5 REASONS SMART WATER UTILITIES NEED A WEATHER STATION

Professional Weather Monitoring for "Smart" Water Utilities

Meteorological data can be a critical tool for water utility managers to make intelligent decisions to improve efficiencies, safety, and public information.

With the rise of data-driven decision-making and inter-agency collaboration, weather monitoring is becoming increasingly important across government agencies. The Internet of Things movement is a big drive toward Smart Everything – Smart Phones, Smart Cities, Smart Governments.

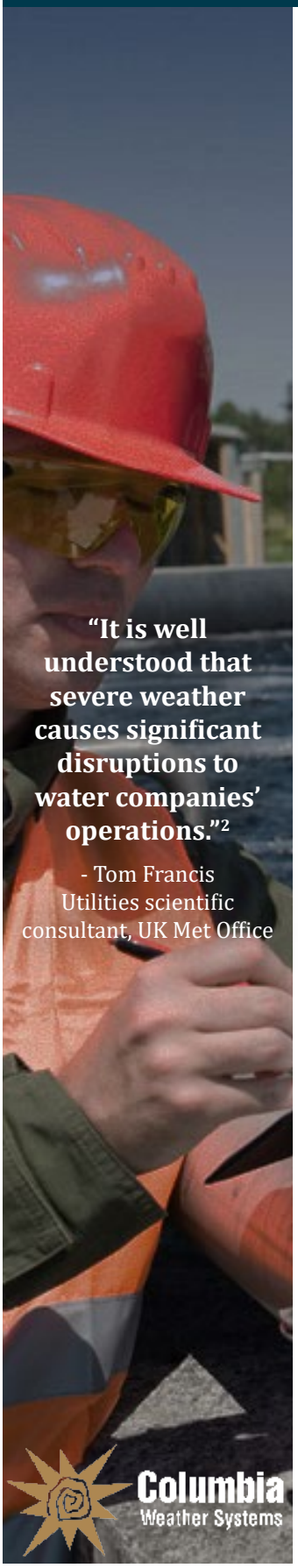
With the integration/interoperability of city-wide agency systems, "Smart Water" plays a significant role and weather monitoring is a part of it.

"The operational and financial performance of a water company is inextricably linked to weather conditions"[1]

- Tom Francis
Utilities Scientific Consultant,
UK Met Office

Columbia Weather Systems

#1: OPERATIONS



Whether dealing with water supply or water treatment, weather conditions impact operations. Operating procedures are created taking meteorological factors into consideration. Standard decisions can be automated for normal operations and planned/documented for special circumstances such as chemical release or severe weather.

"Certain weather conditions trigger actions at our facilities," says Jonathon Sudar of Central Utah Water Conservancy District. "We monitor air temperature, wind speed and water temperature. We know from past experience what combination of these parameters will cause ice to form on our intake screens and when we need to open the bypass gates."[3]

Rainfall is one of the most impactful meteorological parameter on water management systems. Overflows can adversely affect systems and public health. Monitoring environmental precipitation is key to helping manage, whether the solution is diversion or chemical treatment.

Some normal operations based on weather conditions can be automated with a weather station interfaced to the SCADA or PLC system. Weather monitoring systems can be used to activate alarms for notification, as well as control based on specific weather parameters such as precipitation accumulation, high or low temperatures, and high wind speed.

Dealing with the rare chemical release or spill involves environmental monitoring including temperature, wind speed and direction for neighbor notification, effective response, and potential evacuation. When listing "All" Hazards that beset utilities, 6 out of 18 are weather-related according to "The All-Hazard Consequence Management Planning for the Water Sector." These include Flood, Extreme Winds, Lightning, Drought, Hurricane/Tornado, and Severe Weather. Consequences include service disruption, damage to infrastructure, loss of revenue, etc.... [4]

Preparedness guidelines suggest an Emergency Operations Center, and that sheltering-in-place may be required during certain types of emergencies, including severe weather or chemical release. A weather station is standard equipment for an Emergency Operations Center. Meteorological factors may influence critical decisions.

In the EPA's Water Sector Incident Action Checklist, the first item in Actions to Prepare for Extreme Cold and Winter Storms: "Actively monitor weather for inclement weather."[5]

Bottom line, you want to equip your staff with the best possible access to information to increase operational efficiencies and empower ability to make timely decisions. A weather station on-site provides key data as weather conditions can change suddenly and the line between safe and hazardous may be just a few degrees.

#2: ODOR CONTROL

Many facilities are located proximate to commercial and/or residential neighbors. Forward-thinking plant managers want to be good neighbors and take steps to reduce odor issues from the plant, whether chemical or sewage.

