# REGULATIONS

# OF THE

# BOARD OF HEALTH

# COMMONWEALTH OF VIRGINIA

## Governing the Disposal of Sewage

BUREAU OF ENVIRONMENTAL HEALTH
DEPARTMENT OF HEALTH
RICHMOND, VIRGINIA

1968

# REGULATIONS

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# BOARD OF HEALTH

# COMMONWEALTH OF VIRGINIA

## Governing The Disposal of Sewage

*Issued by:* Bureau of Environmental Health
Department of Health
Richmond, Virginia

As authorized by Section 32-6, 9, 64, 65, 66, 67, 68, Code of Virginia, the State Board of Health is authorized in conformity with the provisions of Title 9, Chapter 1.1 to adopt, amend, and repeal rules and regulations for the purpose of carrying out the provisions of Chapter 1, governing the means of sewage disposal

Approved by the State Board of Health on July 13, 1962
To become effective on October 1, 1962
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To become effective on September 1, 1963

# VIRGINIA STATE BOARD OF HEALTH
# RICHMOND, VIRGINIA
# RULES AND REGULATIONS FOR THE DISPOSAL OF SEWAGE IN THE COMMONWEALTH OF VIRGINIA
## (Health Laws Reference-Title 32 Code of Virginia)

32-6 Rules and Regulations—The Board may make, adopt, promulgate and enforce reasonable rules and regulations from time to time requiring and providing for the subjects which follow in this chapter.

32-9 Garbage, sewage and refuse disposal—The Board may regulate the method of disposition of garbage or sewage and any other refuse matter, or any combination thereof, in this State. The Board is authorized and directed through joint studies with authorized representatives of common carriers, to consider control devices and to investigate possible devices where none exists to control the discharge of human waste from common carriers.

32-64 Occupation of house without sanitary privy or closet—In any city or incorporated town in the State and for a radius of one-half mile beyond the corporated limits thereof and elsewhere in the State whenever the local board of health shall deem it necessary, it shall be unlawful for the owner of any house or other building to be used as a human habitation to occupy or to rent or lease the same for occupancy by any person, firm or corporation, or for any person, firm or corporation to occupy same until such house shall have been supplied with a sanitary privy or closet of such form as to comply with the law. If any landlord shall fail to supply any house of his with a sanitary privy or closet as required by this section, his tenant shall supply the same in conformity with the orders of a health officer or health inspector and may deduct the cost thereof from any sum due to landlord for rent.

32-65 Certain camps and public buildings to have sanitary closets or privies—It shall be unlawful to maintain or to rent or lease any recreation or construction camp, or to use any building for educational purposes, or to permit the use of any building or tent for protracted meetings, until such camps or buildings are supplied with sanitary closets or privies.

32-66 Tenant or lessor not to neglect privies or closets—It shall be unlawful for any tenant or lessor of premises properly supplied with such a sanitary privy or closet to neglect it or to allow it to cease to be sanitary within the meaning of 32-67.

32-67 Meaning of "sanitary closet or privy"—For the purpose of the three preceding sections a "sanitary closet or privy" is deemed to be any one which provides for the disposal of human wastes or excrements in such a manner that they shall not be accessible to flies or obviously endanger a source of drinking water.

32-68 Penalty for violations as to privies or closets—Any person, firm or corporation violating any provision of sections 32-64 to 32-66 shall be deemed guilty of a misdemeanor and, upon conviction thereof, shall be fined not less than five dollars nor more than twenty-five dollars, and each week's failure to comply with any provision of such sections shall be deemed a separate offense.

# PART I--GENERAL PROVISIONS

## ARTICLE 1. DEFINITIONS

The following definitions shall apply in the interpretation and enforc ment of these regulations:

SECTION A. HEALTH COMMISSIONER

Shall mean the chief executive officer of the State Board of Health or authorized agent.

SECTION B. PERSON

Shall mean an institution, public or private corporation, individ partnership, or other entity.

SECTION C. SEWAGE

Shall mean the human excrement and/or such kitchen or laundry w as may be present from residences, buildings, industrial establishments or o places.

SECTION D. PERMIT

Shall mean a written permit issued by the Health Commissioner thorizing the construction of a sewage disposal system.

SECTION E. SEWAGE DISPOSAL SYSTEM

Shall mean a device designed and constructed to receive and/or sewage from one or more premises, such device to serve less than four hu (400) persons.

SECTION F. APPROVED SEWAGE DISPOSAL SYSTEM

Shall mean a sewage disposal system approved by the Health Commiss

## ARTICLE 2. PERMITS

SECTION A. VALID PERMIT

It shall be unlawful for any person to construct, alter or extend allow construction, alteration or extension to a sewage disposal sys the Commonwealth of Virginia unless a valid permit has been issu that system by the Health Commissioner in the name of a specific for a specific location.

### Section B. Application for Permit

Application for such a permit shall be made in writing on a form required by the Health Commissioner and shall include plans and specifications for the desired installation. The Health Commissioner shall require soil evaluation and any tests necessary to be conducted under his supervision, to determine the adequacy of the proposed system. Such information shall be made a part of the application.

### Section C. Approval of Permit

When, upon review of the application, the Health Commissioner is satisfied that the proposed design is adequate for the conditions under which the system is to be installed and used, a written permit to proceed with construction shall be issued.

### Section D. Denial of Permit

When, upon review of the application, the Health Commissioner determines that the proposed design is inadequate, or soil geological conditions are such as to preclude safe and proper operation of the desired installation, a permit to proceed with construction will be denied.

### Section E. Voidance of Permit

Permits will be null and void at the end of twelve (12) months after issuance, unless extended by the Health Commissioner in writing.

## ARTICLE 3. INSPECTIONS

### Section A. Required Inspections

The Health Commissioner shall make such inspections as he may deem necessary during construction to determine compliance with these Rules and Regulations.

### Section B. Installation

No part of any installation shall be covered or used until inspected and approved by the Health Commissioner. Any part of an installation which has been covered prior to approval shall be uncovered upon order of the Health Commissioner.

# PART II—PIT PRIVY

## ARTICLE I. DESIGN AND CONSTRUCTION

### SECTION A. LOCATION

1. The privy shall be placed near the home but shall be located with care to avoid polluting nearby wells or springs.

2. The privy shall be located at least 100 feet from any source of potable water supply.

### SECTION B. CONCRETE SLAB TYPE PRIVY

1. *Pit*—The pit must be dug 5 feet deep, 3 feet 8 inches long, and 3 feet 2 inches wide.

2. *Curbing*—The curbing shall be 3 feet 8 inches long (front to back), with a width of 3 feet 2 inches and a depth of 5 feet 7 inches (outside dimensions). Good quality, sound rough boards, preferably hard wood or cypress, of not less than one inch thickness shall be used, with sound 2x4's or heavier uprights in the corners. In lieu of lumber for curbing, 4 inch concrete, cinder blocks or bricks may be substituted. Mortar is to be omitted from the vertical joints in the lower half of the pit to provide adequate seepage. There shall be scarcely any space between outside of curb and walls of pit. The curb shall extend above the ground level seven inches.

3. *Forms for Concrete Floor and Footing*—The floor or concrete slab of the privy shall extend 4 inches beyond all sides of the curb. The seat opening (25 inches x 15 inches) is to be centered from side to side. The 25 inch dimension begins at the outside edge of back of curb and extends to the front. The opening in the platform shall be made 26 inches by 16 inches to support the box, which is to be made 25 inches by 15 inches.

4. *Pouring Concrete Footing and Slab*—Clean, sharp sand and gravel free from dirt are essential for concrete as are the measurements of materials, thorough mixing, and the right amount of water. The proportions shall be one part cement, two parts sand, four parts gravel. Not over five and one-half gallons of water to each sack of cement shall be used if the materials are dry. If materials are wet, only four gallons of water shall be used to sack of cement. The gravel, sand, and cement shall be first thoroughly mixed dry. The footing shall be poured to the level of the top of the floor platform with no reinforcing. Concrete floors shall contain ⅜ inch reinforcing rods and concrete to thickness of three inches. After the slab is troweled to a smooth surface, it shall be covered so that it will not dry out too quickly.

