Sewage Permit Process Backgrounder and Guide

Northwestern Health Unit

www.nwhu.on.ca

Sewage Permit Process Backgrounder and Guide

Program Goal

To ensure that the installation of private sewage systems comply with Part 8 of the *Building Code Act, S.O. 1992* so that human health and the environment are protected.

Program Description

The Northwestern Health Unit is legislated under the *Building Code Act, S.O. 1992* through the Ministry of Municipal Affairs and Housing to deliver the Part 8 Sewage Program.

Part 8 refers to the section of the *Building Code* regarding sewage systems. Assigned responsibilities include:

- Issuing permits and performing inspections for sewage systems according to the *Building Code*. This responsibility includes permits for all private residences and commercial operations with a maximum daily flow rate of 10,000 litres per day or less.
- Inspecting proposed severed lots and land development sites and providing information to the appropriate regulatory authority on the suitability for on-site sewage treatment.
- Investigating complaints concerning malfunctioning sewage systems. Systems found to be in violation of legislation are followed up with for correction.
- Conducting permit searches and lot inspections as requested.

The Building Code requires that sewage systems be designed by certified designers and that they are installed by licensed installers. There is also a provision for homeowners to design and install their own system.

The Northwestern Health Unit does not design sewage systems.

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Owner Responsibilities

1. Signing the Sewage Permit Application to certify that the information is correct;
2. Ensuring that the proper site evaluation is completed;
3. Ensuring that the design of the system complies with the Building Code; and
4. Contacting the Northwestern Health Unit prior to making any alterations to existing or malfunctioning systems.
5. In most cases, the property Owner will hire an Installer or a third-party Designer to conduct the site evaluation and design the system on the Owner's behalf. The Installer or Designer will then act as the Owner's agent.

Designer Responsibilities

1. Conducting the site evaluation to determine site-specific information to be utilized for design;
2. Discussing with the owner on the use, size, maintenance requirements and appearance of system and components to consider during the design phase;
3. Preparing the detailed design, including all design information as required by the Building Code and the Northwestern Health Unit;
4. Ensuring design specifications meet all requirements of the Building Code; and
5. Providing support to both the owner and the installer on the principles of the design and any specific requirements for construction as well as operation and maintenance of the system upon completion. All designers must have a valid Building Code Identification Number (BCIN).

Contractor and/or Installer Responsibilities

1. Ensuring that a permit has been issued prior to beginning the construction or alteration of a sewage system;
2. Reviewing, understanding, and complying with design drawings, specifications, and instructions for the installation of sewage systems;
3. Obtaining permission from the system designer prior to making any changes to a design, and informing the designer of any discrepancies in the drawings and specifications, or changes in site conditions;
4. Ensuring that all work conducted on the installation is in accordance with the Building Code;
5. Ensuring that all materials used for the installation comply with the Building Code and specified design requirements;
6. Instructing the owner of the sewage system on the proper use of the system and its maintenance; and
7. The installer is not responsible for site evaluation or design of the system, unless he/she has been specifically contracted to do so. All installers must have a valid Building Code Identification Number (BCIN).

Public Health Inspector/Chief Building Official Responsibilities

1. Reviewing the submitted sewage application to ensure it conforms with Northwestern Health Unit policy and the Building Code;
2. Conducting site inspections as required, to verify the information on the sewage application permit;
3. Conducting an inspection to verify that the installation complies with the Building Code; and
4. The Public Health Inspector/Chief Building Official **is not responsible** for the site evaluation, percolation testing, or design of a system.

Septic System Installation Process Step-by-Step Guide

1) The owner obtains a copy of the *Sewage Permit Process Backgrounder and Guide* and the Northwestern Health Unit *Sewage Permit Application Form*.

2) The owner determines the appropriate type of system to service proposal.

3) The owner determines if the scope of the project is within the abilities of the applicant or if a qualified third party is required to assume the role of designer. If not the owner, this role can be filled by a qualified and competent third party who holds a valid BCIN.

4) A site evaluation is performed by the owner or designer. This includes a thorough review of topographical features, site drainage and subsurface materials and conditions. Soil characterization, including laboratory analysis of all design soils, must be performed at this stage.

5) The system is designed by the owner or qualified designer. The design consists of the completion of all required sections of the Northwestern Health Unit Sewage Permit Application Form, the submission of laboratory results for design soils and a copy of a property survey.

6) The application is submitted to the Northwestern Health Unit along with the application fee.

7) The application is reviewed by the Chief Building Official of the Northwestern Health Unit to determine compliance with the Building Code and to ensure all required information is submitted.

8) An on-site inspection is scheduled to review site features; **or** the *Refusal of Application for Sewage System* form is sent to the applicant that requests either missing information or design that meets the Building Code. A revised Northwestern Health Unit *Sewage Permit Application Form* must be submitted and approved prior to scheduling a site inspection.

9) An incomplete application will not be reviewed for compliance with the Building Code. The required permit review period begins once a complete Sewage Permit Application Form is submitted.

