# SECTION 3

## 3 SYSTEM COMPONENTS

All components or materials utilized in an on-site sewage disposal system must meet the specifications in this guideline and be approved for use by Nova Scotia Environment. If a product, component or material is not currently listed in this guideline, it must be approved Nova Scotia Environment prior to use.

## 3.1 SEPTIC TANKS, HOLDING TANKS AND PUMP OR SIPHON CHAMBERS

The following requirements apply to any tank that is selected or designed for use as a septic tank, holding tank, pump and/or siphon chambers:

1. The tank must be designed to carry a minimum of 600 mm of earth cover.
2. The top of the tank must be marked to indicate the maximum permissible depth of bury.
3. Septic and holding tanks must conform to Standard CAN/CSA-B66-00 or the latest revision. Metal tanks are not permitted for use as a septic tank, pump or siphon chamber; acceptable materials are reinforced concrete, fibreglass, or polyethylene. Holding tanks, if located above ground, must be non-corrodible. For underground holding tanks, metal is not permitted.
4. Where a tank is installed in an area where high groundwater levels may occur, the manufacturer shall include instructions to prevent flotation of the tank.
5. All tanks must be watertight.
6. Where a riser is required, it shall be
   - watertight
   - firmly attached to the tank with a permanent watertight seal
   - designed to resist frost action.
7. The cover of a tank or a riser shall be
   - watertight
   - secured to prevent unauthorized access and injury.
8. The manufacturer of a prefabricated tank shall provide to the installer instructions for assembly and installation of the tank. The instructions shall have been submitted for review by the Department, to assure that they address the requirements of these Guidelines.
9. A sectional pre-fabricated tank may be assembled on site, provided that the manufacturer's instructions are followed to produce a watertight tank.
10. Where a tank is manufactured from concrete; the bung hole must be permanently closed in a watertight manner.
11. A tank may be constructed on-site if it conforms to applicable requirements of this section and has been designed by a Level 1 Qualified Person
12. ***It is recommended that*** the tank be tested on site after assembly, for water tightness **(see Section 6.4 *for a recommended testing procedure*)**.

### 3.1.1 Septic Tanks

Any septic tank is required to meet the following specifications: **(Figure 3A)**

1. All tanks must conform to the latest edition of Standard CAN/CSA-B66-00 or the latest revision, published by the Canadian Standards Association.
2. It must include a watertight access for purposes of maintenance, inspection, and pump-out.
3. Septic tanks for dwellings must have a total capacity not less than that stated in **Table 3.1.** For larger systems the minimum capacity should be:
   - **For average daily flows up to 9000 l/day:** $V_{tank(1)} = 2Q$
     Where: Q - average daily flow in litres
     $V_{tank}$ - total tank volume in litres
   - **For average daily flows 9000 l/day or more:** $V_{tank(2)} = 9000 + Q$
     Where: Q - average daily flow in litres
     $V_{tank}$ - total tank volume in litres
     $V_{tank}$ may be achieved by one or multiple tanks in series or parallel; design volume represents total minimum capacity.

**The minimum required septic tank capacity is 2800 L. Septic tank sizes larger than the required minimum may reduce problems and extend the life of an on-site system.**

**TABLE 3.1**

**MINIMUM CAPACITY OF SEPTIC TANKS FOR DWELLINGS**

| Number of Bedrooms | Minimum Liquid Capacity (litres) |
|---|---|
| Up to3 | 2800 |
| 4 | 3300 |
| 5 | 4500 |

- ❖ When selecting a tank, the depth of bury must be considered. If it is greater than 600 mm, the tank shall be stamped to indicate that it has been designed to withstand burial to the required depth.

4. These values must be increased by 20 percent where a garbage grinder is used.
5. Access to a tank must be provided by a single opening at the outlet of the tank to provide effluent filter access, but two openings—over the inlet and outlet—are recommended for easier service. The dimension of any opening shall meet CSA requirements.
6. A riser shall be extended to the ground surface and the cover fitted with a suitable locking mechanism. The area around the riser should be graded to divert surface water away from the riser.
7. The top of a septic tank must be at least 150 mm and not more than 1500 mm below finished grade or as specified by the manufacturer's instructions.
8. Where a siphon chamber is included in the system, it may be an integral part of the septic tank, or be a separate structure.

9. The manufacturer's instructions shall describe how inlet and outlet connections to the tank are to be made in a watertight and structurally secure manner.
10. If a sewage lift pump discharges to a septic tank
    - The volume of the septic tank must be at least 4500 L
    - The discharge per cycle from the lift pump must not exceed 115 L
    - The discharge rate from the lift pump must not exceed 45 L/min
    - The discharge line from the lift pump must be fitted with a flow control valve.
    - A two compartment tank is recommended.
    - Two single tanks in series can be used as a substitute for a two compartment tank.
11. Except as indicated in Section 3.1.1 #10 above, two compartment tanks are not currently required, but they are recommended because they reduce solids carry-over to the disposal field.

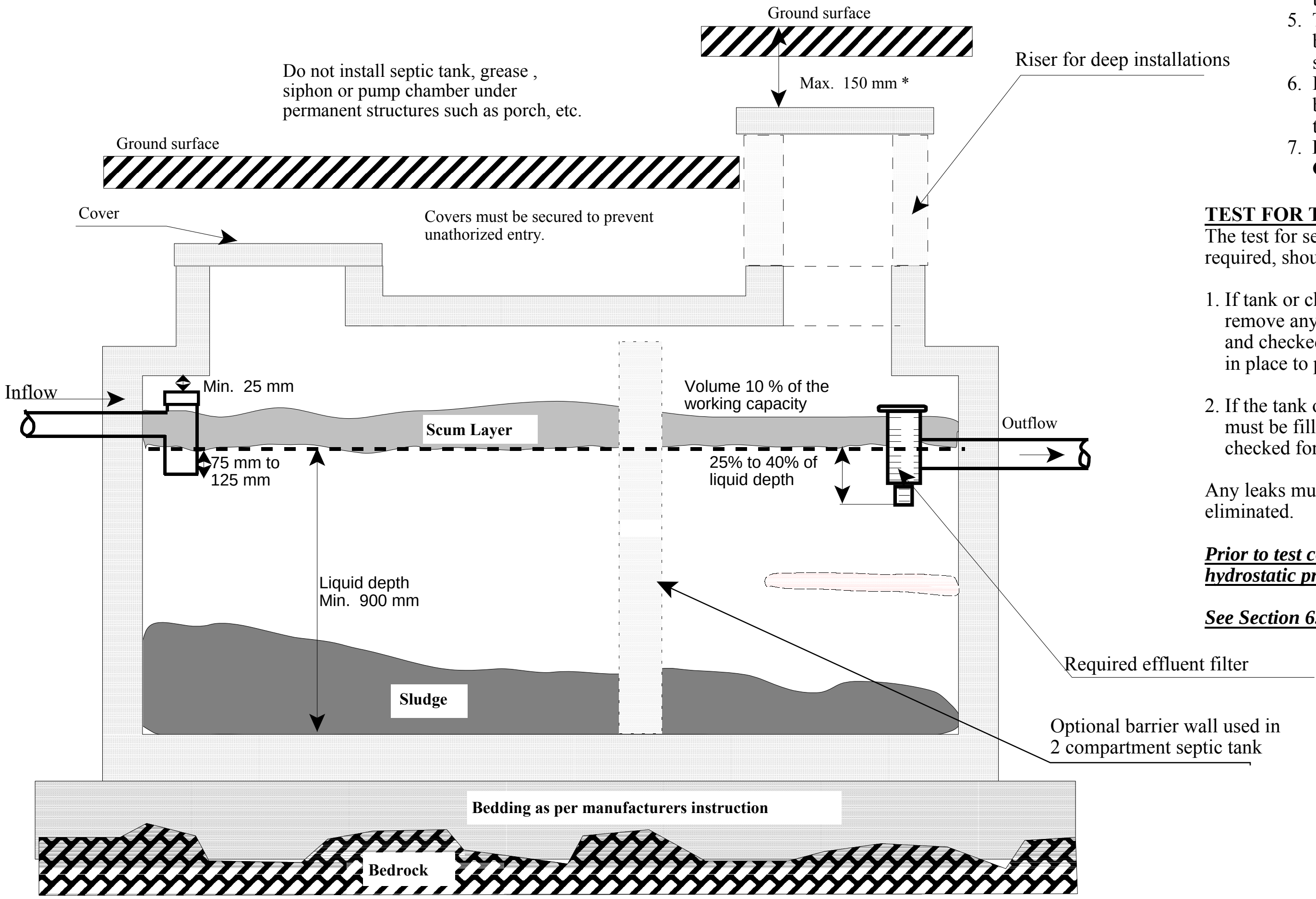
    Where a two compartment tank is used:
    - the final compartment should be approximately one-third of the total volume
    - the interconnecting port should be about 2/3 of the liquid depth from the bottom of the tank.
12. All residential septic tanks are required to have a septic tank effluent filter that meets NSF Standard 46 (components of wastewater treatment systems) and has easy access at finished grade over the outlet of the septic tank for filter maintenance. A properly fitted effluent filter will decrease the risk of solids entering the disposal field and prolong life of the system.

