# PRIVATE SEWAGE DISPOSAL SYSTEMS

# INFORMATION FOR INSTALLERS 1982

Alberta

LABOUR
General Safety Services Division
Plumbing and Gas Safety Services Branch

READ THIS FIRST

TO INSTALL A SEPTIC TANK AND FIELD, FOLLOW THESE STEPS:

1. Select a sunny, well-drained site.

2. Check the minimum distance requirements in the Regulation Book.

3. Select the septic tank size. If you buy, obtain a detailed dimensioned sketch of the septic tank which you propose to use.

4. Run a percolation test on the soil where the field will be. See Regulation.

5. Determine the total length of weeping lateral required.

6. Determine how much clean ($\frac{1}{2}$" to $1\frac{1}{2}$") gravel you need.

7. Determine whether the ground is sloping or is level.

8. Select the point of elevation of the building drain as it passes through or under the basement wall.

9. Submit: A completed "Application for Private Sewage Disposal Permit" form: a cheque payable to The Provincial Treasurer; and a sketch of your proposals to the nearest Provincial Inspector.

10. After you receive your permit in the mail, or verbal approval from the Inspector, proceed with the installation.

11. Phone your inspector, and request an inspection before covering.

## PREFACE

This manual has been prepared to assist the non-urban citizens of Alberta, in the selection and installation of a private sewage disposal system.

The trend toward de-centralization and dwellings on small acreages, finds an ever increasing number of Alberta Residents living in areas where the installation of a public sewerage system would be impractical. Such buildings must depend upon private sewage disposal systems to treat their water borne wastes in a safe and efficient manner,

The improper treatment of sewage can foul the air, pollute the soil and endanger the drinking water of yourself, your neighbors, or even a community, thus every sewage disposal system in the province is required to comply with the requirements of the Alberta Plumbing and Drainage Regulations. This manual will help you to understand those requirements. Contact your District Inspector for advice and assistance before any work is commenced.

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## INTRODUCTION

The fact that many of the communicable diseases are transmitted from one person to another as a result of the fecal contamination of food or water makes it necessary that human excreta be disposed of so that no opportunity will exist for the transmission of infection. The safe treatment of sewage may be defined as that which renders impossible the contamination of any water supply, and successfully insures against exposure to flies, and the development of diseases and nuisances.

## SEWAGE DISPOSAL SYSTEM PERMITS

A person who proposes to install a private sewage disposal system anywhere in Alberta must first make application for a Private Sewage Disposal System Permit.

## SAFETY

- Don't attempt to de-sludge or service a septic tank. Hire a properly equipped professional.

- Never enter a septic tank or cesspool as toxic gases maybe present.

- A septic tank & field should be protected. Set posts or a fence to prevent vehicles, animals, truck, etc., from driving over them.

- Don't discharge sewage or sewage effluent on to the ground surface where children, dogs, fowls, animals, etc., can come into contact with it.

- Report any failure to your District Inspector. He can give you professional advice.

## PIPING THE SEWAGE

### THE BUILDING DRAIN

The main building drain which conduets the sewage from the plumbing fixtures to the septic tank is required to be of C.S.A. (Canadian Standards Association) Certified pipe and can usually be 3" in size. The pipe should be graded at ¼" of drop for each foot of its length.

Take special care to see that both the inlet and outlet piping connections to the septic tank are tight and permanently sealed so that sewage will not leak into the soil surrounding the septic tank.

Where the septic tank is the normal three feet from the building, 1½ feet to 2 feet of earth cover will be sufficient frost protection for such a short building drain.

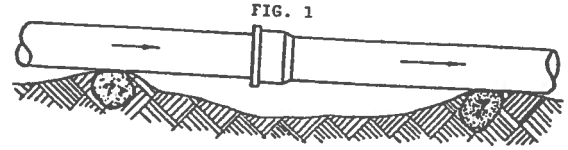
### LAYING SEWER PIPE

In the laying of piping the grade per foot and the total length should be used to determine the total fall in the line (See illustration). By the use of a transit, irrigation level, or sighting along a spirit level, set wooden pegs to the proper depth to indicate the bottom of the line at both ends. Lay pipe on a firmed trench bottom, and by sighting down line of installed sewer, maintain an even and constant rate of fall. Sags cause stoppages.

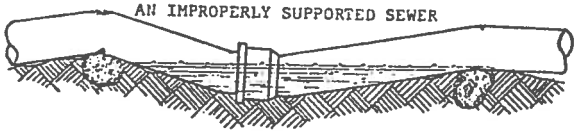
Intermediate pegs may be used for long lines. For short pipes such as weeping tile or vitrified tile, the use of grade boards nailed flush with the pegs is recommended. All sewer piping within 50 feet of any water supply must be leak-proof.

SUPPORTING WATER TIGHT SEWERS
AND SEPTIC TANKS

FIG. 1



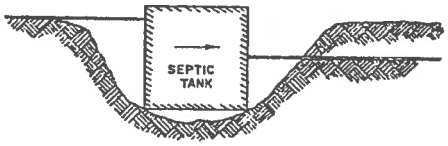
AN IMPROPERLY SUPPORTED SEWER



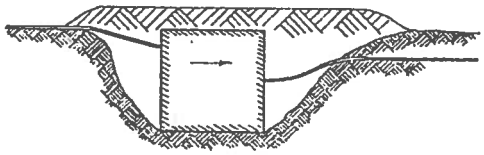
WILL FAIL

SEWER
FROM HOUSE

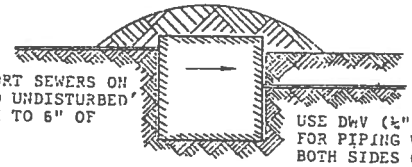
EFFLUENT
SEWER
TO DISPOSAL FIELD




IMPROPERLY SUPPORTED SEPTIC
TANKS AND SEWERS



WILL SETTLE AND FAIL



SUPPORT SEWERS ON
SOLID UNDISTURBED
EARTH TO 6" OF
TANK.

USE DWV (½" WALL THICKNESS
FOR PIPING WITHIN 6' OF
BOTH SIDES OF SEPTIC TANK.

SUPPORT SEPTIC TANK ON LEVEL SOLID UNDISTURBED CLAY OR
ON LEVEL TAMPED SAND OR FINE GRAVEL.

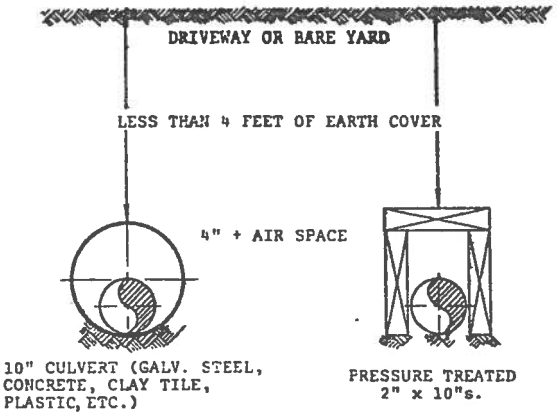



FIG. 2 "FROST BOX"

Any water tight sewer must be laid so the barrel of the pipe rests on an even continuous support of undisturbed earth or tamped granular material. Grade the trench bottom carefully before laying the pipe.

