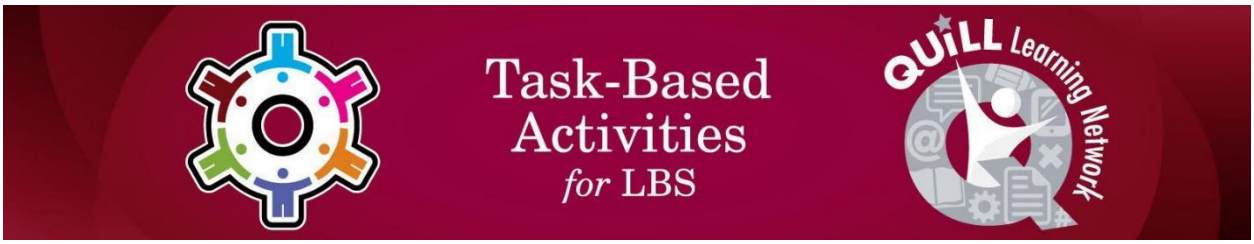

Task Title: Calculating the Size of a Residential Septic System

OALCF Cover Sheet – Learner Copy

Learner Name: _____

Date Started: _____

Date Completed: _____

Successful Completion: Yes ☐ No ☐

Goal Path: Employment ☐ Apprenticeship ☐

Secondary School ☐ Post Secondary ☐ Independence ☐

Task Description: The learner will make calculations for installing septic systems in rural communities using the Ontario Building Code.

Main Competency/Task Group/Level Indicator:

- Find and Use Information/Read continuous text/A1.2
- Find and Use Information/Interpret documents/A2.2
- Communicate Ideas and Information/Complete and create documents/B3.2a
- Understand and Use Numbers/Use measures/C3.3

Materials Required:

- Pen/pencil and paper and/or digital device
- Printer to print chart used in Task 4 (optional)
- Calculator or digital device with calculator function

Learner Information

Plumbers must understand the calculations for sizing a septic system in a residential home, including the daily flow rate, the wastewater absorption rate and the size of the tank needed.

Read “Calculating the Size of a Septic System of a Residential Home”.

Calculating the Size for a Septic System of a Residential Home

How to interpret the code!

The building code can be quite intimidating and confusing. Here is a quick guide to help you with how to design a new system.

All septic systems that are within a single lot and rated to accept a total daily flow rate of <10,000 L must comply with the Ontario Building Code (OBC). The average 3-4 bedroom house is rated at 2,000 L.

All systems must be built according to the OBC regardless of how the residence will be used such as seasonal cottage use or low occupancy numbers. The system must be built to meet the maximum use possibility of the residence in case the property is sold to new owners or changed from seasonal use to a year-round residence.

It is the homeowners' responsibility to contact local governing authorities and acquire the necessary permits associated with the septic system installation or repair.

The following guide has been put together to assist you with meeting *minimum* OBC regulations for residential septic systems. Local governing authorities may have additional by-laws in place requiring additional design requirements.

The two main factors that dictate the size and design of a septic system are the maximum daily flow and soil/site conditions.

<table>
<tr><td colspan="5">Maximum Daily Flow</td></tr>
<tr><td colspan="2">50L per Fixture Unit over 20</td><td>Bedrooms over 5</td><td colspan="2">Each 10 sq M of Living Space over 200 sq M</td></tr>
<tr><td>Full Bathroom
(Toilet, shower, sink)</td><td>6</td><td rowspan="3">500L per additional bedroom</td><td rowspan="3">200 sq M to 400 sq M</td><td rowspan="3">100L for each 10 sq M over 200 (rounded up)</td></tr>
<tr><td>2 pc Bathroom
(toilet, sink)</td><td>5</td></tr>
<tr><td>Shower
(stand alone)</td><td>1.5</td></tr>
<tr><td>Floor Drain
(basement)</td><td>2</td><td rowspan="7"></td><td rowspan="4">400 sq M to 600 sq M</td><td rowspan="4">75L/10 sq M (rounded up)</td></tr>
<tr><td>Sink
(not included in bathrooms)</td><td>1.5</td></tr>
<tr><td>Garburator</td><td>3</td></tr>
<tr><td>Dishwasher</td><td>1.5 (if connected to a sink)</td></tr>
<tr><td>Laundry Tub</td><td>1.5</td><td rowspan="3">600 sq M and up</td><td rowspan="3">50L/10 sq M (rounded up)</td></tr>
<tr><td>Clothes washer</td><td>1.5</td></tr>
</table>

Step 1: Calculate the maximum daily flow, as per the OBC calculation.

