

Edmund M. Lamphere, "Flush Tank Used to Prevent Sewer Freezing,"
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FLUSH TANK USED TO PREVENT SEWER FREEZING

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In Fairbanks, Alaska, the problem of freezing sewers has plagued residents and city officials ever since the present sewer system was constructed in 1938. In the approximately 13 mi. of sewer lines, there are more than 100 dead ends. There is as little as 4 ft. of cover over the lines in many places; and since they are laid in the street, the insulation value of snow cover is practically eliminated. The water supply of Fairbanks consists of private wells giving water of poor quality (hardness up to 900 p.p.m. and iron up to 100 p.p.m.). This results in low water usage. These facts, together with relatively flat grades and an extreme climate, lead inevitably to freezing.

When freezing occurs, the lines must be thawed with steam generated by portable boilers. The annual cost of such thawing operations alone is approximately \$20,000, an exorbitant cost for a city of 8,000 population. Various devices and operating procedures have been carried out in an attempt to overcome this annual costly freeze-up. One such device is described in the following.

Observations on the system beginning in 1949 indicated that low flow was one of the most significant factors affecting freezing. Accordingly, in October, 1951, the city of Fairbanks, in cooperation with the Arctic Health Research Center (U.S.P.H.S.), constructed a flush tank at one of the dead ends to determine whether or not freezing could be prevented by its use. A line that had \$1,500 in thawing costs charged against it for the previous winter was selected for the test.

Tentative plans followed conventional flush tank design with the exception that the water was to be heated. Both oil and electricity were considered as means of heating. Oil heat was ruled out because it would require more attention than could be given it. Investigation of power costs showed electricity to be too expensive. Therefore, the heating idea was dropped.

As-Built Construction of Tank

Since winter was just around the corner, the final design was dictated by whatever materials and equipment could be obtained within a reasonably short length of time.

The as-built construction of the tank is described as follows:

A section of 4-ft. wood stave manhole with a mastic-coated, 2-in. plank bottom and a 2-in. plank cover was used for the tank proper. In addition to being cheaper, the manhole section was much easier to install in freezing weather than either masonry or concrete.

To control flushing, a 4-in. Miller siphon with a drawdown depth of 13½ in. was used. This arrangement discharges about 115 gal. per flush.

A 2-in. well was driven through the bottom of the tank to supply the necessary water. A pump with a capacity of 660 g.p.h. was available, so that is what was used. The pump was mounted inside the tank, as close to the top as possible.

As a precaution against flooding the pump motor if the sewer froze in spite of the flush tank, a check valve was placed in the tank outlet and a float switch was attached to the motor.

To allow easy access to the tank no backfill was placed over the top. In its place, a 4-in. layer of sawdust enclosed in a canvas sack was used.

Thermocouples were placed outside the tank at 1-ft. intervals from the top of the tank to 1 ft. below the tank bottom. These were installed to determine whether or not some type of insulation might be valuable in future installations of a similar nature. Thermocouples were also placed in the water supply line, in the water in the tank, and in the air above the water level.

Operation

The tank was put into operation on December 12, 1951. Leakage was noted on this date to be about 250 g.p.h. through the tank. However, by the middle of February, 1952, leakage was practically non-existent and development of the well had raised the pump output from 400 g.p.h. to 825 g.p.h.

When operation was started, a 200-w. light bulb was placed inside the tank above the water level to prevent icing and to keep the pump warm. Bulbs of successively smaller sizes were installed as time went on, and eventually thermocouple readings showed that a 25-w. bulb would supply plenty of heat with outside air temperatures down to -50° F.

The sewer was kept open during the entire winter by use of this tank, although a power failure in January nearly spoiled the record. As a result of the power failure, the pump was stopped for four days and at the end of this time inspection at a downstream manhole showed the line to be about three-fourths full of ice. However, a few flushes cleared away the ice and no further trouble was experienced.

Costs

Construction costs of the tank came to \$852.00 and the power bill for the four months of operation was \$87.00. Thus, when this total is compared with the \$1,500 thawing costs of the previous year the flush tank not only paid for itself, but saved the city approximately \$560.00 in the first year.

On the basis of the past winter's experience with the flush tank, the city of Fairbanks plans to install at least one and possibly more tanks during the summer of 1952. Construction costs on these tanks should be much less than on the 1951 tank as the ground will not be frozen when they are installed.