10) The area of the proposed system is staked out by the owner with test pits left available for inspection or new test pits are coordinated for the scheduled on-site inspection.

11) The owner, or representative, attends an on-site inspection with a Public Health Inspector or Chief Building Official. The inspection includes confirmation of all site-specific topographical information and sub-surface conditions through the inspection of test holes.

12) The Sewage Permit is issued on site, mailed out; **or** the *Refusal of Application for Sewage System* form is issued with details on outstanding requirements. This form will also indicate if re-inspection is required. Re-submitted application forms proceed from Step 7, and re-inspection fees may apply.

13) Once the sewage permit is issued, the applicant has the system substantially completed in accordance with the design and Building Code.

14) The Northwestern Health Unit is contacted to arrange an inspection of the substantially completed system. All components of the design need to be on-site and installed, but open for inspection.

15) The substantially completed system is inspected for compliance with the design and the *Building Code*. Measurements and features of the site and the installation are recorded.

16) Permission to continue with the installation is granted or the *Refusal of Constructed Treatment Works* form is issued. Details of non-compliance are identified on the form with the status of re-inspecting the site clearly identified. The owner must ensure all noted items are corrected, all fees are paid and a successful inspection has been completed by the Northwestern Health Unit prior to final completion.

17) A *Certificate of Completion* is issued by mail within 15 days of final inspection.

The owner or a representative must be on site during all inspections.

On-Site Sewage Systems

The following sections describe briefly the types of systems available and information about each classification. Please consult the *Building Code* for more complete information.

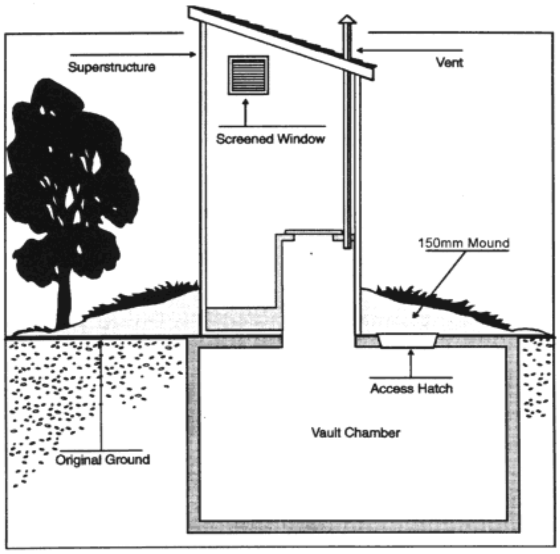
Class 1 Systems

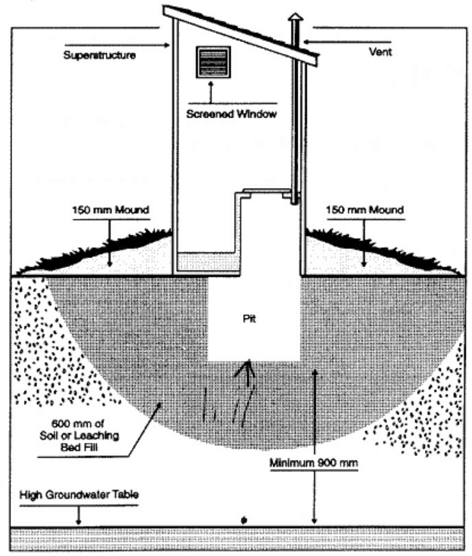
These systems consist of privies, composting toilets, chemical toilets and incinerating toilets. There are several types of privies such as an earth pit privy, a portable privy and a privy vault.

Class 1 systems are only for human waste. These systems are often used in conjunction with a Class 2 System for minimal plumbing (as described below). The Building Code includes clearance distance requirements for privies to watercourses, property lines, wells and to underlying features such as bedrock and the water table.

Construction requirements for privies specify a minimum amount of soil surrounding the pit (600 mm) and the depth of the pit to underlying groundwater or bedrock (900 mm).

Composting toilets are allowed to have sub-floor units with an overflow drain that discharges to a Class 3 Cesspool.





Class 2 Systems (Greywater Systems)

Greywater is defined as wastewater from sinks, showers, bathtubs and other non-toilet fixtures. A greywater system is a soil-based system that treats and disposes of the wastewater. It can consist of trenches, stabilized pits, or porous vessels, however, pits and vessels are frequently too small in the sidewall area to be practical.

The Building Code allows minimal plumbing fixtures to flow to a greywater system as determined by calculating the design flow using predetermined flow rates. Washing machines are restricted from flowing into these types of systems because laundry waste has a very high concentration of fibrous lint that clogs soil based systems prematurely.

The Code specifies two different flow rates, based on the supply of water, to determine the Daily Design Flow Rate. Pressurized supply water is assigned a Design Flow Rate of 200 litres per fixture unit of plumbing. A supply of non-pressurized water (water tower) is assessed as having a Design Flow Rate of 125 litres per fixture unit of plumbing. Each sink or shower has a count of 1.5 fixture units.

