

SERVING FLORIDA'S WATER AND WASTEWATER INDUSTRY SINCE 1949



Florida Water Resources JOURNAL

July 2023

**Stormwater
Management
and Emerging
Technologies**

Editor's Office and Advertiser Information:

Florida Water Resources Journal

1402 Emerald Lakes Drive

Clermont, FL 34711

Phone: 352-241-6006

Email: Editorial_editor@fwrj.com

Display and Classified Advertising, ads@fwrj.com

Business Office:

1402 Emerald Lakes Drive, Clermont, FL 34711

Web: <http://www.fwrj.com>

General Manager:

Michael Delaney

Editor:

Rick Harmon

Graphic Design Manager:

Patrick Delaney

Mailing Coordinator:

Buena Vista Publishing

Published by

BUENA VISTA PUBLISHING for

Florida Water Resources Journal, Inc.

President: Richard Anderson (FSAWWA)
Peace River/Manasota Regional Water Supply Authority

Vice President: Jamey Wallace (FWEA)
Jacobs

Treasurer: Rim Bishop (FWPCOA)
Seacoast Utility Authority

Secretary: Mish Clark
Mish Agency

Moving?

The Post Office will not forward your magazine. Do not count on getting the Journal unless you notify us directly of address changes by the 15th of the month preceding the month of issue. **Please do not telephone address changes.** Email changes to changes@fwrj.com or mail to Florida Water Resources Journal, 1402 Emerald Lakes Drive, Clermont, FL 34711

Membership Questions

FSAWWA: Casey Cumiskey – 407-979-4806 or
fsawwa.casey@gmail.com

FWEA: Karen Wallace, Executive Manager – 407-574-3318

FWPCOA: Darin Bishop – 561-840-0340

Training Questions

FSAWWA: Donna Metherall – 407-979-4805 or
fsawwa.donna@gmail.com

FWPCOA: Shirley Reaves – 321-383-9690

For Other Information

DEP Operator Certification: Ron McCulley – 850-245-7500

FSAWWA: Peggy Guingona – 407-979-4820

Florida Water Resources Conference: 407-363-7751

FWPCOA Operators Helping Operators:

John Lang – 772-559-0722, e-mail – oho@fwpcoa.org

FWEA: Karen Wallace, Executive Manager – 407-574-3318

Websites

Florida Water Resources Journal: www.fwrj.com

FWPCOA: www.fwpcoa.org

FSAWWA: www.fsawwa.org

FWEA: www.fwea.org and www.fweauc.org

Florida Water Resources Conference: www.fwrc.org

Throughout this issue trademark names are used. Rather than place a trademark symbol in every occurrence of a trademarked name, we state we are using the names only in an editorial fashion, and to the benefit of the trademark owner, with no intention of infringement of the trademark. None of the material in this publication necessarily reflects the opinions of the sponsoring organizations. All correspondence received is the property of the *Florida Water Resources Journal* and is subject to editing. Names are withheld in published letters only for extraordinary reasons.

Authors agree to indemnify, defend and hold harmless the Florida Water Resources Journal Inc. (FWRJ), its officers, affiliates, directors, advisors, members, representatives, and agents from any and all losses, expenses, third-party claims, liability, damages and costs (including, but not limited to, attorneys' fees) arising from authors' infringement of any intellectual property, copyright or trademark, or other right of any person, as applicable under the laws of the State of Florida.

