

yet making produce of secondary importance."

Of land treatment Mr. Rust says:

"In broad irrigation we are informed that it will take about one acre for every 100 of a population, but with intermittent filtration the sewage of 1000 persons may be satisfactorily disposed of on the same area. We are also told by authorities that efficient filtration will remove 99 per cent. of the bacteria, and it is this system combined with perhaps broad irrigation, to some extent, that I suggest to your council as being suitable to your city. The only land available in sufficient quantities for this purpose is situated in the township of York, east of Leslie Street and North of Danforth Avenue, extending eastwardly almost to East Toronto, and northerly to a branch of the Don. There is about 1,100 acres in this section, and is admirably fitted for the purpose. A great portion of this area has to-day no value for agriculture, the soil being sand running down to a great depth. I would recommend, providing this land can be purchased for a reasonable figure, and if this system of sewage disposal is adopted by the council that about 600 acres be purchased, and that at present about 300 acres of it be laid out for filter beds. There is no doubt that arrangements could be made with a number of the owners and tenants of some of the lands in this district so that they would be only too glad to receive a portion of the sewage upon their properties during part of the year. The remaining portion of the sewage could be turned upon the filter beds, and the effluent conducted to the nearest watercourse. The soil is of such a porous character that there could be no difficulty in disposing of 50 or 60 thousand gallons of sewage upon an acre. The question of the efficient working of the filter beds during our severe winter may be considered by some as an objection but from the results obtained in the New England States, where the winter is almost as severe as ours, I do not anticipate any difficulty."

The cost of installing such a system is estimated at \$1,730,000, while the annual cost of operation would be \$70,000, less the revenue derived from the sale of the produce raised on the sewage farm.

As to the system of chemical precipitation the report says:

"The next method of disposal to be considered is that of chemical precipitation. This system, which a number of your council have seen in operation in Hamilton, is carried out by turning the sewage into large tanks after it has been treated by chemicals. The sewage is then passed slowly through the tanks to enable the suspended matter to settle to the bottom. It is necessary of course to have sufficient tank capacity to permit of a sufficient number to be out of use while the sludge is being removed. Disposal of the sludge is the most difficult part of the sewage precipitation, the sludge being used on land as manure, or got rid of by

filling in lowland or by burning. Authorities inform us that precipitation removes from fifty to sixty per cent. of the organic matter. American engineers assume that for every 1000 persons, fifty four cubic feet of sludge may be expected. The disposal of the sewage by precipitation is carried out in a large number of the principal cities of England, notably Leeds, London, Manchester and Bradford. In America there are several plants in operation, the largest of which is at Worcester, Mass. Providence, R. I., is now engaged in constructing works of this character. It is a question whether the removal of about half of the organic matter from our sewage would permit of its being turned into the lake without creating a nuisance, and I therefore considered in connection with chemical precipitation that the effluent should afterwards be purified by filtration, either by turning it upon the natural soil, or if sufficient land cannot be secured at a reasonable price for this purpose, artificial filters could be constructed. It may perhaps be found during the winter months and after a strong wind has been blowing from a westerly direction, that it would not be necessary to further purify the sewage by dropping it on the filter beds, but after treatment with chemicals it could be permitted to discharge into the lake. In connection with this matter the Local Government Board of England is now compelling nearly all the cities using this system alone to supplement it with further filtration. I have in my estimate assumed that the most economical and satisfactory chemicals to be used would be lime and either sulphate of alumina or copperas."

The cost of installing a system of precipitation would amount to \$1,150,000, while the annual cost of operation would approximate \$105,000.

Either of these systems, land treatment or chemical precipitation combined with Land Treatment, would in the opinion of Mr. Rust meet the requirements of the city, but he recommends that before incurring so heavy an expenditure as either would require, that the advice of a specialist in this class of work, be obtained.

#### Road Reform.

The following is an outline, in brief, of a system of road control which a great many townships in Ontario could consider with profit:

Do away with the statute labor roll entirely.

To raise the money required, levy a rate on the assessment of the township.

For road purposes, divide the township into a convenient number of divisions, usually four.

Apportion the money available for road improvement, among the divisions.

In thus apportioning the money equably, keep in view all circumstances, viz: Importance of roads, work needed on them, benefit resulting to the greatest number of people, amount of traffic, assessment, etc.

Appoint one township road commissioner to advise and counsel with, and carry out the directions of the council.

The office of road commissioner should be similar to that of the township clerk or treasurer.

Councillors should not act as commissioners, as they are subject to undue influence from the ratepayers, and the term of office is uncertain.

A general plan for road improvement should be laid down by the council for the commissioner to follow.

This plan should specify the width to be graded, width and depth of road metal, character of drainage, etc., of all roads.

Roads of importance should not be less than twenty-four feet between the inside edges of the open ditches. No road should be of less width than eighteen feet.

Early in the year the council and the commissioner should go over all the roads to consider the work to be undertaken.

Works of construction, such as hauling gravel, ditching and drainage, building of culverts and bridges should be done by contract, and supervised by the road commissioner.

No account for labor or material should be paid by the treasurer, except on the certificate of the road commissioner.

Minor work and repairing should be done by day labor, only the road commissioner being authorized to employ, direct or discharge men or teams.

All roadmaking machines should be in the care of the road commissioner.

Only the road commissioner should employ, direct or discharge the men or teams needed to operate the machinery.

Should the council desire to interfere in any of these matters they can do so through the commissioner.

The same men and teams should be hired to operate the machinery for the entire season, or longer if possible, as they become proficient and do better work. This applies particularly to the operator of a road grader.

The commissioner should keep a pay roll to return quarterly to the council, showing who have been employed and the amount paid, the roll to be then filed for auditors.

This roll will act as a check on favoritism on the part of the commissioner. Work should be divided much as possible among the residents of the township desiring it.

Work should be commenced with a definite end in view and continued systematically, from year to year if necessary, until the entire road mileage has been brought to a proper standard.

Mr. Robert Surtees, who for twenty-four years has been city engineer of Ottawa, has resigned. The salary attached to the office is \$2,500. Important sewage work costing \$450,000 are about to be undertaken, and an engineer will doubtless be chosen with respect to his qualifications for carrying on this work.