5. *Seat Box*—The seat box shall be constructed of sound, well-seasoned tongue and groove boards of not less than ¾ inch thickness with corner uprights and a cleat across underneath of the seat just back of the seat hole to support the top. The seat box shall be 15 inches wide and 25 inches long (front to back) outside dimensions. The height shall be 15 inches, including the seat top. The seat box shall slip through the floor 3 inches and be held in place by 1x3 inch strips nailed to the box at the floor. The front of seat hole shall be spaced 2 inches from the front edge of the seat box and centered from side to side. This hole shall be cut on a ½ inch bevel, sand papered and rasped. The top side of the hole shall be 12 inches (front to back), 10 inches (side to side), and 11 inches by 9 inches on the bottom. On the back of the seat top, an opening 5 inches (front to back) and 4 inches across is to be cut, over which ventilating flue is placed. This opening is to be covered with 16 mesh copper screen wire before ventilating flue is placed on top. An inch board as wide as the vent is to be nailed to the vent and to the seat box at the back. A small strip is to be nailed to the seat top on each side of the vent. A cleat the same thickness as the lid and 2 inches wide and 16 inches long is to be nailed to the seat top in front of the vent. The lid hinges are to be nailed to this cleat.

6. *Lid*—The seat hole shall be covered with a light, self-closing lid 17 inches long by 12 inches wide.

7. *Ventilation*—To make the ventilator, two 1x4's and two 1x6's 12 feet long are necessary. These four boards shall be made into an open box 6 inches square with a 4 inch opening 12 feet long. Cement coated nails 6 inches apart shall be used to assure a permanently tight ventilator. The 4 inch opening at the seat box shall be screened with copper wire screen.

8. *Privy Building*—The roof shall project 6 inches beyond the walls of the building on front and sides and 10 inches at the back. The side walls shall extend flush with top of rafters, but boards forming front and back of building shall extend only to top of plates, leaving 4 inch opening under roof for ventilation.

### Section C. Double Wood Slab Privy

1. *Acceptability*—The double wooden slab type privy shall be used only when a temporary privy is required.

2. *Pit*—The pit must be dug 4 feet deep, 4 feet 2 inches long, and 3 feet 8 inches wide.

3. *Curbing*—The curbing shall be 4 feet long (front to back), 3 feet 6 inches wide, and 4 feet 8 inches deep (outside dimensions). The pit shall

be curbed from bottom to top to prevent caving. Good quality, sound rough boards of not less than 1 inch thickness shall be used, with sound 2x4's or heavier uprights in the corners. The curb box shall be made on top of the ground and placed in the pit so as to extend 8 inches above the natural surface of the ground. After the curb box is placed in the pit, and leveled, the earth from the pit shall be tamped into any openings between the outside of the curb and walls of pit. All the earth from the pit shall be banked back against the outside of the curbing and tamped to form a firm mound around the top of the curb. This mound shall slope away in all directions to drain surface water and prevent pit from overflowing in time of rain or high ground water.

4. *Wood Slab*—The finished slab or floor of the privy shall be 4 feet 4 inches long by 3 feet 10 inches wide. The slab shall consist of 2x8's on edge, 2 inch sub-floor, top floor, and 2x4 braces underneath. The 2x8's are to be cut full and serve as the outside foundation for the two floors. The 2x4's shall support the seat box opening on either side placed 16 inches apart. The sub-floor shall be completed with 2x8's, leaving opening for seat box. This opening shall be a full 26 inches long (front to back) and 16 inches wide (centered side to side).

5. *Privy Building*—The privy building shall be constructed in accordance with the specifications outlined in Section B. 8.

## PART III—SEPTIC TANK SYSTEM

### ARTICLE 1. DESIGN AND CONSTRUCTION

#### Section A. Septic Tank

1. *Design*—Septic tanks shall be rectangular in shape and the length shall not be less than twice nor more than three times the width. The liquid depth shall not be less than 4 feet and the freeboard or airspace shall not be less than 1 foot.

2. *Size*—The size of a septic tank shall be based on the potential capacity of the home. In no instance shall a septic tank have a liquid capacity less than 720 gallons. The size of the tank shall be based upon a retention period of 24 hours plus a sludge storage of 30 per cent. The following Table I shall be used in computing the size of the septic tank:

## TABLE I—DAILY WATER CONSUMPTION RATES

| *Daily Water Consumption* | *Gallons per person per day* |
|---|---|
| Family dwelling with only conventional fixtures | 50 |
| Family dwelling with automatic washer | 67½ |
| Luxury residence or estates | 100 |
| Elementary schools with cafeteria and no shower | 10 |
| High schools with cafeteria and showers | 16 |
| Motels with bath or shower, and toilet | 55 |
| Trailer courts (per trailer) | 250 |
| Restaurants, toilet waste and automatic dishwasher | 15 |
| Restaurants, toilet waste and manual dishwasher | 10 |
| Service stations (per vehicle served) | 10 |
| Factories (per person, per 8 hour shift exclusive of industrial waste) | 20 |
| Drive-in theaters (per car space) | 5 |
| Swimming pools and bath houses | 10 |
| Picnic parks, toilet waste only (per picnicker) | 5 |
| Picnic parks with bath houses, showers and flush toilets | 10 |

Any septic tank receiving waste from a garbage disposal unit shall be increased in capacity by 50 per cent. All homes shall be considered to have a potential occupancy of two people per bedroom in computing septic tank capacity.

3. *Construction—Ready Made Septic Tanks*—Precast concrete septic tanks may be used if they comply with design and capacity requirements. The side walls and bottom of such tanks shall be at least 2½ inches in thickness. The top shall have a minimum thickness of 3½ inches. Such tanks shall have reinforcing of at least 6"x6" mesh, No. 12, welded wire fabric. Minimum compressive strength of concrete shall be 3,000 pounds per square inch. Aggregate used in the concrete shall not be larger than No. 9 stone (Virginia Highway designation ¾ inch size). Concrete shall be vibrated or well rodded to minimize honeycombing and to assure reasonable water tightness. The

hole to receive the tank shall be 8 to 12 inches greater than the tank size to permit the proper placement of the tank and backfill. Where rock or other undesirable obstruction are encountered, the bottom of the hole must be excavated an additional 6 inches and backfilled with sand, crushed stone or gravel to the proper grade. Single compartment Residential Bituminous Coated Metal Septic Tanks may be approved provided they meet the standard design and comply with United States Department of Commerce Commercial Standard 177-51.

4. *Construction—Poured In Place Septic Tanks*—For poured in place septic tanks up to 4 feet in width, the reinforcing for the cover slab shall consist of welded wire mesh reinforcing with 4 inch x 4 inch spacing made of No. 4 gauge wire. For tanks wider than 4 feet, the cover slab shall be reinforced with ½ inch rods spaced 6 inches center to center both ways. Single piece poured in place tanks shall have a bottom at least 6 inches in thickness. The walls of all poured in place tanks up to and including 1,000 gallons capacity shall be at least 6 inches in thickness and the tops of such tanks shall be at least 4 inches in thickness. Poured tanks with capacities greater than 1,000 gallons but less than 1,480 gallons in capacity shall have walls at least 7 inches in thickness. Poured tanks with capacities 1,480 gallons or greater shall have walls at least 8 inches in thickness. All poured tanks with capacities in excess of 1,000 gallons shall have tops at least 5 inches in thickness.