The Official Publication of FSAWWA, FWEA, and FWPCOA



Florida Water Resources JOURNAL

News and Features

- 4 2023 AWWA State of the Water Industry Report Now Available
- 16 2023-2024 FWEA Board of Directors
- 17 2023-2024 FWEA Officers, Chairs, and Advisors List
- 34 Contractors Roundup: Safety: It's More Than Just Common Sense—
Eric Komanowski
- 48 Florida Stormwater Rule Update
- 50 Southwest Florida Water Management District Governing Board Elects Officers for 2023-2024 Term

Technical Articles

- 8 Stormwater Master Planning: An Important Tool for Climate Adaptation and Resilience—*Sussette Irizarry, Gabriel Milian, Marlon Medina, and Christine Wartman*
- 36 Don't Get Caught With Your Pumps Down: Using Analytics to Improve Pump Reliability and Performance—
Mike Bernard

Education and Training

- 23 Florida Water Resources Conference
- 27 FWPCOA Training Calendar
- 40 FSAWWA Fall Conference General Information
- 41 FSAWWA Fall Conference Registration
- 42 FSAWWA Fall Conference Competitions
- 43 FSAWWA Fall Conference Water Distribution System Awards
- 44 FSAWWA Water Conservation Awards for Excellence
- 47 CEU Challenge
- 49 Treo Center

Columns

- 6 Let's Talk Safety: Climb on to Ladder Safety
- 20 C Factor—*Patrick "Murf" Murphy*
- 24 FWEA Focus—*Suzanne Mechler*
- 28 Test Yourself—*Charles Lee Martin Jr.*
- 30 FSAWWA Speaking Out—
Greg D. Taylor
- 32 Reader Profile—*Dustin Chisum*

Departments

- 45 New Products
- 51 Classifieds
- 54 Display Advertiser Index



ON THE COVER: The Central District Wastewater Treatment Plant in Key Biscayne. To learn how the plant is addressing climate adaption and resilience, go to page 8. (photo: Stantec)

Volume 74

July 2023

Number 7

Florida Water Resources Journal, USPS 069-770, ISSN 0896-1794, is published monthly by Florida Water Resources Journal, Inc., 1402 Emerald Lakes Drive, Clermont, FL 34711, on behalf of the Florida Water & Pollution Control Operator's Association, Inc.; Florida Section, American Water Works Association; and the Florida Water Environment Association. Members of all three associations receive the publication as a service of their association; \$6 of membership dues support the Journal. Subscriptions are otherwise available within the U.S. for \$24 per year. Periodicals postage paid at Clermont, FL and additional offices.

POSTMASTER: Send address changes to Florida Water Resources Journal, 1402 Emerald Lakes Drive, Clermont, FL 34711

Don't Get Caught With Your Pumps Down: Using Analytics to Improve Pump Reliability and Performance

Mike Bernard

Much has been written about the potential for plugging pumps in both wastewater and raw water pumping applications. The prolific use of variable frequency drives on pumps offers both improved process control and the potential to reduce energy expenditures. Unfortunately, operating these pumps at reduced speeds is leading to increased incidents of pump plugging, and therefore, increased potential for sanitary sewer overflows (SSOs). Most commercially available remedial systems focus on alarming, or even potentially reversing, the rotational direction of the pump if predetermined current set points are exceeded. These systems, however,

do not provide much insight into their overall performance potential.

The Case for Closely Monitoring Pumps Using Advanced Analytics

Data analytics of individual pump performance provides a more-holistic approach to the life cycle asset management and operation of these critical assets. Analytics can be used to decipher mountains of data from instruments in real time so that operators, managers, and engineers can work collaboratively to ensure

Mike Bernard is vice president of business development at Specific Energy in Georgetown, Texas.

that systems are operated, maintained, and even designed properly for the given service.

Simple illustrative dashboards convey live operating data and actionable alerts in the case of abnormal operation much more effectively than screens full of numbers. It's perplexing that even today's economy cars have simple dashboards (Figure 1) based on complex analytics that can calculate current fuel efficiency and whether it's operating within the car's performance envelope (tachometer), and yet today's multimillion-dollar pumping stations don't have anything similar to help operators make better decisions and take decisive action to prevent incidents like SSOs.

This no longer has to be the case.

Just like a car's dashboard that summarizes important information into graphics, the proper use of analytics can summarize pump station operations into easily understood graphics that quickly convey actionable recommendations. It only takes a second to look at a car's dashboard to tell whether the car is operating properly and water and wastewater operators shouldn't have to spend any more time than that looking at their pump station "dashboards" to know if they are performing optimally.

