

School Water Audit

Activity Time: This duration of this activity can range from a few hours to several weeks. It would take your students approximately 4 to 6 hours for a classroom audit and up to two weeks for the school-wide audit (based on one to two hours per day).

Objectives:

In this activity, students are introduced to *water efficiency* and the importance of conserving natural resources.

Introduction:

Every time you turn on the tap, flush the toilet, or water the lawn, you are using water provided by the Region of Peel. Lake Ontario is the source of water for the vast majority of Peel's more than one million residents. In accordance with provincial regulations, this water is treated at Peel's two water treatment plants located on the shores of Lake Ontario. This is a mechanical and chemical process that ensures the quality of our drinking water. This system provides limited quantities of treated water over a given time period. Each day the average Peel resident uses 289L of water, being amongst the highest users in the world.

So, where does all this water go? What do Canadians do with all that water per day? We only drink 1% of all the water we use. The list below shows the ways in which we use all this water at home.

- Flushing the toilet - 28%
- Washing our clothes -23%
- Showering and bathing - 19%
- Sinks -15%
- Leaks -10%
- Baths 3%
- Dishwasher 2%

Water Smart Peel (www.watersmartpeel.ca) is the Region of Peel's Water Efficiency program. The goals of Water Smart Peel are:

- To provide information on water use to residents and businesses
- To encourage water efficient practices through incentive
- To reduce by 10% individual daily water consumption, by 2015.

Through a variety of experiments, observations, and mathematical calculations, students will determine the water use in their classroom and/or school. They will also discuss possible ways for reducing water use and provide recommendations for water efficiency measures at school and home.

They can also look at water beyond their needs to those needs of other life forms in the environment. A discussion could include the reduced water levels in the Great Lakes. Are we taking more than we need and what can we do about it?

Materials:

- Measuring cup
- Timer
- Paper
- Pencils
- Drawing paper

Procedure:

PREPARATION

1. Draw a plan (map) of the school. Note all the features in the school including classrooms, gym, library, bathrooms etc. The map is important, even for the classroom audit, as all students and teachers use water fountains and washrooms.
2. Mark all the areas in the school that use water: fountains, in-classroom sinks, teachers' lunch rooms, showers, toilets, urinals, custodial areas, etc.
3. Note how many students are in the class. How many are boys and how many are girls? If you are going to continue to do an entire school audit you must find out how many students go the school, and the gender make up. How many teachers and support staff are there and what's their gender? This is important to know as females and males use water differently.
4. How old is the school and has it ever been renovated (new fixtures, new toilets). This fact can make a big difference in your calculations. Ask your principal or school custodian how old the school is and if the washrooms, sinks etc. have ever been renovated (replaced, updated, retro-fitted).

THE AUDIT

Students will have to use their powers of observation to investigate and prevent the wasteful use of water. Divide students into groups and assign each group to an area of the school to investigate. **Note:** You must investigate washrooms and water fountains even for the classroom audit.

1. Faucets - this a two part observation
 - i Observe your classroom faucet. Check to see if it is leaking. If so, how significant is the leak? Is it a small drip (once every 10 seconds), large drip (constantly dripping), or a stream of water? Use the table provided to calculate leaks. If there are no leaks, record that too. Calculate water usage at this location.

If you are doing the school-wide audit, visit every faucet in the school to observe if there is leaking. Use your school plan to ensure that you observe all the school's faucets (washrooms, custodian's sink).

- ii Measure the time required by each student to wash their hands and record the time beside each student's name on a list. Now ask each student

how many times a day they wash their hands (think each time you go the bathroom, before or after your snack, at lunch, etc.).

Use the Faucet Calculation sheet to determine the total volume of water used per day for hand washing by all the students in the class (or school).

2. Water fountain observations. How many are there? Do they run constantly or only when people drink? Use your stop watch and measuring cup to determine the volume of water a fountain uses per minute. Use the Water Fountain Calculation sheet to record these observations.

Now ask everyone in the class how often they use the fountain. How long does it take them to get a drink? Do they fill water bottles from it? Maybe a little observation at recess will tell you how long each student drinks from the fountain. Measure and record students' drinking times.

3. Washroom duty. Use the Toilet Calculation form for these observations.
 - i. How many toilets are there in each washroom? (Don't forget staff washrooms).
 - ii. How many urinals are in the boys washroom? How often do the urinals flush? Observe the time between flushing and record on the Urinal Calculation sheet.
 - iii. Find out how many times in a day each person in the class uses the toilet/urinal. Include recesses and lunch breaks. Try to be accurate.
 - iv. Use the urinal and toilet flushing calculation sheets to determine the volumes of water used.