5. *Inlet and Outlet Fittings*—The inlet invert shall be not less than one inch above the outlet invert in any septic tank. Inlet and outlet fittings shall be of cast iron. Joints shall be of soft lead well caulked, made up before placement in the tank. The following will be required for cast-iron fittings in any septic tank:

2, 4-inch cast-iron soil pipe tees
2, 18-inch lengths of cast-iron pipe
1, 9- to 12-inch length of cast-iron pipe with hub for addition to outlet tees

6. *Location*—The septic tank shall never be closer than 50 feet from any water supply.

### Section B. Sewer Line

1. *Construction*—The sewer line from the house to the septic tank must have tight joints so there will be no leakage. The cast-iron soil pipe must be extended to a point 5 feet outside the building where it is joined to the sewer from the house to the septic tank. If the well is located within 50 feet of this point, the cast-iron pipe must be extended more than 50 feet from the well before it joins the house sewer. Pipe used for the house sewer

shall be 4 inches or greater in diameter and constructed of cast iron, vitrified clay, concrete, cement asbestos, bituminized fiber or other suitable materials. Where two different types of sewer pipe are connected, a proper type of conversion adapter shall be used. The elevation of the house sewer shall be such as to permit the installation of the septic tank system at optimum depth. Clean outs shall be installed when turns of 45 degrees or greater are necessary and where straight runs are in excess of 90 feet. When the sewer line cannot be laid straight from the house to the tank, it shall be laid in a straight line as far as possible and then a one-eighth or one-sixteenth bend used. The next section shall be laid straight as far as conditions permit and another bend put in. The point where bends are made shall be marked in some way so that the line can be found easily. If it is necessary to have a bend or more than 45 degrees, a manhole shall be installed.

2. *Grade*—For a 4-inch sewer line, the grade shall be not less than one foot per 100 feet or 1¼ inches for each 10 feet in length. The grade for a 6-inch sewer line shall be 7½ inches per 100 feet or ¾ inch for each 10 feet of length.

### Section C. Subsurface Tile Field

1. *Location*—The subsurface tile field shall never be closer than 100 feet from any water supply.

2. *Units*—The units of the subsurface tile field shall consist of a distribution box and subsurface tile distribution lines to carry the liquid from the distribution box to the field and a number of lines with ¼ inch open joints.

3. *Distribution Box*—The distribution box shall be constructed with all outlet pipes placed at exactly the same elevation in order to distribute the flow as equally as possible to all lines. The distribution box may be constructed of either concrete, brick, or masonry block, with one inlet pipe and as many outlet pipes as desired. The outlet pipe must be placed at exactly the same level. The inlet pipe shall be placed at least one inch higher than the outlet pipe. Where excessive velocities are anticipated, the flow shall be reduced by the use of a baffle, tee or ell. The distribution box must be installed on a solid foundation, either natural or artificial. Equal distribution of effluent to all outlets shall be determined by water testing.

4. *Feeder Lines*—The feeder lines shall consist of water tight lines connecting the outlet from the distribution box to its respective subsurface tile line.

5. *Construction*—The open joint subsurface tile field consists of a series of shallow lateral trenches excavated to a depth of 24 to 30 inches and to

depths of more than 30 inches depending upon soil characteristics showing higher absorptive conditions and also on the topography, and to a width of 24 inches. Trenches 18 inches wide to a width of 36 inches will be permitted, provided that the total number of linear feet of tile is adjusted to give the same number of square feet of area in the bottom of the trenches. The slopes of the line shall be not less than 2 inches nor more than 4 inches per 100 feet. The size of the individual aggregate media used in trenches shall be not less than ½ inch nor more than 2½ inches. Aggregate material to a depth of 6 inches shall be placed in a trench with top of stone flush with the top of the grade board. The open joints are to be covered with 6 inch x 10 inch tar paper strip; the tar paper to be minimum weight of 30 pounds. After laying, aggregate material shall be placed around the tile to hold it in place, covering it to a depth of 2 inches. There shall be at least 6 inches of aggregate under the tile, providing a total of 13 inches of aggregate under, beside, and on top of tile. When the trenches are filled, the earth shall be well rounded above the surface of the ground to allow for settling. Subsurface drain tile lines shall be spaced at least three times the width of the trench, with a minimum spacing of 6 feet. Length of subsurface drain tile lines shall not exceed 100 feet and shall be 75 feet or less where feasible. Drainage tile shall be 4 inches in size and shall consist of farm tile, vitrified clay, bituminized fiber, or concrete tile meeting American Society of Testing Material Standards. Tile shall be spaced with ¼ inch open joints.

6. Percolation test shall be used on one of the means for determining the suitability of the soil for subsurface tile fields and to determine the amount of absorption area needed. All other necessary information shall be correlated into these findings, including the observations of soil scientists. When percolation tests are made, such tests shall be made at points and elevations selected as typical of the area in which the disposal field will be located. The following procedure shall be used in the performance of percolation tests.

(a) Tests shall be made in holes which have been kept filled with water at least 4 hours.

(b) Percolation rates shall be figured on the basis of the test data obtained after the soil has had the opportunity to become saturated and to swell at least 24 hours.

(c) Enough tests should be made in separate holes to assure that the tests are accurate. When subsurface tile fields are planned for schools and other public buildings, at least one test hole shall be provided for each 400 square feet of the proposed subsurface tile field site. For residences, three or more tests shall be made in separate test holes spaced uniformly over the proposed absorption field site.

(d) Type of test hole: Dig or bore a hole with horizontal dimensions of 4 to 12 inches and vertical sides to the depth of the proposed absorption trench.

(e) Preparation of test hole: Carefully scratch the bottom and sides of the hole with a knife blade or sharp pointed instrument, in order to remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Remove all loose material from the hole. Add 2 inches of coarse sand or fine gravel to protect the bottom from scouring and sediment.

(f) Saturation and swelling of the soil: It is important to distinguish between saturation and swelling. Saturation means that the void spaces between soil particles are full of water. Swelling is caused by intrusion of water into the individual soil particle.

(g) In the conduct of the test, carefully fill the hole with clear water to a minimum depth of 12 inches over the gravel. In most soils, it is necessary to refill the hole by supplying a surplus reservoir of water, possibly by means of an automatic siphon, to keep water in the hole for at least four hours and preferably overnight. Determine the percolation rate 24 hours after water is first added to the hole. This procedure is to insure that the soil is given ample opportunity to swell and to approach the condition it will be in during the wettest season of the year. Thus, the test will give comparable results in the same soil, whether made in a dry or in a wet season. In sandy soils containing little or no clay, the swelling procedure is not essential and the test may be made as described under item h, after the water from one filling of the hole has completely seeped away.

(h) Percolation rate measurement: With the exception of sandy soils, percolation rate measurements shall be made on the day following the procedure described under item g above. If water remains in the test hole after the overnight swelling period, adjust the depth to approximately 6 inches over the gravel. From a fixed reference point, measure the drop in water level over a 30-minute period. This drop is to be used to calculate the percolation rate. If no water remains in the hole after the overnight swelling period, add clear water to bring the depth of water in the hole to approximately 6 inches over the gravel. From a fixed reference point, measure the drop in water level at approximately 30 minute intervals for four hours, refilling 6 inches over the gravel as necessary. The drop that occurs during the final 30-minute period is used to calcuate the percolation rate. The drops during prior periods provide information for possible modification of the procedure to suit

local circumstances. In sandy soils or other soils in which the first 6 inches of water seep away in less than 30 minutes after the overnight swelling period, the time interval between measurements shall be taken as 10 minutes and the test run for one hour. The drop that occurs during the final 10 minutes is used to calculate the percolation rate.

7. *Absorption area requirements for private residences*—The following absorption area requirements (Table II) shall apply for private residences, based on percolation rate measurements. These requirements provide for the use of garbage grinder and automatic sequence washing machine units.