### 3.1.2 Holding Tanks

1. A holding tank must conform to the latest edition of Standard CAN/CSA-B66-00 or the latest revision, published by the Canadian standards Association. **(Figure 3.B)**. Also refer to testing specifications in **Section 6.4**.
2. The capacity of a holding tank for a single unit residential dwelling shall not be less than 4500 L. Refer to **Table 4.13** for selection.
3. A holding tank shall be equipped with an audible and visible high level alarm.
4. A holding tank shall be installed so that its locked riser cover is exposed at or above finished grade, and the area around the cover must be graded to divert surface water.
5. All openings, including the riser, must meet CSA requirements..
6. The installation, operation and maintenance of the holding tank shall be in accordance with minimum standards and policies. Refer to **Subsection 4.10** for further details and selection of holding tank.
7. A **below ground tank** shall be constructed of a non-metallic material.
8. A holding tank may be utilized for **above ground** services provided:
    - the tank is constructed of non-corrodible material
    - secondary containment is supplied (dykes, berms, etc)
    - adequate weatherproofing is provided to prevent freezing in the tank or lines
    - the tank is supplied with adequate hold down and support systems
    - the inlet shall be on the top of the tank and the inlet line shall be self-draining
    - drain valves are locked when not in service or security in the form of a fence is provided the tank vent is equipped with an odor control device or is extended sufficiently above grade to eliminate odors at ground level
    - tank to be installed according to existing Nova Scotia Environment policies, regulations and operational bulletins

**FIGURE 3.A**

# SEPTIC TANK




GENERAL:

1. A septic tank for a single family will generally require pumping every 3 to 5 years, but should be inspected yearly.
2. Septic tank for commercial applications should be inspected every 6 months.
3. Septic tank should be pumped when the sludge accumulates to a level approximately 450 mm below the bottom of the outlet fitting, or if the scum level builds to within 75 mm of the bottom of the baffle or tee outlet.
4. Septic tank must be pumped by a registered septic tank cleaner.
5. Tank, pump/siphon chambers, covers and risers must be sealed completely watertight. Surface drainage should be directed away from the tank or chamber.
6. If the invert of the tank or chamber will be installed below groundwater level it shall be secured in place to prevent flotation
7. **DO NOT ENTER SEPTIC TANK, PUMP CHAMBER OR GREASE TRAP**!

**TEST FOR TANKS AND PUMP/SIPHON CHAMBERS**

The test for septic tank and siphon/pump chamber water tightness, if required, should be conducted after installation and before backfill.

1. If tank or chamber is installed below ground water level, first remove any water from the tank. Tank must be left for 30 minutes and checked for any visible leaks. Prior to test tank must be secured in place to prevent flotation.

2. If the tank or chamber is installed above ground water table, tank must be filled with water to its outlet, left for 30 minutes and checked for any visible leaks

Any leaks must be repaired and test repeated until all leaks are eliminated.

***Prior to test confirm with manufacturer that tank will withstand a hydrostatic pressure.***

***See Section 6.4 of the Guidelines for further information***.

Dimensions shown on this sketch are for illustration only. Design of the tank must follow latest edition of standard CAN/CSA - B66-M00 or latest revision

* Riser may extend to surface provided the cover is fitted with a suitable locking mechanism.

9. ***It is recommended that*** the holding tank be tested on site after assembly, for water tightness **(see Section 6.4 *for a recommended testing procedure*)**.

### 3.1.3 Pump and Siphon Chambers

The pump or siphon chamber discharge capacity must be sized to distribute effluent over the entire disposal field during each dose. This allows utilization of the entire field and minimizes the possibility of breakout of effluent in a localized area. Periodic dosing also allows the infiltrative surface to drain between doses. These cycles of alterative dosing and resting may maintain higher infiltration rates in the clogging mat and thus extend the life of the system.

The normal dosing frequency should be a minimum of two times per day for a system that is selected. More frequent lower volume doses are recommended. The discharge volume must be large enough to flood the entire distribution pipe. Unless the level 1 or 2 qualified person specifically selects the pump to be used, it is the installers responsibility to ensure that the pump has the proper capacity of achieving equal distribution throughout the field.

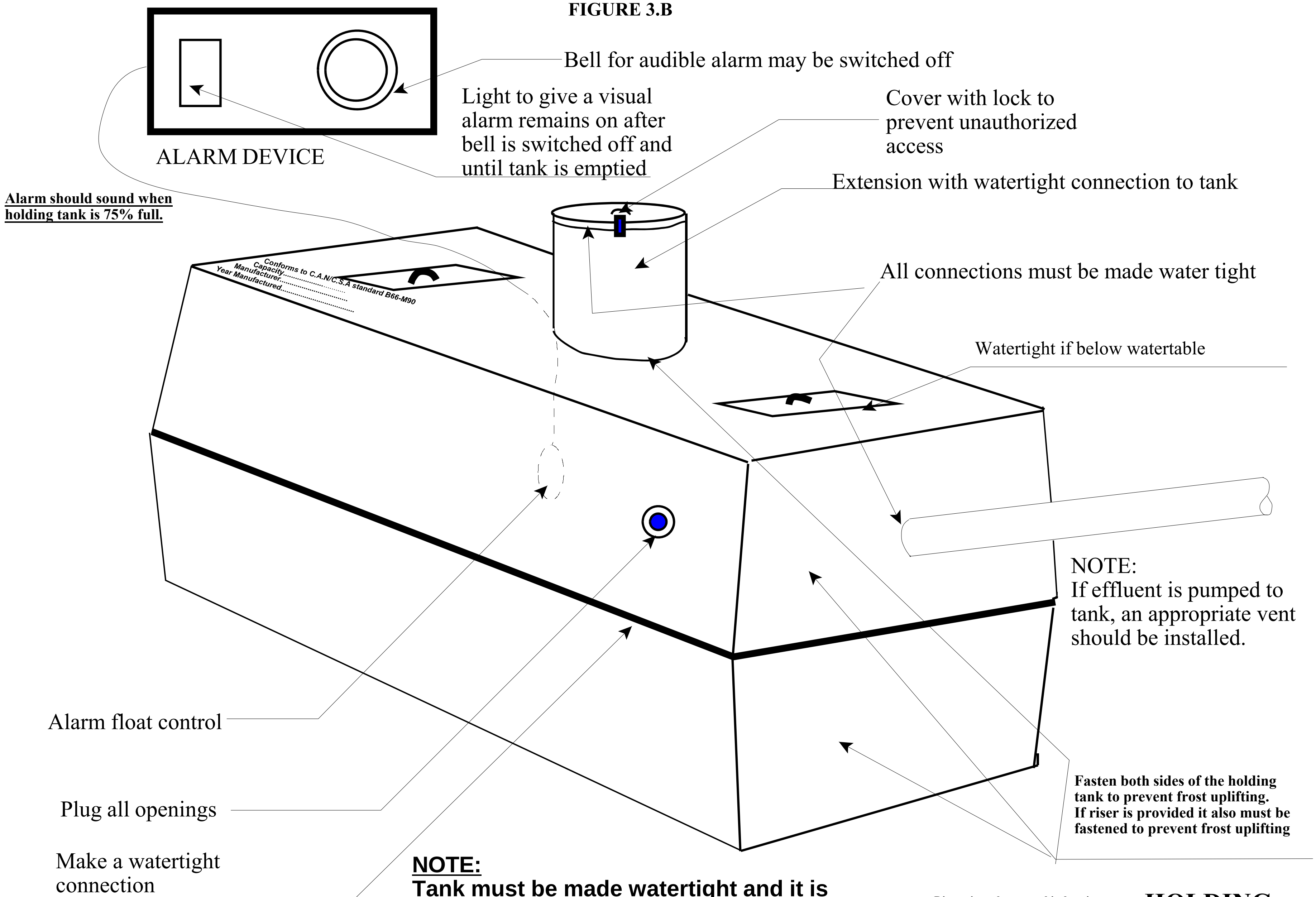
A typical **pump chamber** is shown in **Figure 3.C** and shall conform to Canadian Standards Association specification CAN/CSA-B66-00 or the latest revision.

