

to the contractors, the city and the engineers. The intake has been in continuous use since last November.

Connections are provided at the screen-house so that either water under city pressure or steam under boiler pressure can be turned into either intake pipe.

The actual loss of head in this entire system, when pumping through one intake at the rate of four million gallons per 24 hours, is about 7 ins.

A sludge pump is placed in compartment F of the screen-house to remove sediment from compartments A or B or from any of the basins from No. 19 to No. 15, suction pipes being provided in each basin.

The screen-house is provided with a 5-ton travelling crane for lifting the screens. The screens are cleaned by washing them with a hose inside the building, the washings running back to the river.

Screens Not Yet Cleaned

After about five months' use there is about 3½ ft. of sand in front of the coarse screens, possibly an average of 1½ ft. of sand in basin No. 19 and practically none in basin No. 15. It has not yet been found necessary to clean the screens. At the old Sarnia pumping plant the screens had to be cleaned during every heavy blow down the lake. No silt has reached basin No. 1 or the pumps, and only the slightest amount of discoloration has been noticed in the water at the taps in Sarnia since this new intake has been installed. Both silt and sand were pumped into the mains during every heavy blow when the old intake, two miles further down the river, was used. On Saturday, April 17th, the water in the river, appeared quite milky and turbid, while that coming through the intake was beautifully clear. Frequent analyses of the water taken during the winter months show that it is free from injurious bacteria and practically pure.

Harry Hall, superintendent of the Sarnia water works, very ably superintended the work for the engineers during construction. Alderman Herbert Sanders, chairman of the Water Works Committee, took a keen interest in the work and assisted Mr. Hall with many excellent suggestions.

Further Improvements Being Designed

Further improvements to the Sarnia water works are now being designed. The old pump-house and intake at George St., in the centre of Sarnia's business district, now have to be maintained. Fire must be kept in the boilers and a day and night staff in the pump-house. This was ordered by the fire underwriters as standby protection for the city on account of the fact that there is now only one main between the city and the new pump-house at Point Edward, about two miles away. Should there be any accident to that main the entire water supply from the new intake at Point Edward would be cut off, and the old intake and George St. pumping station would be called into use. A duplicate main from Point Edward to the city will be laid at a distance of approximately 40 ft. from the existing main, and then the underwriters will permit the old intake and the George St. station to be abandoned, thus effecting a great saving in coal, maintenance and attendance. Moreover, as Sarnia grows and extensions are made to the pumping capacity of the Point Edward station, similar extensions would have to be made to the standby plant at George St. This duplication of machinery can be avoided only by the construction of the duplicate, or reserve, main.

The existing steel main from Point Edward to Sarnia is leaking badly at the joints, which will be replaced by new flanged joints. The pumps in the Point Edward station will be rearranged so as to be driven electrically off peak; on peak they will be steam-driven as at present, and provision will be made to handle the coal by modern machinery.

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, states that the commission is now operating 61 miles of railway and that bonds have been issued to finance an additional 69 miles. Engineering reports have been made on 500 miles.

APPLICATION OF ENGINEERING PRINCIPLES TO WATER WORKS OPERATIONS TO OFFSET INCREASED COST OF LABOR AND MATERIALS

THE water works department of Lynn, Mass., has met increases in wages and cost of materials of 75 to 100% during the last four years without increasing its rates or any increase in the amount of water sold. How this was accomplished is described by Reeves J. Newsom, Commissioner of Water Supply of Lynn, in a paper read before the March meeting of the New England Water Works Association. Excerpts from the paper follow:—

The writer took charge of the water supply system in July, 1916, and found an ample field for the application of engineering principles to the methods of operation. The improvements noted are of the kind which will stop wastage and increase revenue. The improvements needed to better the service will come later.

The Lynn system is supplied by the watersheds of four artificial ponds and the Saugus and Ipswich Rivers. The combined catchment area from which water is drawn covers 58 square miles, and the available yield is about 35,000,000 gals. per day, while the present consumption of the city is approximately 8,500,000 gals. per day. Three pumping stations are used on the supply system to pump water from the rivers, or from one pond to another as it passes through them in the process of purification. A fourth pumping station, located in the city, pumps into the mains and the equalizing reservoir and standpipe. Three of the four ponds are in a chain and have a combined storage capacity of a little under four billion gallons. It requires from four to eight months for water to pass from the rivers into the distribution mains. The fourth pond, with a capacity of 350 million gallons, is used as an emergency supply to the distribution mains and can be filled from two of the other ponds.

Distribution System Partly Metered

The distribution system is about 58% metered and the per capita consumption is slightly over 70 gals. The system is valued at about \$5,000,000, with a net bonded indebtedness of approximately \$1,000,000. The receipts from the sale of water have varied little from \$350,000 per year since 1916, of which from \$130,000 to \$165,000 yearly has been needed for debt requirements.

One of the first things coming to the writer's notice was the fact that the abatements, including adjustments for advance fixture assessments, amounted to about \$13,000 per year. A complete reorganization of very lax office methods, and a strict enforcement of the regulations and the shut-off rule have saved \$7,000 per year of this amount.

The service pipe in use by the department in 1916 was a type manufactured with a lining, was of high first cost and when used with Lynn water it did not stand up satisfactorily. After some investigation, it was decided that the most economical and serviceable was cement-lined pipe. To prevent the breakage of the lining with ordinary pipe cutters, all pipe was cut in the shop to fit the requirements by the use of a metal cutting machine, which, on a test with a single blade, cut 140 ¼-in. discs from a piece of 1-in. lined pipe without breaking the cement. To prevent exposed threads in connections, malleable iron countersunk fittings are used, which we line ourselves with lead, leaving only six threads unlined. When this lining comes in contact with the cement lining of the pipe it makes a snug fit without danger of crushing the latter.

The saving effected by the use of this kind of service pipe is in excess of \$4,000 per year.

Motorizing Department Effects Saving

In 1916 the department depended on the use of horses in all its repair work. The motorizing of this work has reduced the number of foremen from five to four, and the number of men on routine repair work about 20%.

The meter repair shop was not properly equipped to test meters over 1 in. in size and no attempt was made to test and repair meters over 2 ins., although 25% of the revenue from metered water was registered by these large meters.