From the Board

Installing the First Trilateral Underdrain System in India


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In Indian municipal surface water treatment plants, rapid sand gravity filters play a crucial role in polishing clarified water to achieve standard turbidity norms of less than 1 ntu. Traditionally, conventional rapid filtration rates are limited to 6,000 Lph/m² (2 to 2.5 gpm/ft² US).

Such filters have inherent deficiencies, as only the upper, fine-grain media layer plays a role in filtration because of how the grains are hydraulically graded during backwash. As a result of this process, also known as *surface filtration,* the filters clog rapidly, and service cycles are limited. Frequent turbidity breakthroughs also can occur if the beds aren't washed on time. When source water quality deteriorates each season, backwashing frequency increases appreciably. Indeed, two backwashes in a 24-hr cycle may be required.

In-depth filtration technologies like monomedia, dual media, and multimedia enable high-rate filtration and a high-quality filtrate. Unfortunately, such technologies aren't popular in most municipal water treatment plants because of the extremely conservative mindsets of engineers who fear adopting what they consider to be nontraditional methods for treating drinking water.

However, in 2015, in a town called Sangli in Maharashtra, specifications for an 80-mld plant required *coarse media filtration,* with a filtration rate of 10,000 Lph/m² and a bed depth exceeding 1 m. This simply means monomedia, deep-bed filtration.

The suggested filter underdrain included nozzles on a false-bottom floor for a uniform, concurrent air-water wash—a basic requirement for cleaning these types of beds. The process involves constructing a concrete slab about 0.90 m (3 ft) above the filter bottom to create a plenum chamber. The false slab is supported by multiple stub columns. The nozzles are embedded in the false bottom, over which the media is laid with minimum gravel support. This arrangement is cumbersome to construct and execute, and the additional concrete structural cost is considerable. However, a traditional manifold-lateral system doesn't work in this case, as it's normally designed for a separate air scour followed by a water wash.

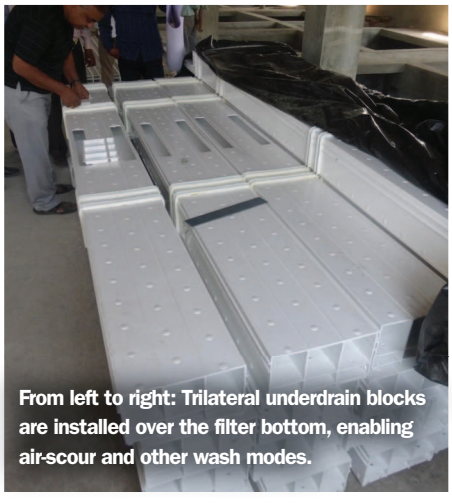
After convincing local authorities to install this "alternative" advanced system, a trilateral underdrain was adopted for the plant's filter beds. The system's main advantage is that its design ensures a uniform, concurrent air and water wash. Also, the system can be operated in air-scour only or water-wash only mode. All three modes are applicable at relatively low headloss (pressure drop).

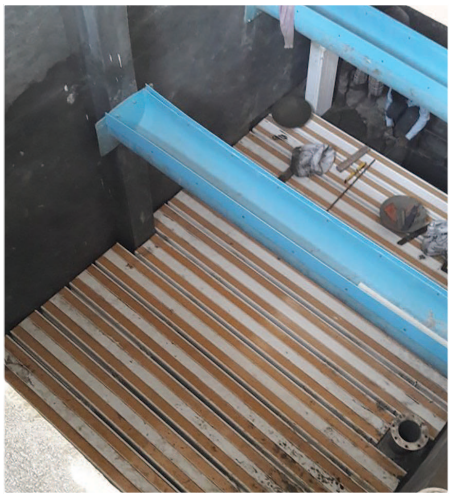
Another advantage of the system is that it comes in prefabricated polyvinyl chloride or polypropylene blocks, which are easy to assemble onsite with a semiskilled workforce. Also, the blocks can be directly laid over the filter bottom with a central (or side) manifold pit. Hence, the filter walls don't require additional height.

For this plant, the manufacturer recommended using all three modes to clean the beds. The backwashing operation starts in air-scour mode at a rate of 80–100 m/hr. That step is followed by a concurrent air-water wash at a rate of 15–20 m/hr. The final step calls for a water-only wash at a rate of 30–40 m/hr. The coarse filter media doesn't expand during the backwash.

The plant has been online for the last six months, and the backwashing operation is highly efficient. The filter runs are normally 48–72 hr when clarified water turbidity is less than 5 ntu. To date, the plant has consistently delivered filtered water with less than 0.5 ntu turbidity. In short, the technical advantages of a trilateral underdrain make it a simple, cost-effective solution for efficient filter-cleaning operation.

—Shirish Kardile,
AWWAIndia Strategic Board Chair


From left to right: Trilateral underdrain blocks are installed over the filter bottom, enabling air-scour and other wash modes.



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