

Sept 1, 2025

Today, I have finalized the idea of what to do for my project this year. I plan to use my greywater equation and adapt it to Calgary, changing the “R” variable to be interchangeable based on many factors. Greywater is produced indoors, so I may need to cover different areas where it is produced (shower, bathroom sink, non-toxic water usage, dry flushing, laundry). I will develop a testing tool out of my equation to differentiate households based on the amount of greywater they produce. Using the categories “low, average, and high” producers may help households see their greywater reuse potential.

This project doesn't involve experiments so instead, I'll use trusted city reports and published studies. Experts also come into this equation, some data is inaccessible to the public, so I'll look into those with jobs in large scale greywater reuse, water quality, water pipelining, and from locations such as TELUS Spark and the Bonnybrook wastewater plant.

Sept 7, 2025

Today, I have drafted an expert email that I can send to the following:

- Alain Pietroniro (Hydrologist, expert in water reuse pipelining at UFC)
- Wendy Huang (Hydrologist and researcher at UFC)
- Bonnybrook wastewater plant (Accessible by calling 311)
- Andrew Tay (Expert on water treatment, chair member on reuse committee, UFC prof.)

It should be finalized around Tuesday. The data I need is based on Calgary greywater/wastewater production/reuse in the past 5 years, city pipeline structure and infrastructure (homes, communities, location), and any water recycling initiatives going on within Calgary. I will then sort this data and apply it to the background research/statistics area.

“Hello _____

My name is Arya Shetye, a Grade 9 student at Louis Riel School in Calgary, working on a science project that studies greywater usage in homes. I have been an avid participant at the Calgary Youth Science Fair with strong interest in innovative resource management solutions.

For the first phase of my project, I have developed an equation to estimate household greywater production using Canadian water usage data. Sources like showers and bathroom sinks are easier to monitor, making greywater management practical. Also, recycling greywater offers significant conservation benefits.

Next steps:

- Collect Calgary water use data by dwelling type and season
- Apply my equation to this data

I am seeking data on Calgary's potable water usage over the past five years, ideally broken down by home type (detached, townhouse, apartment) and by season. I am also interested in information about the city's water pipeline infrastructure and any water recycling initiatives. Any relevant resources or insights would be greatly appreciated.

Regards,

Arya Shetye"

Sept 18, 2025

Today, I have emailed the experts. Looking at large scale greywater reuse is more complex than researching at home conservation methods as the data is scarce, and can only be found in studies. I have, though, found a very helpful case study on greywater reuse in Ontario. In 22 homes, identical greywater reuse systems were installed to monitor water savings. By monitoring the water balance, water quality, energy consumption, durability, maintenance requirements, and installation process, the conclusion drawn showed that each system saved roughly 41 liters of water per day. The author has taken into consideration how the cost of the system and maintaining it will require government subsidization, however implementing greywater reuse puts less strain on the central demand for water. Over the next few weeks, I hope to see how some of the tables can contribute to my understanding of shaping the "R" variable.

Sept 29, 2025

Recently, Mr. Pietroniro (expert in hydrology and engineering water-saving mechanisms @ UFC) has responded to my email. He explains that a student is reviewing water data from the City of Calgary and will get back to me soon.

With the research, I have found the UFC online research library. Some of the data sets I will look at and review in the next week are from EPCOR (Edmonton), the main water utility company. The sets include historical water consumption by class, water usage per neighborhoods/blocks, and multiple years of statistics in megalitres.

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Annual Average Monthly Residential Water Consumption by Neighbourhood (Multi-Year) Export

