Protect Your Lake

Protect Your Investment

Introduction

Greater Sudbury is the "City of Lakes" and many people living on waterfront properties are dedicated to protecting the water quality around their homes. Recently, several lakes in the Sudbury area have developed blue/green algae blooms affecting drinking water and closing beaches.

Some of the causes of algae blooms are faulty septic systems, storm water run-off and increased levels of phosphorus and nitrogen.

There are other factors to consider with waterfront properties.

Many of the area cottages and camps are still owned by one of the original family members or one of their descendants. Because most of these "older family cottages" were intended for seasonal use and not designed for shower and laundry facilities, the existing septic/greywater handling systems on the properties may be outdated and ineffective. Due to increasing demand for premium waterfront properties, many of these properties are being put up for sale and property owners may not be aware of the obstacles in trying to liquidate these assets when an approved septic/greywater treatment system is not in place.

The purpose of this booklet is to provide property owners with information on waste water management.

Protect Your Asset - Plan a "Head"

There are several ways to maximize your property value and improve salability while protecting a pristine water source and making a positive environmental impact.

Important facts about financing waterfront properties…

As a potential buyer, mortgage approval and down payment requirements are substantially influenced by the presence of a suitable source of potable water and an approved septic system and road access.

- **Potable Water** – Depending on the quality of the water available (lake, well etc.), different purification methods can be used - from ultraviolet lights to filters, providing all the "Health Unit Approved" potable water any waterfront property owner may need.
- **Septic System - Public Road Access** – Most commercial lenders will typically extend a mortgage on a permanent waterfront home with as little as a 5% down payment providing the septic system pre-requisite is met…if not, that down payment often jumps to as high as 35% on recreational and seasonal properties.
- **Septic System – Private Road Access** – Unlike public road access, commercial lenders typically demand a minimum down payment of 25% on a permanent waterfront homes with an approved septic system while a 35% down payment would typically apply if an approved system did not exist.

Typical Waterfront Property Mortgage Down Payment Requirement

Based on sale value of -	$ 300,000.00				$ 150,000.00			
Intended Use	Permanent Year-Round				Recreational - Seasonal			
Road Access	Public		Private		Public		Private	
	%	**$**	**%**	**$**	**%**	**$**	**%**	**$**
With Septic System	5%	15,000	25%	75,000	10%	15,000	25%	37,500
Without Septic System	35%	105,000	35%	105,000	35%	52,500	35%	52,500

The above chart is intended to demonstrate how much more difficult it may be for a potential buyer to afford the purchase of a waterfront property without an approved septic system.

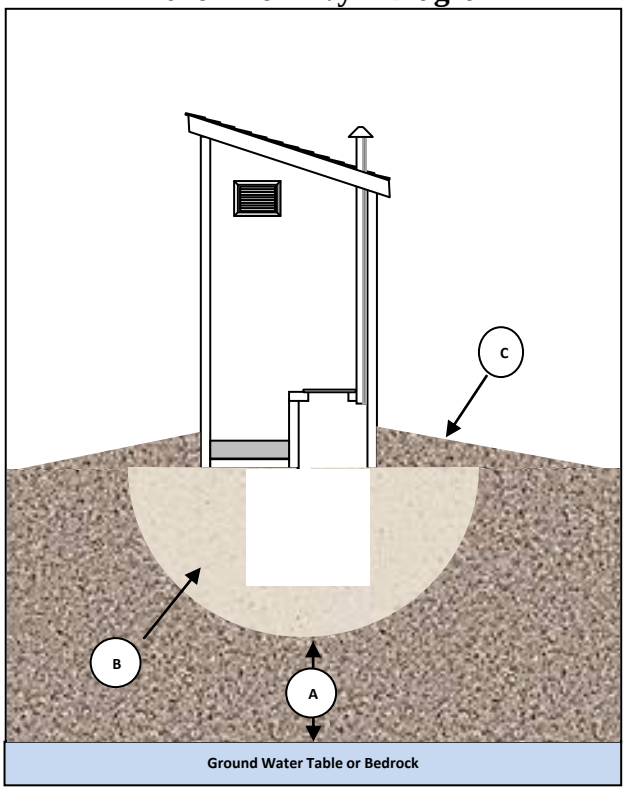
Stand Alone Toilets (Class One)

