

Chapter H 53**SEWERAGE**

- H 53.01 Plant design
H 53.02 Operation

H 53.01 Plant design. (1) GENERAL PLANS. The general plans shall show:

- (a) Topography, including all streams or watercourses and approximate contour lines.
- (b) Location of wells, or other sources of public water supply.
- (c) Location, sizes, grades and direction of flow of all sewers, also the elevation of the inverts and the depth of cut or street elevation at all manholes.
- (d) Location of outlets, treatment plants, by-passes or overflows, manholes, lampholes, flush tanks, siphons, pumping stations and other accessories.

(2) DETAIL PLANS. The detail plans shall show:

- (a) Profile along the line of all sewers except where reasonably accurate contour lines are indicated on the general plan.
- (b) The cross section of all sewers unless of standard pipe.
- (c) Details of all manholes, flush tanks, catch basins, inverted siphons, etc.
- (d) Details of such pumping equipment as may be provided.
- (e) A map of the property to be used for the disposal or treatment works on which shall be indicated topography, location with reference to the sewer district, the municipality and built-up sections, and the arrangement of the various treatment units.
- (f) Complete details of all treatment units shall be given, including elevations of the various parts of the plant and of the high and low water levels of the streams or body of water into which the effluent is to be discharged. The depth, size and uniformity of all stone or sand for filters shall be indicated.

(3) TYPE OF SYSTEM. All new systems shall be designed as sanitary sewers or on the "separate" plan. In existing systems constructed on the "combined" plan, adequate storm water overflows shall be provided in connection with treatment. Furthermore, future developments and extensions shall be constructed as "separate" rather than "combined" systems when practicable. No storm water from streets, roofs, cisterns, etc., shall be allowed to discharge into sanitary sewers.

(4) SEWER GRADES. All sewers shall be laid to a grade not less than that indicated in the following table, except when necessary because of special conditions, in which case detailed reasons therefor shall be given.

Size of pipe	Fall in feet per 100 feet of sewer
6 inches -----	.45
8 inches -----	.30
10 inches -----	.22
12 inches -----	.18
15 inches -----	.14
18 inches -----	.11
21 inches -----	.09
24 inches -----	.08

(5) **MANHOLES.** Manholes shall be installed at all changes in grade or direction and at distances not greater than 400 feet apart. Lamp-holes may be used only for special conditions and shall not be substituted for manholes nor installed at the end of laterals greater than 250 feet in length.

(6) **ALIGNMENT.** All sewers shall be laid in true alignment between manholes.

(7) **TREATMENT.** (a) Treatment shall be provided in connection with all new installations, the extent of which will depend on local conditions. In connection with developing or modifying existing systems where no treatment is now provided, efforts shall be made to so reconstruct the system as to bring the sewage together at points suitable for treatment which shall be provided as soon as practicable.

(b) Plans for sewage treatment will be approved only when the following rates of operation are not exceeded except where special conditions exist, when the board may permit higher rates and modifications.

1. Screens—a minimum of $\frac{1}{2}$ inch in either direction between bars or meshes of coarse screens of the stationary type.

2. Grit chambers—a maximum sectional area such as to give a mean velocity of flow between 0.5 and 1.0 feet per second for maximum rate of sewage flow, and lengths of chambers to be not less than three times the width.

3. Septic tanks—a detention period of eight hours. Septic tanks, except under special conditions, are not approved for municipal sewage treatment.

4. Imhoff or similar tanks—

a. In the flowing-through or settling chamber, a detention period of not less than 2 hours.

b. In the sludge digestion compartment, a capacity of not less than 1.5 cubic feet per capita computed below a horizontal plane 18 inches below the slot.

c. Gas vent area not less than 10 per cent of total surface area of tank and width not less than 2 feet.

5. Intermittent sand filters—1,000 persons per acre of area, the filter to have a minimum depth of 3 feet above the under drains.

6. Contact beds—1,000 persons per acre of area per foot of depth, with a minimum depth of 4 feet.

7. Trickling filters—3,000 persons per acre of area per foot of depth, with a minimum depth of 5 feet.

The effective size of sand for intermittent sand filters should not be less than .2 millimeter nor more than .4 millimeter. Contact beds should consist of stone not less than one-half inch in diameter nor more than 2 inches, while for trickling filters the corresponding sizes should be $\frac{3}{4}$ of an inch to $2\frac{1}{2}$ inches. Sedimentation or other treatment to remove the suspended matter from the effluent of trickling filters will usually be necessary to prevent local nuisances.

(8) **DISINFECTION**—the contact period of sewage and disinfecting agent, in tanks, or their equivalents, not less than $\frac{1}{4}$ hour. Chlorinating devices shall be of suitable types and ample capacities to apply chlorine at a rate sufficient to produce an excess of not less than 0.5 part per million of chlorine (by ortho-tolidin test) in the final effluent. Treatment plants shall be divided into such a number of units that necessary repairs or alterations can be made without impairing the character of the effluent.