The Daily Design Flow Rate is used to calculate the sidewall area of a system based on the percolation rate of the soil to be used to construct the system. The *Building Code* requires:

a) A minimum of 600 mm of design soil to surround the greywater system;
b) A minimum of 900 mm of soil between the underlying bedrock or groundwater table and the bottom of where wastewater is applied; and
c) A maximum of 1000 litres of design flow per system.

Class 3 Systems (Cesspools)

These systems are soil-based systems that treat and dispose of the overflow water from composting toilets. They can be constructed as a trench or as a pit. These systems can be relatively small as the volumes are significantly lower than wastewater from greywater systems.

The Building Code requires a minimum clearance distance of 900 mm from the bottom of the pit or trench to the underlying bedrock or groundwater table. Where a lid extends to the surface, it must be lockable.

Class 4 Systems (Septic Systems)

These systems are designed to accept all plumbing.

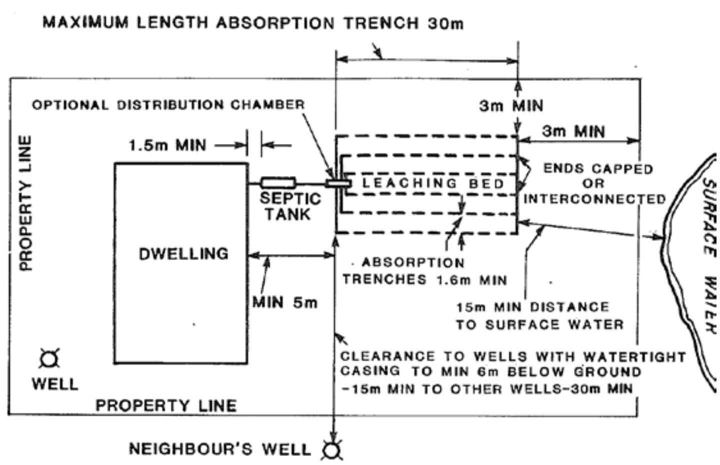
Septic systems consist of a two-compartment septic tank and a soil based absorption system. The downslope area of where the sewage is applied is called the mantle. The mantle provides additional area for treatment and is an important component of all septic systems.

All new septic tanks must incorporate an effluent filter to further protect against solids flowing to the drainfield portion of the system. Documentation about the quality of the soil to be used for the installation must be provided for all septic systems.

Absorption Trench Type Septic Systems

Absorption trench type systems consist of a gridwork of perforated piping that discharges effluent via a distribution box or solid header pipe. Individual distribution lines are installed using 1.6 metre (minimum) centre offsets. Options include:

- Conventional stone and pipe trench systems constructed in native soils;
- Conventional stone and pipe trench systems in raised, imported soils;
- Chamber type trench systems in native soils;
- Chamber type trench systems in raised, imported soils; and
- Other trench replacement technologies in both native and imported soils.



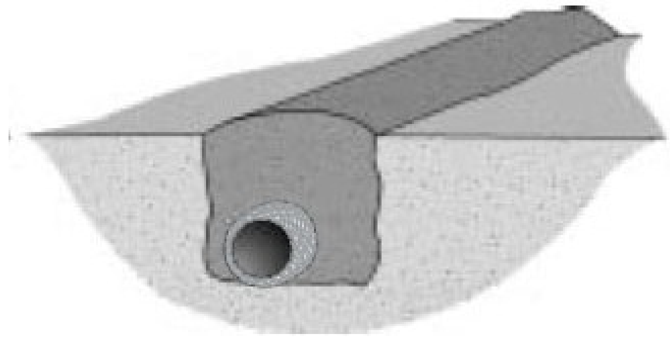
TYPICAL ARRANGEMENT OF A SEPTIC TANK SYSTEM

All of the absorption trench type systems have the same *Building Code* requirements:

- Minimum 900 mm from the trench bottom to underlying bedrock or high groundwater table;
- Overall trench length based on the design soil or Percolation Rate(T_D); and
- An imported mantle where the system is constructed with imported fill.

Conventional Stone and Pipe Systems

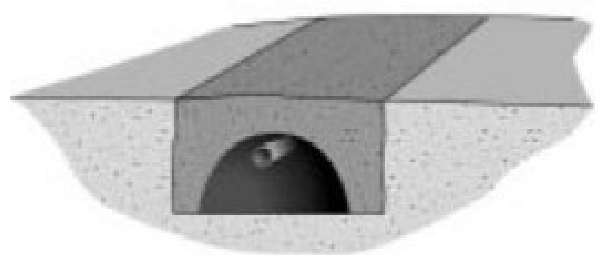
These systems consist of stone and pipe trenches constructed in either native soils or imported fill. The length of piping required is determined by using the Daily Design Flow Rate and the percolation rate of the design soil. The design soil is very important as a moderate sized dwelling may require 80 meters or less of distribution piping in a well-drained sandy soil, but it would require 400 meters of distribution piping in a heavy clay soil.



A sample permit of a trench type system is available at www.nwhu.on.ca .

