SEPTIC TANKS

Virginia State Department of Health—Richmond, Virginia

1965

FOREWORD

The intent of this bulletin is to set up minimum standards of construction for residential septic tank systems together with sub-surface tile fields. To obtain a satisfactory installation under these minimum standards, acceptable quality workmanship and materials are essential.

Your septic tank is an important part of your home. Take good care of it for your own protection. If trouble occurs, call your **health department** for an inspection and instructions. The local sanitarian can help you with the location, construction and maintenance of your septic tank. Call upon him for advice.

LOCAL ORDINANCES

Most counties and cities of the State have local ordinances regulating the disposal of sewage. These ordinances should be consulted before undertaking construction of any disposal system and their provisions complied with in all respects. Also, F.H.A. requirements should be considered. The stronger requirement (local ordinance or F.H.A.) will prevail where applicable.

BEFORE CONSTRUCTING A SEPTIC TANK SYSTEM, A SEPTIC TANK PERMIT MUST FIRST BE SECURED FROM THE LOCAL HEALTH DEPARTMENT.

SEPTIC TANK MAINTENANCE SUGGESTIONS

See that the area around your sub-surface tile field is kept well drained. If the land is low and flat, it may be necessary to dig a drainage ditch to take off surface water. If there is a high ground water table, a ditch made three feet deep or deeper will lower the ground water level below the drainfield and will improve the efficiency of the system.

If the land is high and well drained, do not allow depressions which will collect water in extremely wet weather. Water allowed to stand over the sub-surface tile field will seep into the drain tile and fill up the entire system, thus causing water to break out to the surface or to back up into the house.

Keep the area over the sub-surface tile field clear of trees and shrubbery. The roots of willow, cottonwood, dogwood, gum, elm, or maple trees cause damage to sewer lines and drainage lines. A sod over the drain field is desirable.

Septic tank systems should be examined for need of cleaning at least every three to five years upon the advice of the **health department**. The depth of accumulated sludge should not exceed ⅓ the liquid depth at the discharge end of the septic tank. A grease trap, where needed, should be cleaned at least once a month or more frequently as recommended by your health department.

Use bleach solutions, lye, Drain-o, etc., sparingly. The effect of these on the operation of the septic tank is detrimental where used in quantity.

DO NOT MAKE ALTERATIONS TO THE SYSTEM WITHOUT FIRST CONSULTING YOUR HEALTH DEPARTMENT.

Do not allow heavy machinery to run over the system as it may cause considerable damage by breaking the tile or the septic tank top.

Do not make a drive-way over the drainfield or cover any part of it with a building. This will pack the ground to such an extent that the efficiency will be greatly impaired. It might cause the tile to be crushed, especially during wet weather.

DO NOT PLACE SO-CALLED SEPTIC TANK CLEANING COMPOUNDS IN YOUR SEPTIC TANK SYSTEM. THERE IS NO MATERIAL THAT WILL ELIMINATE THE NEED FOR CLEANING YOUR SEPTIC TANK.

Do not allow a transient or unknown septic tank cleaner to do your work.

BEFORE CLEANING OR REPAIRING YOUR SEPTIC TANK, CALL YOUR LOCAL HEALTH DEPARTMENT.

CARE OF THE DISTRIBUTION BOX

The distribution box is the first place to check when looking for sources of trouble.

If water is not running into the distribution box, any of the following conditions may exist:

Obstruction in outlet tee in tank, or obstruction in the sewer line between the septic tank and fixtures in the house. These require the services of a competent plumber.

When the distribution box is full of water, any of the following conditions may exist:

There may be obstructions from roots or sludge. Trees causing trouble should be removed, sub-surface tile field cleaned and relaid or tile field reconstructed.

There may be a broken drain tile which should be located and replaced.

The distribution box should be inspected and cleaned when the septic tank is cleaned. Thus, the life of the sub-surface tile field will be prolonged.

DESIGN OF A SEPTIC TANK

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.

SIZE OF A SEPTIC TANK

The size of a septic tank should be based on the potential capacity of the home. In no instance will a septic tank of less than 720 gallons actual working capacity be permitted. The size of the tank not covered by the table on page 19 shall be based on a retention period of 48 hours plus a sludge storage of 30 per cent.