Earth Pit Privy (Outhouse) – Often used for isolated cabins or seasonal use cottages where running water may not always be readily available, the earth pit privy (outhouse) is likely still the most commonly used sewage waste disposal structure in use today. Even though there have been several new developments in recent years, this basic yet effective installation is inexpensive to build and operate. If properly built, the earth pit privy can last for decades and can serve as a back-up to any conventional septic system when the gang arrives for the summer holidays.

Regulatory set-back distances and construction

- 3m (10ft) from property line
- 15m (50ft) from open water or drilled well
- 30m (100ft) from dug well
- Pit bottom must be 90cm (3ft) above water table or bedrock (A)
- Pit sides must be reinforced to avoid sidewall collapse - (suitable material can be lumber / concrete blocks / metal sheeting)
- Pit sides must be surrounded by 60cm (2ft) soil or leaching bed fill (B)
- Soil around structure must be raised and mounded 15cm (6in) to avoid surface water infiltration (C)

Earth Pit Privy – Diagram



Alternatives to Stand Alone Privy

The convenience of having an indoor toilet without the expense of a full blown septic system has generated a growing market for cottage owners seeking more modern technology. Sometimes used for sleep camps (bunkies), these alternatives are often influenced by the overburden content (soil and ground cover) and topography of a property as well as easy access for pump-outs.

Even though others types exist, the most common alternatives to the old traditional outhouse fall into three primary categories - composting toilets, incinerating toilets and chemical toilets.

In very simplistic terms, the **Composting** toilet relies on aerobic bacteria for decomposition so sewage must be aerated to optimize its effectiveness. The **Incineration** toilet utilizes electricity, natural gas or propane to heat the raw sewage, boiling away liquids and converting residue to a powdery sterile ash. The **Chemical** toilet utilizes potent chemicals such as sodium hydroxide or lye to burn and corrode organic tissue, liquefying the solids while killing the bacteria.

	Advantages	**Disadvantages**
Composting Toilet	No septic system required No permits required	High maintenance Bacteria sensitive to cold Requires heat source Not suitable for high volume
Incinerating Toilet	No septic system required No permits required No disposal problems	Requires energy source Downtime during incineration Relatively high cost
Chemical Toilet	No septic system required No permits required Rentals available (ideal for family reunions / large groups)	Use of toxic chemicals Effluent disposal may be a problem due to harsh chemicals

Visit the following websites for additional alternative toilet details:-

- Cottagelife.com/alternativetoilets
- Ecoethic.ca
- Separett.ca
- Envirolet.ca
- Sun-mar.com/ct

Greywater – The Silent Invader

Long gone are the days when grandpa used to scoop-up buckets of fresh camp water from the end of the dock so grandma could boil water in a stove top kettle to wash the dishes. The evolution of the piston water pump eliminated grandpa's daily water-fetching trip to the lake however he had to retrofit grandma's kitchen with a new sink and plumb an outside water outlet for her new wringer washing machine. With the advent of running water came the need to build a drainage pit (usually consisting of a couple of methodically punctured 45-gallon drums) directly adjacent to the cabin.

Now-a-days, a high-capacity jet pump complete with reservoir sits where the old piston pump once was and is usually accompanied by a high efficiency hot water tank. More often than not, a warm shower has replaced the refreshing morning swim. We have gone from using 8 to 10 litres of water per day per person to 10 times that volume simply because it's become so much more convenient.

Have you asked yourself recently…where does all that soapy waste water go?

Chances are that unless you have upgraded grandpa's old drainage pit in recent years, much of this greywater may be finding its way to your shoreline and ultimately into the lake.

