

Waterford Township Water Treatment Facilities

Opto 22 Monitoring and Control Equipment Keeps Systems Running at Michigan Water Treatment and Sewage Pumping Facilities



Since 1996, the Waterford Township Department of Public Works (DPW) has used Opto 22 hardware and software in its water treatment plants, sewer pumping stations, and other facilities. Serving a community of more than 74,000 Michigan residents, the Waterford DPW has utilized Opto 22 to provide the automation, monitoring, and control systems for 62 sewer pumping stations, and to pump and treat water from 15 wells and 12 water treatment plants into a 350-mile distribution system.

“With the Opto 22 hardware, we monitor and control approximately 1,900 I/O points for the water and sewer systems,” says Terry Biederman, Director of Public Works for Waterford Township. “We also monitor nearly 1,200 separate alarms and we’ve configured the hardware to email staff when predefined events occur or when maintenance needs to be performed.”

Currently, the Waterford DPW is using Opto 22 *mistic*- and SNAP PAC-brand systems at its nearly 90 water treatment and sewer pumping facilities.

“The water treatment plants are designed to remove iron and manganese from the water and inject chlorine for disinfection and orthophosphate for corrosion control,” says Biederman. “A typical setup will have an industrial PC connected to a remote telemetry unit (RTU), such as a *mistic* or SNAP PAC programmable automation controller, through either Ethernet or serial connections.”

One of the critical functions performed by the Opto 22 hardware is monitoring and controlling water tank levels by turning water treatment plants on and off as necessary. When a tank reaches a

programmable “on” level, the controllers start the facility and regulate various equipment and systems, including variable frequency drive (VFD) pumps that regulate based on both flow and pressure process variables.

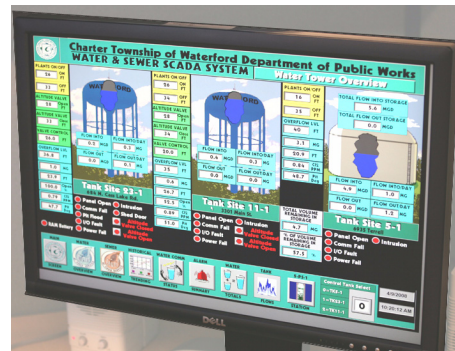
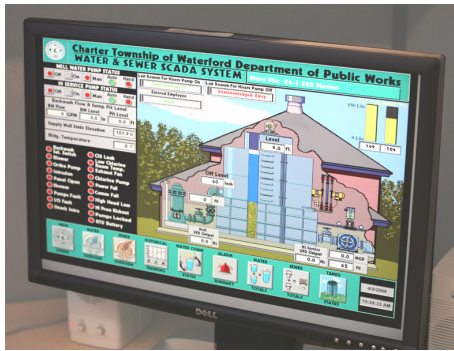
“The primary design calls for the facility to be turned on and regulated based on a maximum water flow set point,” says Biederman. “However, as the discharge pressure at the facility reaches the preprogrammable maximum level, a PID loop in the Opto 22 controller supercedes this and automatically switches the process variable and setpoint to effectively maintain the maximum pressure. This continues until the plant shuts down or until the flow from the plant drops below 55 gpm, thereby preventing ineffective pumping.”

As Biederman explains, older pipes in the system can’t handle the high pressures sometimes generated by the high-service pumps at various facilities. The switch to pressure-based PID regulation, combined with the use of altitude valves (also controlled by the Opto 22 PACs) prevents excessive pressure and water hammers in the distribution system and has helped reduce yearly water main breaks throughout Waterford Township from 60 or more per year to around 20 per year.

This and other improvements have created tremendous cost savings for the township. Since 1996, Waterford’s water system has grown over 20%, while simultaneously energy costs have skyrocketed. However, over this same period, the total pumping and treatment energy budget has increased by only \$62,000, from \$450,000 per year to \$512,000 annually. The sewer pumping



Consultants from all over the U.S. and Canada visit Waterford to study the facilities’ high level of automation.



HMI screens were developed to give Waterford personnel visual representations of equipment and processes and point-and-click control capabilities.

energy budget has seen similar efficiencies, with the energy budget increasing by only \$4,000 since 1996, from \$68,000 to \$72,000 annually.