Suggested Daily Water Consumption Rates	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

Note: Any septic tank receiving waste from a garbage disposal should be increased in capacity by 50 per cent.

BUILT-IN-PLACE AND READY-MADE SEPTIC TANKS

The description and detailed cuts contained in this bulletin will be helpful to the home owner who anticipates the installation of a septic tank.

Precast concrete septic tanks manufactured at a central point and transported to place of installation are available. These tanks may be used if they comply in general with the design and capacity of poured-in-place concrete septic tanks. 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″ x 6″ 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" 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.

In certain locations, in excavating the hole, rock or other undesirable obstructions may be encountered. When this exists, the bottom of the hole must be excavated an additional 6 inches and then backfilled with sand, crushed stone or gravel to the proper grade. There are available Single Compartment Residential Bituminous Coated Metal Septic Tanks which may be approved provided they meet the standard designs and comply with the United States Department of Commerce Commercial Standard 177-51.

LOCATION OF SEPTIC TANK AND SUB-SURFACE TILE FIELD

The location of the septic tank and sub-surface tile system must be selected with care in relation to the water supply. The septic tank should never be closer than 50 feet to the well or spring. The sub-surface drainage system should never be closer than 100 feet to the water supply. If the ground is level, there is no way to tell the direction in which the underground water flows. Therefore, if the well does not have a tight casing for a depth of 50 feet or more, the farther away the tank and sub-surface tile system are located from the well, the less will be the danger of polluting the water supply. On the other hand, if the ground has a gradual slope for a long distance, the underground water probably flows the same direction as the slope. Therefore, if the tank and sub-surface tile system are located down hill from the well, there should be less danger of contaminating the water supply.

The owner must take care not to pollute either another person's water supply or his own spring or well. The sewer line from the house to the septic tank must have tight joints so there will be no leakage. The plumber should be required to extend the cast-iron soil pipe 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 should be extended more than 50 feet from the well before it joins the house sewer.

SEWER LINE FROM HOUSE TO SEPTIC TANK

The sewer from the house to the tank is commonly called the house sewer. Pipe used for its construction shall be of adequate size, 4 inches or greater, and of cast-iron, vitrified clay, concrete, cement asbestos, bituminized fiber or other acceptable 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" should be installed where 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 should be laid in a straight line as far as possible and then a one-eighth or one-sixteenth bend used. The next section should be laid straight as far as conditions will permit and another bend put in. The point where bends are made should be marked in some way so that the line can be found easily in the future if there should be any trouble. If it is necessary to make a bend of more than 45 degrees there should be a manhole.

LEAST FALL ALLOWABLE IN HOUSE SEWER LINE

How much or how little fall shall be used in a house sewer so that it will be self-cleaning is a question which often is asked. For a 4-inch sewer, the fall or grade should not be less than one foot per 100 feet, which is approximately 1¼ inch for each 10 feet in length. The fall for a 6-inch sewer may be 7½ inches per 100 feet or ¾ inch for each 10 feet of length. These are safe minimum slopes and lesser grades should not be used unless absolutely necessary.

TREE ROOTS CLOG SEWERS

Roots of trees, especially cottonwood, maple and willows, clog sewers. Certain fast growing shrubs and undergrowth often cause considerable trouble, especially if the joints are not tight. In seeking moisture, a root will find its way through a very small opening, and once it gets in, it will grow rapidly, filling up a section of the sewer and forcing the mortar out of the joints. It even can wrap around tile pipe and break it by contraction. If the sewer line cannot be laid far enough away from trees and shrubs that roots cannot reach it, more than usual care should be taken to see that the joints are well made and plenty of mortar is used. In such situations or to safeguard a nearby water supply, it is best to use cast-iron pipe with leaded joints. While this costs more in the beginning, it usually proves a saving in the end.