Externally Sourced Datasets More Info

Year	Neighbourhood ID	Neighbourhood Name	Summer Average	Winter Average	Annual Average	Geometry
2019	5170	EMPIRE PARK	10-20	10-20	10-20	MULTIPOLYGON (((-113.498967535...
2019	5220	GREENFIELD	10-20	10-20	10-20	MULTIPOLYGON (((-113.534844062...
2019	4020	ALDERGROVE	10-20	10-20	10-20	MULTIPOLYGON (((-113.652089099...
2019	5060	BLUE GULL	10-20	10-20	10-20	MULTIPOLYGON (((-113.531774039...
2019	4500	SHERWOOD	10-20	10-20	10-20	MULTIPOLYGON (((-113.585042479...
2019	2010	ABBOTTSFIELD	10-20	10-20	10-20	MULTIPOLYGON (((-113.387633619...
2019	3460	ALBANY	10-20	10-20	10-20	MULTIPOLYGON (((-113.560245079...
2019	2430	KIRKNESS	10-20	10-20	10-20	MULTIPOLYGON (((-113.381310210...
2019	6010	ARBYLL	10-20	10-20	10-20	MULTIPOLYGON (((-113.466013786...
2019	2130	CASSELMAN	10-20	10-20	10-20	MULTIPOLYGON (((-113.430665059...
2019	5010	ALLENDALE	10-20	10-20	10-20	MULTIPOLYGON (((-113.502597727...
2019	5020	ASPEN GARDENS	10-20	10-20	10-20	MULTIPOLYGON (((-113.541642189...
2019	1010	ALBERTA AVENUE	10-20	10-20	10-20	MULTIPOLYGON (((-113.492257337...

Filters (1) Clear All
Year: equals 2019

< Previous Next > Showing Rows 1 to 13 out of 267

(table found on UFC online library, courtesy of EPCOR)

October 4, 2025

Reviewing the tables and further reading the Ontario water article has sparked some questions.

- Why has the water usage per household in winter and summer stayed the same for all neighborhoods in Edmonton?
- Will the data from Calgary yield similar results?
- What caused the neighborhoods of Glenridge Ravine, Paisley, and Oliver to differ in winter water consumption (avg. was 0-10 m³/month)?

October 10, 2025

Still waiting on a response from Anahita. The Craig Madeline Jean case study has proven useful and is similar to my project. They have also categorized the households

as either low, neutral, or high greywater producers.

Table 12: Categorization of each field study house as a high, medium or low greywater producer and consumer.

Producer / Consumer	House #
High / High	1, 8
High / Medium	7, 9, 14, 16
High / Low	2, 3, 5, 6, 11, 15, 19, 20, 22
Medium / High	13
Medium / Medium	4, 18
Medium / Low	12, 21
Low / High	-
Low / Medium	10
Low / Low	-

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Their definition of “greywater consumer”, however, is how much treated greywater the household uses. Although I am not entirely sure how the installed system works, I hope to use the information as I research different types of greywater reuse applications.

Next week, I will look in detail into greywater filtration systems.

October 17, 2025

Unfortunately, the expert I contacted has not reached back, so I am on the lookout for another. A lot of the information that I was previously looking for is either unavailable, unmeasured, or not able to be shared with the public. Wastewater treatment plants do not, apparently, track the volume of water they take in daily.

I have found that articles from greywater reuse companies around the world give the most detailed information on reuse systems. In part with Google Scholar/ Consensus, I did a rapid search before reading each link.

Today, I looked at bucketing and diversion systems. Bucketing is a physical method of water recollection, you just take a bucket and collect greywater for reuse. It’s quite interesting to see how DIY’s have used recollected greywater to grow their plant bed.

Diversion systems use a switch to redirect greywater to a filtration/surge tank from what I understand, and it is “diverted” to be reused (usually for irrigation/ toilet flushing).

Going deeper into the Craig Madeline Jean article, it looks like the reuse system installed in the 22 homes is a combination of a diverter system and a dual plumbing system.

Next week, I will look at larger greywater filtration systems, including the dual plumbing system seen in many of my readings today!

October 25, 2025

Today, I have looked deeper into large scale greywater reuse systems. These installments are more of investments, really, and should be suitable for high-greywater producing households.

Firstly, the BioBarrier, listed as a membrane-filter. The company, BioMicrobics, is located in the United States. I called them today to ask about the BioBarrier, and they redirected me to their sister company in Edmonton called Movewater.

The other greywater reuse system I observed today is called the dual plumbing system. Simply put, the greywater from source (shower, sink, laundry) is redirected into a 10-50 liter filtration barrel and immediately treated and sent to the reuse location (irrigation/toilet). It's similar to the diverter, however, the dual pipes are installed next to the sewage/ potable water pipe, so the reuse is automatic.