Greywater Leaching Pit (Class Two)

A leaching pit is a soil based system designed to dispose of wastewater other than human body waste. The main ingredient of greywater is phosphorus derived from soaps and detergents.

CLASS 2 - LEACHING PIT can only be used for the disposal of greywater wastes which come from plumbing fixtures, such as sinks, showers, or laundry machines. Under the Ontario Building Code, this system can only be used if the daily greywater septic flow is less than 1,000 litres per day. Anything more requires a Class 4 conventional septic system.

The leaching pit design is based on percolation time of soil relative to the amount of greywater flowing into the system. In order to establish percolation time, a soil analysis must be completed by a licensed professional. For this test, a recognized facility will determine how long it will take water to filter through a submitted sample of native soil. This report will be expressed in Time (T) = min/cm. For example, some soils such as clay have a lower absorption rate (T = 50 min/cm) than other soils such as sand (T = 5 min/cm) therefore the size of the leaching pit is directly related to the type of soil that exists at the selected site on the property.

With a pressurized water system, each plumbing fixture is determined to generate 200 liters per day while a non-pressurized water system is deemed to generate 125 litres per day therefore we must first calculate the potential greywater volume flowing into the leaching pit in order to determine a suitable design.

Class 2 - Greywater Pit - Daily Septic Flow (DSF) Calculation (Example)

Fixture Type Description	Quantity	Fixture Units	Total Fixture Units	System (Litres)	DSF Results
Kitchen Sink	1	1.5	1.5		
Washing Machine	1	1.5	1.5		
Shower	1	1.5	1.5		
		Total	4.5		
Pressurized water system (200L x qty fixture units)				200	900
Non-pressurized water system (125L x qty fixture units)				125	562.5