CONSTRUCTION OF SEPTIC TANKS

To build the tank of concrete, it is first necessary to dig the hole of sufficient size and depth and then provide forms for holding the concrete until it becomes thoroughly set. Where the soil is tight and firm, it is possible to dig the hole the exact size of the outside dimensions of the tank and allow the earth sides of the hole to serve for the outside form for the concrete. It is necessary then to use only one wood form for the inside with just a narrow outside wood frame around the top. If the soil is loose and "crumbly" or sandy, both inside and outside forms of wood should be used.

FITTINGS

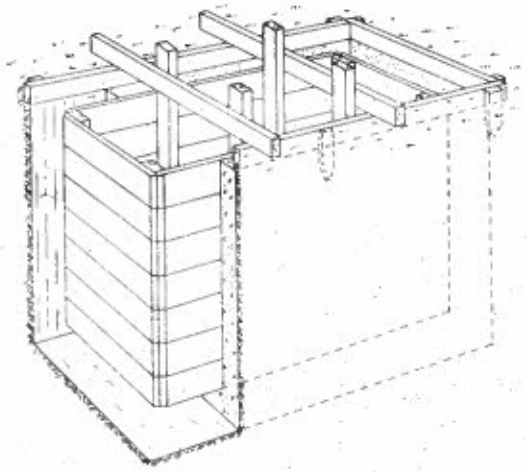
The septic tank inlet and outlet fittings shall be of cast iron.

For cast iron fittings, the following will be required:

2—4-inch cast iron soil pipe tees

2—18-inch lengths cast iron pipe
1—9-to 12-inch length cast iron pipe with hub (for addition to outlet tees)

Joints shall be soft lead, well caulked, made up before placement in the tank.



METHOD OF FORMING SEPTIC TANK WHEN OUTSIDE FORM IS NOT REQUIRED

REVISED 5-54 PLATE 2

THE CONCRETE MIXTURE

To secure a practically water-tight septic tank, it is particularly important to make the best concrete possible. This can only be done by accurately measuring and proportioning the cement, sand and gravel and by mixing carefully according to approved methods. The mixture for the septic tank should be of a texture and consistency that will provide a reasonably water-tight construction.

Pouring the Concrete Bottom and Side Walls

The first two "batches" of mixed concrete should be lowered in a bucket or "coalscuttle" and emptied in a pile down through the middle of the bottom. As each "batch" is emptied the concrete should be tamped until the water comes to the top and the mass spreads out to a 6-inch thickness through the middle portion of the bottom and tapers off towards the sides and ends. The third "batch" should be poured outside the form and tamped until sufficient concrete runs under and joins that previously poured, forming a uniform 6-inch thickness for the bottom of the tank. The remaining "batches" necessary should be poured evenly around the outside of the form and thoroughly spaded as poured.

When the septic tank is constructed of brick or masonry block the bottom slab should be poured prior to the construction of the walls. The slab should be at least 6 inches thick and the overall dimensions should be at least equal to the outside dimensions of the tank.

The inlet pipe and outlet pipe should be placed as shown in Plate 1 when the wall at both ends of the tank is built up to the level of 4 feet above the floor. All walls then should be completed up to the level of the top of the inside form. The green concrete must be allowed to "set" for a period of about 48 hours before any further work is done on the tank. After the concrete is sufficiently "set," the inside forms should be removed. This is done by prying off the top and bottom braces and the corner pieces of the form, and taking out the sides and ends separately. This leaves the tank ready for the construction of the cover.

THE CONCRETE COVER

Pour the concrete top of the tank in three independent sections with half-lap joints, any or all of which may be removed, thus exposing the entire inside of the tank. This type of top is shown in Plate 1.

For tanks up to 4 feet in width, the reinforcing for the cover slab should consist of welded wire mesh reinforcing with 4-inch x 4-inch spacing made up of No. 4 gauge wire. For tanks wider than 4 feet the cover slab should be reinforced with ½-inch rods spaced 6-inches center to center both ways. Single piece poured-in-place tops may be installed provided manholes are installed in close proximity to the inlet and outlet fittings.

UNITS OF THE SUB-SURFACE TILE FIELD

The units of the sub-surface tile field consist of a distribution box and sub-surface tile distribution lines to carry the liquid from the distribution box to the field and a number of tile lines with ¼-inch open joints. The distribution box should be constructed with all outlet pipes placed at exactly the same elevation in order to distribute the flow as near equally as possible to all lines in the field.