All of the Opto 22 PACs provide Biederman with the flexibility to design his control programs using flowcharts, which are easier and more intuitive for the DPW staff to program and understand. The DPW also uses Opto 22's software connectivity tools to create the communications and graphics interfaces needed to deliver data and alarm messages from facilities.

For example, at some of the water facilities, pressure filters are fitted with temperature sensors to monitor tank water temperatures. If temperatures drop to below 38 degrees, a warning email is sent to DPW staff.

"Also, when tank water temperatures reach 35 degrees, the control program was designed to automatically look for freeboard in the distribution system tanks and turn the facility on to move the water, thus keeping it from freezing and rupturing the pressure filter," says Biederman. "If the distribution system tanks do not have the freeboard to pump the water into the system, a facility backwash process is initiated to move the water."

The Opto 22 control system addresses other operational issues as well. At a large sewer pumping station, grease clogs and other debris in the wetwell were clogging pumps, causing numerous difficulties. To solve this, DPW staff and a Waterford Township consultant designed a wetwell backflush process and wrote the control program to have the control system redirect all station flow through a Vaughn Chopper Pump that "purees" the material in the wetwell. After 10 minutes, a second pump is activated and pumps the material out of the wetwell while the puree process continues. Then, after 10 more minutes the program ends and the station automatically returns to normal operation.

Biederman used PAC Project Professional to convert many programs he had designed for his older *mistic* controllers on a "one-for-one" basis. The conversion took place instantly (upon opening the old strategy with the new software) and required very minimal editing.

"We appreciate the fact that Opto 22 *mistic* control programs can integrate and run on the new SNAP PAC controllers," Biederman says. "It's allowed us to maximize our investment by not having to upgrade every time Opto 22 introduced new hardware."

"With Opto 22, when it comes to the older hardware, our support is always there and we keep it simple," adds Tom Edwards, Senior Technical Advisor at Opto 22. "Due to purposefully engineered backward compatibility, we don't have to force customers to replace their older hardware. It's up to them. SNAP PAC controllers used with PAC Project Pro can talk to any existing *mistic* I/O without any problems."

Biederman used Intellution® software to develop the human machine interfaces for the Opto 22 control system at the Waterford DPW's central office but uses Opto 22's FactoryFloor and PAC Display HMI development software at the water treatment facilities and major sewer pumping stations.

"For HMI development, PAC Display has many of the features of the more expensive Intellution and the symbol factory offered is equal if not better," he says. (Support for the Opto software is also free of charge—decidedly cheaper than the Intellution product.)

Biederman continues, "The Opto 22 PAC communicating to field I/O acts like a brain communicating to your central nervous system. And the more I/O I have, the more control and functionality I can exercise."

Another advanced functionality of the DPW has been the deployment of broadband wireless capabilities and a Geographic Information System (GIS) with integrated Computer Maintenance Management System (CMMS) and electronic document management. DPW staff can view electronic maps and graphical representations of the

township's water and sewer infrastructure and—by clicking on a pipe, valve, or pumping station—can view work order histories, engineering documents, and other relevant information.



Automated meter reading and other communications capabilities are enabled through the township's broadband wireless network.

The Waterford DPW has also begun implementing Automated Meter Reading (AMR), which allows customer water meter information to be transmitted via radio to collectors connected to the township's

broadband wireless network. The meter reads are then sent through the network to the DPW offices for processing—without a human meter reader ever having to leave the office.

Thanks to the performance of the Opto 22 control and monitoring hardware and expert programming by both the township staff and systems integrator, Perceptive Controls, Waterford Township has established a reputation for possessing and operating one of the most advanced SCADA systems in the state, if not the entire country.

The Waterford DPW's advanced monitoring capabilities and very high levels of automation have gained widespread attention. More than 20 consultants and other municipalities from all over the U.S. and Canada visit the DPW each year to tour its SCADA and other technology deployments.

"We use technology to solve problems and operate more cost effectively and efficiently," Biederman concludes. "There's always a continuing evolution of technology so it's just good business sense to leverage the functionality, communications, and interoperability that our Opto 22 control system and customer management, GIS, and communications tools and infrastructure provide."