.
- **Ease of use and operator satisfaction**—Designed for simplicity, Opto 22's *groov* View HMI allows non-technical staff to easily access and manage critical data. Operators can request custom tools or features, such as new control buttons or setpoint adjustments, which Chase can quickly implement.

FLOWING INTO THE FUTURE

With their systems stabilized and securely accessible, Morro Bay is looking ahead to expand its use of Opto 22 IIoT technology.

One major upcoming project involves Indirect Potable Reuse (IPR)—a method of injecting reclaimed water into the groundwater basin, which helps buffer water supply and mitigates the risk of saltwater intrusion.

But Chase's vision doesn't stop at individual projects. He is working to establish a city-wide standard for control systems that prioritizes security, reliability, and cost effectiveness.

"We've already saved hundreds of thousands by doing this work in-house," Chase notes, "and we're confident that we can continue to scale efficiently as we tackle new challenges."

By aligning their future projects with Opto 22's innovative solutions, Morro Bay is laying the foundation for a resilient

"We're aiming to standardize on Opto 22 hardware for all new projects. The security, ease of access, and the fact that we know exactly where it's made and can source it reliably are huge advantages for us."

- Grant Chase, Operational Technology Specialist

Morro Bay monitors wastewater treatment KPIs in Grafana.

water infrastructure that will serve both its residents and visitors for decades to come.

"We're aiming to standardize on Opto 22 hardware for all new projects," Chase explains. "The security, ease of access, and the fact that we know exactly where it's made and can source it reliably are huge advantages for us."

ABOUT CITY OF MORRO BAY

The Public Works Department of the City of Morro Bay is committed to enhancing the quality of life for its residents and businesses by developing and maintaining the city's infrastructure in a safe and environmentally sensitive manner. The department provides many services to the city including maintaining safe and reliable water deliveries, waste water collection, and treatment.

For more information, please visit:
https://www.morrobayca.gov

ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov* EPIC® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

groov RIO Ethernet-based edge I/O modules, introduced in 2020, include I/O and IIoT software in a compact industrial package that goes anywhere.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.

MADE IN THE USA

The company is especially trusted for its continuing policy of providing free product support, free online training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact **Opto 22 Pre-Sales Engineering**:

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