Chamber and other Trench Type Replacement Systems

Manufacturers have successfully obtained Provincial acceptance of their products through the Building Materials Evaluation Commission (BMEC). There is a separate BMEC Authorization Report for each of the approved trench replacements. Trench replacement products include plastic chambers, expanded polystyrene (EPS) chambers and media (geo-synthetic aggregate) containing bundles.



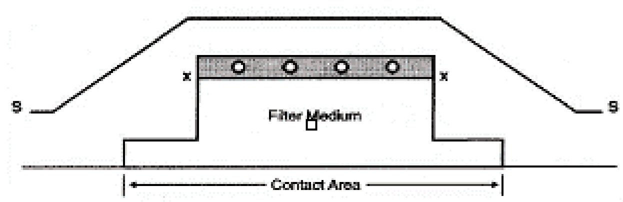
Chamber

Filter Bed Systems

These systems consist of a conventional septic tank and a relatively small drainfield on top of very specific filter sand. A mantle is required with filter beds in poor, native soils.

There are two types of filter bed systems:

- Filter beds with a septic tank; and
- Filter beds with proprietary treatment.



A filter bed consists of:

- 750 mm of uniformly graded sand that meets a very specific grain size envelope;
- 300 mm of crushed rock that contains piping on maximum 1.2 metre centres;
- An expanded area of filter sand where the native soil is not sand; and
- A mantle based on the native soil.

When the Daily Design Flow Rate is over 3000 litres per day, the following apply:

- The loading rate changes from 75 litres per square metre to 50 litres per square metre;

- Multiple filters (max.50 m^2) are required; and
- Proprietary treatment is required for daily design flows in excess of 5,000 litres.

A sample permit of a filter bed system is available at www.nwhu.on.ca .

Proprietary Air or Media Type Systems with Area Bed

These systems consist of either an air technology or media technology type treatment unit used with a low profile area bed constructed out of specific sand and stone.

An area bed type system consists of a continuous stone layer over top of a sand layer and a downslope mantle as specified in the Building Code.

Proprietary Air or Media Type Systems with Shallow Buried Trenches

These systems consist of either an air technology or media technology type treatment unit used with a network of pressurized, shallow buried trenches.

A small diameter pipe, with sufficient holes drilled in it to allow the effluent to spray inside the entire length of the chamber, is suspended inside the chamber. There must be a measurable excess of pressure at the end of the system (600 mm).

- They must be designed and installed by an authorized agent of the manufacturer.
- An annual sampling contract with an approved sampler and on-going maintenance contract must be submitted at the time of permit application.
- These systems are not allowed in imported fill.
- No mantle required.

Class 5 Systems (Holding Tanks)

Holding tanks are large single compartment tanks used for collection and storage of sewage for removal by a licensed sewage hauler.

Holding tanks are allowed in limited circumstances:

- A municipal sewer is going to be available within a limited time.
- Temporary facilities, such as construction trailers at industrial sites.
- To remedy an unsafe existing sewage system where the property is too small for a septic system.

Requirements for holding tanks include:

- The minimum sized tank for any installation is 9,000 litres.
- All plumbing must be connected into the system.
- All tanks shall be alarmed with both an audio and visual alarm.
- Tanks must be anchored if they are subject to lifting by groundwater forces.
- A contract with a licensed hauler must be obtained for appropriate hauling and disposal of sewage at an approved site.

Holding tanks are sized according to the Daily Design Flow Rate, Q. The capacity of a holding tank is a minimum of seven times the calculated daily flow rate.

Introduction to Design Principles

Systems can be designed by:

- Homeowner for own system;
- Licensed installer for systems they install; or
- Third party Designer.

There are two key elements to all designs:

- Total Daily Design Sanitary Sewage Flow (Q); and
- Percolation Rate (T) of soil to be used. (The Northwestern Health Unit has identified the three possible T times as T_D, T_N, and T_M - for Percolation Rate of Design Soils, Native Soils and Mantle Soil, respectively.)

Scope

The following information is primarily for the design of conventional type systems consisting of a septic tank with either a septic field or a filter bed system. Proprietary type systems need to be designed by a third party Designer who is competent in providing detailed design.

Total Daily Design Sanitary Sewage Flow (Q)

The flow rate is used:

- To design both the tank and leaching bed size of the system; and
- To calculate the size of the mantle.

All types of buildings including dwellings are assigned a Daily Design Flow Rate. The Building Code has two tables that list Residential and Non-Residential Occupancies.

For dwellings, a Base Flow Rate (BFR) is first established from the Residential Occupancy Table and potential extra flow is assigned for:

- Bedrooms over five; or
- Floor area in excess of 200 m^2; or
- Plumbing in excess of 20 fixture units.

The Building Code requires that, where multiple calculations of flow are permitted, the highest flow be used. The floor area calculation usually results in the highest flow where the dwelling exceeds two or more of the three possible ways to calculate flow.

Notes:

Guest cabins need to be included in the calculations whether they are plumbed or not, unless there is an approved system servicing them.

Water softener backwash water should not be connected into a septic system. They adversely affect the bacterial action and add an unnecessary volume to the system.