Note- Maximum Allowable DSF 1000 Litres for Class 2 System

Percolation Time of Native Soil: T= 9 Min/Cm

Construction Requirements

Minimum Sidewalls Required Calculation $\frac{T \times DSF}{400} =$ _____ M^2

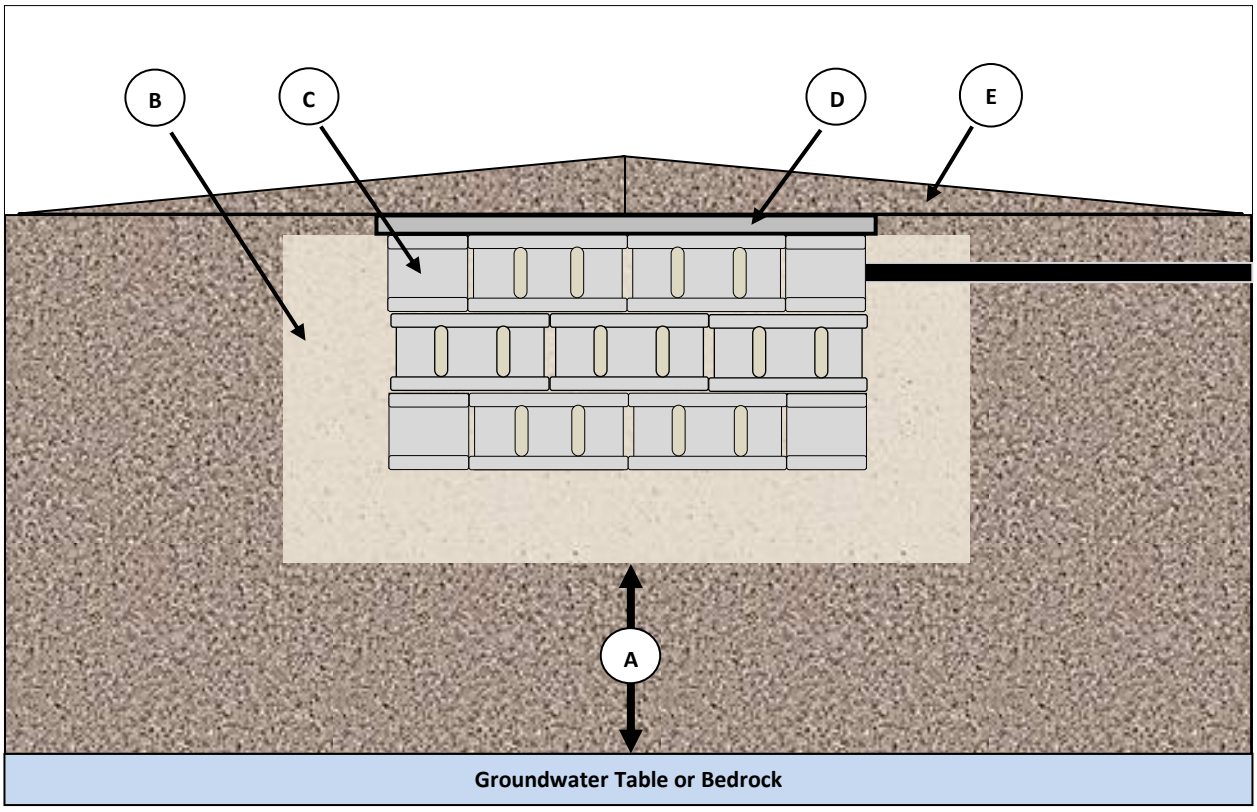
With Pressurized Water System 20.25 M^2

With Non-pressurized Water System 12.62 M^2

Actual Leaching Pit Size	Width (M)	Length (M)	Depth (M)	Total Area (M^2)
Pressurized System	5	5	1	20
Non-pressurized System	3.15	3.15	1	16

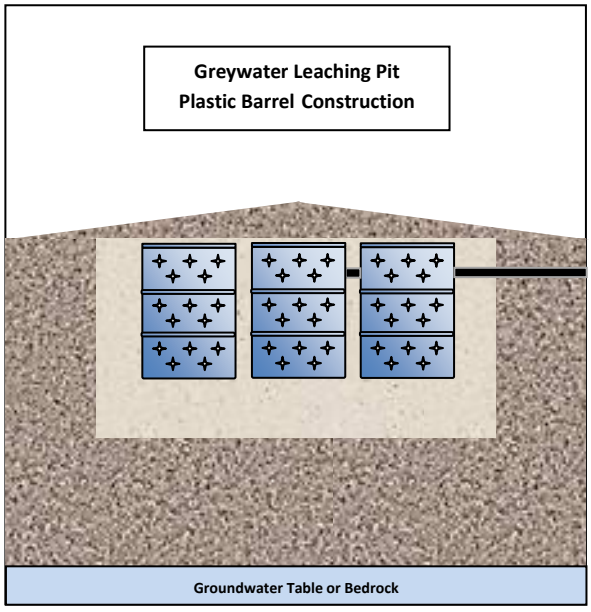
Greywater Leaching Pit

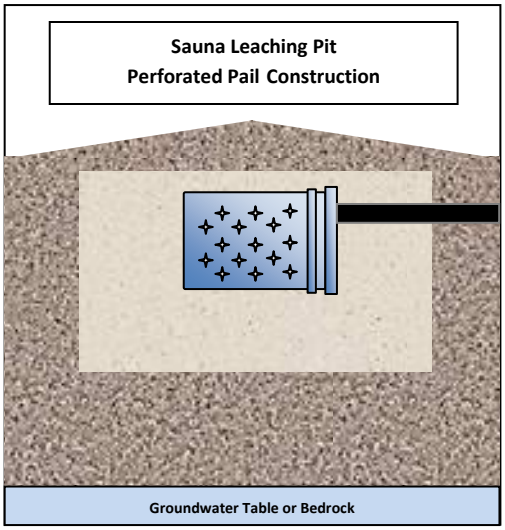
Greywater Leaching Pit – Concrete Block Construction