4. Teachers' Lunchroom (for the school audit only)
Observe the sink, washroom facilities, and whether there is a dishwasher. How often does the dishwasher run? How many teachers use the staff lunch room? These are all important facts in our investigation.

5. Final Calculations

Compile the calculations from steps 1-4 above to find the total water use in your classroom. Use the "Total Water Use" sheet, which also suits calculations for the entire school.

Debrief:

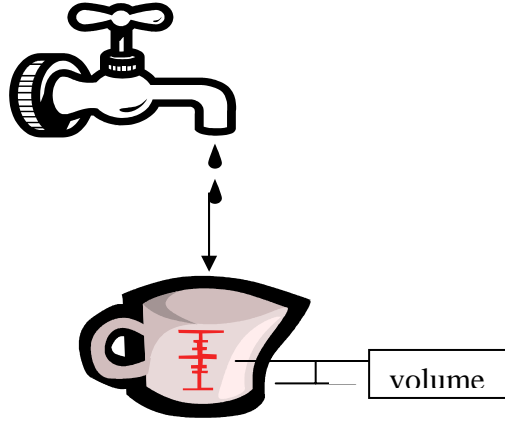
Come up with ways to save water in your school, e.g. fix leaking faucets, turn off fountains that run continually, replace old water fixtures. Visit www.watersmartpeel.ca for water saving tips to share with the class.

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Faucet Calculation Form

STEP 1



Use a measuring cup and a stop watch to observe your findings. Flow the faucet for 10 seconds. Measure the amount of water in the cup.

Flow Rate is the volume of water in 10 seconds.

Volume _____ divided by 10 = Flow Rate per Second i.e. 10 millilitres per second

STEP 2

Record how long it takes each of you to wash your hands. Take an average. Use your stop watch and time each person washing their hands. Now add up all the times and divide by the number of students. This is your average hand washing time in seconds.

On average, how long does the class run the faucet while washing hands?

In _____seconds

On average how many times does each of you wash your hands a day? _____
(number of times you wash). Count the number of times each student washes their hands and total them all. Divide the total by the number of students. This will give you the AVERAGE time the students in your class take to wash their hands. Record this in seconds

STEP 5

(You may skip this step if you are doing a classroom audit and find no leaks). Calculate how much water is lost by leaks and drips. Note: in order to discover if any of the school's faucets are leaking you need to go to each classroom and bathroom to observe. Obtain permission from the teacher before entering any classroom.

Observations:

- Slow drip
- Fast drip
- Steady stream of water

Using the table provided, measure and record how many faucets in the school are leaking. Use a measuring cup and a stop watch to do these measurements. (Allow the faucet to drip into the measuring cup for 1 minute. Measure the amount of water in the cup).

Now calculate total leakage per minute by adding up each volume of water for the leaking faucets. Example faucet 1 is leaking 100ml per minute, faucet 2 is leaking 200ml per minute the total leakage is 300ml per minute

Record here the total volume of water lost to leaks per minute _____ (*Leakage*)

Multiply this figure by 60 minutes (to give the volume per hour) and 24 hours (in a day) to give you the water leakage per day.

Leaks x 60 Minutes x 24 hours = water loss per day

_____ Leak volume (per minute) x 60 mins x 24 hrs = _____ ml/day

Convert this volume to litres. (100ml =1 Litre) = _____ Litres

Total water use at faucets is represented by "F" (total volume at faucets per second)

F = Hand washing + water loss per day

F = hand washing _____ + water loss per day _____

F = _____ L (total volume in litres)

= Total water use per day at the faucets _____

Urinal Calculation Form

STEP 1: For continual flushing urinals (ones that flush themselves) skip to Step 4. For urinals requiring flushing or ones that flush only after use follow steps 1 to 3.

Vf = Flush volume based on school age

Older than 20 years - 19 litres per flush

10 to 20 years (but built before 1996) -12 Litres per flush

Less than 10 years (built after 1996) - 3.8 litres

STEP 2: Record how many times on average boys use the urinal. Keep track of how often boys use the washroom. Divide this number by two as males often just use urinals. Now total up all the urinal usage for the boys and divide by the number of boys in the classroom to obtain average urinal usage.

Uu (urinal usage). Total usage divided by number of boys=_____ Uu

STEP 3: Use the volume of water (Vf) (assumed from Step 1) per flush and multiply it by the average number of times (Uu) boys in the class used the urinal!