Requirements for a pump chamber include:
1. The liquid capacity of the chamber shall provide storage equal to one days flow.
2. The chamber shall be equipped with an audible and visible high level alarm, level controls, and other accessories required to assure its effective and reliable operation.
3. If the top of the tank is more than 150 mm below finished grade, a riser must be provided to extend to within 150 mm of finished grade. Extending the riser to ground surface is recommended and must include a cover and locking mechanism.
4. The dimension of any opening shall meet CSA requirements.
5. The elevation of the tank shall be such that any horizontal seam is located above the highest seasonal groundwater table
6. The high water alarm level must be below the level of the horizontal seam.
7. ***It is recommended that*** the pump chamber be tested on site after assembly, for water tightness **(see Section 6.4 *for a recommended testing procedure*)**.

A **siphon chamber** shall conform to Canadian Standards Association specification CAN/CSA-B66-00 or the latest revision. ***A sample of a siphon chamber is detailed in Figure 3.E and 3.F.***

Requirements for a siphon chamber include:
1. If the top of the tank is more than 150 mm below finished grade, a riser must be provided to extend to within 150 mm of finished grade. Extending the riser to ground surface is recommended and must include a cover and locking mechanism.
2. The dimension of any opening shall meet CSA requirements.
3. ***It is recommended that*** the pump chamber be tested on site after assembly, for water tightness **(see Section 6.4 *for a recommended testing procedure*)**

**FIGURE 3.B**




**NOTE:**
**Tank must be made watertight and it is recommended that the tank be tested for leaks before it is placed in operation. See section 6.4 for a recommended testing procedure.**

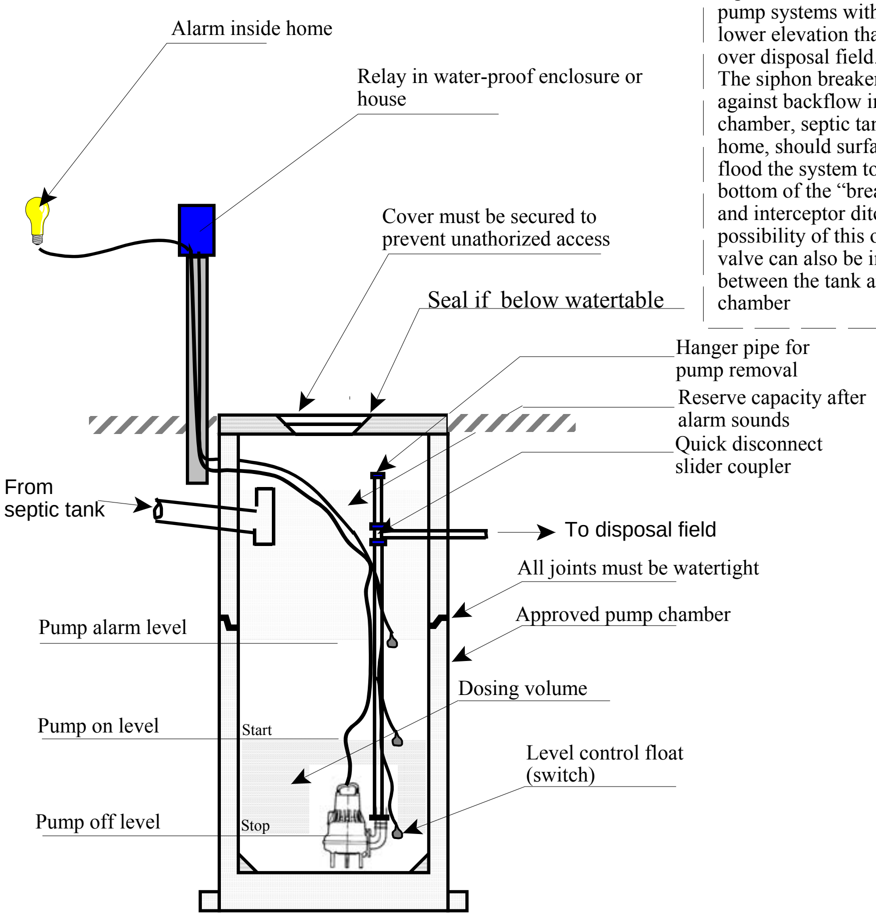
**Dimensions shown on this drawing are for illustration only. Design of the tank must follow latest edition of standard CAN/CSA - B66-00**

**HOLDING TANK**

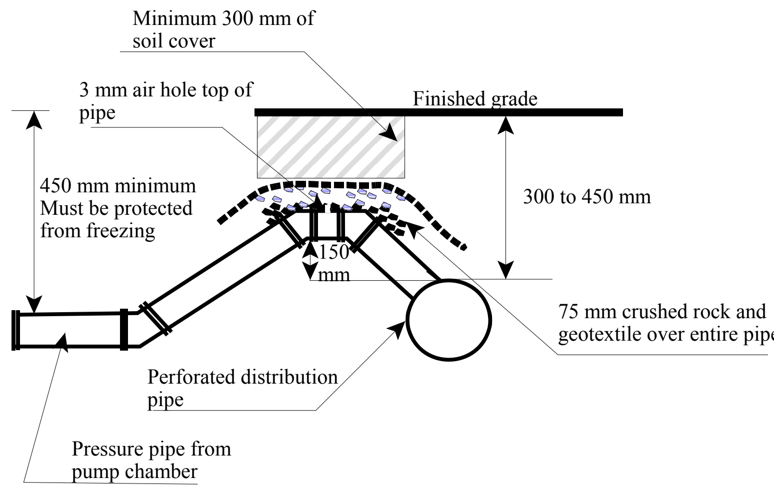
FIGURE 3.C

# Pump installation

Siphon Breaker is required on all pump systems with pump chamber at lower elevation than finished grade over disposal field.
The siphon breaker does not protect against backflow into the pump chamber, septic tank and possibly the home, should surface or ground water flood the system to a level above the bottom of the "breaker". Lot grading and interceptor ditches will reduce the possibility of this occuring. A check valve can also be installed on the line between the tank and the pump chamber




## TYPICAL DETAIL OF FORCEMAIN CONNECTION TO DISPOSAL FIELD "SIPHON BREAKER"




**NOTES:**

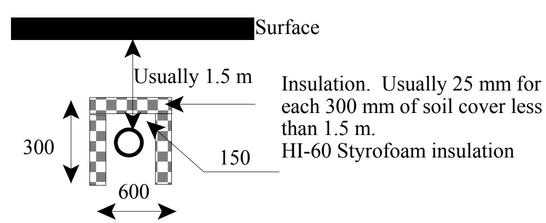
1. The pump chamber must be watertight and surface water must be diverted away from the pump chamber.
2. The pump intake should be kept above the floor at the distance recommended by manufacturer . (Frequently 150 mm or more).
3. The start level control should be set to deliver the required dosage plus an allowance for backflow from the discharge line (if backflow is used for frost protection).
4. The alarm system and the pump must be on separate circuits.
5. All electrical connection are to be made outside the pump chamber and must comply with appropriate electrical code and safety regulations.
6. Pump must be suitable for submerged sewage operation.
7. Level control floats to be non clogging.
8. All pipe joints must be pressure resistant.
9. The pump stop level should be at least 100 mm above the impeller of the pump

**FROST PROTECTION:**
Following may be employed to protect pressure pipe from freezing:

1. Allowing the effluent to drain back through the pump and into the pump chamber by removing the check valve. This can only be done if design of the pump allows it. Check with manufacturer prior to removing check valve.
2. Installation of check valve at the pump with a bleeder hole just ahead of it. This would prevent effluent from flowing back through the pump and still allow the line to drain.
3. Installation of check valve and pipe protection such as:
   a. Sufficient soil cover over the line. (Usually 1.5 m)
   b. Insulation of the line.
   c. The use of heater tape

Pipe must be installed to prevent any sagging.