Regulatory set-back distances and construction

- 3m (10ft) from lot line
- 10m (30ft) from drilled well
- 15m (50ft) from dug well or open water
- Pit bottom must be more than 90cm (3ft) above water table or bedrock (A)
- Pit must be surrounded on all sides and on bottom by 60cm (2ft) soil or leaching bed fill having a percolation rate greater than 1 min/cm or less than 50 min/cm. (B) (pit-run gravel ideal)
- Pit sides must be reinforced to avoid sidewall collapse (material can be treated lumber, concrete blocks, field stone, plastic barrels, metal sheeting) and shall be an open-jointed construction that will permit leaching from the pit.(C)
- Pit surface must have a tight, strong, access cover for maintenance purposes. (D)
- Soil around structure must be raised and mounded 15cm (6in) to avoid surface water infiltration. (E)





Sauna Leaching Pit (Non Pressurized Water)

The ruling is that if your sauna has a drain, the greywater it produces must go into a leaching pit.

Even though the same regulatory set-back and construction distances apply, a sauna's DSF (daily sewage flow) tends to be relatively low when a pressurized water system does not exist.

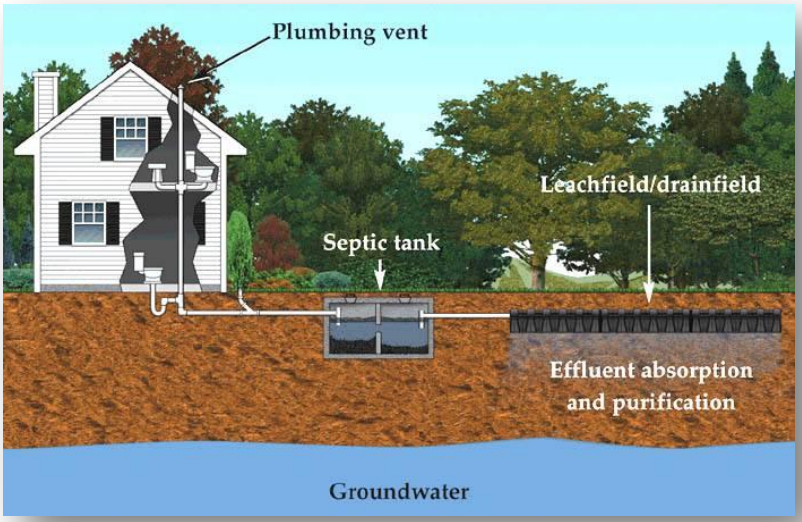
If such is the case, an effective leaching pit may be constructed utilizing something as simple as a 20-litre (5 gallon) plastic pail.

Alternatives and Special Applications

Although the Ontario Building Code provides various defined specifications for the construction of greywater pits, alternates for special applications are often considered and approved by the local authorities. Waterfront property owners are therefore encouraged to consult with their public health inspector for recommendations or guidelines of variants applicable to a specific site.

Conventional Septic System (Class 4) – What Is Involved?

When community sewer hook-ups are not available, the most common type of septic system used to service single-family dwellings, multiple units, and commercial premises is called a Class 4 system. It is typically composed of a treatment unit (septic tank or tertiary treatment unit) and a leaching bed. A septic tank is a watertight vault with two compartments in which raw sewage accumulates. The main purpose of the septic tank is to collect the sewage and separate solid materials from the liquids. The heavier solids settle to the bottom of the tank (sludge layer) and the lighter oils and greases rise to the top forming the scum layer, the liquid in the septic tank then flows by displacement into the leaching bed. All new septic tanks are fitted with an effluent filter at the tank's exit keeping the sludge and scum trapped inside the tank.



Conventional Septic System (continues)

The leaching bed (field bed, leach field or drain field) is comprised of absorption trenches and distribution pipes which treats the sewage effluent (liquid portion) by a combination of physical, chemical and biological reactions within the soil mass.

A conventional septic system will include a concrete or plastic septic tank plumbed from your home by a 102mm (4in) PVC pipe. The distribution pipes are constructed of 76mm (3in) or 102mm (4in) perforated PVC pipe laid in a bed of gravel. Atop the bed of gravel is a geotextile material which will help prevent roots, dirt and other debris from filling the gravel or pipes.