All daily flow calculations start with the number of bedrooms. Most people assume it is based on the number of bathrooms or current occupants, but that is not the case.

The OBC assumes that for every bedroom, 2 people could be living in the residence. Average daily use per person is approximately 275 L, and therefore, the maximum daily flow could be around 500-600 L / bedroom.

OBC Bedroom Rate:

1 Bedroom – 750 L
2 Bedrooms – 1100 L
3 Bedrooms – 1600 L
4 Bedrooms – 2000 L
5 Bedrooms – 2500 L

(If you are building a home with more than 5 bedrooms, consult a professional)

The OBC refers to the Maximum Daily Flow as "Q" for all calculations.

Calculate the number of fixtures (bathrooms, sinks, etc.) and total living space to determine additional L/day to add to base bedroom rate. The greater of these calculations will need to be added, not both.

Fixtures:

Each fixture has a pre-determined hydraulic load which must be used to calculate daily flow.

For example: a toilet with flush tank has a hydraulic load of 6, a laundry tub has a load of 1.5, a washing machine has a load of 1.5 and a sink has a load of 1.5. Each of these is multiplied by the hydraulic load.

2 toilets = 2 x 6 = 12
1 laundry tub = 1 x 1.5 = 1.5
1 washing machine = 1 x 1.5 = 1.5
1 sink = 1 x 1.5 = 1.5

Add all of the totals to determine the fixture count.
12 + 1.5 + 1.5 + 1.5 = 16.5
16.5 is the total fixture count

If the total fixture count exceeds 20, then 50 L per additional fixture will need to be added to the bedroom base rate (round up for each half).

For example, if your total is 23, then you may have to add 150 L to the bedroom base rate.

Living area (m2) (all living space, excluding basement)

To convert from sq ft to m2 multiply by .092903

If the house living space exceeds the included limit of 200 m2, additional flow will be added to the base rate using the following calculation:

For each 10m2 of living space over 200 m2 to a max of 400 m2, calculate 100 L per 10m2. (rounded up)

(if your house is greater than 400 m2, consult a professional)

Once the living space and fixture count flow rates have been calculated, whichever is greater must be added to the base bedroom rate.

For example:

Calculate the maximum daily flow rate for a 4-bedroom house with 3 full bathrooms, kitchen sink, clothes washer, laundry tub, dishwasher and total living space of 224 m^2.

Bedroom Rate = 2000 L (4 bedrooms).

The total fixture units for the house will be 23.5

Fixture units 20 + 3.5 = 23.5

add 50L for each number above 20 3.5 x 50 = 175 (round up) = 200L

The total Living space = 224m2

Living space 200 m2 + 24m2 = 224m2

add 100L for each 10m2 above 200m2

24 m2 x 100 = 2.4 x 100 = 240 (round up) = 300L

The largest daily flow for the living space and fixture count is 300 L which is added to the 2000 L

The Maximum Daily Flow (Q) will be 2300 L.

Step 2: Soil/Site Conditions

The other factor to be calculated is the rate at which the treated wastewater will be absorbed into the soil.

This is called a "T" time.

"T" time is equal to the number of minutes it takes for the water level to drop per cm in a water filled hole in the receiving soil.

Sandy soil has a common T time of <10 (meaning it took less than 10 minutes for the water level to drop 1 cm in the water filled hole).

Sandy loam soil T time can be 20 or more because the smaller soil particles may slow the rate of absorption.

Clay (worst soil) the T time is generally over 50 because clay particles are so fine and tightly packed.

The most common method of identifying the percolation rate is to send a soil sample to a lab for analysis. The cost associated with a soil analysis ranges from $200-$300 for the test, plus the time and labour to dig the hole and deliver the sample.