## TABLE II—ABSORPTION AREA REQUIREMENTS

| Percolation rate (Time required for water to fall 1 inch, in minutes) | Required absorption area, in sq. ft. per bedroom standard trench | Required absorption area, per 100 gallons/ day of water used |
|---|---|---|
| 1 or less | 70 | 52 |
| 2 | 85 | 63 |
| 3 | 100 | 74 |
| 4 | 115 | 85 |
| 5 | 125 | 93 |
| 10 | 165 | 122 |
| 15 | 190 | 140 |
| 30 | 250 | 184 |
| 45 | 300 | 222 |
| 60 | 330 | 244 |

Note 1—Over 60 minute rate will require special design

Note 2—In every case, sufficient area shall be provided for at least two bedrooms

Note 3—Absorption area for standard trenches is to be figured as trench-bottom area

Note 4—In no case shall a subsurface absorption field for a home be installed with less than 190 square feet of absorption area per bedroom

## PART IV–STABILIZATION POND

The following standards shall apply for the installation, alteration, repair or extension of any waste stabilization pond in the Commonwealth of Virginia.

### ARTICLE 1. DESIGN AND CONSTRUCTION

SECTION A. DESIGN

1. Original construction shall provide at least one (1) surface acre, measured at the four ft. depth water level, per four hundred (400) persons served at 0.2 lbs. 5 day 20° C B. O. D. per capita per day, including the population equivalent of any industrial wastes to be discharged to the sewer system under the following conditions:

(a) Depending on the site location and requirements of the receiving stream, the 400 persons per acre per day figure may be appropriately reduced to provide the storage period referred to above.

(b) Minimum detention shall be 25 days at 100 gallons per person per day at depth of four feet or less.

(c) Chlorination and perhaps also means for removing algae shall be provided where demanded by the receiving stream.

(d) The outlet structure shall be placed on the horizontal pond floor adjacent to the inner toe of dike embankment. A permanent type walkway from top of dike to top of outlet structure for access shall be provided for all stabilization ponds.

2. Stabilization Ponds for School

(a) For high schools with showers the equivalent full-time population shall be considered to be in the ratio of 100/16 or 6.25 pupils equal one full-time resident.

(b) For elementary schools without shower facilities the ratio shall be 100/10=10 pupils equal one full-time resident.

3. The choice between the use of single cell and multiple cell ponds will be dictated on the basis of local conditions and downstream water use. Where a greater degree of treatment is necessary or desirable, one or more cells in series may be added to the primary cell; provided, however, that the primary cell shall have a surface area equal to that set forth in A-1. Two cells or multiple cell units designed for either series or parallel operation to allow proper seasonal load adjustment by putting units in and out of service and to permit series operation to afford greater protection of effluent quality are recommended for all installations where a reasonably high degree of treatment is desired or required.

4. Where ponds of one or more cells follow some type of conventional primary treatment device, the requirements in A-1 may be reduced to compensate for the B. O. D. reduction in the pretreatment unit(s) but the surface area should be not less than 75% of A-1.

5. The shape of all cells shall be such as to produce a uniform perimeter, with no islands, peninsulas or coves permitted.

6. Sufficient area shall be provided at all installations to allow room for expansion due to normal growth.

### Section B. Location

1. Criteria used in setting the distance of conventional sewage treatment plants from the nearest habitation or residence will apply in case of raw sewage stabilization ponds.

2. If practical, ponds shall be located so that prevailing winds will be in the direction of non-inhabited areas. Preference should be given sites which will permit an unobstructed wind sweep across the ponds, especially in the direction of local prevailing winds.

3. Natural run-off from the drainage areas around or above shall be excluded from the pond by adequate drainage ditches or by-passes.

4. Proximity of ponds to water supplies and other facilities subject to contamination shall be critically evaluated to avoid creation of health hazards or other undesirable conditions.

### Section C. Embankments and Dikes

1. Compacted embankments of impervious materials shall be constructed, unless the entire pond and dikes are water proofed or sealed. See Section D-4.

2. From the standpoint of maintenance and structural stability the following slopes and widths of embankments are recommended:

(a) Minimum embankment top width should be not less than 8 feet for ponds of 1 acre or larger.

(b) Maximum embankment slopes should not be steeper than:
Inner—3 horizontal to 1 vertical
Outer—3 horizontal to 1 vertical

(c) Minimum embankment slopes should not be flatter than:
Inner—4 horizontal to 1 vertical

Outer—not applicable, except that significant volume of surface water shall not enter the ponds

(d) Minimum free board should be 3 feet

3. Normal minimum liquid depth shall be 3 feet.

4. Normal maximum liquid depth shall not be more than 5 feet.

5. Embankments and excavated areas shall be dressed with top soil, raked, fertilized and seeded, except below the water line. Newly seeded areas shall be protected by straw or other suitable cover until a good stand of grass cover has been obtained. Alfalfa should not be included in seed mixtures since the long roots of this plant are apt to impair the water holding efficiency of the dikes. Additional protection for embankments such as riprap may be necessary as soil conditions and pond size warrant.

## Section D. Pond Bottom

1. The pond bottom shall be as level and as smooth as practicable at all points. Shallow or feathering fringe areas usually result in locally unsatisfactory conditions.

2. The bottom shall be cleared of vegetation and debris. Organic material thus removed shall shall not be used in embankment construction.

3. Soil formations must be relatively tight to avoid undue liquid losses through percolation or seepage. Soil boring to determine soil characteristics shall be made a part of preliminary surveys to select pond sites.

4. The ability to maintain a satisfactory water level in the lagoons is one of the most important aspects of design; one for which the owner must be primarily responsible. Some use has been made of bentonite, asphalt coatings, clay blanket, plastic linings and other sealing materials. Sealing by these methods can best be considered as a special problem for individual installations, with the owner basically responsible for adequate sealing to permit maintenance of satisfactory water levels.

## Section E. Influent Lines

1. The influent line into single celled ponds shall be essentially center discharging and influent lines into the primary section of multiple-celled ponds shall be essentially center discharging, but this does not apply to those cells following the primary cell in series operation.

2. Either upward or horizontal discharging influent lines may be used where the sewage is pumped to the pond. Horizontal inlets shall be used for gravity flow. When upward discharging lines are used, the discharge end of

the pipe should be located approximately one foot above the bottom of the pond. If sewage is discharged to pond through force main an anti-siphoning device shall be provided on force main at a point immediately outside the dike.

3. The end of the discharge line shall rest on a suitable concrete apron with a minimum size of four feet square. Larger aprons and influent piping supports are suggested in cases where the soil is unstable.

4. Manholes or clean-outs are required where inlet pipe passes through the embankment. Normally this should be a drop manhole with invert of influent sewer placed at or above the 5 ft. water level of the pond.

5. Influent lines shall be placed on or under the bottom. The use of exposed dikes carrying influent lines to the center of the pond will be prohibited, as such structures will impede circulation. Inlet lines on pond bottom shall be anchored to concrete pads placed flush with the pond bottom.

### Section F. Interconnecting Piping and Overflows

1. Cast-iron pipe of ample size is recommended for interconnecting piping and overflows.

2. The final overflow structure shall provide means for varying the water level from 3 ft. depth to 5 ft. depth in increments of 0.5 ft. or less with points of withdrawal of effluent spaced so that the effluent can be withdrawn from depths of 0.75 ft. to 2.0 ft. below pond water surface irrespective of the depth of water in the pond. At depths greater than 2 ft. below surface, the pond water will often be devoid of oxygen.

3. Overflow lines shall discharge onto concrete slabs. These lines should be vented if siphoning may be developed.

4. The pond or ponds shall be provided with means for completely draining each unit independent of other units.

5. Cast-iron pipe is recommended for pond effluent and/or drain line.

### Section G. Chlorination Equipment and Contact Tank

1. Chlorination equipment when required shall be of the solution feed type for feeding liquid chlorine from cylinders. Chlorinator capacity shall be adequate to feed at least 15 p.p.m. based on the design flow. Chlorinators shall be housed in a separate heated chlorinator room provided with mechanical exhaust fan. Scales of adequate capacity for weighing cylinders of chlorine shall be provided for each installation. A chlorine testing set for testing residual chlorine and direct reading of residuals up to 2.0 p.p.m. or more shall be provided.