PROTECTING SEWERS FROM FROST AND TRAFFIC

All sewer piping located under a driveway, road, path, or bare yard, with less than 4 feet of earth cover, should be protected by a "frost box". See Illustration.

Note: In cases where it is necessary to locate the septic tank some distance from the house, and this line requires protection, the frost box should terminate 3 feet from the building wall, If carried to the wall, it may conduct odors to the building. Tamp clay tightly around the building drain for this 3 foot interval.

## THE SEPTIC TANK

PURPOSE

The septic tank is essentially a water-tight storage container into which raw sewage is discharged and retained for 24 hours or more. Its purpose is primarily to allow solids in the sewage to settle out (sludge) or to float (scum) thereby permitting the liquid portion of the sewage to leave the tank comparatively free of settleable and floating solids.

Sewage which has emerged from a septic tank is termed "Sewage Effluent" Thus the subject of sewage disposal falls into two distinct stages: (1) The retention and dibestion of floating and settleable solids in the septic tank; and (2) the safe disposal or treatment of the effluent.

HOW THE SEPTIC TANK WORKS

There is a common belief that in some mysterious biological manner the septic tank "purifies" the sewage so that the effluent is completely safe-even for drinking. It is imperative that the septic tank owner thoroughly understands the dangers of such a belief and that he attain a definite respect for the dangers of sewage effluent.

This can be achieved when it is understood that the septic tank largely accomplishes its purpose through the digestion of the sludge by anaerobic bacteria. These anaerobes are present in the body wastes. They thrive in an environment which is warm, wet, dark and devoid of fresh air.

The septic tank simply allows the sewage to rest for a 24 hour period under these conditions, so that rapid mutiplication of bacteria takes place. If the bacteria which accomplish this degestion can multiply many thousands of times in the septic tank, so also then can the pathogens or disease producing bacteria in the sewage be expected to multiply.

Actual tests have shown that the overflow of effluent from a septic tank is often higher in bacterial content than the sewage which entered.

It is because of this danger that the Alberta Government concerns itself with the matter of septic tanks and sewage disposal.

## SALT AND WATER SOFTENERS

The water used in regenerating a water softener contains a high salt content and may have an adverse effect on a septic tank. The large volume of cold water will chill the contents of the septic chamber and thereby may retard the bacterial action.

It is advisable to run the softener regeneration water to an area where surface discharge would be acceptable, or to a separate leaching cesspool. Do not by-pass the septic tank and run the softener waste to the sewage disposal field.

## SEPTIC ACTION STARTERS

Digestion will eventually establish itself spontaneously in a tank receiving normal household sewage providing temperatures are not extreme and the proper environmental conditions exist in the septic tank. The course of such digestion proceeds, however, though a sometimes prolonged odiferous acid stage before reaching alkaline conditions under which digestion proceeds most effectively, and with least odor nuisance. The addition of lime (not chloride of lime) will reduce the odiferous stage and provide alkaline conditions for the most efficient septic action. Tanks started in cold weather should be partially or totally filled with hot water. The growth of the bacteria generates a very small amount of heat.

Contrary to a popular rumor, scientific tests indicate that "The addition of yeast does not appear to accelerate sludge digestion in the tank. Seeding with digested sludge appears to be advantageous however".

## SLUDGE AND SCUM

Not all of the suspended matter in the raw sewage is digestible in the septic tank. Along with some of the faecal material, sand, soil, seeds, fruit skins, etc. settle out and become sludge in the bottom of the tank. Grease, oily substances, soap curds, and fats rise to the surface in the septic tank and eventually form a thick scum. The digestion process and the growth of the anaerobes in the settled sewage produce tiny bubbles of gas. As these bubbles drift upward, they entrain minute particles of suspended solids in the sewage. This also contributes to the scum. The scum, being buoyant, floats partly above the water line - (27%). This is the reason for the 9 inch minimum freeboard of "Depth of Air Space" required in a septic tank.

The accumulated scum roughly averages half the volume of the accumulated sludge.

The scum should not be unduly disturbed between cleanings as it provides a layer of insulation against heat loss and also seals the air way from the anaerobes.

The rate of accumulation of sludge plus scum is considerably greater during the first year of operation. After that, probably due to the compaction and digestion, the rate of accumulation drops from about 18 Imperial Gallons per person per year for the first year, to a fairly constant rough average of 5½ Imperial Gallons per person per year.

## CLEANING THE SEPTIC TANK

In Alberta, a septic tank must be a minimum size of 400 gallons, because the extra cost for septic tanks which are larger is not justified by an appreciable improvement in the quality of the effluent. The size of the septic tank determines little more than the interval between cleanings.

The septic tank should be checked each spring or early summer for the amount of accumulated sludge and scum in it. A septic tank with 18" of sludge is ready to be cleaned. To check for sludge depth, wrap a long stick with terry cloth to four feet from one end. Insert the wrapped end of the stick until it touches the bottom of the septic chamber (first compartment). Leave for two minutes. Withdraw the stick carefully. The darker sludge line will show on the terry cloth.

It is not necessary to thoroughly scrub and flush the septic tank chamber until it is visibly clean. The small amount of sludge that will remain on the floor and walls when the tank is emptied will re-seed the septic tank and contribute to the re-establishment of its normal operation.

Vacuum-pumped sewage hauling tanks are available commercially to clean septic tanks. Such equipment is capable of doing an excellent cleaning job without spillage. Persons wishing to improvise their own equipment and do their own cleaning should be extremely careful about spillage and about thoroughly cleaning and sanitizing themselves, their clothing, and their equipment afterward.

Checking and servicing the sewage disposal system should be considered a part of the regular spring clean-up of the premises, so that bacterial action will have a chance to re-establish a normal action and temperature before the cold weather commences.

**DANGER**

Deadly gases are present in a septic tank. Never enter a septic tank unless it has been open for at least 12 hours after being pumped out. Never enter a septic tank unless the procedure and methods approved by the Occupational Health and Safety Division have been complied with.

## IF THE SEPTIC TANK IS NOT CLEANED SOON ENOUGH

If the septic tank is not cleaned soon enough, the detention period which it will provide for the sewage, will continue to decrease. As a result, more and more suspended solids will be carried into the effluent disposal system, and the percolation surface of the soil will become clogged and eventually a complete blockage and failure of the system will result. The septic tank can usually be cleaned many times for the price of installing a new effluent disposal system.

## THE DISPOSAL OF SLUDGE

Many of the pathogenic or disease producing bacteria found in sewage are capable of becoming spores, in which state they can withstand extreme cold or heat and extended drying conditions. For this reason, caution should be exercised in disposing of the sludge from a septic tank.

If the contents of a septic tank, or cesspool are spread on a field of summer-fallow where it will be well away from buildings or animals, it will rapidly become inoffensive and is a good nitrate fertilizer. Burial and covering is always an excellent method.

Never permit sludge to contaminate any surface waters.

