How Low Can You Go? Drought-Proofing Water Pump Stations for Critical Infrastructure

How water and electrical utilities can address drought

HOLDEN, MA, UNITED STATES, September 12, 2016 /EINPresswire.com/ -- Water is essential for our lives and our infrastructure, but longer and more intense periods of drought are drying up groundwater aquifers in many populous sections of the U.S.

Thermal power plants rely on surface water to cool the steam that drives the turbines and generates electricity. Increasing drought also leaves more communities reliant on purifying surface water for drinking. The problem is that surface water pump stations were designed for surface water elevations that may no longer be counted on when drought strikes.

How can pump station operators ensure that their critical operations run smoothly during challenging drought conditions? Hydraulic flow experts at Alden suggest three strategies.

1. Create drought-resistance by knowing the numbers.

Whether for drinking or cooling water, operators may need to get creative when drought strikes. But first, they must know how low water levels can get before endangering the pumps themselves or their ability to supply water. If drought conditions are leading to lower-than-recommended water levels in a wet well, one way to determine whether there's a problem is to perform scale physical flow modeling. In Texas, where drought duration and intensity has been increasing, several stations have taken this action. The models have provided both data on flow patterns and data needed to predict potential air entrainment problems—information required to keep the stations operating in challenging weather events.

2. Listen. That sound could be a clue.

Pumps are designed to operate with a specified amount of upstream water pressure, known as Net Positive Suction Head Required (NPSHR), as well as a specified submergence below the wet well water surface. Two serious problems can occur when these requirements are not met, such as in a drought or low water level situation. Both come with telltale sounds that operators should be monitoring. The first, cavitation, a process in which water "boils" and forms vapor within the pump impeller because of low pressure, sounds like rocks rolling around inside the pump. It causes erosion of the pump impeller. The second, air entrainment, happens when pumps no longer have sufficient submergence, similar to a vortex in the bathtub when the water level gets low. Air entrainment sounds like sucking or rumbling, and can cause changes in pump performance, loss of suction, fluctuations in component loads and vibration severe enough to destroy the pump.

3. Find the bottom, and go below.

With observational and modeling data in hand, a plant has the ingredients to determine which (and whether) wet well design modifications could help the plant to operate at even lower water levels. In the case of the Texas stations, modeling revealed undesirable flow characteristics at low water levels,

and the models were used to derive wet well modifications that would allow lower water surface elevations without compromising performance. These included lowering the pumps, and the addition of subsurface wall grating, pump bell floor splitters, horizontal grating at the water surface, and curtain walls.

Since 1950, data shows that certain regions of the world are experiencing longer and more intense drought—a phenomenon that is projected to continue as the climate warms. Having a strategy in place to drought-proof pump stations in hard-hit regions can help ensure essential power generation and drinking water operation.

About Alden
Alden (Alden Research Laboratory, Inc.) is an internationally acclaimed leader in solving flow-related engineering and environmental problems. For more than a century, Alden has provided engineering, field and laboratory technical assessments to meet regulatory agency and operational requirements. With laboratories in Massachusetts and Washington and offices across the country, Alden provides compliance, environmental services, physical and computational flow modeling, flow meter calibration, and field services. Founded in 1894, Alden is the longest continuously operating hydraulic laboratory in the United States. Learn more at www.aldenlab.com.

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