## PIPE INSULATION




**Volume of 1m pipe section**

| Diameter (mm) | Volume(l/m) |
|---|---|
| 38 | 1.30 |
| 44 | 1.55 |
| 50 | 2.16 |
| 64 | 3.10 |
| 70 | 3.38 |
| 75 | 4.70 |
| 89 | 6.20 |
| 95 | 7.12 |
| 100 | 8.20 |

## 3.2 BUILDING SEWERS AND EFFLUENT LINES

A building sewer for a single unit dwelling, which is defined as the part of the building drainage system carrying sewage that extends from the septic tank or public sewer to a point one metre out from the foundation wall, shall be a 100 mm diameter pipe, conforming to Canadian Standards Association specification CAN/CSA B-182.1. Cleanouts shall be provided at intervals of not more than 30 m, if the length of the building sewer exceeds 60 m.

A building sewer shall be laid at a slope of not less than 2 percent.

An effluent pipe for a single unit dwelling, which is defined in the Regulations as a non-perforated pipe used in a system to transfer effluent from a septic tank, pump or siphon chamber to a disposal field shall be a 75 or 100 mm diameter pipe for gravity flow systems and must conform to Canadian Standards Association specification CAN/CSA B-182.1.

An effluent pipe for a gravity flow system shall be laid at a slope of not less than 1 percent.

## 3.3 DISTRIBUTION SYSTEM

### 3.3.1 Crushed Rock or Gravel

Crushed rock shall be:

- cleaned, washed, and screened,
- free of soft or friable material,
- 98% (by weight) of rock or gravel shall pass a 35 mm screen and
- 98% (by weight) of the rock or gravel shall be retained on a 12 mm screen.

### 3.3.2 Imported Sand Fill

The following requirements apply to:

- the buffer in a distribution system, i.e., C2 and raised C2
- the construction of all above ground systems, i.e., a C3 and a mound

This material shall:

- if it is a naturally occurring or manufactured sand or recycled crushed glass, have a permeability, as placed on site, between 0.00003 and 0.0005 m/sec, as determined by the falling head permeability test **(Appendix B)** and have a maximum particle size corresponding to the appropriate ASTM-33 or CSA A23.1 specification for fine aggregate.
- when designing or selecting a system with a specified fill permeability within the acceptable range of 0.00003 and 0.0005 m/sec; the Qualified Person shall ensure that fill with the specified permeability range required by the selection or design is used in system construction.

### 3.3.3 Filter Sand and Sloping Sand Filter Material

The following requirements apply to:

- The layer of sand (filter sand) installed under the crushed rock in all systems
- The sand used to construct a sloping sand filter

This material shall:

- be a manufactured sand that meets the current ASTM-33 or CSA A23.1 specifications; or
- be a naturally occurring or manufactured sand or recycled crushed glass having a permeability, as placed on site, between 0.0001 and 0.0005 m/second as determined by the falling head permeability test **(Appendix B)** and have a maximum particle size corresponding to the appropriate ASTM-33 or CSA A23.1 specification for fine aggregate.

### 3.3.4 Safety Considerations for use of Recycled Crushed Glass

When using recycled crushed glass as a replacement for imported or filter sand in an on-site sewage disposal system, the QP must ensure its permeability meets the requirements outlined in Sections 3.3.2 & 3.3.3 for its intended use.

Qualified persons and installers intending on using the crushed glass in on-site sewage disposal systems in Nova Scotia shall be knowledgeable of the material safety information provided by the manufacturer.

### 3.3.5 Barrier Material (Geotextile)

Barrier material is required in disposal fields to prevent silt in the covering soil from washing or falling into the crushed rock distribution trench.

The barrier material shall:

- be a non-degradable man-made fibre such as polyester or polypropylene;
- have an opening size less than 700 microns; and
- have a permeability greater than 0.001 m/sec.

This specification will normally be met with a light weight (50 g/sq. m or more) non-woven (i.e. felted, needle punched or heat bonded fibre) fabric or proprietary geotextile. The ability to stretch and deform is perhaps of more importance than tensile strength. It should be noted that typical woven geotextiles of ribboned film have insufficient permeability and porosity for adequate aeration of the disposal field and for upward permeation of effluent in high water table conditions.

## 3.4 EFFLUENT DISTRIBUTION PIPE

### 3.4.1 General

Uniform distribution of septic tank effluent over the entire area of the disposal field is critical for the performance and the long life of the system: uneven distribution can result in progressive clogging of the soil interface, or inadequate treatment in very permeable soils.

Periodic dosing of the effluent, with resting periods between doses, also improves the performance of a system.

Effluent distribution can be accomplished by one of two basic methods:

- a gravity distribution system, in which effluent flows from a septic tank to a disposal field because the water level in the tank is higher than the level of the field, or
- a pressure system, in which a pump or siphon is used to create pressure that will force effluent throughout the distribution system

Pipe and pipe joint fittings used in a disposal system must be selected to provide:

- durability
- resistance to crushing due to surface loading
- resistance to differential settlement of soils and system components.

### 3.4.2 Gravity Distribution Pipes

Gravity pipes in an on-site system shall:

1. be watertight, except for pipes in a disposal field;
2. have an internal diameter not less than 75 mm; and
3. have a slope of 50 to 100 mm / 30 m.

Distribution pipes shall conform with Canadian Standards Association standard CSA B182.1 with a hole spacing as described and shown in diagram 3.D. The pipe shall be of PVC or ABS plastic, unless an alternative material with equal or better properties is approved Nova Scotia Environment.

The pipe shall be perforated with 13 mm holes:

- in the invert, at intervals of 3 to 4 m; and
- at 60 degrees to the invert, at intervals of 1 m or less.

The invert holes are intended to disperse smaller flows; the side holes will disperse larger flows.

### 3.4.3 Pipe Used In a Pressurized System

A pressurized system is more effective than a gravity system as it provides both uniform distribution and periodic dosing of the disposal field. The disadvantage of a pressurized system is the higher capital cost and the extra maintenance requirements associated with the pump or siphon. Pressurizing using a pump or siphon is required:

- where an end fed field is longer than 30 m or a center fed field is longer than 60m;
- where the natural ground slope is not uniform and a gravity system might concentrate effluent at one on more weak spots in the field;
- for all C3 and Mound fields; or
- for any system where the disposal field is at a higher elevation than the septic tank.

Where a pump or siphon is required, the solid pipe from the pump or siphon chamber to the disposal field must have a minimum diameter as specified by the pump or siphon manufacturer but shall not be less than 30 mm. For a pump system this line shall be equivalent to the Canadian Plumbing Code requirements for water pipe (CSA B137 Series) so that it can withstand the pressure exerted by the pump. Lower pressures are generated by a siphon and solid pipe meeting CSA B182.1 with glued joints should be acceptable. All pumped systems should be connected to the disposal field using a "siphon breaker" as shown in **Figure 3.C.**

For any system **selected** to serve a single family home using a Mound or C3 field, solid 75 or 100 mm pipe with holes drilled as outlined in Subsections 4.7.4 and 4.8.4 must be used.

For any other system selected to serve a single family home using a pump or siphon, the perforated pipe in the distribution field can be similar to gravity distribution pipe (Subsection 3.4.2) only all joints must be glued and a 13 mm hole drilled in the top of the pipe 150 mm from the end cap(s). **In addition the distribution piping must be placed such that there is no slope on the piping in the distribution trench.**

For systems serving more than 1500 l/day (designed by a QP1), the pipe diameter, and hole spacing must be calculated, based on the system hydraulics, in an effort to provide uniform distribution throughout the disposal field. In a designed system the minimum acceptable pipe diameter is 35 mm.

Freezing of the pressure line is a potential problem if it does not empty after every discharge and it is not insulated. **Figure 3.C.** lists several steps that can be taken to protect the pressure line from freezing.