## USE OF THE SEPTIC TANK

All domestic plumbing fixtures including the bath, water closet, basin, kitchen sink, and laundry tubs must drain into the septic tank. Rain water, seepage water (If an appreciable amount), and water used to rinse and regenerate water softener units should not be admitted to the system.

An excessive volume of cold water from any source may wash away and seriously deplete the bacteria population in the tank as well as lowering the operating temperature. It has been found that all normal household wastes may safety discharge to the septic tank.

Laundries, hospitals, large public kitchens, etc., may be expected to contribute volumes of wastes which would be better handled by a separate system. An expert should be consulted in these or any other unusual cases.

Small amounts of household chemicals such as bleach used to disinfect water supplies or to sterilize dishes will not reduce the septic action, but habitual admission of large amounts may be detrimental.

## LOCATION OF THE SEPTIC TANK

In locating a septic tank consideration should be given to the protection of the potable water supply. The septic tank is considered to be a water-tight component of the disposal system, and as such it must be located the proper distances from the building wall, any property line, any cistern, and from any well or other source of water supply, as required by the regulations.

The general planning should be to locate the septic tank adjacent to the bathroom and on the opposite side of the house from the water supply. If arrangement permits, the south side of the house is preferable to the north. The surface drainage from the septic tank and effluent disposal system must be away from the water supply and buildings. The disposal field should be on high, well drained land where the water table is over 7 feet below the surface. Under a well kept lawn, is an ideal location.

## TO SELECT THE SIZE OF THE SEPTIC TANK

Research has indicated that septic tanks which are too small, regardless of daily sewage flow, are not satisfactory. For this reason the Regulations in Alberta specify a minimum tank capacity of 400 Imperial Gallons.

Septic tanks to accommodate waste from garbage grinders should have thier capacity increased by 50% or have the tank cleaned every year.

As previously indicated, a septic tank or settling tank is intended to provide a detention period of 24 hours where the phenomenon of changing raw sewage to a disposable form takes place. It is important to note that when reference is made to sizes and capacities of tanks, one should not consider the siphon (or dosing) chamber in these figures, although the siphon chamber is usually constructed as an integral part of the structure which also includes the septic tank.

The liquid depth or depth of sewage is measured vertically from the floor to the invert of the outlet of the septic chamber, and in no case may be less than 4 feet. A free board of 9" or 10% of working volume is required from the liquid level to the top to allow for the escape of gases and accumulation of scum. The maximum travel for the sewage between inlet and outlet must be provided so that as many solids as possible will settle. This travel shall not be less than 48 inches.

## TYPES OF SEPTIC TANKS

### SEPTIC TANK WITH SIPHON IN THE EFFLUENT CHAMBER

1. A = Settling or Septic Chamber.

   B = Effluent or siphon chamber equipped with an automatic siphon.

2. Trickle - Type Septic Tank (No effluent or siphon chamber)

3. Septic Tank with effluent chamber equipped with a pump.

   A = Settling or Septic Chamber.

   B = Effluent or siphon chamber, equipped with a pump. This chamber is also often referred to as the dosing chamber. (See Illustrations below)

Note: The working capacity of a Septic Tank is the volume of liquid contained in the first chamber and does not include the volume of the effluent or siphon chamber.

Septic Tanks used in Alberta must be marked showing the working capacity, whether it is a siphon, trickle or pump type, and

- the volume of the effluent or siphon chamber

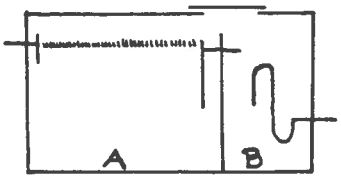
The markings on a tank would be similar to the following:

400 - P - 85

Where the 400 = working capacity

P = Pump

85 = Volume of discharge available from the dosing chamber.

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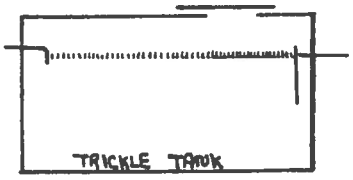


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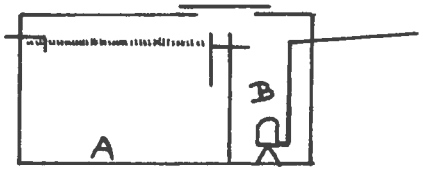



3.

## SIZE OF EFFLUENT OR SIPHON CHAMBER

The effluent or siphon compartment should have a capacity to flush ½ gallon for each 1 foot of weeping lateral.

## CONSTRUCTION FEATURES OF A POURED - IN - PLACE CONCRETE SEPTIC TANK

Steel Reinforcing: Poured-in-place concrete septic tanks, especially larger ones, should be reinforced with 3/8" or 1" rods:

Top: 12" apart, across, 1½" from interior face of concrete.

Walls: 6" apart, horizontal, 15" apart vertical, 2" from interior face.

Floor: 8" apart both ways, 2½" from interior face.

Concrete Mix: Use Type 5 Sulphate Resistent Cement. The recommended mixture for concrete is 1:2:3 (a sack of cement, 2 cu.ft. of sand, 3 cu.ft. of gravel or crushed stone) with no particles larger than 1½ in. If pit run gravel is used, a mixture of 1 sack of cement to 5 cu.ft. of good clean pit run gravel is satisfactory. Not over four and one-half gallons of water should be used for each sack of cement, if the sand or gravel are normally damp. A fairly stiff mix makes better concrete than a sloppy one.

To determine if sand is clean enough to make good concrete, apply the follow. test: Put four ounces of sand and eight ounces of 3% lye solution in a 12 oz. bottle, shake, and allow to stand for 24 hours. If the liquid is clear at the time and the silt layer is not over 1/8" thick the sand is satisfactory.

Materials List: For a 400 Gallon septic tank with siphon chamber and concrete top:

| | | | |
|---|---|---|---|
| Cement: | -27 bags | Sand: | -1½ cu. yards |
| Gravel: | -3 cu. yards | Water: | -124 gallons |
| Steel Rod: | -approximately 400 feet | | |

Covers: 3" pressure creosoted rough planks laid across the short span of the tank make a good cover. Overlay this with a sheet of heavy plastic to prevent the earth from trickling through. The finished septic tank should then be covered with at least 18" of heavy soil to prevent odors from escaping, and to protect the contents from temperature changes. For a more durable cover, the planks may be made of reinforced concrete by pouring the concrete mix into appropriately shaped forms. When repairs or cleaning becomes necessary, the whole of the tank can be laid open quite easily, thus providing ample light, ventilation, and access for the work.

If the septic tank is located where traffic or a walk may cross it, a poured-in-place concrete top is required. In this case, a manhole, at least 26" in diameter with a cover must be provided for each compartment. The manhole in the septic chamber should be located to provide accesss to the inlet where stoppages are most likely to occur. The manhole in the siphon chamber should be directly over the siphon bell

Protective Coatings: The high humidity combined with the gases present in the septic tank have a decidedly deteriorating effect on concrete and metals at and above the water line.

All corrodable materials, fittings, siphons, bells, concrete walls, concrete covers, concrete manholes, etc., inside a septic tank should be completely and permanently protected by a heavy, durable and permanent protective coating such as hot tar or equal.

