

duplicate accurate drawings showing all parts of the plant in such detail that the whole may be erected from those plans.

While the city specifies that the plant must be "mechanical," that is slow-sand designs are barred, the competition is open to all types of mechanical plants, whether by pressure or gravity, patented or unpatented, provided, of course, that all guarantees required are furnished and all other conditions of the specifications complied with.

The specification is very complete, comprising eighty pages of printed matter, with an appendix giving a very useful index to contents. The language used is clear and concise, and the general arrangement of the specification lends itself to the easy finding of any particular portion.

As previously stated in *The Canadian Engineer*, the plant is to be capable of satisfactorily filtering continuously sixty million Imperial gallons every twenty-four hours, with a maximum capacity of not less than thirty million Imperial gallons during any ten hours. The effluent at all times is to be of the standard of purity required by the specifications. This, of course, practically means that the plant must have a daily capacity of seventy-two million Imperial gallons.

Pure Water Assured.

The contractor will be required to guarantee that the mechanical filtration plant which he proposes to furnish, will remove 90 per cent. of all organisms where there are 50 to 500 bacteria per cubic centimeter in the unfiltered water; will remove 95 per cent. of all organisms where there are 500 to 2,000 bacteria per cubic centimeter in the unfiltered water; and 98 per cent. of all organisms where there are 2,000 or more bacteria per cubic centimeter in the unfiltered water.

The contractor must also guarantee removal of 98 per cent. of the B. Coli as determined by the standard methods for the examination of water of the American Public Health Association. All turbidity must be removed, leaving a bright, colorless water, free from taste. Such results must be guaranteed by the use of not more than one grain of alum per Imperial gallon of water, under average conditions. Where such is required, a sedimentation period of not less than three hours must be provided for after the addition of alum.

Each tender must be accompanied by a report of some similar plant, municipal or otherwise, of at least one-half million gallons daily capacity, such report having been made by a reputable disinterested bacteriologist, and showing the daily bacteriological analyses of the water before and after filtration for a continuous period of at least thirty days, including the percentage of B. Coli organisms removed, as well as the percentage of the total number of bacteria; also showing the removal of suspended matter, and the nature of the effluent.

A schedule of quantities must be furnished, showing in detail the prices of the various classes of work and articles to be supplied, which make up the total tender price. These unit prices are for comparison only, and if the contractor finds he has underestimated quantities he can make no claim for extra remuneration, but must supply the additional quantities necessary to the work. The idea of obtaining unit prices is good, as it allows of much fairer comparison of tenders. A firm whose bulk tender is higher than another firm's may really be figuring on lower unit prices, but the higher firm's plans would then call for more material in the work. It would then remain for the Department of Works to determine whether the greater amount of material would add anything to the stability or efficiency of the plant; also

whether the lower firm had made up their low bid by skimping quantities.

The Work Involves Difficulties.

The building of the plant involves engineering and contracting difficulties, and for that reason the specification requires all tenderers to visit the site of the plant, and to familiarize themselves with existing or future obstacles to speedy and safe construction. None of the material excavated from the foundations or otherwise, nor any of the material adjoining the filter plant, or on the Island, or under the waters in the vicinity of the Island, can be used in the construction of the work, without the express consent of the Works Commissioner. It is thought that this is to avoid a repetition of troubles encountered during the construction of the existing slow sand plant.

Tenderers must describe thoroughly the method that they propose to adopt in all the foundations required. The concrete work is well guarded by the specifications, which give instructions regarding materials to be used, the placing, setting and waterproofing of the concrete work. The mixtures to be used are to be satisfactory to the Works Commissioner. The contractor must provide reliable means for handling the water, which may prove troublesome in excavations at the Island, and he must not allow the water to rise above the lowest point to which he excavates. Duplicate machinery, if required, must be provided by the contractor, so that positive drainage is assured.

While it is the intention of the city to have wash-water pumps, air-blowers and other apparatus requiring small power units, operated by electrical motors, contractors are requested to put in an alternative bid for other drives for the three low-lift pumps required. Alternative No. 1 permits these low-lift pumps to be driven by vertical, compound or triple expansion condensing engines. Alternative No. 2 permits these low-lift pumps to be driven by gas engines or in any way desired by the tenderer. In deciding whether to substitute either of these alternatives for the electric drive, the Works Department will take into consideration the cost of transporting coal, etc., to the Island.

The contractor must state in his tender when one-half of the filter plant will be completed, and ready to operate, and when the filter plant as a whole will be completed and ready to operate. Should these dates of guaranteed completion be earlier than December 31st, 1914, and September 30th, 1915, respectively, that fact would undoubtedly be a point in favor of that tenderer. The reason that the Works Department is placing a bonus, as mentioned above, on the early completion of the first half of the plant is that they really need the thirty million gallons of filtered water that one-half of the new plant would give them daily. The existing slow sand plant is not filtering the full requirements of the city.

Must Live up to Guarantees.

The Medical Officer of Health is to test the plant for clarity of effluent and bacteriological efficiency within three months after the plant, or portion thereof, is placed in operation, and in the event of failure to fulfill the guarantees the entire plant may be rejected and all payments to the contractor recovered.

The whole of the work must be carried on and completed without interference with, or interruption of, the operation of the present slow sand plant. The contractor cannot assign, or sublet, any portion of the work without the consent of the Works Commissioner.