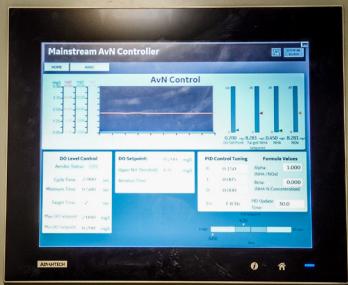


## ► QUICK FACTS

- ◆ **INDUSTRY:** Municipal
- ◆ **PROCESS TYPE:** Activated Sludge (Johannesburg)
- ◆ **TECHNOLOGY:** inDENSE™ & AvN™
- ◆ **PERMITTED FLOW:** 19.0 MGD
- ◆ **STARTUP DATE:** June 2019



## BACKGROUND

The city of Pueblo, CO, is located at the confluence of the Arkansas River and Fountain Creek in South Central Colorado. Aside from its scenic beauty, Pueblo is also home to the James R. Dilorio Water Reclamation Facility (WRF), treating up to 15.7 MGD of wastewater generated by the city and surrounding districts. In 1988, the biological process was upgraded to a Johannesburg configuration consisting of Anoxic → Anaerobic → Anoxic → Aerobic.

Historically, Pueblo's influent characteristics showed a low C:N ratio. This was not an issue until recent effluent limits for Total Inorganic Nitrogen (TIN) and Total Phosphorous (TP) were placed on the facility. Acetic acid was added to boost the C:N ratio and improve treatment performance, however, it came at a cost of \$300,000 annually.

Pueblo hired a local engineering firm to review their process and identify cost effective methods to improve their overall treatment, lower their operational budget and aid in the seasonally poor settleability of their Mixed Liquor Suspended Solids (MLSS).

The engineer evaluated several options and selected the inDENSE™ and AvN™ processes from World Water Works.

## SOLUTION

inDENSE is a gravimetric sludge selection process using hydrocyclones to separate the heavier, denser, more settleable material (underflow) from the lighter sludge fraction (overflow). Pueblo has a RAS splitter box structure; the ideal location for inDENSE. A submersible pump was dropped into the splitter box to feed the inDENSE. The underflow simply drops back into the RAS stream while the overflow flows by gravity to the Dissolved Air Flotation Thickeners (DAFT). Phosphorous Accumulation Organisms (PAOs) and nitrifying bacteria are heavier and larger than other bacteria and report to the underflow. The concentration of these populations improves the facility's biological process.

### SOLUTION CONT.

AvN is an advanced aeration control strategy that further assists the biological process. AvN helps maintain the necessary environment to circumvent the traditional nitrogen cycle; from NH<sub>4</sub><sup>+</sup> → NO<sub>2</sub><sup>-</sup> → NO<sub>3</sub><sup>-</sup> → NO<sub>2</sub><sup>-</sup> → N<sub>2</sub> to NH<sub>4</sub><sup>+</sup> → NO<sub>2</sub><sup>-</sup> → N<sub>2</sub> or nitrite shunt. Oxygen and nutrient monitoring paired with facility specific set points, allow AvN to minimize the aeration energy needed by the activated sludge process. This nitrite shunt process reduces the need for carbon and requires 60% less oxygen, both offering substantial savings to Pueblo.

### PERFORMANCE

Pueblo and its engineer had 4 major goals: Improve settleability, improve Bio-P, reduce chemical consumption, and reduce aeration costs. As previous SVI values had spiked in the winter and spring months, the post inDENSE values remain steady throughout the year, giving Pueblo the confidence needed to consistently run at higher MLSS concentrations thus improving throughput.

### PERFORMANCE CONT.

Both inDENSE and AvN are credited for improved biological treatment. Retention of the proper bacteria and customized aeration control have allowed Pueblo to terminate acetic acid addition, saving \$300,000 annually. More savings were realized with the reduction in PAC addition for phosphorus control. In addition, the city easily meets the current TIN and TP effluent limits, and future limits of 10 mg/L and 1 mg/L respectively.

Power for aeration is often the biggest expense at a WRF. AvN reduced the required oxygen by 60% translating directly to energy savings for the facility by having to operate only one (1) of its five (5) installed blowers.

### CONCLUSION

inDENSE and AvN have improved the plant performance while decreasing the operational costs. The facility is consistently meeting all effluent limits without the aid of carbon addition and reduced volumes of PAC. Process and capacity improvements at Pueblo equate to an equipment ROI of under 2 years, a win for both the engineer and Pueblo.