## SINGLE COMPARTMENT (TRICKLE TYPE) TANKS

A single compartment septic tank may not be used to trickle effluent directly into a disposal field.

A trickle type septic tank having no siphon or pump chamber may be used under certain conditions.

## MANUFACTURED SEPTIC TANKS

Any manufactured septic tank or sewage holding tank must be labelled and are usually constructed of concrete, fibre glass or plastic.

## HOW TO PURCHASE A PREFABRICATED SEPTIC TANK

1. Look for a permanent label on the top of each septic tank, which label is required to provide the information mentioned in the regulations.

2. Check the total loss in elevation between the inlet and the outlet of the septic tank. If this figure is too large, you may find your building drain and the top of your septic tank above ground level.

REMEMBER: Your disposal field perforated piping must be within two feet of the surface; so the outlet of your septic tank should normally be not more than 20" below a level ground surface. If the 18" to 20" cannot be provided a pump instead of a siphon may be used.

3. The first compartment or sedimentation chamber must hold not less than 400 Imperial Gallons of sewage.

4. The volume per flush should be adequate to evenly flood the footage of weeping tile required for your system, and to provide a rest period between flushes.

5. If you have copper drains, wastes, or vent piping in your plumbing system, select a septic tank with a sealed submerged inlet to prevent sewer gases from corroding your plumbing system.

6. If water is available, it is always good practice to fill each compartment of the tank in succession to check for water leakage, air leakage from the siphon bell, and for proper operation of the siphon before the tank is installed. It is essential that water does not leak from one compartment to the other. Some tanks are pre-tested at the factory to save you this trouble.

7. If in doubt about any prefabricated tank, contact your Inspector.

8. When the expected volume of sewage per day exceeds the capacity of a manufactured tank, several tanks may be installed in series to provide the total volume required, as well as an adequate sized dosing or effluent chamber.

## THE DISPOSAL OF EFFLUENT

### EASEMENTS

Boundries and property lines are a major consideration in laying out a disposal system in order to avoid legal difficulties or depreciation of property values.

Every part of the disposal system should be contained within the property lines of the lot of the building served. An owner having several vacant lots and a building on one of them should bear this in mind: he may later wish to sell the adjoining lot and remember too late that his disposal field is located on it.

### EFFLUENT - METHODS OF DISPOSAL

The liquid portion of the sewage passes through the septic tank and is known as effluent. It has a much lower content of fats and solids than the raw sewage. The disposal of this effluent is accomplished by any method which complies with the regulations and depending on the type of soil encountered.

Some suggested methods are:

(a) Sandy and Gravel - septic tank and cesspool. (But this method requires the specific prior written approval of the Plumbing Inspector).

(b) Light and Sandy Loam - septic tank and field.

(c) Heavy Loam with Sand - septic tank and field.

(d) Clay Soils - septic tank and large field.

(e) Clay Soils - lagoon if conditions permit.

(f) High Water Table Areas - septic tank and above ground effluent disposal system (i.e. place field in fill) and in some cases a tight pump-out tank may be required in order to protect water supplies.

(g) If any of the systems (a) to (f) are unsuitable, a water-tight pump-out tank should be used. This may or may not be preceded by a septic tank.

(h) Under special conditions a septic tank followed by a sand filter will be permitted.

(i) In some very isolated and remote locations, a surface discharge type effluent disposal system may discharge sewage effluent to the ground surface. See Regulations for the limitations.

## Percolation Rates - Soil Texture & Chemical Elements of Water Supplies

A percolation test should always be performed at each disposal site to determine the rate that will accept effluent from the disposal system. A percolation test which provides a rate of ~10 min/inch would indicate a more course soil texture than a rate of 10-20 min/inch and therefore would be capable of accepting greater volumes of water or effluent in the same given area and period of time.

The rate at which a soil will accept water or septic tank effluent is dependent upon the size of the pore spaces between the individual soil particals. Sand particals, being much larger than either silt or clay particals provide large pore spaces and little restriction of the movement of water through the soil.

Clays on the other hand have extremely small particals and accordingly, extremely small pore spaces between the particals, providing severe restriction of the movement of water. Also, nearly all of the clay families, shrink when dry and swell on wetting, further reducing pore size. The swelling and shrinking of soils that leave large cracks on the surface is particularly noticeable in soils containing large amounts of Montmorillonite Clay. As a consequence much larger absorption areas must be utilized for the same given amounts of effluent and time.

Montmorillonite clay is found through Alberta in varying amounts. It being the finest textured of all clays, is also affected by chemical elements in the water supply and consequently the sewage effluent.

Naturally soft water or water which has been "softened" with a water softner, contains amounts of sodium far in excess of calcium and magnesium.

Generally it is expected that the higher the ratio between the sodium and calcium + magesium and the greater the percentage of Montmorillonite the greater the probability of reduced percolation.

Sodium in the water causes the Montmorillonite particals to separate, repell each other and flow with the water until they lodge and clog the pore speces reducing percolation. Continued use of water containing amounts of sodium in excess of calcium and magnesium may result in total sealing of the soil.

In sandy porous soils, the pore spaces being much larger, may allow the Montmorillonite particals to be leached from the absorption area and an increase and percolation rates may be obtained.

"Hard" water, or water which contains more calcium and magnesium that sodium has little effect on calcium saturated Montmorillonite Clay and percolation rates are expected to remain fairly constant.

Remember, when water contains more sodium than calcium and magnesium, there is a danger that continued use may cause the soil to become hard and impermeable.

## SUBSURFACE DISPOSAL FIELDS

(a) Purification in the Disposal Field:

Septic tank effluent contains minute particles of sewage, or suspended solids, and intestinal and pathogenic bacteria. When the effluent is percolated into the ground, these impurities are attacked by myriad biological organisms naturally present in the soil. These organisms utilize the organic materials as food and thus oxidize them into safe and stable compounds. Thus, the "secret" of the purification of sewage effluent in the soil is actually a vital stage in the "nitrogen cycle" in which the complex organic proteins are broken down into simple and stable inorganic compounds.

The biological organisms which perform this miracle are "aerobic", i.e. they require the presence of available oxygen for life. Their natural habitat, therefore, is the surface and upper layers of the soil. This explains why lighter soils and comparatively shallow disposal fields are the most efficient for effluent disposal, and conversely, why weeping tile laid 3 feet or more below the surface is not satisfactory.

It also explains the reason for the intermittent flushing of fields, the rest period required between flushes, the air space in laterals, the use of light soil for back-filling of trenches, the use of more tile than is necessary to hold the effluent, etc.

If a portion of a disposal system is permitted to become constantly saturated, the oxygen is driven out of the soil, the aerobic organisms die, the soil becomes sour and septic. The process of oxidizing the suspended solids and the pathogenic bacteria ceases, and a danger to health exists. The suspended solids accumulate rapidly and the interstices of the soil become plugged. The rate of percolation into the soil decreases until the whole disposal system becomes inoperative.

For this reason, longer rest periods are provided between flushes into heavier soils. If the rest period is insufficient to permit proper aeration of the soil, the system will become clogged much sooner. If adequate aeration of the field and soil is possible, the tile will be found virtually free of deposit even after many years.