The size of the septic tank and the amount of distribution pipe your system will require will depend on several factors; a soil analysis to determine how quickly the soil on your property absorbs water, total square footage of the dwelling, number of bedrooms and total fixture units in your home.

Benefits and disadvantages of plastic septic tanks

There is never a worry of a plastic tank rusting or corroding and they are less susceptible to cracking. Plastic tanks are much lighter than concrete tanks making installation much easier.

Although lightweight, a plastic tank can sustain damage during the installation process which can be a costly problem if you have to buy another tank before it is even installed. Because plastic is so lightweight, "floating" can be a problem.

Benefits and disadvantages of concrete septic tanks

Concrete is a common material to use for septic tanks and they will last a long time. Concrete is heavy and strong so one of the things you'll not have to worry about is the tank floating like you will with a plastic tank.

Despite the durability of concrete, they are typically more expensive than plastic tanks, but last longer, so for most people, this outweighs the cost saved initially with the length of time the concrete tank will last. Concrete septic tanks are not the easiest to install simply because they weigh so much and require heavy equipment. Concrete can crack under certain circumstance, but this is not usually a problem.

How Much Does It Cost to Build a Conventional Septic System?

The average home will require a septic tank with a minimum capacity of 3600 liters (800 gallons) as well as approximately 42.5m (140 ft) of distribution pipe in imported soil. Prices for this system can vary widely depending on where you live and the current cost of materials, however for a basic system with optimum percolation test results and conditions, a do-it-yourselfer may expect to spend in the $5,000 to $7,500 range. Unfortunately, conditions are not always perfectly suited for conventional septic systems therefore the cost can climb dramatically. A typical conventional system however should not exceed $15,000 in most cases.

Filter Bed

The filter bed is an alternative type of leaching bed. It may be used on sites where there is insufficient area for a conventional bed, or where there are natural features, such as treed areas, that minimize the available leaching bed area. Unlike an absorption trench leaching bed, in which each line of the distribution pipe is in a separate trench, a filter bed allows the sewage effluent to enter a series of distribution pipes that are set in a common layer of stone. The stone layer covers a surface of filter sand overlying the native soils. Filter beds can be installed either in-ground, partially raised, partly excavated or fully raised as shown here.

Since soils are frequently too hard, too wet or you are living in an area surrounded by solid rock such as the Canadian Shield, you must have another option for a septic bed. The OBC allows for Filter Beds and Fill Based Absorption Trenches.

These beds can be built upon heavy clay, solid rock and high ground water tables. To do this, you must import sand and build your septic system on top of the imported sand. Other than requiring a lot of sand and trucking, there are few down-sides to these systems. They are also known as Mound Systems due to all of the sand that they are mounded upon.

Infiltrators Bio-diffusers Fields

Infiltrators or Bio-diffusers are approved for use and are growing in popularity.

Despite what their name implies, Infiltrators or Bio-diffusers are usually not located on the surface. Rather, most Infiltrators or Bio-diffusers are covered by top soil, disguising the complicated series of pipes and tubes underneath. Unlike a conventional leaching bed, these 1.2m (4 ft) pre-formed segments are installed directly onto the filter sand, eliminating the need for the conventional layer of clean stone.

Alternatives to the Conventional Septic System

By design, waterfront properties often have a shortage of overburden and tend to slope towards the water's edge which means that alternative septic systems will likely need to be considered.

Currently the Ontario Building Code (OBC) approves field beds and filter beds however all other alternate treatment systems are regulated by The Building Material Evaluation Commission (BMEC). This commission is a regulatory agency authorized under the Building Code Act (BCA) who review and approve materials, systems and building designs including septic systems. BMEC make recommendations regarding changes to the building code.