Next week, I will draft an email to Kevin and Mike from Movewater. I will also look at how the different types of reuse systems correlate to the household type (low, average, high)

November 9, 2025

Today, I drafted an email to Movewater, the Edmonton-based greywater reuse company connected to BioMicrobics. Here's what I've got:

"Dear ____,

I hope you are having a great week. My name is Arya Shetye, a grade 9 student in Calgary conducting a research project on greywater reuse. Prior to this email, I contacted BioMicrobics, and they directed me to your email line.

I aim to advance my equation tailored to finding a household's average daily greywater production, and am requesting data related to your greywater reuse system, the BioBarrier.

Please answer the following:

1. On average (per day), how many liters of greywater will the BioBarrier filter and reuse?
2. Would the BioBarrier work indoors even in cold weather ranging from -5 to -35°C?

3. On average, how many liters of water filtered through the system is diverted into the sewer main pipe?

If you are unable to answer these questions, please redirect me to a water reuse expert you know!

Sincerely,

Arya Shetye”

I asked these specific questions so I can add more information about the BioBarrier in cold climates to the greywater reuse systems portion of my write up. Calling greywater reuse companies such as MoveWater benefits my project as they can provide accurate numbers related to how many liters of greywater are filtered on average and the demographics of people that commonly purchase the systems. I infer that the BioBarrier would be suitable for high-producing households with an R variable above my average (>0.65).

I sent out a similar email to another greywater reuse company called Greyter. Their home filtration system is quite large, redirecting almost all greywater back in the home.



This company is based in Burlington, Ontario. A trend I've noticed after researching greywater reuse systems is that a lot of them are located either in Canada or the northern parts of the USA. I believe the greywater reuse systems will be suitable for cold weather if they are manufactured for and in Canada, but I'll need to clarify that after getting a reply!

Next week, I will work more on what influences each household type (low, average, or high greywater producer). This will tie in what greywater reuse method is suitable for different people's lifestyles and how they can calculate their G value.

November 16, 2025

Different types of appliances, their flow rates, household populations, and how frequently an appliance is used impacts variable R, the ratio of greywater production to potable water consumption. High greywater producing households should have either higher-flow appliances, a large population, and frequent appliance usage.

I like to reference the Craig Madeline Jean case study as some of its charts are similar to my project, making it easier to outline each category.

Today, I made charts that show flow rates (low-mid-high). I used statistics from both Calgary's and Edmonton's water conservation guides. In the chart, bathroom sinks, showers, and laundry machines are listed as the appliances that produce greywater. Each one detailed how many L/min the average high flow/low flow appliance consumed, so I averaged the numbers to come up with a final chart.

Appliance / Fixture	Low-Flow / Efficient	Medium / Standard	High-Flow / Inefficient or Old Model	Measurement Unit
Bathroom Sink Faucet	3-5 L/min	6-8 L/min	9-12 L/min	L/min
Kitchen Sink Faucet	5-7 L/min	8-10 L/min	11-15 L/min	L/min
Showerhead	6-9 L/min	10-12 L/min	13-18 L/min	L/min
Bathtub (filling tap)	10-15 L/min	15-20 L/min	20-25 L/min	L/min
Dishwasher	6-10 L per cycle (high efficiency)	11-15 L per cycle	16-25 L per cycle	L/cycle
Clothes Washer (Front load)	40-60 L per load	—	—	L/load
Clothes Washer (Top load)	—	80-100 L per load	120-150 L per load	L/load
Automatic Washing Basin / Sensor Tap	1.5-3 L/min	4-5 L/min	—	L/min

A lot of new, efficient models of either sinks, showers, or laundry machines come from Whirlpool.

November 22, 2025

Thankfully, Greyter has reached back to me and explained that their home reuse system should recycle most of the incoming greywater, and that depends on how much there is. For example, if 60L of greywater was being directed to the filtration tank from the shower, 50L would be reused while the remaining 10L would be sent down the connected sewage pipeline.

I am beginning to finalize what the testing tool should look like as a simple questionnaire.