DISTRIBUTION BOX

Where several lines of drain tile are used, unless there is an arrangement for distributing the flow of the sewage as near equally as possible to the various lines, the tile system will not be satisfactory. The best arrangement is a distribution box. Plate 3 shows the types made of concrete.

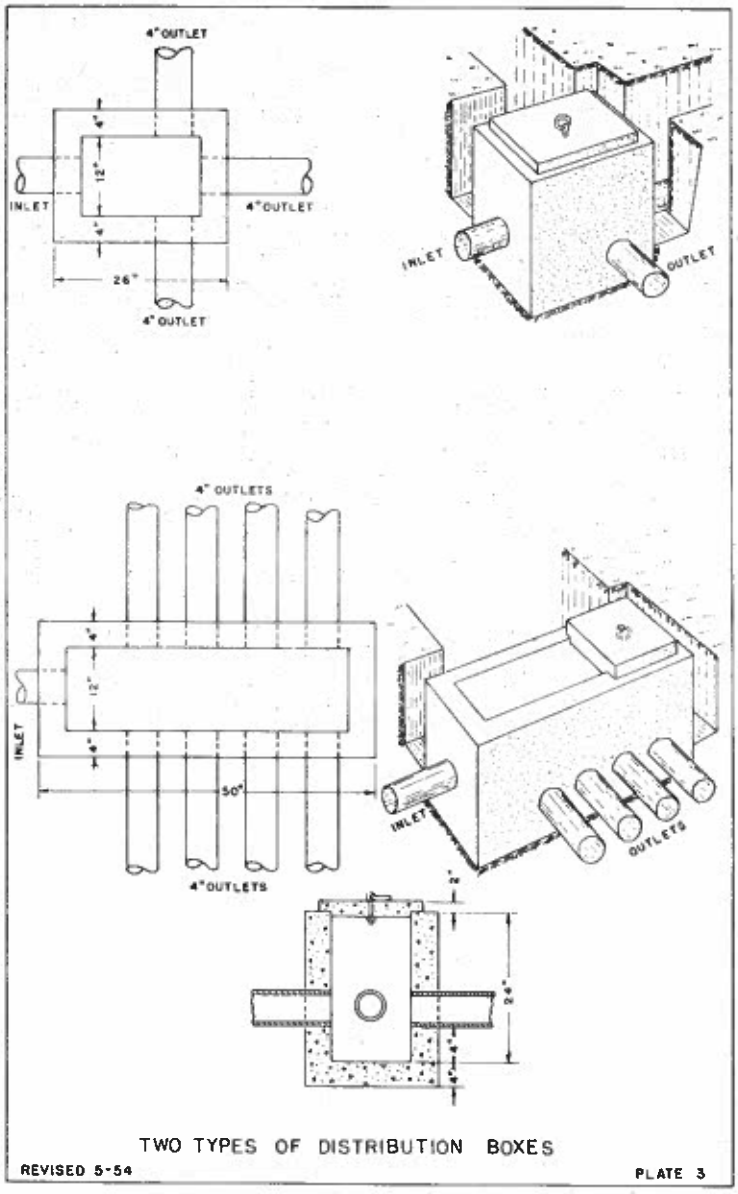
The distribution box may be made of either concrete, brick, or masonry block, with one inlet pipe and as many outlet pipes as desired. The important point is to see that the outlet pipes are placed at exactly the same level. The inlet pipe should be placed at least one inch higher than the outlet pipes.

Where excessive velocities are anticipated the current should be reduced to a minimum by the use of a baffle, tee or ell.

The distribution box should be installed on a solid foundation, either natural or artificial. Equal distribution of liquid to all outlets should be determined by water testing.

FEEDER LINES

The feeder lines consist of water-tight lines connecting the outlet from the distribution box to its respective sub-surface tile line.



The bottom of inlet pipe should be 5 inches or greater above the floor. The outlets must be set at the same level and 4 inches above the bottom, so that equal amounts of sewage will go to the several lines.