Whether it is unusual soil conditions, restricted space, high water table or exposure to bedrock, technology now provides us with a selection of approaches to address these previous obstacles

Tertiary Septic Systems

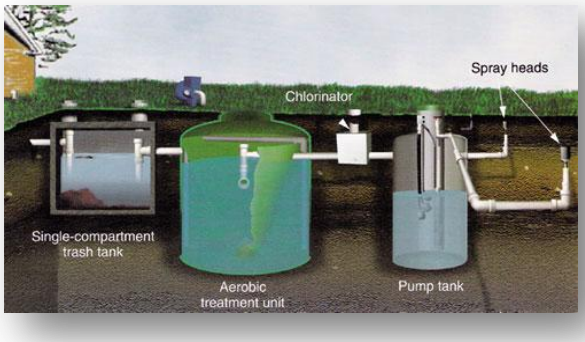
Waste exiting a Tertiary System is reduced to about 1/10 the strength of regular residential strength waste. Because of this, tertiary system leaching bed sizing is reduced by at least 50% and could be as low as 25% of a conventional system depending on the requirements of the household.

Biofilter

There are several Biofilters approved in Ontario. Some use natural filters as media and one technology uses foam blocks. The difference between these is complexity and size advantages. BioFilters slow the waste down, forcing the waste to wait until it is treated before releasing it into the disposal bed.

The Ecoflo Peat moss based unit requires no electricity to operate, making it a favorite of cottagers, and its ultra-high performance numbers have given it a sizing advantage over other systems. Unfortunately, after 8 years of use the peat moss needs to be replaced, costing upwards of $1,800 which means there is an additional average maintenance and operating cost of over $250 per year with such a system. Note that all biofilter systems are regulated and are governed by a service contract.

Aerobic Septic Systems



These systems installed either before or after the traditional septic tank, pump air into the sewage allowing aerobic microbes to improve the effluent quality. This supplement to the anaerobic activity of the septic tank provides relief to the leaching bed. Regardless if in use or not, the pump must run continuously (24/7) therefore, these systems are expensive to operate but there are no filters to replace.

How long do alternative treatment units last?
When properly engineered, installed, and maintained, the overall system (i.e. tank, drain field and treatment zone) should last indefinitely. Individual components such as pumps, electrical components, and filter media may require eventual replacement.

How do alternative systems compare with conventional systems in terms of cost?
Generally speaking, alternative systems will be more costly than conventional stone and pipe systems, especially in aggregate rich areas of the province. However, alternative systems become more economically attractive in areas with a high ground water table or unsuitable soils, especially if gravel and sand are difficult to obtain. Large, raised conventional systems can cost as much, if not more than alternative treatment systems in areas of the province where sand and gravel are not readily available.

How do alternative systems compare with conventional systems in terms of operation & maintenance?
Alternative systems will require more attention and care from the homeowner. Property owners with certain types of alternative treatment system must by law have a maintenance contract with an authorized representative of the manufacturer of the treatment technology. If the home is sold, the maintenance contract must be picked up by the new owner. In addition, owners of alternate treatment units will be required to submit test results (the cost of this may be included in the maintenance contract with the manufacturer). All alternative technologies will require regular tank maintenance, and some will require additional maintenance items, such as the Ecoflo Biofilter, which requires that the peat be removed and replaced after a certain period of time.

Step by Step Instructions for the "Do It Yourselfer"

How to Design Septic Systems

Septic systems are very basic in design and function. While reliable and for the most part maintenance-free, proper planning and installation are crucial to the overall efficiency and life span of your septic system. Proper planning and design at the onset will help to reduce the number of potential costly and nasty problems later.

Instructions

1. A simple "soil squeeze test" (squeezing a palm full of extracted soil into your hand) will indicate if the soil is sandy or clayish. A sandy soil will tend to crumble after your squeeze test suggesting that the soil is likely to have a favorable percolation rate. If however, your hand-full of extracted soil forms a solid mass; chances are that you are on clay. Regardless of your findings, you will need a certified soil analysis to get started. The results will be needed to plan your system as well as to obtain the permit to build the septic system.