(b) Depth of Laterals:

In order to be shallow enough to be in the presence of the necessary aerobic organisms, weeping tile laterals in Alberta should be laid at a depth between 12 in. and 24 in. In very porous soils (gravel) this depth can be increased to about 30 in. if the prior approval of the Inspector is obtained. Installation of a lateral is shown in Fig. 5.

(c) WEEPING LATERALS FIG. 5

A. Trenches for weeping laterals must be 18" minimum width.

Backfill soil over weeping laterals must be porous so capillary action can draw effluent to the surface where it can evaporate and/or be consumed by plants. Do not seal weeping laterals in by using clay or dense backfill. It is often necessary to "make" the soil used for backfill by mixing loam with fibrous material such as peat moss, chopped straw, sawdust, etc. Do not pack the backfill or run vehicles over it. Allow 2 or 3 inches of excess backfill to make up for settling.

A shallow field using porous backfill will be "aerobic". Free passage of air through the soil encourages the growth of "aerobes" which keep the soil open and purify the effluent.

A deeper field in dense soil will be "anaerobic". It will be sour, septic and inefficient.

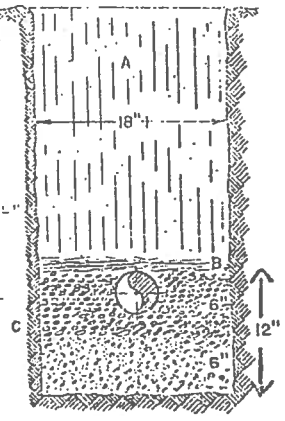
The perforated pipe must be within 12" to 24" of the surface. A shallower field is always the best.

B. Cover the clean gravel with any kink of straw to prevent the backfill soil from filling the air spaces in the gravel.

TABLE 3 GRAVEL REQUIRED

| DEPTH OF GRAVEL | TRENCH WIDTH | CUBIC YARDS OF GRAVEL PER FOOT OF LATERAL |
|---|---|---|
| 6" | 18" | 0.027 |
| 12" | 18" | 0.055 |
| 6" | 24" | 0.037 |
| 12" | 24" | 0.074 |

e.g. A foot of gravel in 300 feet of 18" wide trench requires:
300 x 0.055 = 16.5 cu. yd. of gravel.




WEEPING LATERALS FIG. 5

C. Gravel is necessary for these reasons:

- It allows effluent to escape freely from the perforated pipe.
- It provides free air in the soil for aerobes which are necessary to purify the effluent.
- If perforated pipe is laid directly in soil, the holes soon plug so the effluent cannot escape. Gravel keeps the escape holes open.

The top of the gravel should occur at the level of the center of the perforated pipe. To carry gravel higher than this, would interrupt the upward capillary movement of the effluent toward the surface.

D. Each lateral, throughout its length, should be level perforated weeping pipe. The top of the trench (ground surface) can vary as long as the cover over the perforated pipe stays within the 12" to 24" limits.

Total footage of weeping lateral required may be obtained by using the formula:

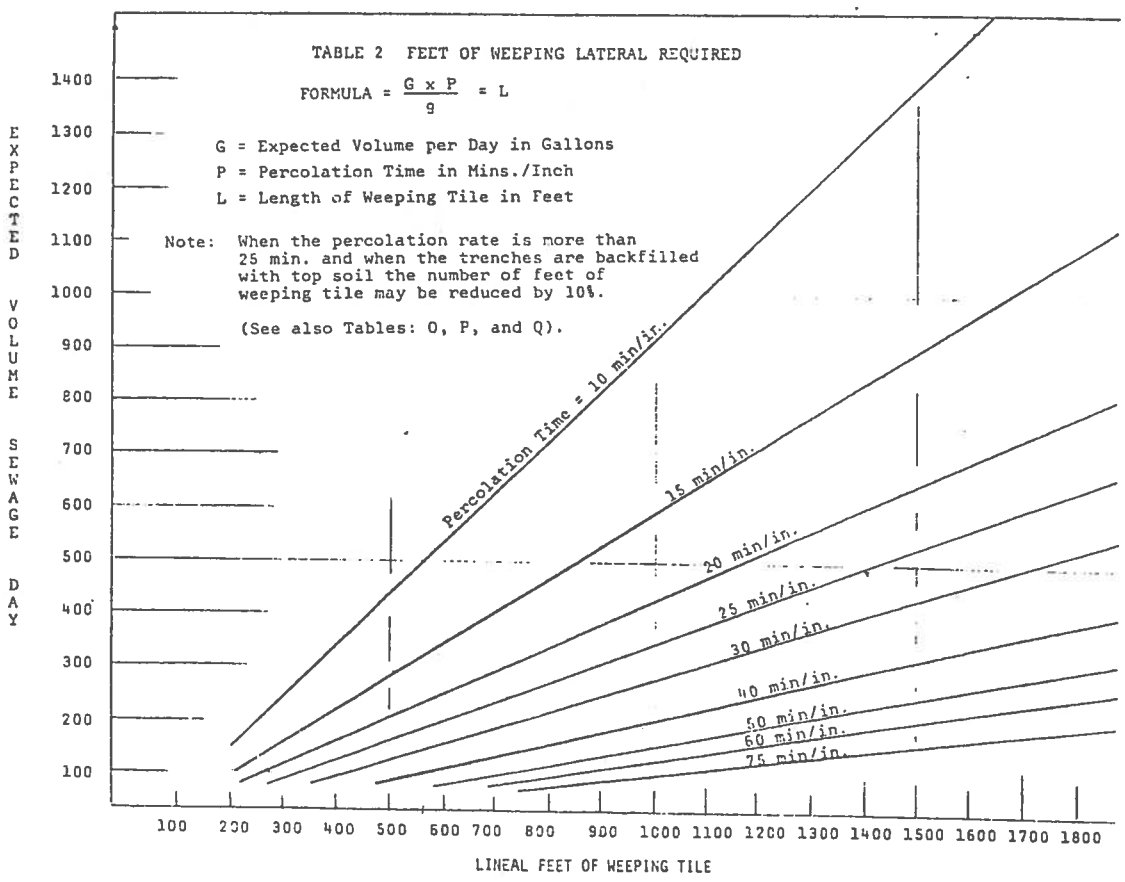
TABLE 2 FEET OF WEEPING LATERAL REQUIRED

FORMULA = $\frac{G \times P}{9} = L$

G = Expected Volume per Day in Gallons
P = Percolation Time in Mins./Inch
L = Length of Weeping Tile in Feet

Note: When the percolation rate is more than 25 min. and when the trenches are backfilled with top soil the number of feet of weeping tile may be reduced by 10%.

(See also Tables: O, P, and Q).



Use the full amount of weeping lateral indicated. An undersized disposal field will soon become overloaded, anaerobic, objectionable, and likely to freeze.

(d) Location of Disposal Field:

See Minimum Distances specified in Regulations.

Avoid hard packed yards, driveways, paths, etc. If the sewer or header must cross under such a bare spot, use a frost box.