SUB-SURFACE TILE FIELDS

Where the daily flow of sewage is relatively small and soil conditions are favorable, sub-surface disposal of the effluent from a septic tank is advantageous. The most common acceptable method is by sub-surface tile lines surrounded by filter material in the trenches as shown on Plates 4 and 5. When shallow trenches are used, aerobic conditions prevail with high biological purification and minimum of soil clogging. A considerable quantity of the liquid discharged to shallow seepage trenches is lost to the atmosphere by evaporation where the area is covered by vegetation, through transpiration. The seepage from the shallow trenches placed well above the water level insures the maximum protection against contamination of the ground water.

The essential factors for the final disposal of sewage in sub-surface tile fields are a soil that is open and porous enough to absorb the effluent and a ground water level at least 3 feet below the surface of the ground. The liquid must be absorbed without ponding or overflowing on the surface of the ground. Heavy tight clay, hardpan and rock and soils with the water table very near the ground surface are unsuitable and sub-surface tile should not be attempted in such formations.

The table on page 19 of this bulletin gives the recommended square footage of sub-surface drain tile and ditches for various soil conditions and sizes of installation. When used by an experienced sanitarian, this table is reasonably satisfactory. Another method of determining the amount of absorption area needed is a percolation test on the site of the proposed sub-surface tile field. This test should be made in accordance with instructions which follow.

PERCOLATION TESTS

Explorations are necessary to determine sub-surface formations in a given area. In some cases, an examination of road cuts, stream embankments or building excavations will give useful information. Wells and well-drillers' logs can also be used to obtain information on ground water and sub-surface conditions. In some areas subsoil strata vary widely in short distances, and borings must be made at the site of the system. If the subsoil appears suitable, percolation tests should be made at points and elevations selected as typical of the area in which the disposal field will be located.

The percolation tests help to determine the acceptability of the site and the design of the sub-surface disposal system. The length of time required for percolation tests will vary in different types of soil. The safest method is to make tests in holes which have been kept filled with water for at least four hours, preferably overnight. This is particularly desirable if the tests are to be made by an inexperienced person, and in some soil (as those which swell upon wetting), it is necessary even if the individual has had considerable experience. Percolation rates should be figured on the basis of the test data obtained after the soil has had opportunity to become wetter or saturated and has had oppor-

tunity to swell for at least 24 hours. Enough tests should be made in separate holes carrying out the principles listed below, to assure that the results are accurate.

1. Number and location of tests: Three or more tests shall be made in separate test holes spaced uniformly over the proposed absorption field site.

2. 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. In order to save time, labor and volume of water required per test, the holes can be bored with a 4 inch auger.

3. 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.

4. 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. This can be accomplished in a short period of time. Swelling is caused by intrusion of water into the individual soil particle. This is a slow process, especially in clap-type soil, and is the reason for requiring a prolonged soaking period.

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 syphon, 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 5, after the water from one filling of the hole has completely seeped away.

5. Percolation-rate measurement: With the exception of sandy soils, percolation-rate measurements shall be made on the day following the procedure described under item 4 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 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 calculate the percolation rate. The drops during prior periods provide information for possible modification of the procedure to suit local circumstances.