2. The chlorine contact tank shall be either a self-cleansing type or it shall be provided with means of removing solids that may accumulate. The contact tank shall provide a detention period of not less than 30 minutes based on design flow.

SECTION H. MISCELLANEOUS

1. Each stabilization pond shall be provided with a primary metering device located on pond effluent for flow measurement. At small installations where recording and totalizing instruments are not provided, the primary metering device shall be equipped with a brass or stainless steel staff gauge graduated in tenths and hundredths of a foot mounted on side wall of approach chamber of float well with the zero set for zero flow through the metering device.

A metering device is also desirable on pond influent. Any measuring device placed on the influent to the pond should be a Parshall flume or other equipment suitable for measuring raw sewage flow.

2. The pond area shall be adequately enclosed with a suitable fence to keep out small animals and children. The fence shall be at least six (6) ft. high with not less than two strands of overhanging barbed wire spaced at 0.5 ft. vertical intervals above the six ft. fence. For ponds of one acre or more, at least one gate eight ft. wide, clear opening, shall be provided to allow entrance of power mowing equipment, trucks hauling chlorine cylinders or service vehicles. Additional gates may be provided as desired, all of which shall be provided with means of locking.

3. Appropriate signs shall be provided to designate the nature of the facility. The size of the sign and lettering used shall be such that it can be easily read by a person with normal vision for a distance of 50 or more feet.

4. An all-weather road shall be provided for nearest existing all-weather road to the stabilization pond for access for maintenance, moving in mowing equipment, for transporting chlorine cylinders, and for inspection and observation.

## PART V—OTHER SEWAGE TREATMENT PLANTS FOR SCHOOLS AND OTHER PUBLIC BUILDINGS

### ARTICLE 1. IMHOFF TANKS

In the design of the Imhoff tank, the following capacities have been provided: settling compartment—2½ hours retention based on the flow from day schools taking place in 8 hours. The capacity of the sludge digestion compartment is based on 6 cubic feet per capita for the full-time resident population, calculated from a point starting 18 inches below the slots.

### ARTICLE 2. SLUDGE DRYING BEDS

Sludge drying beds must be surrounded by a concrete, brick or cinder block wall which extends about 12 inches above the sand and is at a higher level than the adjoining ground surface.

The underdrainage system consists of drain or farm tile laid with open joints.

The sand for the bed shall be clean, coarse and free of silt and fine particles. The graded gravel or stone shall be clean, hard, durable stone such as crushed stone or clean gravel. Crushed limestone is not suitable for the top layer of fine gravel.

Basis of design for sludge drying beds shall be 1½ square feet per capita, based on full-time resident population for open beds. If glass green house covers are used, the area may be reduced to 1 square foot per capita.

The bottom of the sludge drying bed shall be sloped to 4" underdrains. The underdrains shall be surrounded with No. 4 stone with at least 3" of No. 4 stone above the underdains. The middle layer of stone shall consist of at least 3" of No. 9 stone. The upper layer of stone supporting the sand shall consist of at least 12" stone. At least 12" of sand shall be provided.

### ARTICLE 3. DOSING TANKS

It is essential that all parts of the sand or trickling filter receive as nearly as possible the same quantity of sewage. This is accomplished by installing a dosing tank provided with siphon which discharges the sewage to the filter at intermittent intervals. One siphon shall be required for each sand or trickling filter onto which sewage is discharged by a rotary distributor.

Table No. 1 gives the effective volume of the dosing tank for discharging the sewage to rotary distributor on sand filter. This volume shall be sufficient to provide a dosage of ⅛ to ¼ inch of sewage over the entire sand bed being dosed at each discharge of the siphon. Table No. 2 gives the effective volume of the dosing tanks for discharging the sewage to rotary distributor on trickling filter. For a trickling filter, the sewage shall be applied in small doses at frequent intervals.

## TABLE 1

*Sand Filter With Rotary Distributor*

| Number of Persons | | | Siphon and Dosing Tank | |
|---|---|---|---|---|
| Day Students | | Full Time Residents | Eff. Vol. Dos. Tank | Inlet Pipe |
| Without Showers | With Showers | | | |
| 50 | 30 | 5 | 68 | 4″ |
| 75 | 45 | 7 | 102 | 4″ |
| 120 | 80 | 12 | 169 | 4″ |
| 175 | 110 | 17 | 242 | 4″ |
| 250 | 155 | 25 | 300 | 4″ |
| 370 | 235 | 37 | 350 | 4″ |
| 500 | 310 | 50 | 450 | 6″ |
| 620 | 390 | 62 | 500 | 6″ |
| 750 | 470 | 75 | 550 | 6″ |
| 1000 | 625 | 100 | 725 | 8″ |
| 1500 | 940 | 150 | 1060 | 8″ |
| 3000 | 1250 | 200 | 1360 | 8″ |

Note: Effective volume is the volume of liquid in gallons contained in the dosing tank between high and low water level.

## TABLE 2

*Trickling Filter With Rotary Distributor*

| Number of Persons | | | Siphon and Dosing Tank | |
|---|---|---|---|---|
| Day Students | | Full Time Residents | Eff. Vol. Dos. Tank | Inlet Pipe |
| Without Showers | With Showers | | | |
| 50 | 30 | 10 | 68 | 4" |
| 75 | 45 | 15 | 68 | 4" |
| 120 | 80 | 25 | 68 | 4" |
| 175 | 110 | 35 | 90 | 4" |
| 250 | 155 | 50 | 90 | 4" |
| 370 | 235 | 75 | 90 | 4" |
| 500 | 310 | 100 | 150 | 6" |
| 620 | 390 | 125 | 150 | 6" |
| 750 | 470 | 150 | 150 | 6" |
| 1000 | 625 | 200 | 180 | 8" |
| 1500 | 940 | 300 | 180 | 8" |
| 2000 | 1250 | 400 | 180 | 8" |

Note: Effective volume is the volume of liquid in gallons contained in the dosing tank between high and low water level.

The dimensions and other details except effective working volume, of the dosing tank and siphon for operating rotary distributors must be furnished by the manufacturer of the rotary distributor. Names of firms furnishing siphons and rotary distributors will be furnished on request by the State Department of Health.

For sand filters with intermittent flooding, a sufficient amount of sewage shall be applied onto the bed at each dosage to cover the sand to a depth of approximately two inches. The rate of dosing is controlled by the automatic dosing siphons so as to obtain this depth of flooding in a short period in order that the sewage will spread over the entire bed, thereby providing uniform loading on the filter. If pumps are used in place of the automatic siphons, the pump capacity shall be equal to the average discharge rate of the siphon shown in the tables.

Dimensions and other details of dosing tanks and siphons for intermittent flooding of open sand filter beds are show in Table 3.