The disposal field should be constructed on elevated, well drained ground; in particular, the field must not be constructed in low areas which may be subject to flooding or where the water table is within 7 feet of the surface. Also the drainage of the disposal area should be away from the source of domestic water supply.

A sloping, sheltered, well drained, sunny location where the snow piles deep in winter and the grass is well kept in summer is ideal; e.g. under the lawn. Do not allow rank growth to shade the ground surface. Make sure the septic tank is accessible to a "honey wagon" for annual cleaning.

## DISPOSAL FIELDS ON SLOPING GROUND

Some suggested methods for a sloping ground or side hill installation are shown in figures 8A - 8B - 8C.

An important consideration when installing this type of system is to insure an even distribution of sewage effluent throughout the disposal field area, to prevent ponding and breaking out to the ground surface and to insure that each lateral is at it's proper depth.

The weeping laterals for a side hill installation should follow the contours of the hill or slope on which they are placed; ie: each lateral should be level.

SPLIT FIELD

It is often advantageous to install a "split" field type of system in which the effluent is discharged through a diverter valve to half of the field at a time. The advantages of this type of system are:

(a) It provides an extended rest period for half of the field which is not in use. Thereby allowing the unused portion to dry out and rejuvinate itself.

(b) The siphon or effluent chamber of the septic tank need only be half as large as would be required for a normal field.

DISPOSAL FIELDS FOR STEEPER SIDE HILLS

(FOR SLOPES STEEPER THAN 10°)

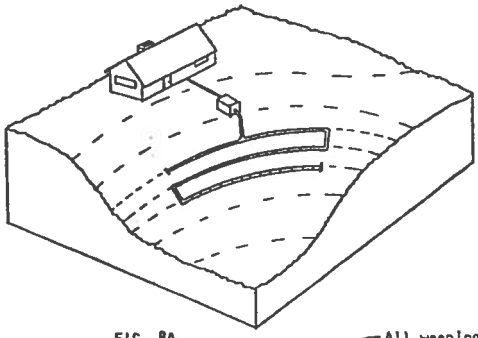
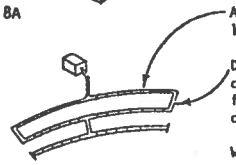


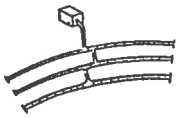
FIG. 8A



All weeping laterals are level.

Drops are solid pipe in a clay pack to prevent water from following outside of drop pipes to a lower level.

When the gravel under a weeping lateral is full of water, that lateral pipe will then drain any surplus through the drop pipe to the next lower weeping lateral. This keeps the lateral pipes empty so they cannot freeze.



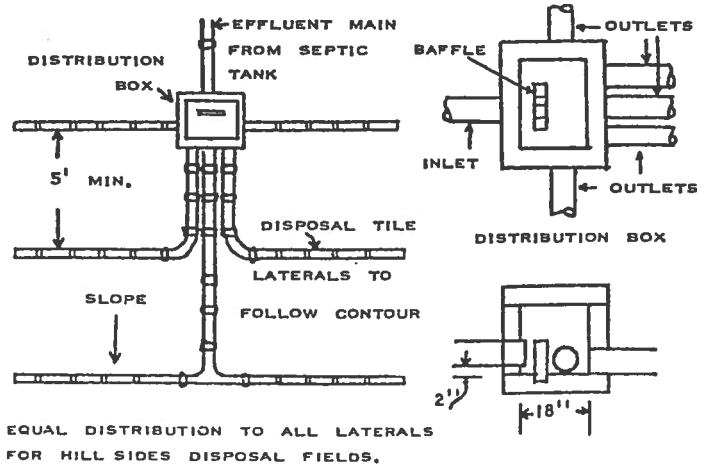

EFFLUENT MAIN
FROM SEPTIC
TANK
DISTRIBUTION
BOX
5' MIN.
DISPOSAL TILE
LATERALS TO
FOLLOW CONTOUR
SLOPE
EQUAL DISTRIBUTION TO ALL LATERALS
FOR HILL SIDES DISPOSAL FIELDS.
OUTLETS
BAFFLE
INLET
OUTLETS
DISTRIBUTION BOX
2"
18"

FIG. 8B

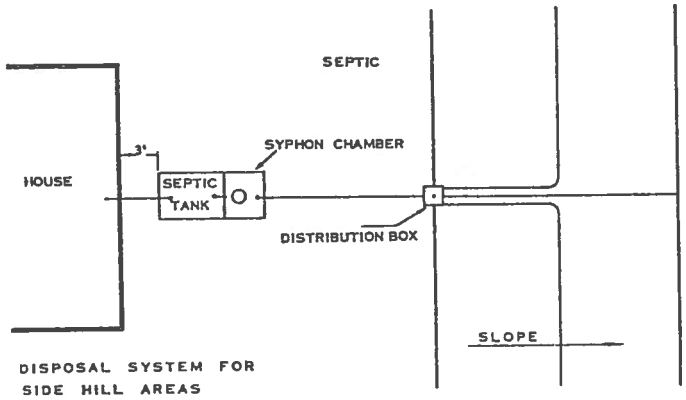

SEPTIC
SYPHON CHAMBER
3'
HOUSE
SEPTIC
TANK
DISTRIBUTION BOX
SLOPE
DISPOSAL SYSTEM FOR
SIDE HILL AREAS

FIG. 8C

(c) Freezing of System:

A properly installed disposal system has an excellent chance of surviving even the most extreme Alberta winters if a few simple precautions are taken.

Disposal systems which do not receive bathroom sewage or hot water are more likely to freeze. Insufficient earth cover on the septic tank may admit air and frost to the contents. The result will be a decrease in bacterial activity and a colder effluent that will freeze in the field.

Siphon or pump chambers assist with the frost problem by saving up the effluent and then flushing it rapidly past cold sections where a trickle would freeze.

Frost boxes should be used to protect any sewer less than 4 ft. deep that is under a road, path, or barnyard. See figure 2.

The liberal use of clean course gravel under weeping laterals allows the effluent to leave the tile quickly and greatly assists in the prevention of frozen fields.

THE EFFLUENT CHAMBER, (SIPHON OR PUMP) - PURPOSE

The effluent chamber, although usually built as an integral part of the septic tank, should be considered as part of the effluent disposal system. It contributes nothing to the treatment of sewage.

By saving up the effluent and discharging it rapidly and intermittently it provides:

(a) even distribution of effluent throughout the field.

(b) the important rest period in the field.

(c) some protection against freezing.

## SIPHONS

There are numerous sizes and materials of automatic siphons marketed today. A good siphon will have a positive flush, with a minimum loss of elevation throughout the whole septic tank.

One feature of the siphon chamber is sometimes a disadvantage. It requires an appreciable total loss of elevation in the system.