Roughly, these will be the sections:

- 1) How many people live in your household?
- 2) How many bathrooms are in your house?
- 3) What water-spending appliances do you have?
- 4) Are they low/high flow?
- 5) Are they outdated models (pre 2010-2000s)?
- 6) Do you consciously try to conserve water?

Using the greywater equation and reference charts + examples, I aim to finish the testing tool by mid-December.

December 7, 2025

I have created a few charts to paste onto the testing tool area of my research document.

Category	Suggested Range (L/person/day)	Possible Description
Low producer	< 50	Low frequency of washing, short showers, low flow fixtures
Medium producer	50-100	Moderate frequency and combination of high & low flow devices
High producer	> 100	Regular long showers, frequent laundry, high flow appliances

This table can be used as a reference at the beginning of the questionnaire, describing the relation between potable water consumption (L) and their fitting descriptions.

Greywater Source	Estimated Daily Volume (L)	Notes (e.g., appliance type, no. of users)
Showers/Baths		
Bathroom sinks		
Laundry		
Kitchen sinks (non-greasy water only)		
Other sources		

This table relies on the user to input the information about how roughly many liters of greywater they produce and additional information that impacts the final R variable.

Right now, I am almost done with the write-up of my project. After compiling the background research, equation, and testing tool, I will start to draw conclusions and work on my extension.

Next time, I want to start revising and verifying the technical language in my write-up to make sure I have the correct terminology.

December 26, 2025

After a longer than expected break, I have started to flag down some terms used in the write-up. I noticed that a lot of the time I was confusing “effluent” with “drainage water”. Effluent is the treated wastewater that is reclaimed into rivers, while drainage water is essentially the water sent to the sewage main.

Some other terms I corrected today included:

- Wastewater -> Greywater
- Recycled -> Reused (Recycling water would send it back to the plants to be treated, while reusing greywater filters it first-hand)

After revising my write-up, I began to think more on real-world applications such as weather-related crises, floods, and the 2024 feeder main break in Calgary. Next week, I will look into these topics and decide which ones to add to the applications sections of my write up.

January 2, 2026

A few days ago on December 30, the Bearspaw feeder main burst again, and I am currently facing stage 4 water restrictions in my community. For the communities of Bowness/ Montgomery, a temporary boil-water advisory has been issued.

This event has led me to think more about greywater reuse on a large scale. If Calgarians were reusing greywater prior to the break, there would be less strain on the wastewater treatment plants and less of a potable water demand. I infer that if our city had already begun to reuse greywater, then we would not have to worry about potable water consumption as much because the filtered/ reused greywater would be used for household purposes that do not involve human consumption (toilet flushing, irrigation, etc). Interestingly, I received an email from my workplace, the YMCA. They explain that anyone using the facilities will need to limit showers to 3 minutes, however, most of the water is being reused with their “LEED Gold” certified systems.

Today, I have researched more on the feeder main break and made connections between greywater reuse and conserving potable water. Next time, I may send an email to the YMCA and ask about their reuse systems.

January 4, 2026

Today, I drafted and sent an email to the YMCA. I want to know about their reuse systems, as most of the reclaimed water is greywater from the locker room showers. This is a great example I can add to the write-up regarding water reuse that already exists in Calgary/ Alberta! Here's what the email looks like:

"To the YMCA,

I hope you are doing well! My name is Arya, a grade 9 student working on a project regarding greywater reuse. I hope you can answer a few questions related to your LEED certified water reuse systems to support my project. Here are the questions:

1. When were the reuse systems installed (year)?
2. Were there any assessment studies done prior? Example, identifying large production of grey water and effective reuse of the same.
3. Are there any impact studies done? For example, how much water consumption is YMCA is able to save due to the water reuse.
4. Who is the provider of the reuse system/technology? (I am trying to reach technology experts in this field as well)

Once again, much appreciate you taking the time out. It's wonderful to know there are greywater reuse systems so actively in use in the city!

Sincerely,

Arya Shetye"

After getting a reply, I will finalize the write-up and add more of my own charts. The completed write-up will then be condensed and pasted onto my trifold.