In addition to simple dashboards, analytics platforms can include monthly summary report cards that allow managers to proactively plan for the refurbishment or replacement of worn equipment before that equipment leads to unplanned outages. Simple access to raw or analyzed data also allows engineers to design supplemental or replacement pumps to better fit the actual conditions of service and potentially identify changes in those conditions that may indicate issues with upstream or downstream piping.

In short, pump analytics empowers utility personnel to work together across disciplines



Figure 1. Automobile dashboard.

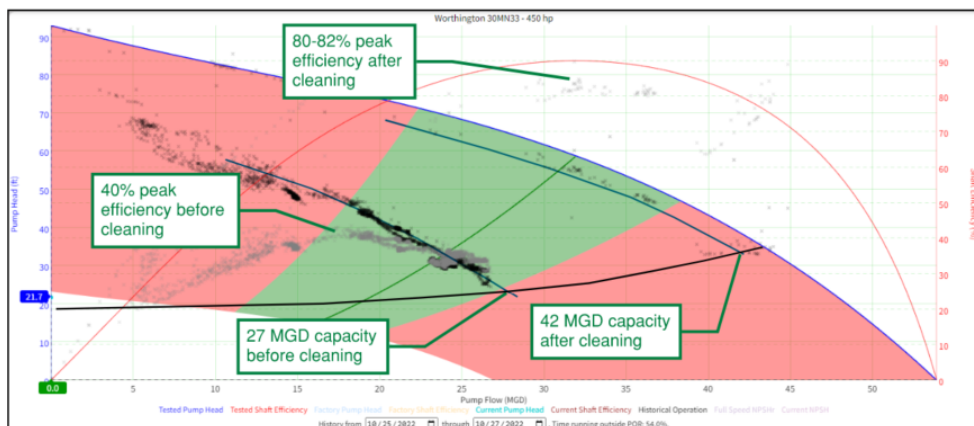


Figure 2. Functional pump curves before and after cycling.

to protect the environment, reduce energy expenditures, and extend the life of equipment.

Recognizing and Correcting Abnormal Pump Conditions

The City of Chattanooga (city) in Tennessee implemented an analytics platform on its Citico Pump Station in 2020. This combined sewage pumping station is the largest in the system and was scheduled for a major refurbishment of its pumps and electrical components. The city desired a comprehensive analysis of the pump sizing and current force main hydraulics to determine if changes should be made.

The analytics platform provided this information, but also indicated that there was a significant amount of deterioration of the impellers on two of the four pumps. This deterioration reduced the real firm capacity of the station from its design of 120 mil gal per day (mgd) to an actual capacity of 102 mgd. Additionally, the analytics platform indicated that plugging or ragging occurs in the pumps when operated at reduced speeds. While adversely impacting energy efficiency, this ragging also robs the station of capacity.

During extreme instances, individual pumps have lost as much as 50 percent of their capacity. This is significant as the station's true firm capacity has been reduced to as low as 80 mgd during heavy inflow and infiltration events. Regaining this capacity is essential in the city's efforts to reduce overflows and comply with its consent decree.

Fortunately, the analytics platform uncovered a positive and useful trend in pump performance connected to daily purging of the bubble level control system. During a purge, the signal from the bubbler indicates that the wet well is empty, so the programmable logic controller (PLC) either reduces pump speed to a minimum or turns off the pump. Five minutes later, the signal returns, indicating that the wet well level is too high. The PLC ramps the pump speed to 100 percent to pull the level back down before stabilizing several minutes later.

The periodic pump cycling is often enough to remove a majority of the foreign material from the impeller. This behavior is illustrated by data in Figure 2, which shows that the Pump 2 capacity increased by approximately 55 percent and the efficiency essentially doubled simply by cycling the pump during the bubbler purge.