Total water for urinal use for the classroom = Vf x Uu = _____ L/day

Total Water Use at School Urinals

Next find out the Pm (Male population) = _____ (number of males).

Then, Total Water for urinals = _____ Pm x _____ Uu x _____ Vf

= _____ L/day

STEP 4: For Continuous Flushing urinals, the amount is calculated as follows.

1. Observe how often the urinals flush, i.e. every 5, 10, 15 minutes etc. Use the form provided to record the observations

2. Note the number of urinals in each washroom

_____ volume of water per urinal x amount per flush _____ L

x _____ number of urinals = _____ L/day

Toilet Calculation Form



Flush Volume = Vf

STEP 1: Assume a toilet flush volume is based on school age (remember to find out how old your school is and if the toilets have ever been replaced):

Older than 20 years - 13 Litre

Less than 10 years (built after 1996) 6 Litres

STEP 2: Record how many times on average you use the toilets:

Girls

Boys

(Note: For Boys divide toilet usage number in two as they have urinals so use the toilet less)

Add up all the times toilet was used and divide by # of students in the classroom to get average usage. $AU = \text{_____} L$ (AU = Average usage).

STEP 3: Find out how many students are in the class. Now multiply the flush volume of water (step 1) by average # of times students use the toilet (step 2) by number of students in the class:

Toilet water volume for the class = $V_f \times AU \times \text{number of students in class}$

= $\text{_____} L \times \text{_____} Au \times \text{_____}$

= Toilet water volume $\text{_____} L$ per day

STEP 4: Next calculate the volume of water used for flushing toilets for the entire school: (skip this step if you are working on a classroom audit only)

P = School population = _____ (# of students).

Total Water Use for School Toilets:

_____ school population \times _____ average usage \times V_f (flush volume) $\text{_____} L$

= $\text{_____} L/\text{day}$

Water Fountain Calculation Form



$$\text{Flow Rate} = \frac{\text{Volume (ml)}}{\text{Time (sec)}}$$

STEP 1: Use a measuring cup and timer the same way you calculated water usage for the faucets. Time for 10 seconds and measure the volume. Divide by 10 to convert to millilitre per second - this is Flow Rate

Volume in 10 seconds = _____ (ml)

Flow rate = _____ ml/sec (divide by 10 to get amount per second)

(Use Faucet Calculation form to time fountains)

Do the Fountains run continuously? If the fountains never shut off (this is an important observation) then skip to Step 6.

STEP 2: How long do you run the fountain when you take a drink? _____seconds (T).

This can be calculated by timing children at the fountain during recess or lunch period, or by asking students to time each other drinking. Add the time together and divide by the number of students observed to reach an average.

STEP 3: On average how many times does a student use the fountain a day?

Record how many times on average students use the water fountain (divide the number of times used in total by the number of students to obtain an average use). This is U (for usage)

STEP 4: Find out how many students and teachers go to the school (or just use your number of students in your class if you are just doing a classroom audit).

P = the population of your school/class (is number of students and staff) _____.

STEP 5: Total water use at fountains:

$$(T_F) = \text{Flow rate}_{\text{flow/sec}} \times T_{\text{ime in seconds}} \times U_{\text{usage}} \times P_{\text{population}}$$

$$= \text{_____ ml} \times \text{_____ sec} \times \text{_____} \times \text{_____} \times \text{_____}$$

$$= \text{_____ ml (millilitres used a drinking fountains)}$$

Convert from millilitres (ml) to litres (L):

$$\text{_____ ml} \times \frac{1\text{L}}{1000 \text{ ml}} = \text{_____ L (V)}$$

1000 ml = 1 L

STEP 6: This step is only for continuous flow fountains. Total water use per day:

Flow rate x 60 seconds in a minute x 60 minutes in 1 hour x 24 hours

$$= \text{_____ L total volume used at fountains per day in Litres}$$

Total Water Use

Based on (the number of) _____ people in the Class (or entire School)
 _____ females and _____ males

Activity	Litres of Water Used Daily L/d	Litres of Water Used Weekly (times 5 days)	Litres of Water Used Yearly (times 40 weeks)	Cost (optional) Water and sewer charges are \$.00101122 per L
Toilets: Average flush volume _____ L per flush				
Urinals: ____ L flushed every _____ mins				
Faucets: _____ L/min				
Fountains: _____ L/min (Running fountains will be: L/min x 60 min x 24 hrs x # of fountains).				
Dishwashers: 32.7 (average) L/cycle/dishwasher (Average)				
Total Water Used Per Year (ADD all the yearly columns to come up with the total)				