Garbage grinders add too much solids to these mostly liquid systems and should not be added. They may clog the effluent filter prematurely causing sewage backup into the dwelling.

Residential Occupancy Table

RESIDENTIAL OCCUPANCY	VOL. LITRES
APARTMENTS, CONDOMINIUMS, Other Multi-Family Dwellings - per person [1]	275
a) Per person, i) with meals and laundry facilities, or	200
ii) without meal or laundry facilities, and	150
b) Per non-resident staff per 8 hour shift	40
BOARDING SCHOOL - per person	300
DWELLINGS	
a) 1 bedroom dwelling	750
b) 2 bedroom dwelling	1100
c) 3 bedroom dwelling	1600
d) 4 bedroom dwelling	2000
e) 5 bedroom dwelling	2500
f) Additional flow for i) each bedroom over 5, or	500
ii) a) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 [2],	100
b) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 [2] , and	75
c) each 10 m^2 (or part of it) over 600 m^2 [2] , or	50
iii) each fixture unit over 20 fixture units	50
HOTELS and MOTELS (excluding bars and restaurants)	
a) Regular, per room	250
b) Resort hotel, cottage, per person	500
c) Self service laundry, add per machine	2500
WORK CAMP or CONSTRUCTION CAMP, semi-permanent per worker	250

Notes: [1] Additional flow must be added where more than two people could sleep per bedroom.
[2] Total finished area, excluding the area of the finished basement.

Floor Area

Finished floor area needs to be determined to assign potential additional flow that may need to be added to the Base Flow Rate, BFR. The table above requires that additional flow be added where the finished area (excluding any finished area in the basement) is in excess of 200 square metres.

A basement is defined as the floor below the first storey and the first storey is defined as the closest floor to the surrounding grade with its ceiling more than 1.8 metres above that grade.

On sloping sites with a walkout basement, a calculation needs to be made to determine where the ceiling is in relation to the average backfill height around the building. On most walkout basements where the backfill on the back wall is to the top of the wall, the finished area in the basement will not need to be added to the design flow. However, plumbing and bedrooms in the basement area still need to be added into the design.

Plumbing

The total number of fixture units of plumbing needs to be determined using the following table.

A bathroom group is defined as a group of plumbing fixtures installed in the same room, consisting of one sink, one toilet and either one bathtub (with or without a shower), or 1 one-headed shower.

Once the number of fixture units is determined, a calculation is performed to assign potential extra plumbing flow. For each fixture unit over 20 fixture units, 50 litres of flow are assigned.

Where additional plumbing connections exist, even without connected fixtures (roughed-in), the fixture unit calculation shall take this into account.

Fixture Units of Plumbing Table

FIXTURE	HYDRAULIC LOAD Fixture Units
Bathroom group	6
Bathtub (with or without shower)	1½
Bidet	1
Clothes washer	1 ½ with 1 ½ in. *trap*
Dishwasher	½
Laundry tub	
(a) single or double units or 2 single units with common trap	1½
(b) 3 compartments	2
Shower drain	
(a) from 1 head	1½
(b) from 2 or 3 heads	3
(c) from 4 to 6 heads	6
Sink	
(a) domestic and other small type with or without garbage grinders, single, double or 2 single with a common trap	1½
Toilet	4

A complete table of fixture units is available in the Building Code.

Soil Types and Percolation Rates

In order to size the sewage system with the proposed structure, the Percolation Rate (T), or the rate at which liquid will move through the soil (expressed in min/cm), will be required.

Percolation Rate (T_x) for various soil materials is denoted by the subscript reference for the Sewage Permit. The variables (T_D) (T_N) (T_M) refer to the percolation rates for Design Soil, Native Soil and Mantle Sand, respectively. Permits are often issued with only the imported design soil being analyzed. The site inspection may reveal that more testing is required where native soils are proposed but not initially submitted.

Determining the Percolation Rate

To determine the Percolation Rate (T_X) for a given soil, choose an option:

a) Collect a sample of the soil to be analyzed and have it tested at an accredited laboratory. Ensure that the sample sufficiently reflects the proposal. Testing a thin seam of good soil in a mixture is not sufficient. Should the laboratory report list a range of values for the percolation rate, the highest value shall apply for design purposes. Laboratory test results are only considered valid if they are dated within 24 months of construction for imported sand.
b) On-site percolation tests are allowed. They must be performed and documented by a third-party Certified Soil Technician. One of the key factors in getting a representative percolation rate is saturating the area in the vicinity of the test.

Test Holes

Test holes are required in the area where the proposed sewage treatment system is to be located to determine subsurface conditions and to properly assess native soils. A minimum of two test holes are required. The test holes must be dug to a minimum of 1.0 metre below the proposed trench elevation, with a record made of all soil types and any of the following:

a) bedrock or boulders;
b) clay, or hardpan soil; or
c) the groundwater table.

Trench depths must be between 600 mm and 900 mm. If your test holes are a minimum of 1.0 metres in depth, with none of the above noted restrictions, you should examine the soil in this 600 - 900 mm range. By comparing this soil with the following chart, an estimate of the percolation rate of the soil can be made.

