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NEWVILLE BOROUGH WATER & SEWER AUTHORITY
WASTEWATER TREATMENT FACILITY EXPANSION
CUMBERLAND COUNTY, PENNSYLVANIA

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The Newville Borough Water & Sewer Authority (NBWSA) recently completed a wastewater treatment facility expansion. The facility is located in Newville Borough, Cumberland County and serves Newville Borough and portions of North Newton Township, Penn Township, and West Pennsboro Township. The NBWSA expanded their existing 0.350 MGD extended aeration process facility by constructing a 0.60 MGD ITT/ABJ Intermittent Cycle Extended Aeration System (ICEAS) continuous fill SBR process facility. The new facility will allow the Authority to meet their future capacity needs and positions them to meet the Department of Environmental Protection's Chesapeake Bay Strategy nutrient loading limits.

The Authority determined that to meet anticipated effluent criteria required by Pennsylvania Department of Environmental Protection (PA DEP), the existing wastewater treatment facility would be converted into aerobic sludge digestion and storage and a new treatment facility would be constructed to meet the future organic and hydraulic capacity needs of the Authority and the Chesapeake Bay watershed nutrient loading limits proposed for existing wastewater treatment discharges.

The new facility consists of two continuous fill, SBR tanks, preceded by an automatically operated fine screen to remove inorganic solids, and a Trojan UV 3000 disinfection unit. The SBR tanks receive raw influent continuously, while treated effluent is discharged to the UV unit for a maximum 60 minute period out of a 4.8 hour treatment cycle. A baffle wall, which isolates approximately 15% of the SBR tank volume, and a rectangular tank configuration prevents short-circuiting of the influent wastewater by directing the influent flow to the base of the tank and spreading it across the entire width of the basin. This pre-react volume, which is aerated with the rest of the tank volume, also acts as a high F:M selector to control the growth of filamentous bacteria. As a safety feature of this process, there is no floating equipment within the SBR basins. All equipment is mounted to the tank walls and can be maintained without entering the basin. The tanks' fine bubble diffusers are grid mounted to the basin floor, but unlike a true batch SBR system, the ICEAS process can operate using a single basin without process modifications or effluent degradation, allowing a basin to be drained for diffuser maintenance, if necessary.

To meet the Chesapeake Bay Strategy nutrient loading limits, the new facility is equipped with mechanical mixers, in-tank dissolved oxygen sensors, and VFD-controlled blowers, so that aeration can be controlled by the dissolved oxygen concentration in the basins during the react period of the treatment cycle. This prevents over-aeration during aeration periods of the react cycle, allowing the dissolved oxygen to quickly crash during anoxic periods in the cycle. Alternating periods of oxic react and anoxic react generate nitrate and denitrify the nitrate created, respectively. Nitrogen gas produced by denitrification is stripped during a final aeration period prior to settling.

The new facility was placed in to service on June 3, 2009. In the period from July 8, 2009 to September 9, 2009 the average analytical results of the new facility's effluent were as follows:

Parameter	Average (mg/l)
CBOD	3.57
TSS	2.63
NH3-N	0.18
Phosphorus	0.98
Total Nitrogen	1.64

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Conventional wisdom says that to consistently meet total nitrogen concentrations below 5 mg/l requires a physical filter and/or a denitrification filter with supplemental methanol feed. In this scenario, methanol is needed to provide soluble BOD to drive the biologically mediated reaction of denitrification, since the effluent from a flow thru or true batch SBR treatment process is devoid of most soluble BOD. Yet the Newville facility includes neither a physical filter nor a denitrification filter. We believe this greater denitrification efficiency is due to the continuous fill feature of the ICEAS SBR process. During the final anoxic periods of the SBR's react cycle, although the overall CBOD concentration in the complete mix SBR basin is low, a greater component of soluble BOD, which is more readily available to the microorganisms, is present in the CBOD due to the continuous addition of raw wastewater. This maintains the driving force for denitrification to lower concentrations of total nitrogen than seen in true batch SBRs and MLE-type processes. We feel that this combined with the quiescent settling conditions of the CSBR result in the greater than anticipated total nitrogen removal. We feel that possibly with the addition of a physical filter, such as a drum or disc filter, we could reliably meet total nitrogen concentrations near 3 mg/l, considered enhanced nutrient removal (ENR).

David Runkle, Laboratory Supervisor, for the Carlisle Regional WPCF, where effluent testing for the Newville wastewater treatment facility is conducted, was skeptical of the initial analytical results. But after seeing consistent results over the first few months of the plants operation, he is impressed with the denitrification performance of the Newville facility.

In addition to a superior effluent, the new facility has experienced operational savings in an area expected to experience significant rate increases in the next few years. A 20-25% reduction in electric costs was realized almost immediately after start-up due to the DO concentration control system and the recovery of oxygen from the denitrification process. Another advantage of the process is its operator friendliness. With no return or recycle pumping to adjust, the only typical adjustment required is the waste sludge wasting rate, in order to maintain your target MLSS concentration. Joseph Lehman, Newville's Operator in Charge, is very pleased with the performance of the new SBR wastewater treatment facility. He is also pleased with the ease of operation and maintenance. Having the ability to treat total nitrogen below permit limits not only reduces energy costs by taking advantage of demand-only aeration and denitrification oxygen release, it can also generate a new revenue stream in the form of nutrient credit trading. Unused nutrient allocations can be sold to other facilities that cannot meet their allocation.

Overall costs (Construction & Engineering) also turned out to be a major advantage. Construction for the new facility began in July, 2008. The costs are referenced in the following table.

Description	Cost
Construction	$2,701,073
General Contract	$2,399,948
Electrical Contract	$272,417
Additional Equipment & Services	$28,708
Engineering (Design & Construction)	$232,929
Total	**$2,934,002**

The General contract was completed by Hickes Associates, Inc. of Alexandria, PA and the Electrical contract was completed by Robert P. Lepley of Lewistown, PA. Engineering costs for the project included design, permitting, and construction monitoring of the new facility. Unit costs for the design and construction of the new facility were approximately $4.88 per gallon of treatment capacity, including modification of the existing treatment units for aerobic digestion. A PennWorks Grant funded a majority of the project ($1,640,110), while the remaining funds were acquired through low interest loans at local financial institutions.