## TABLE 3

*Dosing Tank and Siphons for Sand Filter Using Intermittent Flooding*

| Number of Persons | | | Dosing Tank and Siphons | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Day Students | | Full Time Residents | No. Siphons | Siphon Size | Inside Dimensions | | Inlet Pipe | Outlet Pipe | Min. Water Depth |
| Without Showers | With Showers | | | | Length and Width | Max. Water Depth | | | |
| 50 | 30 | 5 | 2 | 3″ | 4′-0″ | 13″ | 4″ | 4″ | 3″ |
| 75 | 45 | 7 | 2 | 3″ | 5′-0″ | 13″ | 4″ | 4″ | 3″ |
| 120 | 80 | 12 | 2 | 4″ | 5′-9″ | 17″ | 4″ | 6″ | 3″ |
| 175 | 110 | 17 | 2 | 4″ | 6′-9″ | 17″ | 4″ | 6″ | 3″ |
| 250 | 155 | 25 | 2 | 5″ | 7′-0″ | 23″ | 4″ | 8″ | 3″ |
| 370 | 235 | 37 | 2 | 5″ | 7′-0″ | 23″ | 4″ | 8″ | 3″ |
| 500 | 310 | 50 | 2 | 5″ | 8′-0″ | 23″ | 6″ | 8″ | 3″ |
| 620 | 390 | 62 | 2 | 6″ | 7′-9″ | 30″ | 6″ | 10″ | 4″ |
| 750 | 470 | 75 | 2 | 6″ | 8′-6″ | 30″ | 6″ | 10″ | 4″ |
| 1000 | 625 | 100 | 2 | 6″ | 9′-9″ | 30″ | 8″ | 10″ | 4″ |
| 1500 | 940 | 150 | 2 | 6″ | 12′-0″ | 30″ | 8″ | 10″ | 4″ |
| 2000 | 1250 | 200 | 2 | 6″ | 14′-0″ | 30″ | 8″ | 10″ | 4″ |

Note: 1. Reinforce cover slabs with wire mesh

Note: 2. Cover slabs should be approximately 3′-3″x1′-0″x2½″ to facilitate removal

Note: 3. When ordering siphons specify that automatic alternation is required

Dosing tanks for subsurface sand filters are similar in design to those for open filters with intermittent flooding except for the working capacity or effective volume of the dosing tank. For subsurface sand filters, the effective volume of the dosing tank must be equal to the total holding capacity of the tile distribution lines in each unit of the filter in order to fill the lines at each discharge, this insuring equal distribution over the filters. See Table 4.

## TABLE 4

*Dosing Tank and Siphons for Subsurface Sand Filters*

| Number of Persons | | | Dosing Tank and Siphons | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Day Students | | Full Time Residents | No. Siphons | Siphon Size | Inside Dimensions | | Inlet Pipe | Outlet Pipe | Min Wate Dept |
| Without Showers | With Showers | | | | Length and Width | Max. Water Depth | | | |
| 50 | 30 | 5 | 0 | .. | ..... | ... | 4" | .. | .. |
| 75 | 45 | 7 | 0 | .. | ..... | ... | 4" | .. | .. |
| 120 | 80 | 12 | 1 | 3" | 4'- 7" | 13" | 4" | 4" | 3' |
| 175 | 110 | 17 | 1 | 3" | 6'- 0" | 13" | 4" | 4" | 3' |
| 250 | 155 | 25 | 1 | 4" | 6'- 1" | 17" | 4" | 6" | 3' |
| 370 | 235 | 37 | 2 | 3" | 6'- 0" | 13" | 4" | 4" | 3' |
| 500 | 310 | 50 | 2 | 4" | 6'- 0" | 17" | 6" | 6" | 3' |
| 620 | 390 | 62 | 2 | 5" | 5'- 8" | 23" | 6" | 8" | 3' |
| 750 | 470 | 75 | 2 | 5" | 6'- 2" | 23" | 6" | 8" | 3' |
| 1000 | 625 | 100 | 2 | 5" | 7'- 2" | 23" | 8" | 8" | 3' |
| 1500 | 940 | 150 | 2 | 6" | 7'-10" | 30" | 8" | 10" | 4' |
| 2000 | 1250 | 200 | 2 | 6" | 9'-10" | 30" | 8" | 10" | 4' |

Note: 1. Reinforce cover slabs with wire mesh

Note: 2. Cover slabs should be approximately 3'-3"x1'-0"x2" to facilit removal

Note: 3. When ordering siphons specify that automatic alternation is quired

The capacity of dosing tanks for subsurface percolation fields shall directly proportional to the total holding capacity of the tile drainage lir Since the tile lines may not always be completely emptied between dos by soil percolation, it is not advisable to attempt to completely fill the lines at each dosage. Therefore, in order to apply sufficient sewage efflu to obtain good distribution throughout the tile lines of the entire field and the same time not flood the field, a dosing tank capacity equal to six-ten (0.6) of the total holding capacity of the tile drainage lines shall be us See Table 5.

## TABLE 5

*Dosing Tank and Siphons for Various Size Tile Percolation Fields*

| Number Feet Tile | Number Siphons | Siphon Size | Inside Dimensions | | | | |
|---|---|---|---|---|---|---|---|
| | | | Length and Width | Max. Water Depth | Inlet Pipe | Outlet Pipe | Min. Water Depth |
| 800 | 1 | 4″ | 5′– 4″ | 17″ | 4″ | 6″ | 3″ |
| 1000 | 1 | 4″ | 5′– 0″ | 17″ | 4″ | 6″ | 3″ |
| 1200 | 1 | 5″ | 5′– 9″ | 23″ | 4″ | 8″ | 3″ |
| 1400 | 2 | 5″ | 4′– 4″ | 23″ | 4″ | 8″ | 3″ |
| 1600 | 2 | 5″ | 4′– 8″ | 23″ | 4″ | 8″ | 3″ |
| 1800 | 2 | 5″ | 4′–11″ | 23″ | 4″ | 8″ | 3″ |
| 2000 | 2 | 5″ | 5′– 4″ | 23″ | 4″ | 8″ | 3″ |
| 2400 | 2 | 6″ | 5′– 0″ | 30″ | 4″ | 10″ | 4″ |
| 2800 | 2 | 6″ | 5′– 5″ | 30″ | 4″ | 10″ | 4″ |
| 3200 | 2 | 6″ | 5′– 9″ | 30″ | 6″ | 10″ | 4″ |
| 3600 | 2 | 6″ | 6′– 1″ | 30″ | 6″ | 10″ | 4″ |
| 4000 | 2 | 6″ | 6′– 5″ | 30″ | 6″ | 10″ | 4″ |
| 4400 | 2 | 6″ | 6′– 9″ | 30″ | 6″ | 10″ | 4″ |
| 4800 | 2 | 6″ | 7′– 1″ | 30″ | 6″ | 10″ | 4″ |

Note: Effective volume of dosing tank based on 0.6 volume of drain tile used.

## ARTICLE 4. SAND FILTERS

### Section A. General Construction

Sand filter beds shall consist of level areas of sand beneath which there are graded layers of gravel around and over the underdrains. The sewage is discharged onto the beds through rotary distributors or through pipes on to splash plates or, in case of covered filters, through lines of drain tile laid with open joints with the tile lines placed in a 12-inch layer of No. 5 gravel. For open sand filters, the beds shall be surrounded by a concrete, brick, or cinder block wall extending above the sand and at least one foot above ground level to prevent washing in of clay or loam which might clog the sand bed or to prevent encroachment of vegetation or flooding. For covered sand filters, the surrounding wall is not necessary except in case where it is necessary to prevent caving of the earth walls while the sand and gravel are being placed.

The underdrainage system shall consist of drain or farm tile laid with open joints.

SECTION B. MATERIALS

The sand for the filter bed shall be clean, coarse sand, free from clay, loam, or organic matter, and fine particles. The sand shall have an effective size of 0.30 mm. to 0.50 mm. and a uniformity cofficient of not more than 4.0. No more than two per cent shall be finer than 0.177 mm. (80 mesh sieve) and not more than one per cent shall be finer than 0.149 mm. Not more than two per cent shall be larger than 4.76 mm. (4 mesh sieve). The sand beds shall be not less than 30 inches deep.