"Odors from wastewater treatment plants cause neighbors to complain," says Raquel Rimbach in a *Pollution Equipment News* article. "These complaints can escalate, gaining traction with public officials and even the media, negatively impacting the plant's reputation."[7]

Factors such as temperature, precipitation, wind speed and direction contribute to odor intensity and drift. Monitoring and documenting these parameters can help when addressing neighborhood concerns and planning for odor control and mitigation.

For example, research shows a positive correlation of H_2S concentrations with temperature as it facilitates the growth of microbes. An inverse correlation with precipitation can be owing to infiltration and inflow. Meteorological monitoring helps understand correlations with odor factor measurements and make sense of how the plume disperses.[8]

Los Angeles County Sanitation District utilizes weather stations from Columbia Weather Systems at their water reclamation facilities to help manage for odor, based on complaints from neighbors, as well as the possibility of chemical spills. Their Orion 420™ Weather Stations (with 4-20 mA signal interface) integrate with their PLC systems which utilize FactoryTalk software.[9]

Automated weather monitoring provides time-stamped data for documentation and analysis when addressing complaints, as well as modeling and mitigation to prevent future odor issues.

#3: PUBLIC SERVICE

Weather data can serve as an important factor of a water utility's mission to serve the public and provide communication during extreme weather events which may impact water service.

Recreation/Education

Many water districts incorporate reservoirs which may also be used for public recreation. Reservoirs incorporate large bodies of water and often hilly terrain which lend themselves to creating a unique microclimate compared to population centers.

"People may use the data to determine if current weather conditions are conducive to fishing, boating, water skiing, etc."[3]

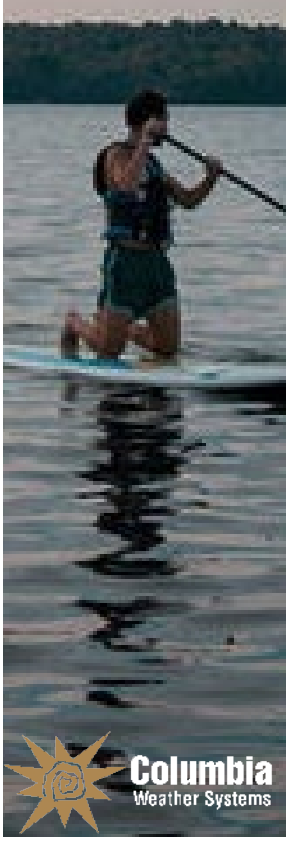
- Jonathan Sudar
Central Utah Water Conservancy District

Weather data can be used for reservoir management and made available to the public to determine whether weather conditions are conducive to, or even safe for, outdoor activities. For example, rain and high winds are a deterrent to water sports and nearby lightning strikes are a "no go." The Pulsar 800™ Weather Station includes lightning detection in addition to standard met parameters of temperature, humidity, barometric pressure, wind speed and direction.

The Jackson Bottom Wetlands Preserve (JBWP) is owned by the City of Hillsboro, Oregon, and CleanWater Services. Initially created as a sewer farm to clean water polluted by cannery and lumbering activities, JBWP has become a regional draw for research and environmental education. They have had a Capricorn™ Weather Station since 2002. In addition to research and educational use, the meteorological data is made available to the general public via Weather Underground, as well as widgets and buttons on the JBWP and city websites.[10]

Usage/Conservation

Whether home-based landscape watering or industrial irrigation, water conservation is based on environmental factors such as precipitation, humidity and temperature. Public acceptance and cooperation relies on persuasive messaging which can be substantiated with weather data.



Whether automated or manual, smart water usage can be as simple as whether it is raining or not, or more complex based on rainfall accumulation or evapotranspiration (ET). ET uses four weather parameters: temperature, wind, solar radiation and humidity.