## 3.5 PUMPS AND SIPHONS

### 3.5.1 General

A pressure distribution system may be fed by a pump or a siphon. Considerations in selection of these devices include:

- Siphons do not require a power source or involve moving parts
- A siphon will operate more effectively if the available elevation difference between the siphon discharge point and the disposal field distribution pipe is 1 m or more. For a normal siphon installation this is equivalent to 2m in total from the tank outlet to the disposal field.
- Siphons can be selected for distances up to 30 m and no less than 0.5m drop from the discharge to the disposal field unless indicated otherwise in the manufacturer's information; in which case, the syphon shall be installed in accordance with the manufacturer's instruction.
- Siphons can be designed for distances greater than 30 m.

When a pressure distribution system is required, the siphon or pump should be designed to flood the disposal field a minimum of twice per day. More frequent lower volume doses are recommended - ensure the entire pipe is completely filled and under pressure.

Where a siphon is required, the siphon must follow a standard design established, approved or adopted by the Department, or shall be designed by a Level I Qualified Person.

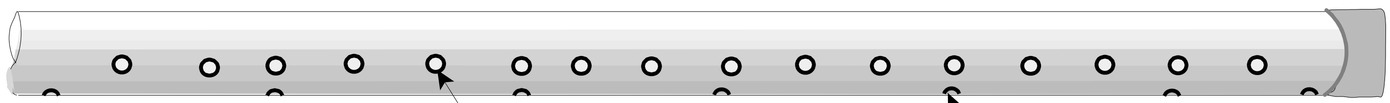
**3.5.1.a Hydraulic Characteristics**

When choosing a pump, consideration should be given to the following:

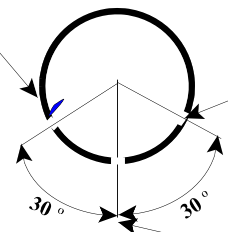
- The difference in elevation between the pump and the distribution pipe.
- The friction loss in the discharge line between the pump and the far end of the distribution pipe.
- A residual head of 600 mm at the end of the distribution pipe.

# FIGURE 3.D

# GRAVITY FED DISTRIBUTION PIPE




## CROSS - SECTION

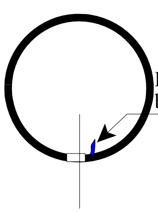



### GRAVITY FED DISTRIBUTION SYSTEM

Pipe diameter 75mm minimum
Maximum length - 60 metres if center fed
Maximum length - 30 metres if end fed
Slope 50  to 100 mm per 30 m (0.16% to 0.32%)
Hole diameter 13 mm
Hole interval at 30 degrees to invert 1 metre or less
Pipe shall conform to CSA B182.1

# PRESSURE FED DISTRIBUTION PIPE


**NOTE: for large systems that are designed hole intervals must be calculated**




### PRESSURE FED DISTRIBUTION SYSTEM

Pipe diameter 38 mm minimum (designed system) ,75 or 100 mm (selected system)
No slope required
Hole diameter 13 mm
Hole interval at invert 1.25 metres or less (selected system)
Pipe shall conform to CSA B182.1 or CSA 137
For larger systems a hydraulic calculations should be used to determine best hole spacing

**See Table 4.9 for hole spacing details**

FIGURE 3.E

# SIPHON

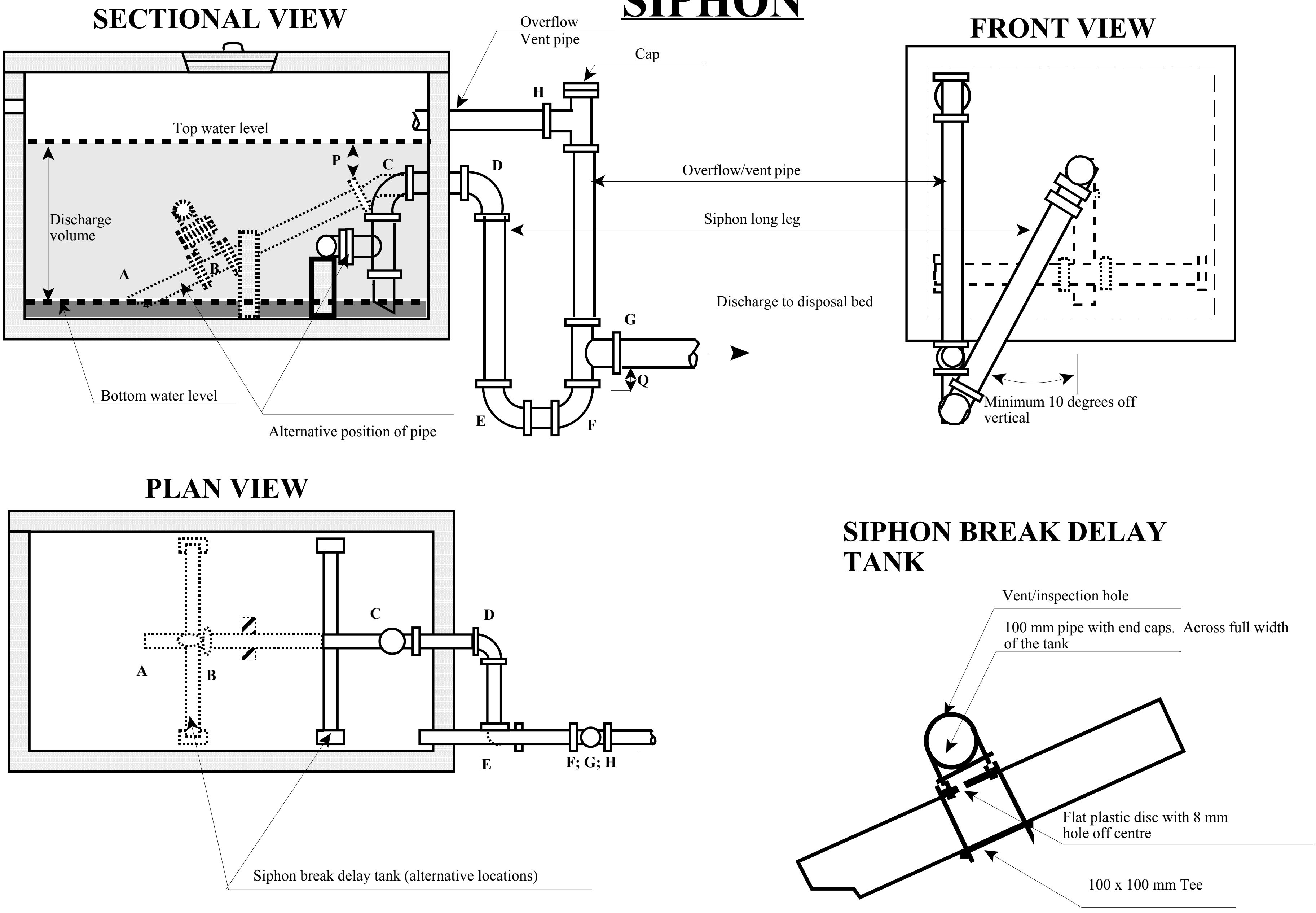
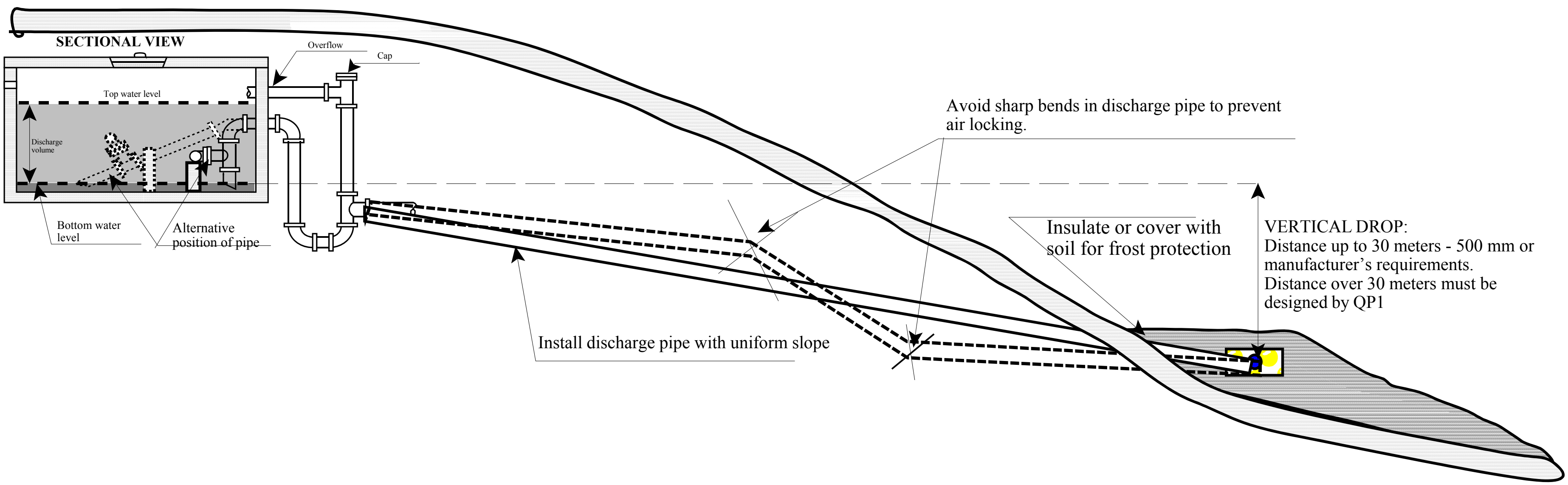