The gravel for sand filters shall conform to "Virginia Department Highways Material Specification (April 1, 1954) Section 206 Coarse Aggregate." (See Appendix No. 1)

## APPENDIX NUMBER I

*Aggregates for Sand Filters and Tile Percolation Fields*

TOTAL PERCENT PASSING

| | Square Sieves—Sizes in Inches | | | | | | | | Sieve Numbers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | 3½ | 2½ | 2 | 1½ | 1 | ¾ | ½ | ⅜ | 4 | 8 | 16 | 100 |
| 4 | .... | 100 | 95–100 | ..... | 35– 70 | ..... | 10– 30 | ..... | 0– 5 | .... | .... | ..... |
| 4-F | .... | .... | ..... | 100 | 85–100 | 60– 85 | 25– 50 | ..... | 0–10 | .... | .... | As 50–40% of No. 4 |
| 5 | .... | .... | 100 | 95–100 | 15– 50 | 0– 15 | ..... | ..... | ..... | .... | .... | ..... |
| 6 | .... | .... | ..... | 100 | 95–100 | 40– 75 | ..... | 0– 15 | 0– 5 | .... | .... | ..... |
| 7-C | .... | .... | ..... | 100 | 95–100 | 40– 75 | 0– 15 | ..... | ..... | .... | .... | As 50–60% of No. 7 |
| 9 | .... | .... | ..... | ..... | 100 | 95–100 | ..... | 30– 65 | 5–25 | 0– 5 | .... | ..... |
| 12 | .... | .... | ..... | ..... | ..... | ..... | 100 | 95–100 | 10–40 | 0–10 | .... | ..... |

The gravel must be carefully placed in well-leveled layers, with the coarse or No. 4 gravel at the bottom around and over the underdrains, with at least 3" of No. 4 gravel above underdrain. Care must be taken to avoid movement or injury to the undrains. The middle layer shall consist of the medium size or No. 9 gravel, at least 3" deep. The fine or No. 12 gravel at least 3" deep is the top layer for supporting the sand above. Crushed limestone is not suitable for the top layer of fine gravel.

Since the efficiency of the filter depends to a large extent on the filter medium (sand and gravel), care shall be taken to obtain sand and gravel of a known quality and size. Before obtaining the sand and gravel, a sample of approximately one pint each of the sand and gravel must be submitted to the State Department of Health or a qualified commercial testing laboratory for observation, sieve analyses and comment as to its suitability.

All sand shall be hand placed in the filters by use of shovels and wheelbarrows. Dumping from trucks onto the filter beds will not be permitted. Board runways shall be provided when wheelbarrows are used.

### Section C. Construction of Sand Filters with Rotary Distributors

A rotary distributor will effect the most even application of the sewage over the bed, thereby increasing the efficiency of the filter bed, making it possible to use a higher dosage rate, or for equal sewage flows to safely reduce the area of sand bed required.

A supply pipe from the dosing tank feeds the sewage to a vertical pipe at the center pier of the filter from which it enters the distributor. The rotary distributor shall consist of two or more horizontal pipes or arms, extending the diameter of the filter and rotating about a central hollow shaft. The sewage shall flow through these distributors from which it is spread over the filter through ports designed to give even distribution over the entire surface of the bed. The horizontal arms are placed a few inches above the sand bed and the discharge of sewage through the ports rotates the distributor.

Since the distributor is driven by the flow of the sewage through the ports, it will be necessary to provide a closely limited hydraulic head on the distributor.

The dosing tank and siphon serve to provide this head to maintain it within required limits. Therefore, it will be necessary for the manufacturer of the rotary distributor to furnish the dimensions and other details, except effective volume of the dosing tank, and including the difference in elevation of high and low water level and that of the arms of the distributor. Also, the manufacturer shall furnish the details of the center pier for the rotary distributor base. The siphon and rotary distributor shall be purchased from the same manufacturer to be certain that these requirements will be met.

There are several companies that furnish siphons and rotary distributors. The names of such companies will be furnished on request by the State Health Department.

The design of the area of the filter beds equipped with rotary distributors shall be based upon a rate of application of 150,000 gallons of sewage per acre per day, which is approximately 3.5 gallons per square foot per day or one-third more than the safe dosage where rotary distributors are not used.

The amount of sewage applied to the sand filter with rotary distributor at each discharge of the siphon shall be equal to a depth of ⅓" to ¼" over the entire sand bed area being dosed.

### Section D. Construction of Sand Filters with Intermittent Flooding

Sand filters designed for intermittent flooding shall be divided into at least two beds for small filters and three beds for the larger filters. Distribution boxes must be provided for diverting the sewage onto the filter bed or beds desired, as it is often necessary to cut one filter bed out of operation for rest periods.

In the design, the area of the filter beds shall be based upon a rate of application of 100,000 gallons of sewage per acre per day or 2.3 gallons per square foot per day.

On filters employing intermittent flooding, a sufficient amount of sewage shall be run onto the bed at each discharge of the siphon to cover the sand to a depth of two inches.

### Section E. Subsurface Sand Filters with Distributing Tile Lines

On account of their inaccessibility and liability of clogging of subsurface sand filters, the rate of dosage allowable shall be 50,000 gallons per acre per day or 1.15 gallons per square foot per day.

The sewage shall be applied to the filter through lines of drain tile laid with open joints with the tile placed in a 12-inch layer of No. 4 stone.

In all cases possible, the top of the filter shall be finished with a 12-inch layer of stone without any earth cover over the stone.

In cases where it is not feasible or desirable to finish the top of the subsurface filter with the stone, then on top of the gravel shall be placed a 3-inch layer of straw, and then the filter shall be covered with a layer of top soil not less than 4 inches nor more than 8 inches deep.

The sand and gravel beneath the top layer of stone and the underdrains shall be the same as for open sand filters, using intermittent flooding.

All sand shall be hand placed in the filters by use of shovels and wheelbarrows. Dumping from trucks onto the filter beds will not be permitted. Board runways shall be provided when wheelbarrows are used.

Distribution boxes must be provided for diverting the sewage onto the filter beds through individual lines or headers with each header connecting to not more than four lines. The far ends of the tile distributing lines shall be tied together through bell and spigot tile and should be vented to atmosphere. As with surface filters, stop gates or shear gates shall be provided in the distribution box to permit either filter unit or header to be placed out of service.

Vehicles and heavy machinery will not be permitted on the bed when placing the cover of gravel, or gravel, straw and earth, since the tile distribution and drain lines may be crushed or moved out of alignment.

## Section F. Trickling Filters With Rotary Distributors

The standard rate trickling filters shall be of crushed stone, about 6 feet deep, with individual pieces ranging in size from 2 inches to 4 inches in diameter.

Sewage shall be applied to the surface of the stone in the form of a spray as uniformly as possible so that it trickles down to the underdrainage system, where it is collected and conveyed to the final settling tank. The filter stone and the underdrainage system must be such as to avoid clogging and permit free circulation of air through the bed. Vent wells shall be provided to aid in circulation.

The side walls of the filter shall be of concrete, brick or cinder block. A solid water-tight wall, suitably designed to prevent clay and loam from washing into the filter and encroachment of vegetation shall be provided.

A concrete floor shall be necessary in trickling filters and this shall be sloped to a central drain to convey the effluent from the filter.

The trickling filter underdrainage system shall consist of vitrified clay underdrain blocks laid directly on and covering the entire floor. The blocks shall comply with all requirements of the specifications of the ASTM and of the Trickling Filter Floor Institute. Cover blocks for the center drainage channel shall have at least three inches of bearing at either end.

The stone for the filter beds shall consist of hard, durable pieces of crushed limestone, traprock or granite screened to the size limits required and shall be free from thin, flat or long pieces. It must be washed and screened and free from sand, clay, loam and organic impurities. All stone shall be hand placed in the filter and dumping from trucks onto filter will not be permitted.

The sewage shall be applied to the trickling filter by a rotary distributor operated by a dosing siphon or pump. The manufacturer of the rotary distributor and dosing device shall furnish dimensions and other details except effective volume of the dosing tank, including difference in elevation required and also dimensions and other details of the center pier for supporting the rotary distributor.

Trickling filters are not acceptable for secondary treatment of the effluent from septic tanks. The design of the trickling filter shall be based on a loading of 275 pounds of B.O.D. per acre foot per day or 3.14 square feet of surface area per 100 gallons.