The city is now evaluating automated pump cycling based upon a preset level of "lost capacity" provided by the analytics platform. Before a major rainfall event begins, operators can proactively check the real firm capacity of

Continued on page 38

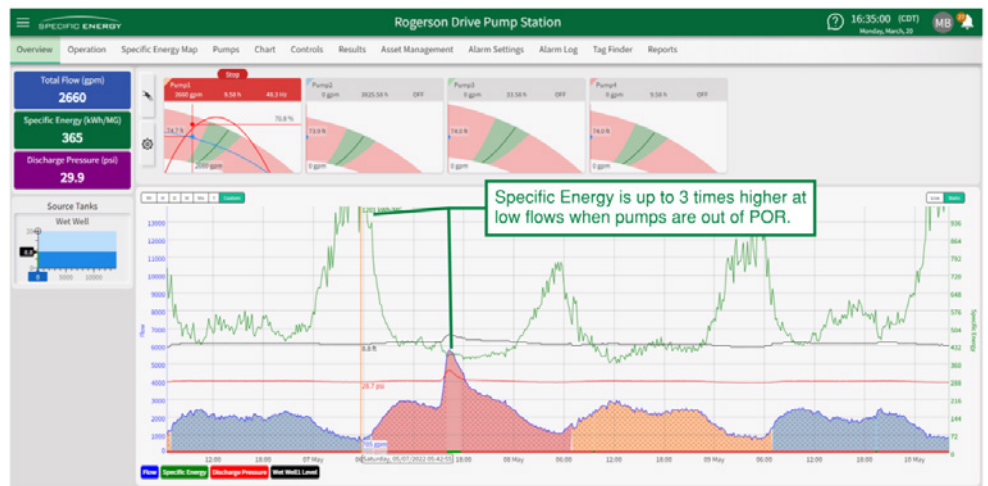


Figure 3. Elevated specific energy during operation at low speeds.

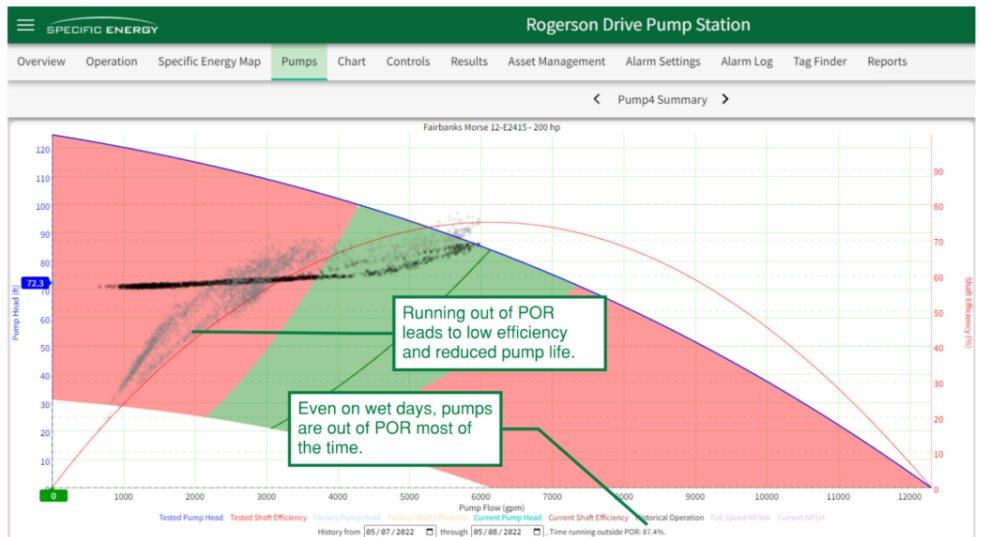


Figure 4. Effect of operation outside of the preferred operating range on efficiency.