Estimate the Percolation Rate

Soil Type	Coarse Gravel, no fines	Gravel, some small rocks	Gravel, Sand Mix, some fines	Sand, uniform, some fines	Sand/ Loam Mix	Silty Loam	Clay
T-Time Min/cm	0 – 1	1 – 5	5 – 15	5 – 15	15 – 25	25 – 50	> 50

Evaluation of Test Pits

Test pit information is required for permit submission. The evaluation involves recording each distinct soil layer (estimated soil type, colour and depth), evidence of groundwater and point of rejection (bedrock). Any soil layer intended for use in the construction of the sewage system as design soil will require laboratory testing to determine design percolation rate. The test pits need to be open for verification at the initial inspection or filled with new pits dug in coordination with the scheduled inspection.

Care must be taken to prevent unauthorized access to open pits to prevent injury or death. The installation of protective fencing should be considered.

Clearance Distances

The tables below identify the minimum horizontal distance clearance between sewage systems and noted topographical features.

The Building Code specifies that all clearance distance requirements are increased two metres for every metre the system is raised above existing grade.

Some municipalities have increased clearance requirements to watercourses. For instance Dryden, Kenora, Red Lake and Sioux Lookout all have a 30 m setback. Always check with your local municipality for the latest clearance requirements.

Clearance Distance Table

CLEARANCE DISTANCES FOR CLASS 1, 2 AND 3 SEWAGE SYSTEMS				
	DRILLED WELLS	DUG WELLS	WATERCOURSE	PROPERTY LINE
Earth Pit Privy	15 m	30 m	15 m	3 m
Privy Vault	10 m	15 m	10 m	3 m
Grey Water System	10 m	15 m	15 m	3 m
Cesspool	30 m	60 m	15 m	3 m

MINIMUM CLEARANCE FOR TANKAGE FOR CLASS 4 OR 5 SYSTEMS	
Structure	1.5 m
Well	15 m
Watercourse	15 m
Property Line	3 m

MINIMUM CLEARANCES FOR DISTRIBUTION PIPING FOR CLASS 4 OR 5 SYSTEMS	
Structure	5 m
Drilled Well	15 m
Dug Well	30 m
Watercourse	15 m
Property Line	3 m

Design Calculations

Treatment Units (Septic Tanks)

The Building Code has requirements for working capacity volume, effluent filters sizing, and dosing chamber delivery volume.

The Building Code classifies both conventional septic tanks and proprietary technology type tanks as treatment units. Proprietary type systems are sized according to the Supplementary Guidelines to the Ontario Building Code or in accordance with a Building Material Evaluation Commission Authorization Report.

Tank Volume

The Building Code requires a minimum working capacity septic tank of 3,600 litres or twice the Daily Design Flow (Q), whichever is greater. For Non-Residential occupancies the tank size is three times Q or 3,600 litres, whichever is greater.

Residential Occupancy	2 times Q = _______________	litres
Non-Residential Occupancy	3 times Q = _______________	litres

Effluent Filter

The Building Code requires an effluent filter be installed on all new tanks installed through the permit process. Effluent filters are also an excellent addition to existing tanks that are already in service.

The septic tank effluent filter shall be accessible. A riser on the septic tank may be necessary to achieve this access, and the access must be secured.

Volume of Dosing Chamber

Dosing is the term used by the Building Code when either a pump or siphon is required. Where a pump or siphon is required, the pump or siphon shall be designed to discharge a dose of at least 75% of the internal volume of the distribution pipe within a time period not exceeding fifteen minutes. This translates to approximately 5 litres per metre of distribution piping within the trench system or filter bed.

Proprietary treatment units often have a dosing chamber volume specified by the *Supplementary Guidelines to the Code* or by the *BMEC Authorization Report*.

Soil Based Treatment Systems

The Percolation Rate (T) and the Flow Rate (Q) are used to calculate the design of all types of soil based systems that are itemized below by the following types:

- Conventional Stone and Pipe
- Chamber and other Proprietary Products
- Filter Bed
- Area Bed and Shallow Buried Trench

Conventional Stone and Pipe Systems

The minimum conventional stone and distribution pipe systems are calculated by using the formula below:

$$L = Q \text{ times } T_D \text{ divided by } 200$$

Where L is the total length of distribution pipe in metres:

Q is the Daily Design Flow Rate in litres; and

T_D is the percolation rate of the Design Soil.

The formula L = Q times T_D divided by 300 ($L=QxT_D/300$) applies where effluent receives additional treatment in accordance with the Building Code.

When fill is imported to construct a sewage system, there will be an increase in lateral (sideways) effluent movement away from the system. To guard against the effluent breaking out to the surface, there must be at least 250 mm of acceptable soil cover for at least 15 metres in the direction that this in-ground movement will take place.

A loading rate calculation, based on the native soil in the sewage system area, must also be applied. The Daily Design Flow Rate (Q) is divided by the appropriate LRM from the table below to obtain the area of the full system. The mantle may need to extend beyond 15 metres to satisfy this loading rate calculation.