**FIGURE 3.F**

# SIPHON INSTALLATION




SIPHON TESTING:

1. Test for watertightness, if required, as outlined on figure 3A for septic tanks. Siphon chamber should be filled with water to the level just before the discharge level.

2. After completing water tightness test, if required, slowly fill up the chamber to trigger siphon discharge. Repeat this test to see if siphon discharges a second time.

The actual design of a pressure distribution system is based upon hydraulic principles and is beyond the scope of these Guidelines. In an attempt to simplify selection and standardize equipment requirements for single family homes, the required dosing capacity for siphons and pumps is as shown in **Table 3.2**.

**TABLE 3.2**

**MAXIMUM DOSING VOLUMES AND PUMP CHAMBER CAPACITY**

| Flow | MAX Dosing Amount per Discharge Event in Litres* | Minimum Pump Chamber Capacity |
|---|---|---|
| **1000 L** | **500 L** | **1000 L** |
| **1350 L** | **675 L** | **1350 L** |
| **1500 L** | **750 L** | **1500 L** |

* **More frequent, lower volume doses are recommended**

When pumping a considerable distance, the dosing amount may have to be increased to compensate for effluent in the pump line returning to the pump chamber after the pump shuts off.

### 3.5.2 Pumps and Controls

This section specifically addresses pressurized systems for delivery of septic tank effluent to a distribution system in a disposal field. However, the component specifications in this section, and the design principals, apply also to pump systems that may be used to transfer sewage from a dwelling to a septic tank, with some differences. Specifications for pumps and piping that handle raw sewage can differ, and pumping into a septic tank introduces concerns that are discussed in Section 3.1. When pumping downslope, the connection is to be made directly into the distribution pipe. If pumping upslope, a siphon breaker is required. The siphon breaker should be located where the pipe from the tank enters the distribution pipe. As well, one 13 mm hole should be placed 150 mm in from each end of the distribution pipe **(Figure 3.D)**.

### 3.5.3 Mechanical-Electrical System

The complete electrical and mechanical system—including pumps, controls, and switches—must be capable of functioning effectively, reliably, and for many years, in a corrosive environment. These systems should be installed according to the Canadian Plumbing and Electrical Code Requirements.

### 3.5.4 Siphon Operations

#### 3.5.4.a Standard Siphon Operation

As sewage enters a siphon chamber and the liquid level rises, air within the siphon discharge piping is slowly forced out. When enough air has been forced out, the decrease in pressure is such that the siphon primes and liquid is drawn out of the tank in one event. Siphons should be designed to deliver the same volume per discharge event as a pump designed for the same disposal field.

The siphon shown in **Figure 3.E** was developed as an alternative to commercial siphons for use in septic tank disposal fields. The siphon is constructed of standard plastic (PVC or ABS) pipe and fittings with solvent welded joints and is suitable for use in a standard pre-cast concrete septic tank as a siphon chamber. The deep draught (the design has been tested at approximately 1.5 m draught) permits the use of a more economical configuration of tank for a given discharge volume.

The two unusual aspects of the design are important. The siphon break delay tank shown at B on the sectional elevation ensures that the upper limbs of the siphon are completely vented when the siphon breaks. Without the tank and orifice disc, the siphon will break by formation of a vortex at A. On cessation of flow the vortex disappears and the low water level settles above the inlet to the siphon leaving a partial vacuum in the upper siphon at CD. On refilling the chamber the partial vacuum lifts the water over the top bend when the general water level is still below CD and the height of water in leg DE is too high for any bubbles of air to be carried to the discharge. Hence, except at very high flows, the siphon passes the inflow to the discharge without priming and the tank does not empty.

With the delay tank and orifice, as the siphon discharges, some water is retained in the horizontal pipe and the orifice does not clear until the general water level is below B, thus ensuring that air can bubble in until the whole of the upper legs are drained down to the general level.

The second feature is the sloping leg DE which assists in priming the siphon at top water level. Water will begin to flow over the top bend D of the siphon when the head P in the tank is approximately equal to the head in leg FG (Q). Streaming down the low side of the pipe, the flow causes rotary motion in the leg EF, creating a form of horizontal vortex, enabling air from leg DE to the held in suspension and vented to the overflow pipe GH. At the same time the weight of water in leg FG becomes less, because of the entrained air, lowering the pressure at E, which enables a greater flow to pass under head P and the siphon quickly primes.

A prototype siphon of 100 mm diameter pipe primed at a flow of 9 litres per minute. The siphon performs equally well with leg ABC vertical or sloping, as tests showed that the volume of trapped air is not critical. The sloping version should be used in circular tanks but does require to be anchored down to prevent flotation. The siphon has been constructed in pipe sizes from 30 mm to 100 mm diameter.

The design may be adapted to almost any shape and configuration of siphon chamber but certain dimensions are critical. The inlet and overflow may be at the same level but must be at least three inches above the selected top water level. The bottom water level will be from three to five inches above the floor of the chamber. The discharge pipe invert should be at least six inches below the floor level of the chamber. The invert of the top bend of the siphon (marked “CD” on the sectional elevation), which passes through the wall of the chamber, should be set at least six inches below the top water level but may be set lower. The bottom bend (marked “EF”) should be set with its invert exactly the same distance below the invert of the discharge (G) pipe as the invert of the upper bend is below the top water level.

The diameter of the pipework does not appear to be critical but it is suggested that 100 mm diameter would be appropriate for chambers larger than 4500 litre discharge, 75 mm for 900 litres or more and 50 to 65 mm diameter for less than 900 litres. The siphon break delay tank or cross pipe should be of the same diameter as the main pipework, but the length has not been found to be critical. From 0.5 to 1.0 m has been found satisfactory. The orifice diaphragm placed between the crossed tee's should be securely cemented or sealed in place. It may be cut from flat plastic sheet approximately 46 mm thick and drilled with a 8 mm diameter hole off centre.

Before putting the siphon chamber in service the bottom bend ("EF") should be filled with water via the vertical inspection pipe, otherwise the siphon will trickle continuously without priming. The siphon may then be tested by filling the chamber, reducing the rate of inflow to perhaps two gallons per minute as the water level rises to the expected discharge height. The test should be run at least twice to prove satisfactory operation.

Maintenance requirements are simple. The chamber should be pumped to remove accumulated sediment whenever the septic tank is cleaned. At the same time the delay tank or cross pipe should be flushed out with a garden hose through the vent hole. Should it become evident that the chamber is trickling continuously at a high water level, it is probably that the delay tank orifice has become blocked. To lower the water level for clearing this, force the siphon to prime by either increasing the inflow to a high rate or temporarily raise the level by blocking the outflow through the vertical access pipe, and then release it.

Prior to putting the siphon chamber in service, it should be tested at least twice to prove satisfactory operation.

### 3.5.4.b Other Adopted Siphon Operation

A siphon system other than what has been described in these guidelines may be approved for use by the Department or the siphon may be designed by a Level 1 Qualified Person.

In the case of a siphon which has been adopted by the Department, the use of such a siphon system must be in accordance with any approval or authorization issued by the Department recognizing it as an adopted siphon under the regulations. In the event that the authorization and/or manufacturers information does not contain information related to the minimum vertical drop requirements for operation, the vertical drop indicated on Figure 3.F shall govern.