Another method is to have a professional perform a percolation test on-site. The cost will be comparable to the lab analysis, but results will be known sooner and be much more accurate.

Septic System and Tank Sizing

Daily Flow and "T" time are used to calculate the tank size

The septic tank must be twice* the daily flow (Q), but no less than 3600 L. The tank must also be dual chamber with 2/3 of the volume in the first compartment. The tank size is to provide 24hr retention time of sewage to allow for proper separation of solids.

**If a garburator is installed, the volume must be three times the daily flow.*

Daily Flow = 2300L

Tank Size = 2300 x 2 = 4600

The Tank Size must be 4600L

Each type of system then has a different equation to be used to figure out the size.

For example:

Conventional trench: Total Trench Length = (Q X T time) / 200

Above house example would be 2300 X 10 (sandy soil) = 23000 / 200 = 115 Meters of total trench length

or

Filter Bed: Total area of Base = ((Q) x "T" time)/850

2300 x 10 (sandy soil) = 23000/850 = 27.06 sq M

A filter bed not only needs to meet the basic equation, there must also be enough surface area for the waste water to be absorbed at a rate of 4 L per sq. M, so for 2300L a surface area of 575 sq.M. is required.

If the T time is 50 or greater, conventional trenches cannot be installed. A raised bed or "tertiary" unit will need to be installed instead.

adapted from http://ontarioseptictank.ca/

Work Sheet

Task 1: What is it the responsibility of the homeowner to do before they install or repair a septic system?

Answer:

Task 2: Why is the number of bedrooms used in the calculation of the daily flow rate?

Answer:

Task 3: List the two main factors that determine the size and design of a Septic System?

Answer:

Task 4: What is generally the "T" time for clay?

Answer:

Task 5: There are 3 residential homes to be built. Use the following information to determine the size of the Septic System required. Use the document "Calculating the Daily Flow for a Septic System of a Residential Home" and use the chart provided to complete the calculations..

a) House 1 • 3 bedrooms • 2 full bathrooms • 1 Clothes washer (Washing Machine) • 1 Laundry tub • 1 Floor Drain • 2400 sq ft. livable space • Sandy soil with an absorption rate of 12	b) House 2 • 2 Bedrooms • 1 full bathroom • 1 Dishwasher • 1 Clothes washer • 1 Laundry Tub • 1 Floor drain • 1150 sq ft. livable space • Loamy soil with an absorption rate of 22	c) House 3 • 4 bedrooms • 3 full bathrooms • 1 1/2 bathroom • 1 dishwasher • 1 Clothes washer • 1 laundry tub • 1 additional sink • 2 floor drains • 3000 sq ft. livable space • Sandy soil with an absorption rate of 10

DAILY FLOW CHART – House # _____			
Fixture or Device	**Number of fixtures within residences**	**Hydraulic Load, Fixture Units**	**Totals** **(Number of fixtures within Residence x Hydraulic Load)**
Bathroom group (Toilet, sink, tub)			
Toilet with flush tank		6	
Toilet with direct flush valve		8	
1/2 Bathroom		5	
Kitchen Sink		1.5	
Garburator		3	
Clothes Washer		1.5	
Dishwasher		1	
Laundry Tub		1.5	
Additional Tub		2	
Additional Shower (Stand Alone)		2	
Additional Sink		1.5	
Additional Toilet		4	
Floor Drain		2	
Total Daily Flow			

DAILY FLOW CHART – House # _____			
Fixture or Device	**Number of fixtures within residences**	**Hydraulic Load, Fixture Units**	**Totals** **(Number of fixtures within Residence x Hydraulic Load)**
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Kitchen Sink		1.5	
Garburator		3	
Clothes Washer		1.5	
Dishwasher		1	
Laundry Tub		1.5	
Additional Tub		2	
Additional Shower (Stand Alone)		2	
Additional Sink		1.5	
Additional Toilet		4	
Floor Drain		2	
Total Daily Flow			

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Additional Sink		1.5	
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Floor Drain		2	
Total Daily Flow			