Loading Rates for Fill-Based Absorption Trenches and Filter Beds

Column 1	Column 2
Percolation Time (T_N) of Soil, min/cm	Loading Rates-LRM (L/m^2)/day
$1 < T \leq 20$	10
$20 < T \leq 35$	8
$35 < T \leq 50$	6
$T > 50$	4

Chamber and other Trench Replacement Product Type Systems

All of these types of systems have individual authorizations under the Building Materials Evaluation Commission (BMEC). The length of trench is calculated using the formula for conventional stone and pipe systems and then applying a factor to either decrease or increase the length of system. The factors range from one-third less system to 20 percent more system.

Chambers are allowed to replace the stone and pipe on filter beds as noted below at 5.03.01.

Filter Bed Type Systems

There are typically three components to be calculated for a filter bed design:

- Effective area of the filter;
- Extended base area of the filter; and
- Mantle area.

Where the native soil is sandy there may not be an extended area or mantle.

Effective Area

The effective area of a filter bed is the area where the filter sand and the stone with piping are located. The effective area includes the following requirements:

- Effective area = Q/ 75 = __________ m^2 where Q is 3000 litres or less.
- Effective area = Q/50 = ___________ m^2 where Q is over 3000 litres.

The effective area contains 750 mm of filter sand under a continuous layer of stone that contains piping installed on maximum 1.2 metre centres. Where chambers are used in lieu of stones the chambers must be on approximate 0.82 metre centres to keep a maximum of 250 mm between the feet of the chambers as required by the BMEC authorization.

Extended Base Area

In silty or clay type soils, the filter sand must be increased to a larger area to aid in distribution of the effluent.

The extended base area of a filter is comprised of a layer of filter sand a minimum depth of 250 mm. It is calculated using the formula:

$A = Q \times T_N / 850$

Where A is the whole area under the filter and the extended area:

- Q is the Daily Design Flow Rate; and
- T_N is the percolation rate of the native soil up to 50 min/cm.

Mantle Area

The mantle is calculated the same as a trench type system by dividing the Daily Design Flow Rate (Q) by the appropriate Loading Rate, LRM. This is the whole system area and includes the area under the effective and extended areas. The mantle must extend a minimum of 15 metres from the piping or chambers. Extending beyond 15 metres is common with filter beds.

Area Bed Systems and Shallow Buried Trench Type Systems

These systems are used with patented, proprietary technology that makes the effluent cleaner than conventional septic tank effluent. The manufacturer or distributor of the proprietary technology should be consulted for a design that meets the Code. There is a requirement to enter into a sampling and maintenance contract with these systems.

Area beds are sized very similar to filter beds with a continuous stone layer calculated by dividing the daily design flow rate by 75 (up to 3000 litres) or 50 (over 3000 litres). There is usually a 600mm sand underlay beneath the stones and a 250mm mantle that extends a minimum of 15 metres. The overall system size must also satisfy the formula $A=QxT/400$ (m^2).

Shallow Buried Trenches are only allowed to be constructed in native soils. A downslope imported sand mantle is not required. There are 3 formulas for calculating trench length (m) based on the percolation rate of the native (design) soils. Q/75 for T<20, Q/50 for T 20-50 and Q/30 for T>50.

Greywater Systems

The process to determine the size of a greywater system includes flow rate and soils.

1. A determination of the flow rate must be made using fixture units of plumbing in conjunction with the type of supplied water (pressurized or non-pressurized). The maximum flow rate per system is 1000 litres.
2. A calculation is made, using the soils to be used to construct the system, to determine the loading rate of the soil. This loading rate is used with the flow rate to determine the sidewall area that is required.
3. The calculated sidewall area is then used to design a configuration or layout that has the required sidewall area with a minimum of 600 mm of design soil surrounding the configuration or layout.

Flow Rate for Greywater Systems

Pressurized supply water is assessed a Design Flow Rate of 200 litres per fixture unit of plumbing. A supply of non-pressurized water (water tower) is assigned as having a Design Flow Rate of 125 litres per fixture unit of plumbing. Each sink or shower has a count of 1.5 fixture units.

Loading Rate for Greywater Systems

Once the flow rate is determined, the formula $L_R = 400/T$ is used to determine the sidewall area of the system where:

- L_R is the loading rate of the sidewalls of the system in litres per square metre; and
- T is the design percolation time based on the 600 mm of soil surrounding the system.

Sample Design for Greywater Systems

Step 1: Determine Flow Rate Cabin has kitchen sink, bathroom sink and shower with a pressurized water system. Flow rate is 3 x 1.5 = 4.5 fixture units of plumbing multiplied by 200 litres per fixture unit = 900 litres.

Step 2: Calculate Loading Rate of Soils A sand with a T time of 5 min./cm is being imported to the site as the native soil is clay. The formula- $L_R = 400/T$ is used. 400 divided by 5 = 80 litres per square metre.