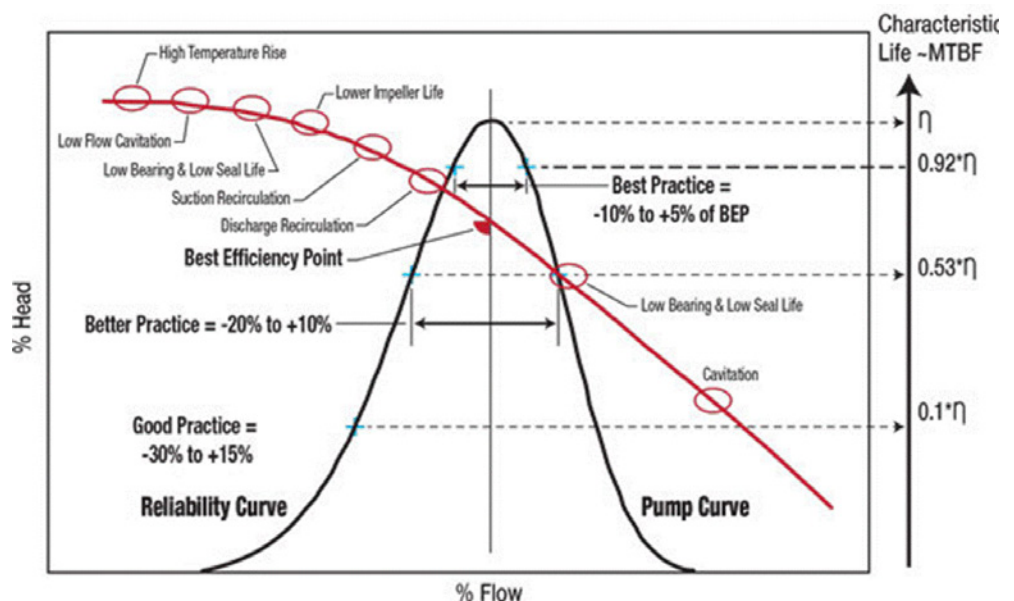


Figure 5. Barringer-Nelson curve (Centrifugal Pump Flow Operating Regions and Impact on Reliability, Budris, WaterWorld 2016).

Continued from page 37

the station and perform any additional “cleaning cycles” on the pumps to assure that the station is performing to its potential.

How to Optimize for an Oversized Pumping System

Orange Water and Sewer Authority (OWASA) in Carrboro, N.C., implemented the same platform at the Rogerson Drive Pump Station, its largest regional wastewater pumping station, in early 2022. The initial finding from the analysis is that these pumps were operating too slowly almost 100 percent of the time.

Like most wastewater pumping stations, this one was designed to convey peak flows during heavy rainfall events; however, these events occur only 10 to 15 times per year. The unfortunate consequence of designing like this is that these pumps are operating outside of their preferred operating range (POR) almost all of the time.

Two things happen when pumps operate outside of their POR:

They waste energy. During low flow periods every night, these pumps consume 300 percent more energy per gal pumped than they would if they were in POR. This is indicated in Figures 3 and 4.

Wasted energy harms pumps. Conservation of energy dictates that this energy must go somewhere. In pumping systems, if it’s not going to pumping water, then it likely manifests as heat, damage, or noise. All of these are damaging for the pumps, which is why the Barringer-Nelson

curve (Figure 5) indicates that operation of pumps outside of POR significantly reduces the life of these critical assets.

The insights provided by the analytics platform have provided OWASA the data and opportunity to evaluate two potential modifications to its system.

The first is to simply increase the minimum speed set point of the existing pumps from 45 hertz (Hz) to 50 Hz. This will move the operation of each pump into its POR, but it will also cause the station to revert to a fill-and-drain mode of operation.

Operations was concerned that this could lead to odor complaints along the force main and a slugging effect at the wastewater treatment plant, so the second alternative is to add a jockey pump at the station that will handle the lower nighttime flows. The addition of a smaller 100-horsepower (HP) pump could both reduce the overall energy expenditure at the facility, as well as extend the life of the 200-HP pumps, so that OWASA doesn’t get caught with its pumps down when it needs them.

Using Analytics to Predict Obstructions in Suction and/or Discharge Piping

Analytics can also identify issues in the piping to or from the pumping systems.