## ARTICLE 5. CHLORINATION FACILITIES

### SECTION A. FINAL SETTLING OF CHLORINE CONTACT TANKS

The effluent from trickling filters shall be treated in a final tank as it will contain a considerable amount of suspended material washed from the filter stone.

The final settling tank shall be a plain settling tank, rectangular in shape. The hopper shall be provided at the inlet end to aid in removal of accumulated solids. The settled sludge can be squeegeed or scraped into the hopper and pumped out by portable pump to the inlet of the primary treatment device. A small portable pump mounted on rubber tired wheels and equipped with sufficient suction and discharge hose shall be provided for periodically removing the sludge from the final tank.

When chlorination of the effluent from the trickling filter plant is necessary, the final tank will also serve as a chlorine tank for providing the necessary detention period for reaction of the chlorine.

The required detention period in final settling tanks following trickling filters is 1½ hours. If this final tank is to be used for flows from school populations, which flows take place in an eight hour period, the dimensions of the tank shall be increased accordingly so as to provide the 1½ hour detention period.

Final settling tanks are not necessary for the removal of solids from the effluent from sand filters as such effluents are usually clear and free of settleable solids. However, in some cases it may be necessary to disinfect the plant effluent before it is discharged into a stream. In such instances, a final tank can be used as a chlorine contact tank for providing the necessary detention period for reaction of the chlorine.

### SECTION B. CHLORINATOR HOUSE

A chlorinator house shall never be less than 8 feet by 8 feet inside dimensions. The building shall be of brick, cinder block or concrete block construction. A ventilator shall be provided near the ceiling on one side and near the floor on the opposite side. The floor shall be of concrete and sloped to a drain. No windows shall be provided in this small building. Heating equipment for maintaining a temperature of 50° F. or above at all times shall be provided.

A water line to supply clean water free from suspended or floating solids and under a pressure of at least 15 to 20 pounds shall be run to the building for operating the chlorinator. Use of an approved potable supply which will also serve for washing up and other uses is preferred, and a sink or lavatory shall be provided in the building.

A terra cotta or concrete pipe with no bends larger than 45° shall extend through the floor and continue to the sewer line, or point of application of chlorine to serve as a conduit for the chlorine hose.

### Section C. Chlorinators

Either liquid chlorine or calcium hypochlorite may be used in the disinfection of sewage and there are several manufacturers of equipment for feeding either liquid chlorine or hypochlorite.

Chlorine gas taken from cylinders or liquid chlorine may be applied to sewage by chlorinators either as a gas or dissolved in water. However, the solution feed chlorinator for feeding chlorine dissolved in water is much more satisfactory.

## ARTICLE 6. FINAL DISCHARGE OF THE PLANT EFFLUENT

The plant effluent from the final unit of the treatment plant shall be piped to the stream where it will be discharged into the water so as to prevent pooling at the outlet. A concrete head wall may be necessary at the stream bank to support the outlet sewer and shall always be provided where there may be erosion around this pipe.

## ARTICLE 7. SEWAGE PUMPS

With few exceptions sewage pumps shall be installed in duplicate with either pump having adequate capacity to handle maximum flow. They shall be adequately housed to protect the pump motors from bad weather and protection shall be given to prevent freezing in any portion of the unit.

No cross-connection between a potable water supply line and sewage pump for priming or sealing packing glands will be permitted.

Pump sumps shall be of adequate size to avoid too frequent operating cycles of the pumps. The sump shall also be designed to prevent excessive settling and accumulation of solids.

For some installations where lift is required between primary settling and final treatment units, the pump sump and pumps can be so designed as to eliminate the need for a separate dosing tank. At any installation where double pumps are substituted for alternating siphons, dual pipe lines and automatic alternating equipment will be required. Where this is done, special consideration must be given to capacity and design of the pump sump, pump discharge capacity and, particularly where delivery is to a rotary or other distributor of this type, the discharge head characteristics of the pump used must be considered. On most units of the latter type some form of flow level control box would be used. Distributor manufacturers recommendations must be accurately followed for each installation.

## ARTICLE 8. SUBSURFACE DRAIN FIELDS

When subsurface tile fields are used to serve schools and other large public buildings some means of dosing the field will be necessary.

A single siphon with one distribution box may be used for dosing a single field that has a total length of drainage tile up to 1200 linear feet. A single siphon together with a weir diversion box and two distribution boxes, or twin alternating siphons and two distribution boxes, may be used for dosing two separate fields having a total length of drainage tile up to 2400 linear feet. All installations having more than 2400 linear feet of drainage tile shall have twin alternating siphons, two weir diversion boxes, four distribution boxes and four separate tile drainage fields.

The maximum total length of tile in the four tile fields must not exceed 4800 linear feet. Any installation that will require more than 4800 linear feet of tile drainage lines will be considered a special case and the owner's engineer will submit detailed plans and specifications to the State Department of Health for approval. Also, the owner or his engineer will submit in writing a proper justification for the larger installations and a satisfactory explanation as to why some other method of secondary treatment would not be more feasible and/or practical for any installation requiring a total length of tile drainage lines in excess of 4800 linear feet.

## ARTICLE 9. CONCRETE

All concrete shall be made from carefully selected, proportioned and mixed material and placed in accordance with current recommendation of the Portland Cement Association. Each cubic yard of concrete shall contain a minimum volume of six gallons. In all cases, however, the amount of water per sack of cement shall be the minimum amount necessary to produce a plastic workable mixture which can be spaded or vibrated into place in the forms. In no case shall the slump be less than two inches or more than six inches.

No concrete shall be placed when the atmospheric temperature is below 35 degrees Fahrenheit. When their air temperature is between 35° F. and 40° F. adequate means shall be employed to heat the water (water shall not be heated to a temperature exceeding 150° F.) and/or aggregate so that the concrete after placement in the form shall have a temperature of not less than 75° F. nor more than 100° F. The heating apparatus shall be such that the materials shall be heated uniformly and preclude the possibility of the occurrence of hot spots which will burn the materials. When the air temperature is below or likely to go below 50° F. all concrete placed during this period shall be protected with sufficient housing or covering of an approved type in such manner that the air surrounding the fresh concrete will

be maintained at a minimum tem, rature of 60° F. for a period of seven days following pouring.

No materials containing frost, lumps or crusts of hardened material shall be used.

Reinforcing steel shall be new billet steel A.S.T.M. 15-54T or Rail steel, A.S.T.M. 16-54T deformed round or square bars and shall be free from dirt, rust, paint, or grease. In order to secure even, smooth finish concrete, construction form must be substantial and unyielding, and erected so that the concrete will conform to the required dimensions and be so constructed as to prevent leakage. Structural concrete work shall not be undertaken except under the immediate supervision of a person thoroughly experienced in this type of construction.

In the design of the concrete it is assumed that all units will be substantially below ground level and backfilled around upon removal of the forms and that concrete will not be subjected to ground water pressure before the units are filled. Should it be necessary to construct the units above ground level, or partly above ground level, steel shall be added as required. Also, if any unit such as the Imhoff tank is constructed partly below ground water level the necessary steel shall be provided.

## PART VI—GENERAL REQUIREMENTS FOR SEWAGE DISPOSAL SYSTEMS

### ARTICLE 1.

A. Nothing contained in Parts II through V shall be construed as debarring any sewage disposal system which has been demonstrated as of least equal efficiency and is approved by the Health Commissioner.

B. All sewage disposal systems shall be located, constructed, or operated in a manner so that they:

1. Do not contaminate any drinking water supply.

2. Do not pollute or contaminate the water of any bathing beach, shellfish breeding ground, or stream used for a public or domestic drinking water supply purposes or for recreational purposes.

3. Are not a health hazard by being accessible to children.

4. Will not violate any Commonwealth of Virginia Laws, Rules or Regulations governing water pollution or sewage disposal.