invert and half in the arch concrete. Numerous tests made on the sections of the aqueduct already built show that these provisions for making the joints watertight are satisfactory. At no point has any leakage been observed other than a slight dampness in a few instances at the junction of the four joints between arch and inverts.

The aqueduct in its course crosses several streams and rivers and in all cases the crossings are made by depressing the structure beneath the river beds. These sections being under pressure are made circular of reinforced concrete. Overflow and blow-off structures have been provided in the aqueduct at the upstream sides of most of the river crossings which will serve the purpose of governing the discharge as well as for providing outlets for the water and drainage thereof for the purpose of emptying portions of the aqueduct for cleaning. The discharges from these overflows enter into the rivers. It will be noted that provision has been made for the entering and removal of a small-sized boat which can be used in the aqueduct for purposes of inspection at times of partial discharge. These overflow structures have all been designed for withstanding a heavy backfill in case it may be found necessary as a protection against frost. It is not anticipated, however, that such protection will be required, as the walls have been provided with double windows and doors, and all openings into the aqueduct are provided with movable covers, the building itself thus forming a closed air space between the aqueduct and the outside air. The exposed metal work in these structures as well as all metal work pertaining to the aqueduct subject to corrosion is of bronze. Boat entrances, separate from the overflow structures, have been provided at various points along the line. Concrete manholes carried up to the surface of the backfill, and provided with heavy cast-iron covers, specially locked, have been located at intervals of one mile along the aqueduct. An inner concrete slab cover has been placed in each manhole 18 ins. below the outside cover, and a bench mark has been set in the wall provided with a brass tag on which the station and elevation can be stamped.

Two Venturi meters have been laid out—one downstream from the intake, and forming part of the depressed section under the Falcon River, and one immediately adjacent to and east of the site of the future reservoir at Deacon. These meters will be formed generally of reinforced concrete, provided with bronze throat rings. Instead of using a continuous ring for the upstream piezometer casting, separate bronze plates spaced equi-distant about the periphery at the upper end of the entrance cone, have been designed, each plate being connected by a separate pipe to a central manifold or header located in the adjacent chamber erected for the recording and integrating apparatus. It is believed that several advantages are obtained by the use of the separate plates over the continuous ring, not the least of which is the less cost. In meters of similar description it has always been found difficult to maintain a large ring in a true circle, and when the necessary bracing has been erected it interferes greatly with the form construction so that it has been difficult to get a smooth and unobstructed joint between the concrete and the face of the bronze ring. By the use of separate plates it is believed that this difficulty will be entirely obviated since the forms can be first trued up to accurate shape and then the plates bolted to the form without danger of displacement. Another advantage in this arrangement lies in the fact that by having a separate pipe between the chamber and each piezometer, any one hole that becomes blocked up can be simply blown out.

Supply Line Between Reservoir Site and Winnipeg.—The construction of a reservoir of 250,000,000 Imperial gallons capacity, to be located at a point "south-east of Transcona," was recommended by the consulting engineers, not as a present requirement, but for some future date when warranted by the growth of the District. It was also advised that the aqueduct at the present time be extended from this point known as "Deacon" to the present McPhillips reservoirs in Winnipeg as a 5-ft. o-in. diameter steel pipe line capable of giving a discharge by gravity to the District of 25,000,000 Imperial gallons per day, which later on could be increased when this demand shall be exceeded by pumping at Deacon, or by the installation of additional pipe lines. Deacon thus marks the west end of the gravity aqueduct.

All the conditions entering into this arrangement have been carefully analyzed during the past two years, and these studies have shown the advisability of using a reinforced concrete pipe 5 ft. 6 ins. in diameter in place of the 5-ft. o-in. steel pipe as recommended. The reasons for the change can be summed up briefly as follows:—

1. Cost.—A study of the difference in actual cost per foot between a 5-ft. o-in. steel pipe and a 5-ft. 6-in. reinforced concrete pipe based on recent prices for both labor and material shows that the cost of the concrete pipe is some 15 per cent. less than that of the steel pipe.

2. Capacity.—The capacity of the 5-ft. 6-in. concrete pipe is estimated to be more than 47 per cent. greater than that suggested for or possible with the 5-ft. o-in. steel pipe between Deacon and the Red River, under the heads available, thus postponing for several years the necessity for the installation of a pumping plant. The additional capacity gained is due both to the increase in size and to the smoother surface.

3. Length of Life.—The length of life of the reinforced concrete pipe can be safely assumed as 100 years. As a matter of fact, if the pipe is kept free from electrolytic action, there is no reason to suppose that it will not last indefinitely under the conditions obtaining here. In the case of the steel pipe its usefulness would be practically gone by the time the necessity for a pumping station at Deacon should arise, so that the cost of a new pipe replacing the first one would have to be carried as well as the cost for the pumping plant.

4. The principal cost of a concrete pipe is in labor and by building it of concrete, the money goes back to the citizens of the District, whereas if built of steel the greater portion of the money expended would not only go outside of the District, but probably out of the country. The materials for the reinforced concrete pipe would be all of Canadian manufacture.

5. On account of the severe side thrust from the walls of the trench consisting in great part of a slippery clay the concrete pipe lends itself to a more rational design than one of steel plate.

6. The Act of the Manitoba Legislature incorporating the Water District does not provide, as was evidently anticipated by the Board of Consulting Engineers when drafting their report to the city of Winnipeg in August, 1913, for delivery of water under pressure for distribution to the several municipalities of the District, and it therefore became possible to design this pipe line from Deacon to the Red River crossing on purely engineering lines.

The pipe will be carried in practically direct line from Deacon to the outskirts of St. Boniface in a trench excavated to a depth of from 10 to 16 feet. It will be extended to the east bank of the Red River under the streets of St. Boniface, crossing underneath the Seine River en route. The line will be carried under the Red River