is improved, and more uniform filter-backwash cycles are possible by lower hydraulic loading; and (4) in chemical treatment, damping of mass loading improves chemical feed control and process reliability. Apart from improving the performance of most treatment operations and processes, flow equalization is an attractive option for upgrading the performance of overloaded treatment plants. Disadvantages of flow equalization include (1) relatively large land areas or sites are needed, (2) equalization facilities may have to be covered for odor control near residential areas, (3) additional operation and maintenance is required, and (4) capital cost is increased.

Design Considerations

The design of flow equalization facilities is concerned with the following questions:

1. Where in the treatment process flowsheet should the equalization facilities be located?
2. What type of equalization flowsheet should be used, in-line or off-line?
3. What is the required basin volume?
4. What are the features that should be incorporated into design?
5. How can the deposition of solids and potential odors be controlled?

Location of Equalization Facilities. The best location for equalization facilities must be determined for each system. Because the optimum location will vary with the characteristics of the collection system and the wastewater to be handled, land requirements and availability, and the type of treatment required, detailed studies should be performed for several locations throughout the system. Where equalization facilities are considered for location adjacent to the wastewater-treatment plant, it is necessary to evaluate how they could be integrated into the treatment process flowsheet. In some cases, equalization after primary treatment and before biological treatment may be appropriate. Equalization after primary treatment causes fewer problems with solids deposits and scum accumulation. If flow-equalization systems are to be located ahead of primary settling and biological systems, the design must provide for sufficient mixing to prevent solids deposition and concentration variations, and aeration to prevent odor problems.

In-Line or Off-Line Equalization. As shown on Fig. 5–10, it is possible to achieve considerable damping of constituent mass loadings to the downstream processes with in-line equalization, but only slight damping is achieved with off-line equalization. The analysis of the effect of in-line equalization on the constituent mass loading is illustrated in Example 5–2.

Volume Requirements for the Equalization Basin. The volume required for flowrate equalization is determined by using an inflow cumulative volume diagram in which the cumulative inflow volume is plotted versus the time of day. The average daily flowrate, also plotted on the same diagram, is the straight line drawn from the origin to the endpoint of the diagram. Diagrams for two typical flowrate patterns are shown on Fig. 5–11.

To determine the required volume, a line parallel to the coordinate axis, defined by the average daily flowrate, is drawn tangent to the mass inflow curve. The required