Extreme Weather

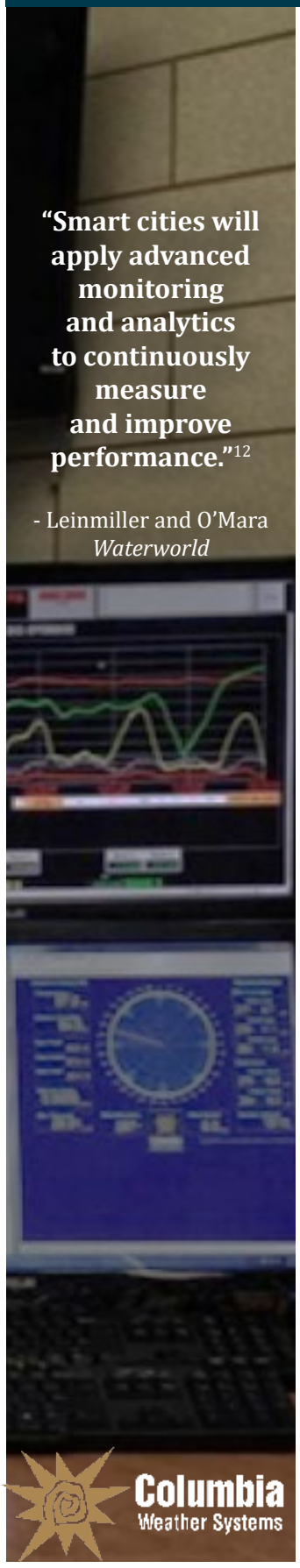
"When the weather is abnormal or the climate is under pressure, water and wastewater services systems stand to lose much of their environment and health benefits" potentially due to infrastructure damage, water loss (such as icing) or contamination (overflow). Extreme weather events such as floods and droughts are occurring with increasing frequency and intensity around the world. These, in addition to events such as winter storms with ice and/or high winds, affect the capacity and operations of water and sanitation infrastructures and services, and thereby threaten the protection such services offer to human health and the environment.[11]

Managing water services during and after such events includes monitoring weather conditions for operational safety, recording data for future analysis, and utilizing weather data in public communications with notification of service disruptions or contingencies.

Optimize the Benefit

An organization or agency can increase the value of its weather station by offering the data to the public it serves. Current meteorological conditions can be made available automatically on the utility's website, a public network like Weather Underground® or a proprietary cloud server.

#4: DATA ANALYSIS



"Smart cities will apply advanced monitoring and analytics to continuously measure and improve performance."[12]

- Leinmiller and O'Mara
Waterworld

The idea of "Smart Water" involves the use of advanced technologies and data to improve operating efficiencies and maintain quality of life for constituents. Smart water utilities are adding Internet of Things (IoT) "assets" such as meteorological sensors to acquire data, in addition to traditional monitoring of flow, pressure, distribution, consumption. Meaningful and actionable data can be used for anomaly detection and control, as well as optimization and prediction.[13]

- Weather information can be automatically monitored and archived for periodic and incident reporting.
- Historical data can be analyzed for process optimization, modeling and planning.
- Adaptations can be automated based on weather parameters for operations with minor fluctuations, as well as emergency measures based on extreme conditions.

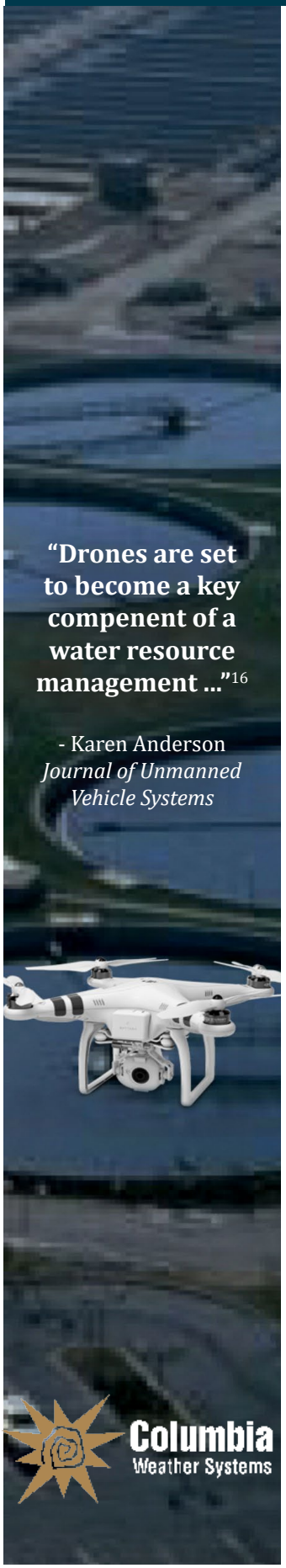
According to Jonathon Sudar, of CUWCD, "Our weather data is collected through a PLC and then stored in a historian program where it can be represented graphically and reviewed. Some of the data (temp, wind speed, precipitation and solar) is exported and used for modeling purposes for our reservoirs. One example where the data is used is in our evaporation modeling."[3]

Another example is handling overflows. Given certain precipitation parameters, such as accumulation and rate, combined sewage overflow (CSO) programs may divert excess flow to storage facilities so that they can process it at a more leisurely pace once a wet-weather event has subsided. Operational data can help make proactive decisions to predict and set up contingencies, for example to divert influent. "If you have the data that is collected, then you can use it to help your operations in a lot of different ways. You can better predict what's going to happen and then manage those situations more effectively."[14]