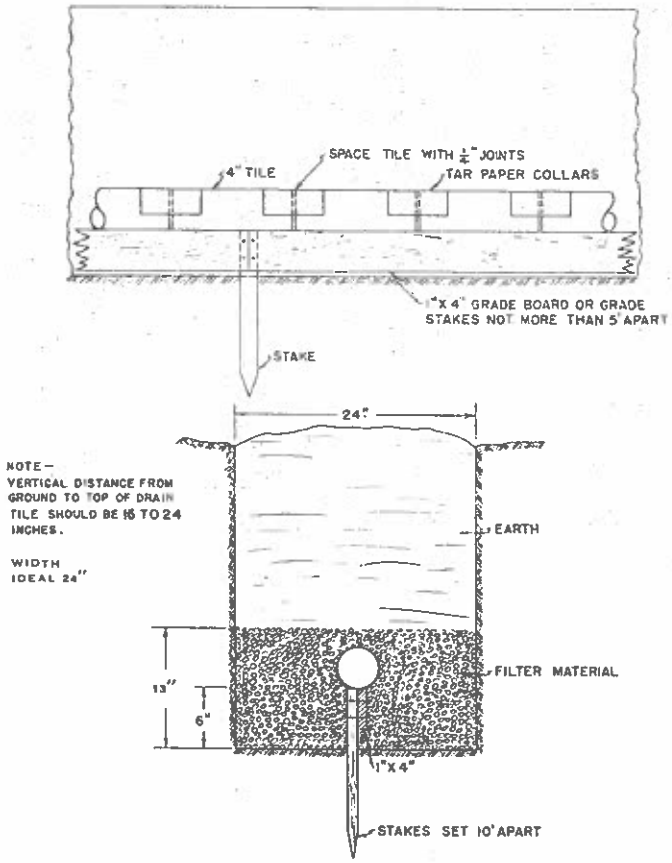
In sandy soils (or other soils in which the first 6 inches of water seep away in less than 30 minutes, after the overnight swelling period), the time interval between measurements shall be taken as 10 minutes and the test run for one hour. The drop that occurs during the final 10 minutes is used to calculate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

Absorption-area requirements for private residences

(Provides for garbage-grinder and automatic-sequence washing machines)

Percolation rate (Time required for water to fall 1 inch, in minutes)	Required absorption area, in sq. ft. per bed room (1) standard trench (2)	Percolation rate (Time required for water to fall 1 inch, in minutes)	Required absorption area, in sq. ft. per bedroom (1) standard trench (2)
1 or less	70	10	165
2	85	15	190
3	100	30	250
4	115	45	300
5	125	60	330

(1)—Over 60 minutes will require special design.
(2)—In every case, sufficient area should be provided for at least two bedrooms.
(3)—Absorption area for standard trenches is figured as trench-bottom area.



METHOD OF LAYING DRAIN TILES

REVISED 10-54, 2-56

PLATE 4

CONSTRUCTION OF THE SUB-SURFACE TILE FIELD

The open joint sub-surface tile field consists of a series of shallow lateral trenches excavated to a depth of 24 to 30 inches, depending on the topography, and to a width of 24 inches. Trenches 18 inches wide to a width of 36 inches will be permitted, provided 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.

After the trenches have been excavated, a line of stakes should be set 10 feet apart down the middle of the trench bottom and 1 inch x 6 inch boards 10 feet long placed edgewise nailed to the stakes. The slopes of the line should be not less than 2 inches nor more than 4 inches per 100 feet. The bottom of such a trench shall be approximately level. The desired slope can be obtained by setting the first stake down ⅜ inch below the level of the preceding stake.

AGGREGATE FOR TRENCHES

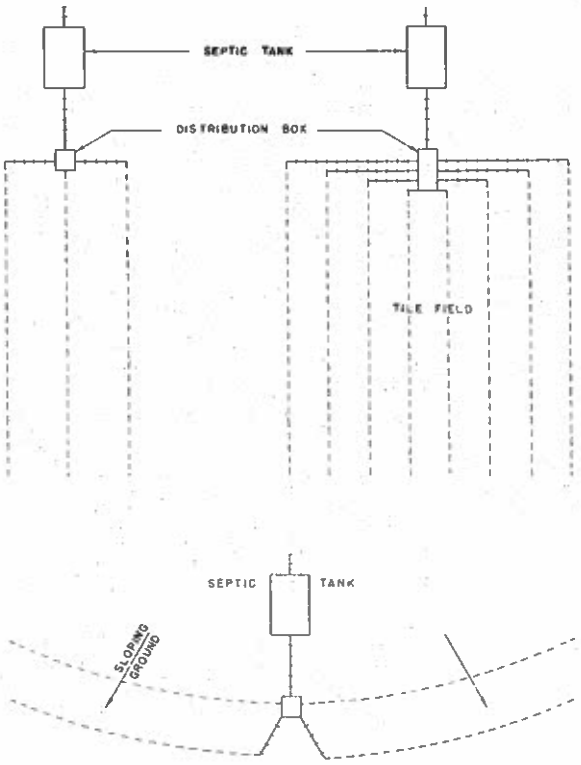
The aggregate must be of such a nature that it will not disintegrate or become cemented under the action of the sewage liquid. Furthermore, it must contain adequate space between the individual pieces to allow free distribution of the liquid to the trench; consequently, aggregate must be durable and properly graded as to size. The most suitable materials normally available are gravel, crushed stone or slag. The size of the aggregate media is very important and individual pieces should 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 a 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 at least 2 inches. When the trenches are filled, the earth should be well rounded up above the surface of the ground to allow for settling. If this is not done, there will be sinks along the line of the trenches after the earth has settled and this will collect surface water and interfere with the working of the tile.