Step 3: Use Results from Steps 1 & 2 900 litres of flow divided by 80 litres per square metre of loading rate = 11 square metres of sidewall area. A trench type system is proposed for this sample, that has a trench height of 300 mm. The required sidewall area of 11 square metres needs to be divided by both sides of the trench and the bottom
(300 mm + 300 mm + 500 mm = 1100 mm or 1.1 metres) to obtain the total length of trench required. $11m^2/1.1m$ = 10 metres of trench.

Step 4: Use Calculation from Step 3 to Design Layout The 10 metres of trench could be split into three distribution lines 3.3 metres each. They could be put on 1.7 metre centres that would allow the 600 mm of design sand that is required beside each trench. This would translate into an excavation of 4.5 metres by 5.1 metres to allow for the 600 mm of sand on the outside of the distribution lines. There would be the need for 600 mm of sand under the area with a further 300 mm of the clay soil to any limiting feature such as bedrock or the high groundwater table.

Holding Tanks

The Daily Design Flow Rate (Q) is multiplied by seven to determine the minimum volume of tank that is allowed.

Note:

1. The minimum sized tank for any installation is a minimum of 9000 litres.
2. All plumbing must be connected into the system.
3. All tanks shall be alarmed with both an audio and visual alarm.
4. A contract with a licensed hauler must be obtained.
5. Tanks often need to be anchored to prevent tank movement when empty or near empty.

Glossary of Terms

Absorption Trench –Distribution line in a septic system.

Applicable law - Legislation that must be complied with or satisfied prior to the issuance of a permit. Requirements are listed at www.obc.mah.gov.on.ca.

BMEC - Building Materials Evaluation Commission is a commission that approves innovative products for use under the Ontario Building Code.

BNQ – Bureau de normalization du Quebec-an accredited Certification and Standards organization.

Cesspool - A Class 3 Treatment System - an excavation or pit that is lined or partially lined and is used for disposal of effluent from a Class 1 Composting toilet.

Clearance Distance - Required minimum horizontal distance between the two nearest points of property features or structures and sewage treatment elements.

Code - Abbreviation for the Ontario Building Code, specifically referencing Part 8: Sewage Systems.
Design Soil - The fill material used to construct a sewage system.

Effluent - Sanitary sewage that is passed through some treatment.

Effluent filter - A screened device that must be installed in the outlet of all new septic tanks.

Fill - Imported soil that is almost always sand.

Filter Bed - Soil based sewage treatment which distributes liquid through piping installed in a bed of filter media and clean stone which is then covered with fill.

Fixture Unit - A Building Code unit of measurement for plumbing.

Greywater - Wastewater from showers, sinks and bathtubs.

Groundwater Table - The groundwater table is the upper limit of the saturated soil body.

Header Line - A length of pipe to connect the distribution pipes in a leaching bed.

Holding Tank - A tank designed for the total retention of all sewage released into it and needing pumping by a licensed sewage hauler.

Leaching Bed - The soil system constructed as absorption trenches or as a filter bed, located in ground or raised above ground (as required by local conditions), to which effluent from a septic tank or secondary treatment unit is applied for treatment and disposal.

Mantle - A Code requirement, consisting of an extension of soil fill to provide additional treatment. It consists of soil having a Percolation Rate (T_M) of less than 15 min/cm, being at least 250 mm in depth and extending a minimum of 15 metres from the leaching bed in the downward direction of lateral flow.

Ontario Building Code Act - The Ontario Building Code Act and its Regulations (Code) are a set of minimum requirements for the safety of buildings with respect to public health, fire protection, and structural sufficiency, by applying uniform standards.

Percolation Rate (T) - The amount of time in minutes that is needed for water to drop 1 cm during a percolation test, as established by the test or by other means..

Privy –Class 1 - A structure used for the sanitary disposal or storage of human wastes without the aid of water carriage.

Proprietary product – A commercial sewage system component using patented technology that has achieved approval by the BMEC, the Supplementary Guidelines of the Code or BNQ.

Raw Sewage – Raw sewage includes untreated liquid wastes of domestic origin such as toilet wastes, waste from sinks, showers, bathtubs, dishwashers and laundry waste

Septic Tank - A two-compartment watertight container in which sewage is accumulated with the intention of extracting scum, grease, and solids from the liquid prior to transport to a leaching bed.

Site Evaluation - The investigative work required to obtain all site-specific information necessary for sewage system design. This includes design information on the dwelling, soils, drainage and identification of topographical features which impact sewage system design.

Substantial completion – A construction milestone where all components of the sewage treatment system have been installed but not yet backfilled. The installed components are to remain exposed until inspected by the Northwestern Health Unit.

Tertiary Treatment - Technological treatment of wastewater to achieve the requirements of Table 8.6.2.2. of the code.

Topsoil - The layer of fertile, dark-coloured surface soil that supports growth.

References

Ontario Regulation 332/12, Ministry of Municipal Affairs and Housing
www.mah.gov.on.ca

Ontario Regulation 374/81, Ministry of the Environment
www.ene.gov.on.ca

Onsite Wastewater Treatment Systems Manual, EPA/625/R-00/008, February 2002, Environmental Protection Act – U.S. Environmental Protection Agency,
www.epa.gov