This was one of the most important benefits for a utility in Texas at one of its raw water pumping facilities. The facility experienced issues in both the suction and discharge piping systems. The barrel strainers on the suction side of the canned turbine pumps were blinding due

to algae buildup, which starved the pumps and reduced output. The analytics platform provides a simple graphical indication to operators when this situation occurs so that operators can know to proactively clean the screens.

The discharge-side obstruction was more challenging to diagnose. The system hydraulics indicated that there was, at times, as much as 250 ft of additional head on the system that should not be there. This additional head, coupled with wear and tear on the pump impellers, increased the amount of electricity needed, while reducing the station’s potential output as much as 28 percent. Fortunately, the utility was able to reduce the head by running foam pigs through the 22 mi of 30-in. diameter main.

With the help of analytics, the system identified that the issue was caused by a combination of sediment and perched air bubbles in the piping due to faulty air release valves. Figure 6 illustrates the hydraulics before and after pigging. The data show that, after pigging, the current pump system hydraulics perfectly match the hydraulics from the original system design. The analytics package allows the utility to monitor the health of both the pumps and the piping systems and enables proactively scheduling maintenance activities to ensure that the utility has the capacity needed to make it through the hot summer months in Texas and keeps the systems operating optimally.

Summary

Almost every water and wastewater pumping system in the world today has some level of instrumentation that generates data. Unfortunately, most of these data are not being properly analyzed to give the operators, managers, and engineers who work with them the actionable insights they need to translate data into optimal system operation.

The application of a powerful analytics platform can provide these insights, reduce energy expenditures, extend the useful life of equipment, and protect the environment by reducing unplanned outages. All of this ensures that water and wastewater operators, managers, and engineers have the information they need to make sure that they don’t get caught with their pumps down.

This article first appeared in the spring 2023 issue of NC Currents, a publication of NC One Water (originally the North Carolina Section of the American Water Works Association and the North Carolina Member Association of the Water Environment Federation). ◊

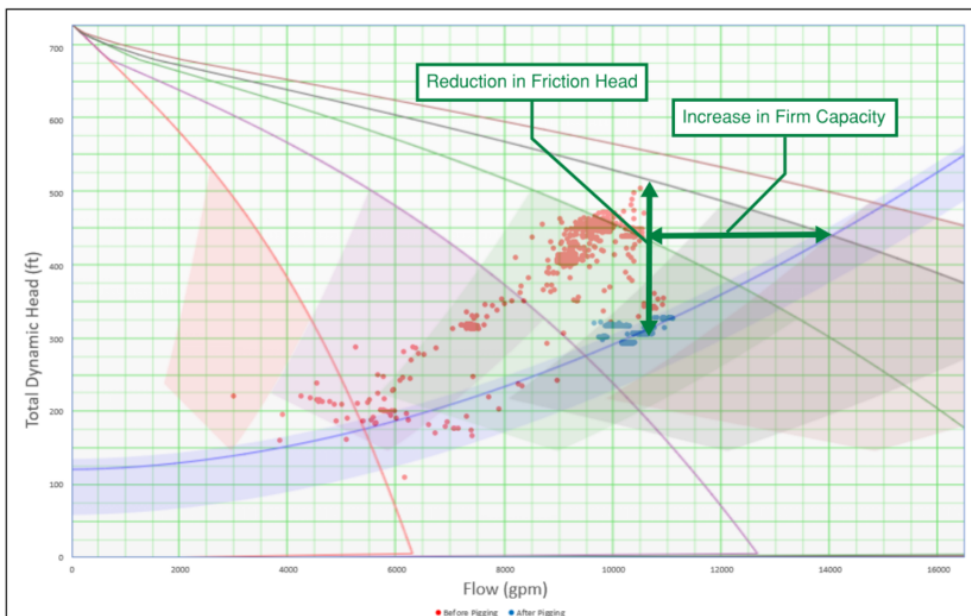


Figure 6. Performance Improvements from pipeline pigging.