(9) **SLUDGE DISPOSAL**. Adequate provision shall be made for the disposal of sludge or screenings in connection with all treatment plants, and in no case will the discharge of sludge or screenings into a stream or watercourse be permitted. Sludge bed areas should not be less than $\frac{3}{4}$ square foot per capita for Imhoff tanks and $\frac{1}{4}$ for septic tanks.

(10) **ACTIVATED SLUDGE AND SPECIAL PROCESSES**. No definite requirements are made for the activated sludge or special processes. Each installation of this character will be considered separately.

(11) **BY-PASSES**. Plants should be of adequate capacity and so designed that by-passes or overflows are not necessary, but if installed, by-passes shall be equipped with lock and key.

(12) **ENGINEER'S REPORT**. The engineer's report shall cover the following:

(a) *Sewage flow*—State the present and estimated population for municipalities twenty-five years hence, and for institutions the present and ultimate capacity. Estimate the amount of domestic sewage, ground water, industrial waste, etc., that the system or various parts thereof may have to care for, both for present and future needs.

(b) *Source of water supply*—Give location of intake or wells, etc., also approximate maximum, minimum and average daily water consumption if public supply is already in use.

(c) *Extent of system*—Extent to which plans provide sewerage facilities, both for initial installation and future development.

(d) *Industrial waste*—Character of industrial wastes inasmuch as they may affect the sewerage system.

(e) *Special features*—Discuss low grades, special devices, etc.

(f) *Type of purification*—Both for present and future need, and reason for adopting the proposed method.

(g) *Soil*—Probable character of soil or strata through which the sewers are to be laid and portion of the system that will be below normal ground water level.

(h) *Cost*—Give estimated cost of integral parts of system, both for the complete design and original installation.

(i) *Stream*—Describe the stream or body of water into which the final effluent is to discharge. If stream, give width, depth and estimated minimum flow. State for what it is used below the outlet and

whether there are any special conditions, as dam, that will affect the flow. If a lake, give approximate areas, also depth in vicinity of the outlet.

H 53.02 Operation. (1) SEWER SYSTEM. The sewer system shall be kept free from obstructions at all times by the use of flushing or cleaning devices where necessary. It shall otherwise be maintained in a proper condition.

(2) PUMPING EQUIPMENT. All pumping equipment shall be maintained in an efficient operating condition in order to prevent backing up of the sewage into the collecting system or bringing into play overflows or by-passes which may result in the discharge of untreated sewage.

(3) SCREENS. All screens shall be frequently cleaned so as to prevent stoppage and the screenings shall be properly disposed of.

(4) TANK TREATMENT. In all methods of tank treatment, the sludge shall be removed and properly disposed of at such frequent intervals as not to interfere with the effective operation of the plant. In general, part of the sludge from Imhoff or similar tanks should be removed every three months except that by removing the sludge late in the fall the tank may be allowed to run through the winter without subsequent removal, providing the sludge storage capacity is sufficient. Tanks should have adequate supervision to guard against stoppages which might result in backing up the sewage into the collecting system or in bringing into play overflows which would result in the discharge of untreated sewage.

(5) INTERMITTENT SAND FILTERS. The dosing devices in connection with intermittent sand filters shall be maintained in an efficient operating condition at all times to assure proper dosing of the various beds. The doses should be of sufficient quantity to provide uniform distribution over the bed (about 3 inches in depth), should be so arranged as to allow for a proper rest period and not exceed three per day. In case the filter becomes "foul," it should be put out of service for sufficient time to recuperate. It is recommended that slow sand filters be covered in the winter in order to obtain satisfactory operating results. If not covered, they should be furrowed or otherwise prepared for winter operation. The filters should be cleaned late in the fall in preparation for winter operation and should also be cleaned as early in the spring as possible. When the depth of the filter sand has been reduced to less than 1½ feet by cleaning, the bed shall be brought to its original depth by adding clean sand of a proper size and quality.

(6) TRICKLING FILTERS. The dosing devices shall be carefully maintained to assure proper operation of the plant at all times. The distribution system should be so arranged as to provide as uniform distribution of the sewage as possible and the spraying nozzles be kept free from obstructions. It is recommended that trickling filters be covered during the winter in order to secure efficient operation. If not covered, the cycle of operation and dose should be so arranged as to prevent freezing and assure continuous operation of the plant.

(7) CONTACT BEDS. All dosing devices of contact beds shall be properly maintained in order to assure maintenance of a cycle of

operation that will produce satisfactory results. The standing full period should not be less than 45 minutes nor more than two hours. The rest period should be at least four hours. The number of fillings daily should not exceed three.

(8) **ACTIVATED SLUDGE AND SPECIAL PLANTS.** No specific instructions are given but such plants shall be so operated as to secure effective results at all times.

(9) **SLUDGE DISPOSAL.** The method of sludge disposal should be carefully maintained at all times and in no case shall the sludge from any treatment tank be discharged into any stream or watercourse, or so disposed of as to create a nuisance.

(10) **DISINFECTION.** Equipment for chlorination of sewage shall be carefully maintained at all times and operated at a rate sufficient to produce an excess chlorine content of not less than 0.5 part per million (by ortho-tolidin test) in the final effluent where disinfection is required. The method of operation for odor control shall be based on a study of local conditions and requirements.