In the case of a siphon which has been designed by a Level 1 Qualified Person; the minimum vertical drop requirements for operation shall be specified by the Level 1 Qualified Person. In the event that a minimum vertical drop is not specified by the Level 1 Qualified Person, the vertical drop indicated on Figure 3.F shall govern.

## 3.6 INTERCEPTORS

Interceptors are installed to intercept and divert surface water and groundwater upslope of a disposal field. An interceptor may be a trench filled with crushed rock, and containing a perforated pipe, or a swale (shallow trench) at the ground surface **(Figure 1.B)**.

Situations in which interceptors are required, and their locations relative to the ground surface, are defined in this Section. Construction of interceptors is described in Subsection 6.12.

### 3.6.1 Interceptor Trench

An interceptor trench may be required or considered in order to address the following situations:

(1) intercept and divert perched groundwater over a layer of impermeable soil
(2) lower a seasonally high groundwater table upslope of a system that is located at lower end of a long slope
(3) intercept and divert surface water.

In situation (1) the base of the trench must be set at least 150 mm into any impermeable layer.

In situation (2) the depth of the trench must be a minimum of 150 mm below the bottom of the distribution field. In some cases this could result in an interceptor depth of up to 2 meters or more.

In situation (3) a trench intended to intercept groundwater may also intercept surface water, or a trench (french drain) may be intended specifically to intercept and divert surface water. In the latter case the trench should be at least 300 mm deep.

The interceptor trench should be 300 to 600 mm in width and be filled with crushed rock that:

- conforms to Section 3.3.1; or
- is clean, washed and screened, is free of soft or friable material and for which 98% (by weight) of the rock or gravel passes a 75 mm screen and 98% (by weight) is retained on a 12 mm screen. When utilizing this material in the interceptor; the interceptor walls must be lined with a geotextile that meets the specifications of section 3.3.4 of these guidelines.

The interceptor may contain a perforated pipe with a slope. The trench must be sloped and sodded where it is practical.

Any interceptor trench must be long enough to divert the intercepted water to a point where it will not enter the disposal system and to where it will freely discharge to the surface, well downslope of the disposal field. It is recommended that the discharge point for the interceptor extend a minimum of 6 metres downslope of the disposal field or buffer. It is recommended that interceptors be located 5 to 10 metres upslope of the distribution field and that they pass no closer than within 5 metres of the end of the disposal field. If these separation distances cannot be achieved, it may be necessary to use impervious fill, such as compacted clay or bentonite, to ensure that surface/ground water does not enter the disposal field nor sewage enter the interceptor.

If the trench is to intercept surface water either the crushed rock should be carried to within 50 mm of the surface--with no final cover material or sod—to allow surface water to enter the trench, or a swale should be included at the surface. The without final cover material option may not be practical if there is a danger that sediment from upslope sources may clog the surface of the crushed rock.

Normally, the interceptor will drain past either or both ends of the disposal pipe, but for very long contour systems, an interceptor trench may be required to cross the disposal system at intervals. Where this crossing occurs the trench shall be constructed of solid pipe and should be laid a minimum of 500 mm below the bottom of the distribution trench (**Figure 1B).** This drain line must be sealed with impermeable fill such as compacted clay or bentonite, for a minimum of 3 metres upslope and 5 metres downslope of the distribution field. Roof water must not be connected to the perforated pipe in an interceptor trench, but may be carried in a solid pipe in the same trench.

In some cases such as highly permeable soils or high surface water flow, it may be advisable to place an optional liner on the downslope and bottom of the interceptor trench. If a liner is utilized, it must be placed along the bottom of the interceptor trench and up the vertical face of the downslope side of the trench; it **must not** to be placed on the upslope side of the trench (**Figure 1B**). The liner shall be a 20 mil HDPE geomembrane with all seams over lapped a minimum of 0.5 meters with an appropriate sealant between the overlap.

### 3.6.2 Interceptor Swale

A swale is intended to intercept surface water. It may be constructed alone, or at the surface of an interceptor trench.

A swale should be at least 0.3 m deep and 0.6 m wide, and sodded with sloping sides to permit mowing.

The length of any swale must be enough to divert the intercepted water to a point where it will not enter the disposal system and sloped down and beyond the system.

## 3.7 GREASE CHAMBERS

Grease chambers are not normally necessary on kitchen waste lines from residential development. However, in some commercial/institutional applications such as restaurants, school cafeterias and kitchens at summer camps, grease chambers are required. For the purpose of these Guidelines, a grease chamber is a chamber where grease floats to the surface while the cleaner water underneath is discharged to the septic disposal system. If this grease is not removed prior to the septic tank, large quantities may accumulate in and block the building sewer or the effluent line to the disposal field or the disposal field itself.

The small grease traps found on some commercial/institutional kitchen drains are not considered adequate to protect the disposal system. The liquid volume of the grease chamber must be large enough to permit the water to cool allowing the grease to separate and raise the top of the tank.

The volume of a grease chamber can be calculated from the following equation:

For Restaurants:

$$V_{grease} = D * (HR/2) * GL * ST * LF$$

Where: D - number of seats in dining area
HR - number of hours open per day
GL - gallons of wastewater per meal (2 or more)
ST - storage capacity (normally 2)
LF - loading factor depending on restaurant location:

- 1.25 - central locations
- 1.0 - recreation areas
- 0.5 to 0.8 - other locations

For Cafeterias or Institutional kitchens:

$$V_{grease} = M * GL * ST * LF$$

Where: M - total number of meals served per day
GL - gallons of wastewater per meal (2 or more)
ST - storage capacity (normally 2)
LF - loading factor:

- 1.0 - with dishwasher
- 0.5 - without dishwasher

For all but large establishments, a converted 2700 litre septic tank would have adequate capacity to serve as a grease chamber and may be the most economical solution even if it has more than the minimum required capacity. To convert a septic tank to a grease chamber, an elbow can be installed on the outlet and extended to be 150 mm above the tank bottom **(Figure 3.G)**.

To allow for proper maintenance, clean out manholes must be extended to finished grade. The cover must be watertight and secured to prevent unauthorized entry. To minimize problems with grease solidifying in the sewer line the chamber should be located close to the building and no more than 10 m from the fixture being served.

### 3.8 FINAL COVER MATERIAL

The complete on-site sewage disposal system must be covered with a layer of soils that will promote the growth of vegetation over the system.

The material used to cover on-site sewage disposal systems is referred to as final cover material and will consist of: "Imported, manufactured or site prepared material consisting of friable sandy silt or silty sand with a 4 to 25 % organic matter content. The material must be free of debris, vegetation, and roots, with no stones greater than 25 mm in size. The material must be capable of supporting grass or similar vegetation."

If the material to be used is in question by the inspector or the qualified person it will be tested by an approved laboratory to verify that it meets the above definition.

## 3.9 APPROVED PRODUCTS

Products for use in on-site sewage disposal must be approved by Nova Scotia Environment, and system installations shall meet the requirements outlined in Section 3.10. Manufacturers or suppliers who wish to market their product in NS are asked to submit a product summary and manual to the On-site Services Program Coordinator. The On-site Coordinator will confirm the product meets requirements and classify the product before adding the product to the list of approved products.

The use of products/materials other than what has been described in these guidelines may be considered provided they meet specifications established or adopted by Nova Scotia Environment. In these cases, the use of such a product must be in accordance with the specifications established or adopted by Nova Scotia Environment in the approval recognizing it as a product for use in on-site sewage disposal system under the regulations. A listing of the current approved products is included in Appendix L.

## 3.10 ALTERNATIVE/INNOVATIVE ON-SITE SEWAGE TREATMENT TECHNOLOGIES

On-site sewage system installations including an alternative wastewater treatment technology must satisfy all of the following requirements to be marketed in Nova Scotia:

- A proven on-site wastewater treatment technology that has undergone third party testing and is recognized by at least one of the following certifications:
    - BNQ Standard **NQ 3680-910** *Stand-alone Wastewater Treatment Systems CLASS* II Secondary treatment minimum requirement.
    - NSF 40 Residential Wastewater Treatment System Class I
    - Alternatively, third party testing may be completed in province (e.g. NS On-site Wastewater Research Centre, Truro, NS) for a minimum of 12 consecutive months. The manufacturer or supplier is responsible for the cost of testing and shall submit a report to Nova Scotia Environment summarizing treatment performance. Treated effluent must meet or exceed the BNQ and NSF effluent quality requirements.
- Flow equalization is provided either as part of the treatment unit or incorporated into the system design to ensure peak and intermittent flows do not disrupt treatment performance.
- Application for on-site approval must be submitted by a Professional Engineer licensed to work in Nova Scotia.
- System must be installed by an installer certified by the Province of Nova Scotia.
- Complies with the *Nova Scotia On-site Sewage Disposal System Regulations*.
- Meets Nova Scotia Environment's *On-Site Sewage Disposal Systems: Technical Guidelines*.

