sating cylinders for doing the duty of the fly wheel in other engines, and it has proved itself an excellent engine. In 1894 still another Worthington engine was added, of about nine million gallons capacity per day at proper working speed. In the current year, 1895, there has been added to the water-power machinery a pair of Leffel turbines driving a pair of double-acting plunger pumps of five million gallons easy capacity per day. They were built by the firm of John McDougall, and take the place of the last of the original breast wheels and its set of pumps.

The additions and demolitions, thus outlined, leave the present strength of the pumping plant as follows.—

Water Power Pumps.	Capacity per 24 hours imperial gallons.
Three pumps of 1856 (nearly worn out) driven by the turbine of 1874	3,000,000
Turbine and pair of pumps of 1865	4,000,000
" " " 1881	3,000,000
" " " 1895	5,000,000
Total water power pumping capacity	15,000,000
Steam Pumps.	
Worthington low duty engine of 1875	8,000,000
Worthington high duty engine of 1886	11,000,000
" " " " 1894	9,000,000
Total steam pumping capacity	28,000,000
Grand total water and steam capacity	43,000,000

The present daily consumption of the city varies between 14 and 18 million gallons, and averages about 16 million gallons per day for the year round Our water-power machinery is thus deficient, at its best in summer, by about three million gallons per day, while at the worst in winter, it is well nigh useless because of the action of the ice in the little old aqueduct. It therefore follows that one of the two high-duty steam engines must always be in use—much of the time both must be in use – leaving only the old low-duty engine in reserve. The cost of steam pumping in 1894 was about $43,500, and this year it will probably be over $45,000. The ratio of cost of pumping by steam and by water has recently been about nine to one, and the pumping expenses will this year, therefore, be some $40,000 over what they would have been if the water-power had been sufficient.

Mr. Thos. C. Keefer and Mr. E. Vanier, civil engineers, were called upon, two years ago, to deal with the question of an increase of the water power, and in a comprehensive report, dated March, 1894, they agreed with former eminent engineers in advising the completion of the new aqueduct, and with it the increase of the water-power machinery and improvement of the tail race. The capacity of the enlarged water-power thus recommended would be 45 million gallons per day in winter, and 50 to 60 millions in summer. The estimated cost of the entire work incident to the enlargement is $1,500,000, and it was calculated that the saving in pumping expenses would balance the interest on the outlay when the city's consumption reaches 25 million gallons per day.

PIPING.

The water from the pumps is conveyed to the city and distributed throughout the streets by 216 miles of main and distributing pipes. By these it is conveyed to the consumers' houses, factories and other premises, by 55,850 service pipes, these being the respective figures for the end of 1894. The main and distributing pipes are practically all of cast iron, and of four to thirty inches diameter. The services are practically all of lead, and mostly ¾ and ¾ diameter. The exceptions are few, and they chiefly occur where a distribution pipe smaller than four inches is laid in a short street or alley to supply a few consumers, and where iron services of greater size are laid for steam engines and fire protection in large buildings.

In 1856, when the new works were opened, there was only one pumping main. It was of 24 inches diameter, and extended from the pumps to the reservoir, *via* Atwater ave., St. Catherine street and McGill College avenue. It had an extension of the same size to Phillips square, where it branched into smaller pipes. Atwater avenue, into which the main was laid, when opened as a street, was appropriately named after Mr. Atwater, the chairman of the water committee during the construction of the new works, and the able and untiring leader in the council in all measures for the carrying out of the enterprise. In 1867 the 24-inch main was doubled. In 1875 a third main, of 30 inches diameter, was laid from the pumps through Atwater avenue and Sherbrooke street to Papineau road, in order to carry a large body of water at full pressure along the high ground and thus feed the pipes running to the lower levels. When Mr Porteous' company discarded wooden pipes about 75 years ago, they substituted iron distribution pipes of 4 inches diameter, and for over 60 years that continued to be the size generally laid down. In 1880 half of the entire pipage of the works was four inch. In 1877 and 1885 the superintendent, Mr Lesage, drew attention to the inability of such small pipes to supply either sufficient water or sufficient pressure for fires in high modern buildings. The insurance companies also took the matter up and agitated that and other questions relating to fire protection, with such effect that a general system of arterial mains was devised and speedily laid down for feeding the hydrants direct where most needed, and for feeding the small pipes at short intervals. Eight inches diameter was adopted as the least size for distribution pipes to be subsequently laid. A systematic changing of the hydrants in the more important districts was undertaken, the smaller old hydrants being replaced by large ones with four nozzles for ordinary hose and a large nozzle for feeding steam fire engines. Many miles of small pipes, some of them half a century old and nearly choked up by rust, have been taken up or abandoned entirely, and larger sizes laid instead The outlay for all this was very heavy, but it has restored the fire pressure, reduced insurance rates, and given what is in general a good efficient distribution system.

All the pipes and hydrants in public streets are the property of the city, and are laid free of charge to consumers. House services within the street lines are also the property of the city, and are laid free of charge to consumers, All extensions of the service pipes upon private property must be made by the owners.

RESERVOIR.

The reservoir of 1856, now called the McTavish or low level reservoir, was originally of oblong shape with semi circular ends, and it was so placed in the mountain slope that the surface of the rock was about level with the water surface on one side and with its bottom on the other The natural rock was used as a wall on the upper side, but on the lower side the water was and is still retained by a masonry wall backed by an embankment, both wall and bank being formed of rock from the excavation. The reservoir was divided transversely into two equal parts by a masonry wall, and together they contained 13½ million gallons. The surface elevation when full is 205 feet above the harbor. The cost was about $200,000. Upon the recommendation of Mr. Lesage, an extensive enlargement was made between 1874 and 1877, at a cost of $398,243, by widening into the rock on the upper side, the division wall being extended through the enlargement. The reservoir remains as thus enlarged; its capacity is 35,000,000 gallons, and its entire cost must be about $600,000. Under the gate-house, which stands on the reservoir bank, there is a well or distributing chamber. Into the bottom of this well the main pipes from the pumps and city are led, and opposite to them is a separate passage to each division of the reservoir. The pipes and passages are all controlled by gates, and by their means the water is turned off or on either division, or either main pipe, at will. The well itself may also be used as a stand-pipe for the pumping machinery in case both divisions have to be emptied at once. The water from the pumps does not go first to the reservoir and thence to the city, as popularly supposed. The reservoir is merely connected with the pumping and city mains by branch mains, and it acts by taking the surplus water when the pumps are delivering faster than the city consumes, and by supplying the deficiency when the pumps are furnishing less than it consumes. The 35,000,000 gallons contained by the reservoir, when full, could supply the city for barely two days. At first thought this appears almost a dangerously small reserve store of water. Whether it is really so or not depends altogether upon the unit division, and the aggregate capacity of the pumping plant and its pumping mains, as related to the city's consumption. If the pumps and pipes be kept so far above all requirements that no reasonably possible break-downs or bursts can leave the pumping capacity short of the consumption, the city is safe with very small storage capacity.

HIGH LEVEL WORKS.

Above the level of Sherbooke at Mountain and of St. Denis st. at Rachel, there is a large area of the city which is too high to be efficiently served by the McTavish reservoir, even for domestic purposes. To supply this there is the High Level System, a complete little waterworks, drawing its water from the main works, but having its own pumping station, reservoir and pipage. Its pumping station is at the McTavish reservoir, and it is equipped with a high-duty steam pump of three million gallons capacity per day, and also with an old low-duty pump of half a million gallons capacity, which is kept only for emergent use. The pumps draw their water from the McTavish reservoir, and discharge into a 12-inch main which connects with the high level distribution