One final and emerging weather-sensitive area is energy-efficiency in all facilities. This is carried even further by the development of energy-recovery and production at some wastewater facilities. These trends are advanced by increasing regulations, tightening budgets, climate variability, and the popularity of concepts such as Zero-Liquid-Discharge. Once again, this is an area for resource optimization and automation based on meteorological factors such as precipitation in conjunction with inflow, wind speed and solar radiation for evaporation, and temperature for biological processes.[15]

With the integration/interoperability of city-wide agency systems, "Smart Water" plays a significant role and weather monitoring can be a part of it. Besides the water utility itself, facilities with weather monitoring equipment can serve as additional climatological data points to improve the "smartness" of other agencies such as public services and energy. According to Leinmiller and O'Mara, "Additional efficiencies are gained when departments are able to share relevant, actionable information."[13]

#5: DRONES



"Drones are set to become a key compenent of a water resource management ..."[16]

- Karen Anderson
Journal of Unmanned Vehicle Systems

As water and wastewater operations continually upgrade and improve procedures, drone technology is becoming increasingly valuable. Also known as Unmanned Aerial Vehicles (UAVs), drones are being used for many things including surveying, inspection, volumetric calculations, safety, education and public relations. Monitoring weather conditions on site enhances the safety and efficiency of drone operations.

In 2017, New Jersey American Water conducted nearly 200 drone flights in over 55 locations. According to Christopher Kahn, senior GIS project manager, inspection and survey provide immediate benefit. For example, by using drones, he says the company can perform elevated water tower inspections with "more accuracy and less risk." Kahn added, "We are able to measure the progression of rust and other conditions, and provide engineers with actionable condition assessments of a larger number of facilities in short order."[17]

"Drones are a great tool to support your asset management program," says Troy Gallagher, Water/Wastewater Market Leader at Mead and Hunt. Using drone footage for public outreach and community education is one benefit. Additionally, drones are being used to collect samples from hard-to-reach locations, inspect and survey large sites, and monitor treatment systems at a distance. In potentially dangerous situations such as a chemical spill, pipe break or gas leak, drones can "provide a first response and identify unknown threats before exposing the human element to danger."[18]

Weather conditions are a critical factor in drone operation. Access to current meteorological data from the immediate environment can help prevent damage to the UAV and its surroundings. These are some important parameters to monitor for safe and effective drone flights.[19]

Temperature: UAVs are designed to fly within certain temperature ranges. Extremes can cause damage, overheating, and shorter flight times due to battery drain.

Wind Speed/Gusts: High wind speed and strong gusts cause difficulty in maneuvering and steady positioning.

Precipitation, Humidity: UAVs do not function well in moisture conditions.

As water and wastewater facilities incorporate drone technology, on-location weather monitoring equipment can enable successful operations. This can be achieved with weather stations at key facility locations, or mobile weather stations deployed wherever the drones are being launched.

CONCLUSION

In the face of historic challenges – climate change, revenue fluctuation, staff turnover, regulations – smart water utilities are recognizing advanced technology as an opportunity to equip staff with the "best possible access to information to increase individual operational efficiencies and empower ability to make correct and timely decisions."[20]

Integrated control systems often incorporate a SCADA system for wide area monitoring and control of operations. "These operations might include remote pumping stations, wastewater collection, water distribution, PLCs, sewer diversion, water irrigation, wet weather overflow, and **weather monitoring**. This integrated architecture ensures that operating parameters are adjusted according to changing situations, thereby helping the plant run smoothly."[21]

Los Angeles County Sanitation District has CWS weather stations, mostly with 4-20 mA signal interface, located at each of their Water Reclamation facilities, as part of their PLC systems. According to Albert Mata, Supervisor of Treatment Plant Operations at Whittier Narrows, their Orion Weather Station was "easy to install" and they love it!

At Columbia Weather Systems our job is to make weather monitoring easy so you can focus on doing your job well.

- Our weather stations have been trusted by industries and government agencies worldwide for over 35 years.
- We offer the latest in met sensor technology with robust monitoring options to suit your unique application.
- Our weather stations can integrate into your SCADA or PLC system or stand-alone depending on your situation.
- Our staff offers personal, friendly technical support at every stage.

Whether you are managing water supply, wastewater, or storm water, weather instruments can provide data to make your operations more effective.

Contact us to help you select the best met station for your requirements.

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