- Manufacturer or supplier provides the department and on-site industry with a design and installation manual that includes operation and maintenance instructions. Manual must contain sufficient information for the installer to construct the system properly and according to the manufacturer's specifications.

- Active systems (treatment units including any mechanical (moving) components: e.g. pumps, aeration) must include an Operation and Maintenance (O&M) contract between the homeowner and a designated professional to ensure proper function for the life of the system. The designated professional must be trained and deemed qualified by the product manufacturer or supplier and have an understanding of on-site sewage treatment. **It is the responsibility of the homeowner and the manufacturer/supplier to maintain the O&M contract after the system has been constructed.**

- No point surface discharge of treated effluent will be permitted; treated effluent must be discharged subsurface and the dispersal bed area (infiltration area) design based on the requirements outlined in the manufacturer's engineering/design manual or as described in **Table 3.3**. *Surface discharge may be considered when replacing a malfunction only if the proposed lot cannot accommodate subsurface disposal and only upon approval by NSE.*

- **NOTE Table 3.3 Max Vertical Hydraulic Loading of Treated Sewage Effluent** is for dispersal bed area design of **vertical flow** systems only.

  - Dispersal bed area design shall be based on the lowest permeable soil and have a minimum of 600 mm of permeable soil. Imported sand fill may be used to achieve the 600 mm of permeable soil and/or improve infiltration in low permeable soils.

- **Lateral flow contour type system area** must be designed based on soil permeability and Darcy's law, as described in Chapter 5.

- Unless designed for disinfection quality effluent (*E. coli* = 0 CFU/100mL), dispersal beds receiving treated effluent from an alternative/innovative technology as described in this section, must maintain vertical and horizontal regulatory separation distances (Table 2.5A).

**Table 3.3**

**Maximum Vertical Hydraulic Loading of Treated Sewage Effluent**

| **Soil Type** | **Permeability range**<br>m/s x$10^{-6}$ | **Treated Effluent[1]**<br>**MAC[2] 30 mg/L TSS & BOD5**<br>L/d/$m^2$ |
|---|---|---|
| Medium to coarse sand | 80 – 500 | 45 |
| Fine sandy gravel | 20 – 80 | 45 |
| Silty Sand | 8 – 20 | 22 |
| Sandy Silt | 3 – 8 | 15 |
| Clayey Silt | 0.8 – 3 | 11 |
| Silty Clay | 0.2 - 0.8 | 8 |
| Clay<br>*if deemed permeable | < 0.8 | 8 |

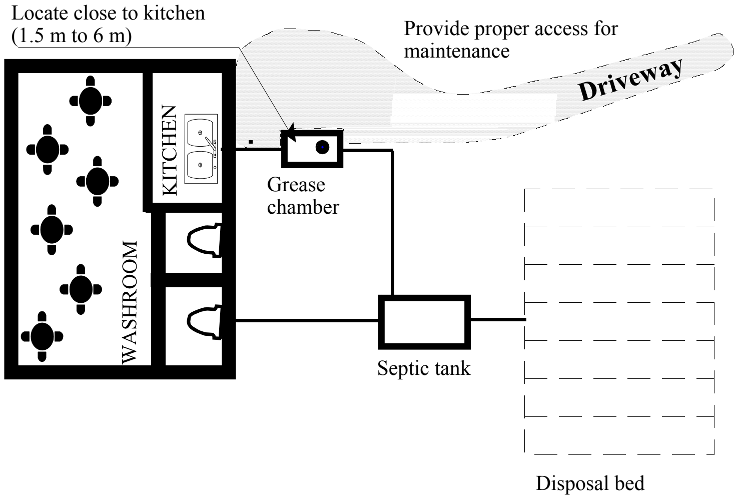
[1]NSF 40 Residential Wastewater Treatment System Class I or BNQ Standard **NQ 3680-910** *Stand-alone Wastewater Treatment Systems* Class II (minimum) Certification

[2]Effluent must be treated to meet the following Maximum Acceptable Concentrations (MAC); TSS: $BOD_5$ (MAC) = 30:30 (mg/L)

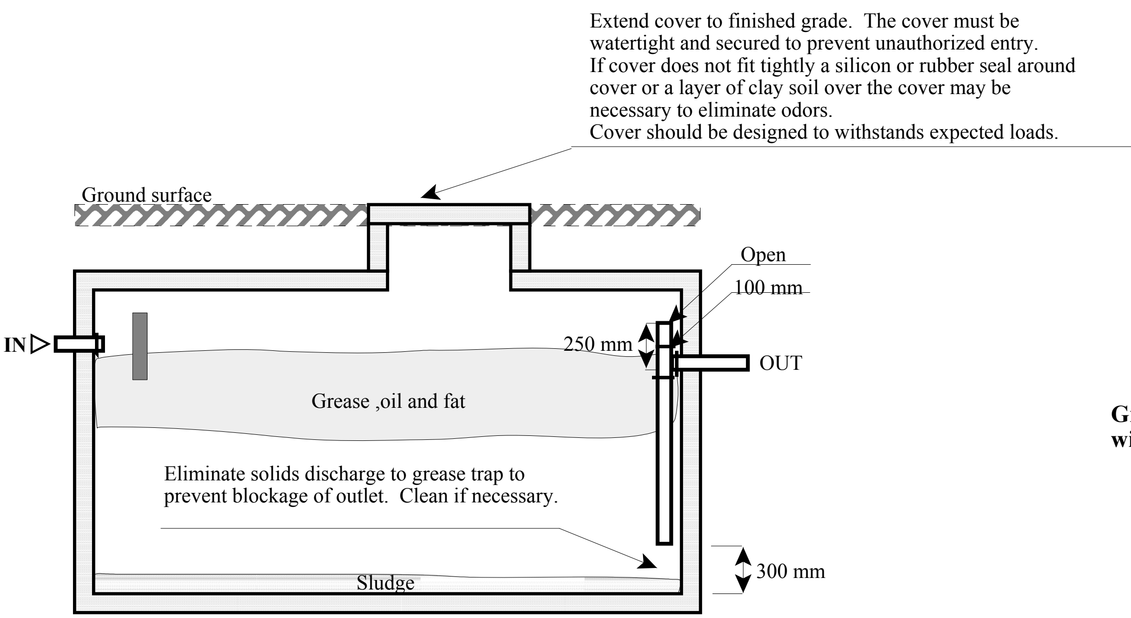
**FIGURE 3.G**

# GREASE CHAMBER

## LOCATION




## CROSS SECTION




GENERAL:

1. Grease chamber are used to remove excessive amounts of grease, oils and fats from wastewater.
2. They are required in some commercial/institutional applications such as restaurants, school cafeterias, and other commercial kitchens or other applications where large amounts of grease may be released.
3. If grease is not removed it can clog sewer lines, inlet and outlet structures in septic tank or distribution pipe in disposal bed.
4. Pump out should occur when 50% of tank capacity has been used. Pump out frequencies may be greater than for septic tank depending on chamber capacity and loading.
5. Excessive use of detergents may emulsifiy some of the trapped grease allowing it to escape chamber.

GREASE CHAMBER LOCATION AND CONNECTION:

1. Grease chamber should be located as close as possible to the kitchen (1.5 m separation from building is required)
2. Only kitchen sink(s) and dishwasher(s) should be connected to grease trap.
3. Grease chamber should be located ahead of septic tank.
4. Waste water from garbage grinders should not be discharged to grease chamber as the high solids loading can upset grease chamber performance and greatly increase the need for frequent pump-out.

**Grease from the chamber must be disposed of in accordance with provincial guidelines**.

**Minimum capacity 2700 l**