2. Completing a permit application…not as hard as it looks!!!

Sewage Permit Application (Example)

Fixture Type Description	Quantity	Fixture Units	Total Fixture Units	For Single Family Dwelling	
				# of Bedrooms	3
Flush Toilets	1	4	4	Total Floor Area (M_2)	200
Sinks & Wash Basins	2	1.5	3	Total Fixture Units	11.5
Washing Machines	1	1.5	1.5	Daily Sewage Flow (DSF) (see permit chart for DSF)	1600
Bathtubs & Showers	2	1.5	3		
		Total	11.5		

Percolation Time of Native Soil: (T= ___Min/Cm)	11

Construction Calculations

Septic Tank Required	(Min 3600L or 2 x DSF)	3600
Leaching Pipe Required	(T x DSF = ____Length of Pipe(M)) 200	TBD
Filter Bed Required	Greater than 3000 (DSF=_____M_2) 50 / Less than 3000 (DSF=_____M_2) 75	TBD
Mantle Area (M_2) (see permit chart for Loading Rate)	DSF = _____(M2) Various T	TBD

3. In most areas, the minimum size tank allowed for a residence is 3600 litres (800 gallons). The tank size you install will determine how often the tank needs to be cleaned (pumped) out. A 4200 litre (1,000 gallon) tank which is usually recommended will need to be emptied about every 3 years when four people live in a household.

4. Ideally, the tank will be slightly downhill from the house and the distribution pipes slightly downhill from the septic tank. If this is not possible, it will be necessary for you to install a septic pump.

5. Choose a flat area away from any ground water or vehicle traffic. The area will need to be large enough to accommodate the amount of distribution pipe required for your system. When planning, remember the septic tank itself should be a minimum of 1.5m (5ft) from the dwelling.

6. The piping will travel from your house to the septic tank to the distribution pipes. Approximately ten feet in front of the distribution pipes you may need to install a distribution box. This box will receive the effluent from the septic tank, and then disperse it evenly between the distribution pipes.

7. The leach field consists of a network of perforated pipes (or "laterals") laid in gravel under the ground that allow the effluent to pass into the ground from the septic tank. In most systems this pipe consists of PVC or the newer chamber style distribution pipes that have a higher surface area. Most septic systems work by gravity where the liquid wastewater from the house flows into the septic system (known as influent) and is discharged from the tank (known as effluent) to the leach (or absorption) field. The absorption field is where the final treatment takes place.

Once your absorption field has been inspected, you can then proceed to cover the piping with a geotextile membrane and backfill the entire area with a layer of topsoil which can be covered with sod or planted with grass seed.

Septic System Maintenance - Problem Indicators

- Toilets or drains that are backed up or run more slowly than usual
- Soggy ground around the septic tank or leaching bed area
- Surface discharge of sewage or septic tank effluent around the septic system
- Activated alarm signals (lights or bells) on special treatment units
- Dosing pumps that run constantly or not at all
- Unusually green or thick grass in or around the leaching bed area

Summary

The primary objective of this booklet is to demystify the workings of onsite septic systems and is intended for information purposes only. All sketches are conceptual and not to scale. Any advice offered should not be construed as professional but as a guide to assist in dealing with the professionals.

While a Public Health Inspector cannot design a system for you, they are receptive and available to answer any questions you may have about your own system design.

Check these websites for more information about sewage systems -

Informative Websites -

Ontario Onsite Wastewater Association (OOWA) - www.oowa.org
Ontario Rural Wastewater Centre (ORWC) - www.orwc.uoguelph.ca
Septic Systems Ontario - www.septicsystemsontario.com
Federation of Ontario Cottagers' Associations (FOCA) - www.foca.on.ca

Informative Publications –

Country and Cottage Water Systems by Max Burns published by Cottage Life Books
ISBN-13 978-0-96969-227-0

Sudbury District Health Unit - www.sdhu.com For Sewage System Application Forms follow www.sdhu.com/Site Map/Health Hazards & Infectious Diseases/Environment/Sewage System/Documents

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