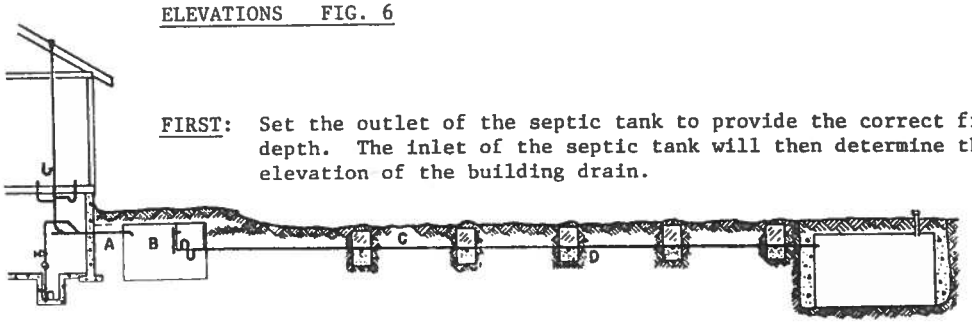
## CAPACITY

The size of the siphon chamber must be in direct proportion to the weeping lateral footage required for the field.

Heavier soil requires a longer rest period between flushes and, of course, more weeping lateral footage; therefore, the capacity of the siphon chamber should be adequate to flush about ½ gallon for each foot of weeping lateral.

When an automatic effluent pump is used instead of a siphon, the volume per flush can be set on the pump controls.

ELEVATIONS FIG. 6




FIRST: Set the outlet of the septic tank to provide the correct field depth. The inlet of the septic tank will then determine the elevation of the building drain.

(A) Locate the septic tank 3' min. from the house.

(A) The building drain (horizontal sewer pipe running from the stack to the septic tank) may be 3" DWV (¼" wall thickness) pipe at a minimum grade of ¼" per foot (2%)

(A) A 4" DWV building drain may have a minimum grade of 1/8" per foot (1%).

(B) Siphon type septic tanks have a loss of elevation between inlet and outlet of about 20" to 36".

Since the field header depth is fixed (C), a septic tank with siphon having a greater loss in elevation between inlet and outlet will require the top of the septic tank and the building drain to be well above ground level.

(C) The field header must be 4" sewer pipe laid as in Fig. 2 at a minimum grade of 1/8" per foot (1%).

(D) All weeping lateral perforated piping and trench bottoms must be exactly level.

(A) Locate the septic tank 1m (3' minimum) from house.

(A) The building drain (horizontal sewer pipe running from the stack to the septic tank) may be 75mm (3 inches) DWV (5mm (¼") wall thickness) pipe at a minimum grade of 5mm per 300mm (¼" per foot) (2%).

(A) A 100mm (4") DWV building drain may have a minimum grade of 2.5mm (1/8") per foot (1%).

(B) When a pump is used, the septic tank can be placed at basement footing level and the building drain can be installed below the basement floor. In this type of installation a man hole extension "F" is required.

(C) The field header must be 100mm (4") sewer pipe laid as in Fig. 2 at a minimum grade of 2.5mm per 300mm (1/8" per foot) (1%).

(D) All weeping lateral perforated piping and trench bottoms must be level.

(E) The pump discharge line may be 1½" or 1¼" plastic pipe.

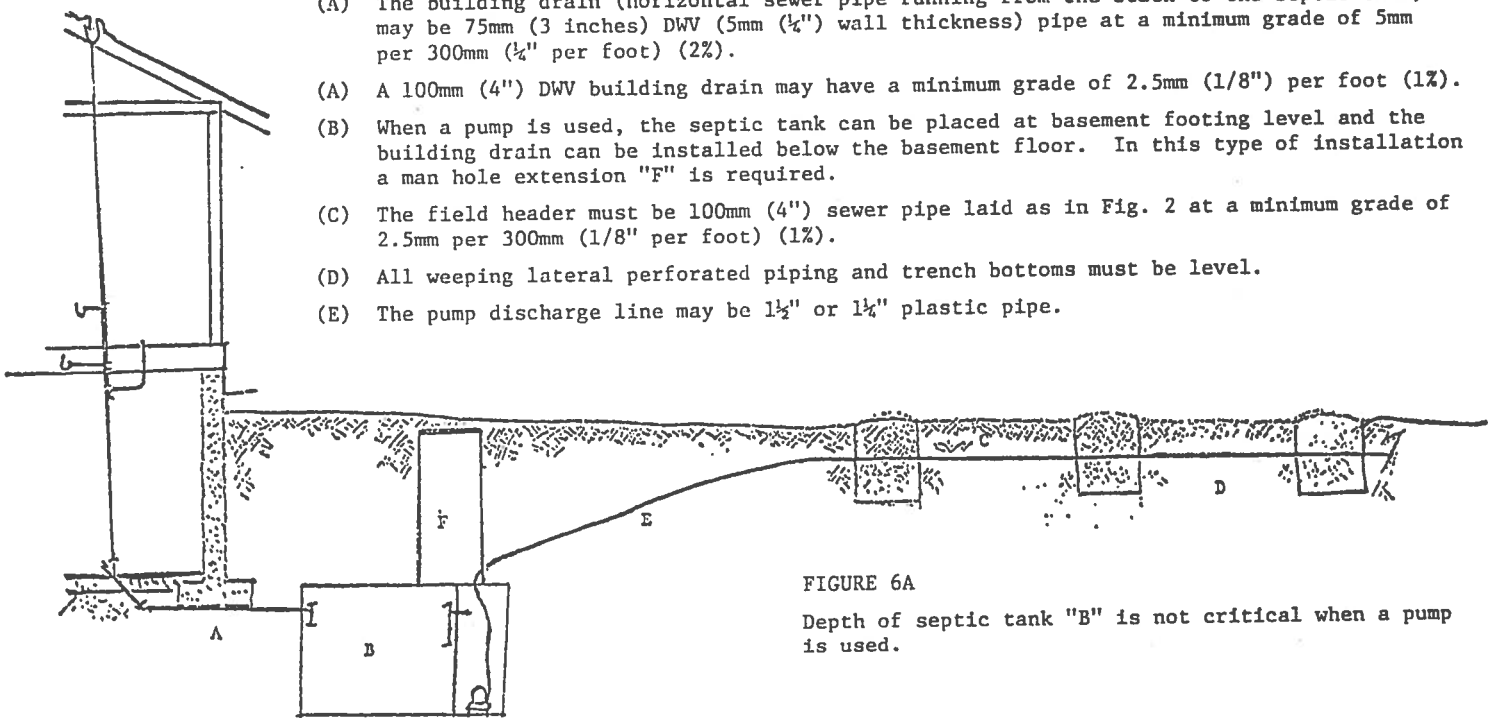



FIGURE 6A

Depth of septic tank "B" is not critical when a pump is used.

## PUMPING OF SEWAGE

(a) Sump Pumps

If the basement plumbing consists of only such fixtures as a floor drain, laundry tubs, or shower, a sump and automatic electric pump may be installed. This will raise the waste water to the level of the building drain and discharge it to the regular private sewage disposal system.

To control stale musty odors it is recommended that after the laundry is completed, the fixtures and sump be flushed through with clear water to which has been added a tablespoon of a household bleach such as Perfex, Javex, etc.

(b) Sewage Lift Pumps (Fig. 14)

Systems can be installed where ALL of the raw sewage is pumped to a higher level to enter a septic tank which has been installed at a normal elevation. This system requireds the purchase of a special pump capable of handling solids.