January 11, 2026

My write up has been edited completely and is ready to go onto the trifold. Thankfully, the YMCA responded and explained that each reuse system was installed with the creation of a facility. For example, at Saddletowne YMCA, the system was installed alongside its construction in 2012. Encouraged by the City of Calgary, the YMCA has now been a "leader" in water conservation.

January 16, 2026

I am currently making my trifold (it's almost finished) and working on my speech.

January 30, 2026

Today is my school's internal science fair competition!

January 30, 2026

After presenting my project, I received valuable feedback from the judges that will help me improve.

- 1) I may want to go deeper into GreenCalgary and how their idea of a Calgary-wide average is dated and may not apply to everyone

- 2) I may want to clarify my extension and add sections about cost-benefit to better model how greywater reuse "saves us money"

I hope I make it to CYSF!

February 4, 2026

I made it to CYSF! My next steps will be to take the judges feedback and add it to my background research/ extension sections.

I noticed a few growing areas over the weekend. My weighted average equation needs to be tested again, I am not 100% confident the numbers make sense. If possible, I may even add a section with an equation tailored to cost-benefit, it seems very interesting.

Over the next month or so, I will be uploading my project information onto the CYSF website while making slight improvements.

February 6, 2026

I learned that the deadline for uploading is March 4. After this date, my final write up and presentation will be complete and ready to paste onto the larger trifold, rather than the small one I used for the school science fair.

February 8, 2026

I found an incredible study online while doing research on cost-benefits of greywater reuse! It is from WaterSmart Alberta and is based in Edmonton/ Calgary. The company itself has an "email us!" feature which I will be using to contact.

I am slightly concerned about how dated some of the information is, as the study was conducted in 2011. Today, I will draft an email to WaterSmart to hopefully see how they estimated their water usage predictions have shifted over the last 14 years.

Today, I have improved some of my charts and images found online via Google Sheets and Canva. The images had text that was illegible according to the judges at my school fair, so I will be enlarging it. I am happy that I did this, I learned how to use Canva!

February 15, 2026

I am halfway through uploading my project information onto the CYSF platform. Although I ran into more than a few technical problems, a peer was able to help me work it out. I have derived another equation for cost-benefit when it comes to reusing greywater.

Potable water (L) = P -> WHOLE HOUSE

Greywater (L) = G -> WHOLE HOUSE

Water Reuse Rate using greywater technology = RR

Water savings % = (G*RR)/P

For example, if the P value was 1200L, the G value 600L, and the water reuse rate 40%, the water savings would equate to:

$$600(.40)/1200$$

$$240/1200 = .20 \text{ or } 20\%$$

I have sent an email to WaterSmart. It looks like this:

Dear WaterSmart,

Thank you for reading this email, I hope you are having a wonderful day! My name is Arya Shetye, a grade 9 student in Calgary, and I'm working on a research project regarding greywater reuse for the Calgary Youth Science Fair.

After reading your report titled, " Greywater Recycling and Reuse in Alberta" from 2011, I have noticed your sections on the economic benefits of reusing greywater at home.

I would love to get more current information regarding some topics in the report, and if possible, reach out to an expert from your team on the matter.

Here are the questions;

1. Compared to your projections from 2011, how do you think reusing greywater will benefit homeowners financially in 2026?
2. How has demand for greywater reuse systems changed in 2026 compared to earlier projections?
3. Have entry-level systems remained around \$1,500–\$6,500, or have prices shifted?
4. What is the current average installed cost per system in 2026?
5. Has technological innovation reduced system costs or improved efficiency (e.g., heat recovery rates)?

Hoping for an early reply.

I hope I get a response quickly so I am able to add it to the online portion!

February 21, 2026

I have been ill and sadly, unable to work on much of the online portion. However, I have decided not to add an entire different section dedicated to cost-benefit on the platform. Instead, I will add my new equation and add my next steps to the extension section. I would love to continue "Getting Greywater Smart" as a passion project in the future, actually sending out my questionnaire to people!

As I was uploading parts of my greywater technology research, the website turned the text into a URL. I will have to ask why this is at school on Monday.

February 23, 2026

I learned that sometimes, you have to turn your word file into a PDF to paste it onto the website. Thankfully, I have finished uploading my project online, and am waiting for a large trifold to start creating!
