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Case study
ICEAS SBR System

# Improving peak flow management and nutrient removal with the Sanitaire® ICEAS SBR System

The Kiski Valley Water Pollution Control Authority (KVWPCA) located along the Kiskiminetas River northeast of Pittsburgh, Pennsylvania is responsible for treating wastewater from thirteen local municipalities. The conventional activated sludge treatment plant, constructed in 1972 was designed for an average daily flow of 7.0 million gallons per day (MGD) and peak flow of 19.1 MGD.

## Challenge

To address peak flows during wet weather events, the Kiski Valley Authority was required by the Pennsylvania Department of Protection to prepare a long-range combined sewer overflow (CSO) plan. Additionally, the authority and community were responsible for creating a plan to expand the treatment plant in order to support population growth and meet future, stricter nutrient removal requirements.

## Solution

KVWPCA worked with KLH Engineers, Inc. and determined that the Sanitaire ICEAS (Intermittent Cycle Extended Aeration System) Sequencing Batch Reactor (SBR) system would be the ideal solution to meet nutrient removal requirements and provide a solution for future plant expansion by converting the existing aeration tankage to aerobic digesters. The plant design included the construction of a four-tank SBR system designed for 7.0 MGD with a peak flow of 31.0 MGD.

The Sanitaire ICEAS SBR system is a continuous-flow biological wastewater treatment process that performs all treatment steps (aeration, settling, and decanting) within a single tank, simplifying operations and reducing complexity compared to conventional activated sludge and SBR systems.

## How the ICEAS SBR System Works

During the aeration step, anaerobic, anoxic, and aerobic periods occur in sequence to achieve BOD oxidation, nitrification, denitrification and enhanced biological phosphorous removal. During the settle step, air and mixing remains off and solids are allowed to settle while the basin continues to fill, providing a supply of BOD for additional denitrification. During the final step, clarified wastewater is decanted from the basin by slowly lowering the baffled trough. Before the the effluent is discharged

The 4-tank ICEAS SBR system was an ideal solution for meeting nutrient removal requirements and future plant expansion needs

**Customer**
Kiski Valley Water Pollution Control Authority

**Project scope**
Design, manufacture, installation and commissioning of an ICEAS SBR system and associated equipment

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to the Kiskiminentas River, there is a further ultraviolet disinfection step.

The residual biosolids generated by the ICEAS SBR system are periodically pumped during each of the decant periods for further processing at the facility. Unlike conventional activated sludge treatment plants, there is no return activated sludge (RAS) further reducing capital and long-term costs.

## Results

The project was completed in May 2016 and increased the treatment capacity to 31 million gallons per day. With the plant upgrade and expansion, the bypass of untreated wastewater was eliminated. The plant is now consistently achieving 97–98% BOD/TSS removal. In June 2018, the average BOD and TSS effluent quality was 3.0 mg/l for both.

> According to Dennis Duryea, P.E., Authority Manager, they now have "…confidence that we can leave the plant for up to 16 hours and not have any issues, as the plant basically runs itself."

In addition to achieving these treatment goals, the plant's operations staff can now handle other facility maintenance tasks due to the simplicity of operation of the ICEAS SBR system. Previously, the conventional activated sludge plant required round-the-clock staffing, 24/7,365 days per year.

In addition, the return of activated sludge (RAS) is no longer needed with the ICEAS SBR system eliminating the need for air lifts or centrifugal pumps and the nuisance odors associated with RAS.

Dennis further commented, "The plant was designed to meet future TN and TP requirements by including anaerobic and anoxic periods in the react cycle. Although the current effluent permit does not require TN or TP removal, the plant has completed testing and confirmed that the system is capable of reducing TN to less than 5 mg/l and TP to less than 1 mg/l."

Eugene Burns, the Operations and Maintenance Supervisor at the plant and the longest-tenured employee at KVWPCA, oversees the maintenance of mechanical equipment. He remarked, "The new plant has exceeded expectations."

| | 2012 | | | | 2017 | | | |
|---|---|---|---|---|---|---|---|---|
| | TSS effluent (mg/l) | % Removal | BOD effluent (mg/l) | % Removal | TSS effluent (mg/l) | % Removal | BOD effluent (mg/l) | % Removal |
| January | 13.1 | 84.0 | 16.5 | 80.3 | 5.1 | 95.5 | 5.3 | 95.1 |
| February | 11.1 | 91.0 | 15.3 | 83.6 | 6.1 | 94.9 | 5.5 | 95.5 |
| March | 11.3 | 91.4 | 12.2 | 85.3 | 8.2 | 94.3 | 6.7 | 95.3 |
| April | 9.0 | 93.1 | 13.0 | 88.7 | 5.7 | 95.8 | 5.3 | 95.5 |
| May | 11.7 | 89.5 | 14.5 | 84.7 | 6.8 | 94.7 | 4.0 | 95.8 |
| June | 7.4 | 94.5 | 11.6 | 90.6 | 4.6 | 97.5 | 3.1 | 97.5 |
| July | 9.8 | 95.5 | 13.8 | 88.4 | 4.4 | 97.7 | 3.3 | 96.9 |
| August | 10.3 | 93.4 | 12.9 | 89.2 | 3.6 | 97.5 | 3.2 | 97.1 |
| September | 11.3 | 94.2 | 11.9 | 91.7 | 4.4 | 98.2 | 4.0 | 97.5 |
| October | 9.9 | 93.7 | 11.0 | 91.9 | 4.8 | 98.2 | 3.1 | 98.1 |
| November | 7.9 | 91.6 | 10.1 | 89.2 | 5.1 | 94.1 | 3.7 | 96.7 |
| December | 13.2 | 86.5 | 11.3 | 87.2 | 4.4 | 96.1 | 3.5 | 97.6 |
| Average | 10.5 | 91.5 | 12.8 | 87.6 | 5.3 | 96.2 | 4.2 | 96.5 |

Monthly comparison of BOD and TSS removal before and after plant expansion. The removal of ammonia-N is not required, however the system achieves an annual average effluent ammonia limit of 2.5 mg/l.





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