Sub-surface drain tile lines should be spaced at least three times the width of the trench, with a minimum of 6 feet. Length of sub-surface drain tile lines should not exceed 100 feet and where feasible should be 75 feet or less. There are various arrangements of laterals, depending upon the topography of the area available as indicated on Plate 5.

Drainage tile shall be 4 inches in size and shall consist of vitrified farm tile, vitrified clay, or concrete tile meeting American Society of Testing Material Standards.

Note:—Remember drain tile should be laid on the top soil just deep enough to permit the ground over it being plowed without striking the tile. An average of 15 inches from the top of the tile to the surface of the ground is best. In no case should the tile be buried more than 24 inches. Also, whenever possible, the drainage field should be laid on the sunny side of the hill.



TYPICAL LAYOUTS OF TILE FIELDS

REVISED 10-54 PLATE 5

FINAL INSPECTION

Every septic tank system must be inspected before approval is given. Final inspection shall include the following:

1. Home sewer, construction and grade.
2. Septic tank, capacity and construction, and fittings.
3. Distribution box, construction, adequate number of outlets, all outlets are equal level.
4. Feeder lines, water tight, properly connected and graded.
5. Sub-surface tile lines, equal length, proper depth, length and grade; proper amount and type of aggregate.

REQUIRED CAPACITIES, RECOMMENDED DIMENSIONS, LISTS OF MATERIALS AND ABSORPTION AREAS

POTENTIAL CAPACITY OF HOME NUMBER OF BEDROOMS	CAPACITY SEPTIC TANK	DIMENSIONS SEPTIC TANK				THICKNESS CONCRETE			CONCRETE MATERIALS REQUIRED			SQUARE FOOTAGE OF TRENCH BOTTOM*		
	GALLONS	A Length	B Width	C Air Space	D Liquid Depth	H Walls	J Top	K Bottom	Cement Bags	Sand Cu. Yds.	Gravel Yds.	Sandy Soils	Medium Soils	Clay Soils
2 or Less	720	7'–0"	3'–6"	1'–0"	4'–0"	6 in.	4 in.	6 in.	21	1–¾	3–½	380	500	660
3	720	7'–0"	3'–6"	1'–0"	4'–0"	6 in.	4 in.	6 in.	21	1–¾	3–½	570	750	990
3	950	8'–0"	4'–0"	1'–0"	4'–0"	6 in.	4 in.	6 in.	26	2–½	4–¼	570	750	990
4	1000	8'–0"	4'–0"	1'–0"	4'–3"	6 in.	4 in.	6 in.	26	2–½	4–¼	760	1000	1320
5	1250	9'–0"	4'–6"	1'–0"	4'–3"	7 in.	5 in.	6 in.	35	3	5–½	950	1250	1650
6	1480	9'–6"	4'–8"	1'–3"	4'–8"	8 in.	5 in.	6 in.	42	3–½	7	1140	1500	1980
7	1720	10'–0"	5'–0"	1'–3"	4'–8"	8 in.	5 in.	6 in.	46	4	7–½	1230	1750	2110

* Most local ordinances specify a minimum amount of subsurface drain tile.

Note: It is recommended that garbage disposal devices not be used in connection with home septic systems. However, if it is used, the septic tank capacity should be increased by at least 50 per cent.

Note: A section between the top and bottom sections of a precast septic tank, commonly called a ring cell, shall not be used to increase MINIMUM CAPACITY.