

Some of these cities were reporting on the costs of combined systems and others on separate storm sewer systems. This is not a factor in the costs analysis since the cost of constructing a storm sewer system, assuming that additions or enlargements of the sanitary sewer system are not included, is the same as the cost of a combined system. This is due to the fact that the size of a satisfactorily designed combined sewer is normally determined by the maximum stormflow, the added sanitary wastes usually not requiring an increase in the size of pipe.

Although "areawide" average cost figures cannot be used to estimate the construction cost of a specific project, they are useful in making projections of capital costs that will be incurred for needed storm sewer systems in various areas of the country where cost-influencing factors are similar. These average reported current construction costs, adjusted downward to account for lower costs in previous years, were used in tables I and II, together with reported figures of capital investments to obtain estimates for the number of square miles of area sewered in the various States and cities.

As stated at the outset of this report, complete economic analyses of storm sewer systems must include the cost of the space occupied by storm water transported by such a system. This concept is relatively new to the field of storm drainage economics, and warrants thoughtful consideration by engineers and others who make decisions in that field.

2. USER CHARGES

Data supplied, in response to a questionnaire distributed in early 1961, by 170 local governments relating to sewer service charges were published³ by the Municipal Finance Officers' Association. User charges vary widely in amount but are seldom employed by cities, sewer districts or others to defray maintenance and operation costs. Such costs are normally provided for by general tax revenues, motor fuel tax funds, and vehicle registration funds.

It is difficult to separate operating costs from maintenance costs in many cities, since few cities have records available. From answers provided in the APWA survey, annual maintenance and operating costs, combined, were noted to range, generally, from \$1,000 to \$30,000 per square mile. The extreme variations may be accounted for by the great variation in the maintenance services provided in different areas, the age as well as the type of sewer system, and the effectiveness of street cleaning operations. Most typical large urban areas would probably be found to expend, for maintenance alone (including cleaning operations), from \$5,000 to \$15,000 annually per square mile of sewered area.

3. BENEFITS

Storm sewer systems enhance the usefulness and hence the value of the areas which they drain. This is the historic economic basis for constructing them. Additional benefits accrue when these systems are designed to serve more than one purpose and when such designs involve the protection of downstream neighbors. An example would be the design of a highway embankment and culvert to serve as a

³ Moak, Lennox L. "A Survey of the Use and Nonuse of Sewer Service Charges in 339 Local Governments in the United States and Canada." Municipal Finance Officers' Association of the United States and Canada, 1313 East 60th Street, Chicago, Ill. 60637, 1962. 66 pages.