

**Water and Environmental Programs
Engineering Success Stories**

State: Maryland/Delaware (Portions of the Town are in both States)

Borrower Name: Town of Delmar

Engineering Firm: Davis, Bowen & Friedel, Salisbury, MD

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Congressional Information: Representatives Wayne Gilchrest, Maryland; Mike Castle, Delaware

Counties: Wicomico, MD and Sussex, DE

Keywords: Nitrogen removal, Vertical loop reactor

Vertical Loop Reactor Chosen As BNR Method At Delmar WWTP

Description of Problem/Issue:

The Town of Delmar has a 0.85 mgd wastewater treatment plant, and needs to provide further reduction in nitrogen level in their plant discharge. The State of Maryland is providing special grant funding to assist communities in accomplishing this goal, and Delmar has also applied for RUS funding.

Five alternatives were evaluated in the Preliminary Engineering Report, including:

1. Single Sludge Recirculation
2. Vertical Loop Reactor
3. Fluidized Bed System
4. Fine Bubble Aeration
5. Spray Irrigation

Based on a decision matrix, the Vertical Loop Reactor (VLR), by Envirex, was selected. It narrowly out ranked the second best alternative of Fine Bubble Aeration. The VLR was the least expensive alternative for capital cost, at an estimated \$627,000 for construction cost only, and also for estimated O&M costs. Major cost components include the concrete basin, the VLR equipment, and mechanical/electrical work. There are also various other modifications to fit the new system into the existing plant.

Specific advantages of the VLR over the other alternatives include fewer disruptions to the existing operation, and minimum impact on site space allowing for future expandability.

The VLR will be installed in the process prior to the existing aeration basins. In the VLR, a combination of aeration disks and coarse bubble diffusers produce an environment where nitrification and denitrification occur simultaneously in the same

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basin. A portion of the aeration basin effluent will be recycled to the head of the VLR, which allows the denitrification of ammonia that was nitrified in the aeration basin. Internal recycle rates are lower than those used in conventional BNR.

The total process with VLR will be able to meet compliance discharge limit of 8 mg/l total nitrogen.
