linity and a free carbonic acid content of 5 parts or more, on account of the removal of the zinc and corrosion of the iron, it was thought that if a normal carbonate alkalinity were maintained the corrosive action would be slight and the physical appearance of the water standing one night would not materially differ from that running a few minutes. It was observed, however, that while the overnight water was not colored yellow to the extent that it was prior to the removal of the free carbonic acid, yet it presented a slight milky appearance and was not as clear as water drawn off a few minutes later. At the end of the test this pipe was split open for examination, and at the end bearing the brass faucet there was a uniform soft deposit of a brownish color that shaded off to a cream color about one inch back. This was undoubtedly the result of galvanic action. It is reasonable to assume that particles of this soft deposit might have been loosened when the faucet was opened in the morning, thereby accounting for some of the higher iron contents. The zinc coating on the interior of the pipe was in good condition with the exception of a few small pin-head deposits. There was a very thin slate-colored coating over it. A section cut from about mid-length of this pipe did not contain any rust, but was spotted with cream-colored tubercles ranging in size from a pin-head to irregular deposits 3/8-inch long, 1/4-inch wide and 1/16-inch thick. Near the cast iron main the thin coating over the zinc was colored brown in spots and cream-colored tubercles also were present. The interior surface of this piece was much rougher than that from the mid-length of the pipe, and it was evident that dross from the spelter bath had adhered to the surface.

Examination was made of a one-inch galvanized iron pipe that had served as a service to a cottage for about six months. About 12,000 gallons of water per month had passed through this pipe. A piece was also cut out of another service about 1,000 ft. long which had been in use about seven months. The condition of these two pipes was such that the continual use of galvanized iron pipe was considered inadvisable, not on account of the corrosion of the zinc coating, but because the soft deposit will reduce the capacity in a comparatively short period. The rate of accumulation of this deposit varies with the amount of water passing through the pipe, the smaller the flow and the greater the periods of time between discharges, the more quickly the incrustation forms.

It is evident that at the temperature of water prevailing in service pipes in the tropics (24 degrees to 30 degrees Centigrade), the normal carbonate alkalinity as $CaCO_3$ must not exceed 8 parts per million as a provisional standard, with the possibility that this limit may be too high; instead of the 13 parts given by Whipple as a maximum beyond which precipitation will occur.

A piece of one-inch galvanized iron pipe which had been in service for five years was found to be covered on the interior with a rust-colored deposit from 1/16 to 3/16 of an inch thick. All of the zinc coating had disappeared. This furnished an excellent illustration of the action of a soft water that had been treated with alum with the resultant residual alkalinities varying from 2 to 10 parts per million and containing an average of 6 parts per million of free carbonic acid.

Saskatchewan province has been divided into eight districts under the Highways Act, and superintendents have been appointed as follows:—Battleford, F. Kissack; Prince Albert, F. McDougall; Saskatoon, W. Grant; Yorkton, E. B. Webster; Regina, C. F. McLellan; Weyburn, J. T. Cameron; Moose Jaw, A. McCallum; Swift Current, J. R. Reid.

ESTIMATING SEWAGE FLOW FROM FLOOR AREA*

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THE usual method of estimating sewage flow on the basis of resident population is unreliable and misleading for a municipal district like that of lower Manhattan, with its tremendous daily influx of transients in the office buildings, hotels, department stores and manufacturing buildings. In certain wards the resident population is steadily decreasing, although the number of individuals in the ward during business hours probably is not. In fact, the areas where most losses in resident population occur, owing to business buildings replacing residences, are the areas in which the amount of transient population is the greatest. This transient population, especially that in hotels, contributes a material amount to the sewage of the district.

This population is dependent upon the area of floor surface occupied; that is, in the case of a building that extends full size to the roof, upon the ground space occupied by the building times the number of floors in the building. Some statistics taken by the Sewer Bureau in department stores and hotels show actual densities of daily working population in department stores varying from 865 to 2,670 per acre (including street surface), this varying with the season of the year; while in hotels the density varied from 770 to 2,630 per acre. These figures do not include the number of people shopping in department stores or those in the hotels who are not either guests or employees.

William W. Brush, in making estimates for the Catskill water supply, made an investigation from which he decided that "other things being equal, the amount of water used in any building would be dependent upon the ground area covered and the number of stories in height." He decided that the amount of water used in any building is proportional to the size and height of the same. The total floor area can readily be obtained from available atlases of the city. Meter readings of hotels and business buildings taken in 1916 show the average consumption of six of the best hotels to be 526 gallons per thousand square feet of floor area, varying from 368 to 694. Five tenement and apartment houses gave an average of 230 gallons per thousand square feet, varying from 138 to 295; and five office and manufacturing buildings gave an average of 250, varying from 194 to 271. Each class of buildings gave a peak load about 25 per cent. higher than the average.

In most cities, anything like accurate forecasting of consumption would be complicated by the difficulty of estimating the number of floors to which the buildings in the several districts would be carried; but New York now has zoning laws which limit the heights of buildings in the different zones, and it can be assumed as a maximum that all of the buildings in a zone will reach the maximum permissible height. In the calculation for Manhattan, the total area is reduced by 33 per cent. to allow for streets, and this net area is further reduced by 15 to 30 per cent. for court areas required by law. The building area thus obtained is then multiplied by the average number of floors, giving the total floor area; and this area, expressed in units of 1,000 sq. ft., is then multiplied by the constant gallons-per-day factor for the class of buildings which is

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