(c) Effluent Pumps

An alternate method to a sewage lift pump is to install the septic tank deep enough to receive the sewage from the building by gravity, and to raise only the effluent to a suitable disposal level. Pumps may be installed as in Fig. 15A or 15B. The pump should be specified by the maker to be suitable for handling sewage effluent.

The pump is automatically controlled. It is essential that no electric motors, wiring, switches, or working parts of the sewage pumping system be subjected to the highly corrosive and deteriorating effects of the atmospheric conditions which exist in the effluent chamber. (See Electrical Inspector)

The cross sectional area of the effluent chamber and the setting of the controls combine to determine the volume of effluent per flush. This volume/flush should be about ½ gallon/1 foot of weeping lateral.

NOTE: All pumps and controls installed, must be in accordance with all applicable electrical requirements and to the manufacturers specifications.

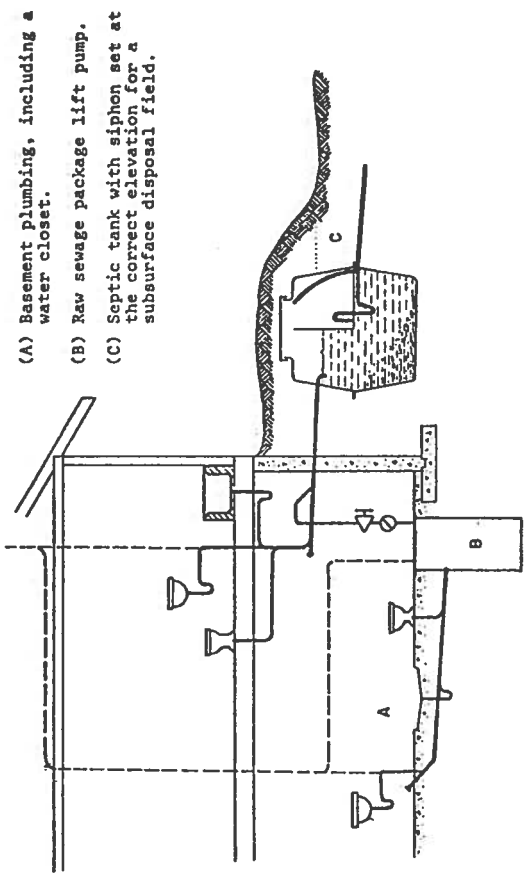

(A) Basement plumbing, including a water closet.
(B) Raw sewage package lift pump.
(C) Septic tank with siphon set at the correct elevation for a subsurface disposal field.
C
A
B

FIG. 14

EFFLUENT PUMPING

A. Building drain for basement plumbing.

B Deep-bury septic tank with effluent chamber and extended manhole.

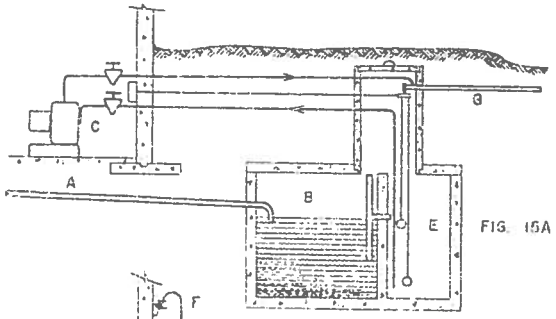



FIG. 15A

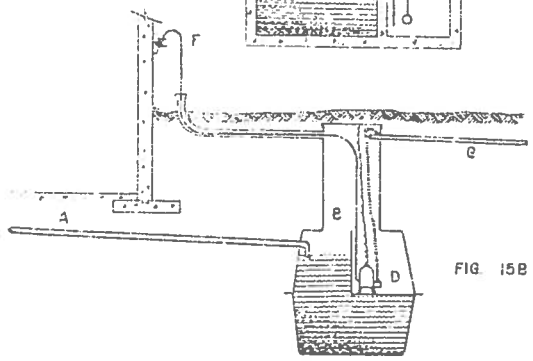



FIG. 15B

C. Effluent pump with liquid level control.

D. Submersible effluent pump with flexible discharge pipe, and plastic rope to remove pump for servicing.

E. Liquid level controls setting determine the volume per flush.

F. Weather-proof electrical plug-in.

G. 4" DWV (¼" wall thickness) water-tight effluent sewer pipe (may change to 4" sewer pipe 1/8" wall thickness 6' from septic tank).

## ABOVE GROUND SEWAGE EFFLUENT EVAPORATION MOUND DISPOSAL FIELD SYSTEM

The above ground filter or evaporation mound may be used where the ground water table is within 5 feet of the surface or where the soil is impervious. The effluent is pumped to the distribution header pipe through plastic delivery pipe.

A 12" layer of fibrous sandy loam should be sandwiched throughout the mound between two layers of gravel. This will assist the capillary action and aid in the even dispersal of the effluent over the whole mound.

The mound size will vary depending on the expected volume of sewage per day. Some mounds are designed to utilize a pressure header and distribution pipes, rather than a 4" header and 4" laterals.

## WATER-TIGHT SEWAGE HOLDING TANKS REQUIRING PUMPING

In congested areas where the minimum distances cannot be provided for other forms of disposal, it may be necessary to install a water-tight sewage holding tank and haul all sewage away for disposal in a suitable location. Such tanks need not be preceded by a septic tank. This may be the only method of disposal for some locations satisfactory to the Plumbing Inspector. The high cost of operation dictates that this method be used only where absolutely necessary. The capacity of the holding tank is dependent on the frequency of pumping required.

## PONDING OR LAGOONING OF SEWAGE ( See Regulations)

The pond system has been used sucessfully in Alberta in rural areas. Generally the pond is made large enough to hold one year's flow of sewage and some care is taken to avoid shallow areas by excavating at the edges where the ground has a natural gentle slope. The pond should be well away from any residence. They are recommended particularly in areas where the heavy clay sub-soil would make the use of a subsurface effluent field unreliable.

The sewage going into the pond may have prior treatment (by septic tank) or may flow directly to the pond with no treatment. Experience has shown that odors are usually not a problem.

Treatment is accomplished through aerobic digestion in contrast to the action of anaerobic bacteria and anaerobic digestion which occurs in the septic tank. The combined action of bacteria and algae accomplish the treatment of sewage in lagoons. The design and location of all lagoons for single family dwellings must be approved by the Plumbing Inspector. Larger lagoons require the prior approval of Alberta Environment.

The design of a sewage lagoon for private sewage disposal is to be such that it has a level bottom and liquid depth of four (4) to six (6) feet with a detention period of one year. Lagoon berms must be constructed of compacted clay with all black dirt stripped and berms properly keyed so that any seepage is eliminated. Berms are to have a 6-foot top width and slopes of three horizontal to one vertical with 18 inches of freeboard. Surface runoff is to be diverted around the lagoon. Fencing of all lagoons, adequate to its location with proper posting is required for safety of people and animals.

The operation of a sewage lagoon requires regular inspection, control of grass and weed growth on the berms. To prevent a lagoon from freezing solid, it is recommended that a small pit be placed in the floor of the lagoon to provide a 2' or 3' depth for the inlet pipe.