Modernizing and Enlarging an Activated-Sludge Plant

Sewage-treatment facilities at Hagerstown, Md., extended by constructing grease chamber, preliminary settling tanks and diffused-air aeration tanks—Mechanical dewatering of undigested sludge proves highly efficient

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HAGERSTOWN, MD., one of the early cities in the United States to use the activated-sludge method for treatment of its sewage, completed in May, 1933, a program of major extensions and betterments to its sewage-treatment works originally constructed in 1924-'25. The remodeled plant is of particular interest on account of grease separation by compressed air and the conversion of undigested solids to inoffensive sludge cake by vacuum filters.

The plant effluent is discharged into Antietam Creek, which has a drainage area of 190 square miles and dry-weather flows often as low as 20 to 30 cu.ft. per sec. A dam located about a mile below the plant outfall forms a pond about 80 ft. wide and 8 ft. deep, which extends upstream beyond the treatment works. To avoid unwholesome conditions in the stream, a high degree of treatment is necessary.

The original plant

Before improvement, the plant included coarse bar screens, a revolving fine screen, grit chambers, aeration by a novel and experimental type of mechanical aerator and final sedimentation. The screenings and sludge were dried, after heavy lime treatment, on open sand beds, and the dried sludge was then spread on city-owned farm land.

The original aeration equipment was of the turbo-aerator type placed in the center of deep rectangular tanks. With various changes, including application of compressed air through a row of plates placed around the equipment, it was operated intermittently each summer until the fall of 1929, when its use was abandoned because of failure to obtain satisfactory results. Another aerating device of similar type but of different make was installed for trial in each of the two tanks in 1930, and after extensive trials and tests, it was removed by the manufacturer in 1931 because it did not prove economical or satisfactory for local conditions.

During the eight years of operation of the original plant the disposal of undigested limed sludge on the open beds was only moderately successful. The beds, which were constructed without lateral underdrains, became clogged, and it was necessary to dispose of a substantial portion of the sludge by pumping directly to ditches and lagoons.

These circumstances and increasing sewage flow necessitated extensive improvements. Fortunately, the original structures were well built, in excellent condition, and their arrangement was such that the greater portion could be used to excellent advantage in providing a modern up-to-date treatment plant at a very reasonable total cost.

Design data

The plant is designed for an average flow of 4 m.g.d., based on an average flow of 100 gal. per capita daily from a connected population of 40,000 people, predicted for 1945. Complete treatment is given to all flows, however, up to 6 m.g.d. Full preliminary treatment is provided for a flow of 8 m.g.d., and flows in excess of 6 m.g.d. are bypassed after passing through the preliminary tanks.

The data in the following tabulation were used in the design of the plant, based on an average rate of flow of 4 m.g.d.

Grease-separation tanks, average minutes detention	4
Preliminary tanks, average hours detention	1
Aeration tanks, average hours detention (sewage plus 25% return sludge)	6
Air provided at average flow, cu.ft. per gal.	1.2
Air pressure, lb.	7
Final tanks, gal. per sq.ft. daily	800
Dry solids in sewage, lb. per capita per day	0.2
Per cent moisture of mixed sludge	97
Minimum sludge filtering rate, dry-sewage solids per hr.	1.0

Overflow chamber

In the main 54-in. trunk sewer about 300 ft. above the plant a new overflow chamber, with a drain to the creek, has been provided. The elevation of the weir is such that at least 8 m.g.d. will pass to the plant before any overflow takes place, although for emergency purposes a gate is provided, so arranged as to divert the flow at any desired rate.

FIG. 1—THE NEW sludge filter building of the Hagerstown sewage-treatment plant and the original sludge-drying beds are at the right. The new office and laboratory and the original service building are in the center background.

Screens

From the 54-in. sewer the sewage passes first through bars spaced 2½ in. apart, cleaned by hand, and then through a cylindrical screen, 5 ft. in diameter and 4 ft. long, with ⅜-in. openings, located in the service building. The fine screenings accumulate in a pit or sump at the screen and are removed once each day by pumping to a 10,000-gal. sludge tank located in a wing of the building, where they are treated with lime and mixed with sludges also pumped to this tank. This portion of the treatment has been retained practically as originally installed.

Grease-separating tanks

From the fine screen the sewage passes through concrete conduits under the floor of the building to a grease-separating tank, a section of which is