the case of combined sewers, an additional allowance for storm and other surface runoff tributary to them must be included. Large sewers should have similar capacities, but due to the inherent time lag of concentrating the full flow of the smaller collecting lines in the larger main or trunk sewers, the per capita requirement when flowing full can be reduced to not less than 250 gallons per day per person served.

In order to minimize maintenance and prevent undue stoppages, no sanitary sewer collecting lines should be constructed less than 8 inches in diameter. The selection of material with which the system is constructed should include an appraisal of the characteristics of any possible industrial wastes which might be contributed to the system, the local soil and ground water characteristics, the possibility of septicity occurring in the lines, the durability and strength of the material itself, as well as its ability to withstand abrasion and the continuous pounding caused by traffic passing over it.

Under normal circumstances, sewer conduits have a reasonable life in excess of 50 years, as demonstrated by the many sections of sewer systems throughout the United States that were constructed prior to the turn of the century. Of these older conduits, many have had their efficiency substantially reduced by the failure of the material used for joining the pipes. This failure of the joint material has allowed roots, earth, and ground water to enter the lines, thereby blocking them, or increasing the amount of infiltration thereto, and in some instances even undermining the line to the point of collapse. Routine maintenance alleviates part of these problems through the removal of the tree roots and other materials that tend to block the lines. Infiltration and undermining are often not detected until a major failure on the part of the system is discovered, at which time either replacement of some sections of systems has to be undertaken, not because of structural failure or loss of efficiency of the existing sewer collecting system, but, because of radical changes in the use of the area served by the system. Areas that were originally utilized for single-family dwellings, have through time become locations of high population density concentrations, or even industrial complexes, whose needs far exceed the design capacities of the original system in the area. This problem will continue to persist as long as society continues to be mobile, but can in part be met through the planned orderly growth and development of our metropolitan complexes.

2. EXISTING CAPITAL PLANT

(a) *Growth and Distribution*

The inventory of municipal waste facilities conducted by the Public Health Service of Department of Health, Education, and Welfare in 1962 disclosed that there were 11,420 communities in the United States served by 11,655 sewer collecting systems in 1961. An estimated 118 million people, as well as innumerable commercial establishments and industrial complexes were provided service by these facilities. The number of facilities and the estimated population served by them, population size group and geographic location are presented in table 1.