H_2O Wakefield

Report Part B – Water Quality Parameters

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Report Part B – Water Quality Parameters

Executive Summary

- H_2O Wakefield is a small volunteer group of local residents formed because of concerns regarding the safety and security of well water in the village.
- Part B is a summary of well water quality testing carried out by H_2O Wakefield during the summer-fall 2021.
- Part B addresses the second goal of H_2O Wakefield to encourage residents to understand their wells, in particular how to protect and maintain them.
- A grant from the Municipality of La Pêche's Green Fund, and support from R-Cube (Wakefield's Rona store) meant that H_2O Wakefield was able to provide a substantial subsidy for water testing.
- 30 homeowners participated in Part B of the project.
- 47% of the wells tested had higher levels of bacterial contamination than is considered safe for health by the government. 73% of the wells exhibited some level of bacterial contamination.
- 42% of wells for which we have physico-chemical data have higher levels of manganese than is considered safe for health by the government.
- As a result of this project, homeowners learned how to take action to ensure that they were not drinking contaminated water, including treating their wells and undertaking further remedial action if the problem persisted.

Introduction

This is Part B of the H_2O Wakefield report, which summarises the results of well water quality testing carried out by members of H_2O Wakefield, during the summer-fall of 2021. It represents the second phase of the project to assess the access to adequate quantities of safe drinking water for residents of the neighbourhood (Chemins Burnside, Elmdale and Legion). Part A "Report on the H_2O Water Survey" is available from H_2O Wakefield. The third phase, to provide educational resources, including a website will be completed during the spring of 2022.

H_2O Wakefield is a small volunteer group of local residents. The group was formed because of concerns that were being expressed by community members regarding the safety and security of the well water supply in the village of Wakefield.

The goals of H_2O Wakefield are to:

- develop awareness of water as a human right and a shared community resource;
- encourage residents to understand their wells, in particular, how to protect and maintain them;

- obtain a better understanding of groundwater and well water sources in Wakefield;
- support growth that is sustainable and equitable; and
- engage all levels of government to facilitate their role in understanding our groundwater sources and ensuring these are protected.

In November 2020, H_2O Wakefield carried out a survey of homeowners on the streets of Burnside, Legion and Elmdale (see Part A of the report). Following the results of the survey which assessed well functionality (depth, water flow and water usage), the group applied and successfully received monies from the Municipality of La Pêche's Green Fund. The grant allowed H_2O Wakefield to offer a subsidy to interested residents to test their well water.

Among many other groups and individuals, acknowledged at the conclusion of the report, H_2O Wakefield is particularly grateful to R-Cube, Wakefield's Rona store, for assistance in obtaining the well water-testing kits, managing the interface with the testing laboratory, and offering reduced fees for this project.

The cost for a complete test suite of water parameters (as recommended by the Québec government) is $214.00 plus tax. R-Cube offered a reduced price to H_2O Wakefield of $180 + tax (i.e., $206.96). Thanks to the grant from the La Pêche Green Fund, we were able to offer a subsidy to 24 homeowners who expressed an interest in having a comprehensive analysis of their well water. These homeowners each contributed $62 for the testing, with the remainder provided from the grant monies. In addition, where it was evident there was need, or where the homeowner contributed services in kind (five homeowners in all) the cost was fully subsidized. One homeowner paid the full price. R-Cube also offered a reduced fee of $38 + tax for re-testing of microbiological parameters following "shocking"/ treating a well where the initial testing (through this project) had highlighted bacterial contamination issues.

Methods

The 53 respondents to the survey of well water functionality were contacted individually to ascertain their interest in testing their well water. Of these respondents, 30 individuals responded positively.

A testing protocol was developed based on instructions from the testing laboratory Eurofins and Rona (see Appendix A). The protocol was trialled by sampling the well at the property of two of H_2O Wakefield's members. The protocol was then adjusted to accommodate any difficulties encountered. As the aim of this project is to encourage a better understanding of well water and its management, the protocol was intended to assist homeowners in understanding how to test their well water.

The homeowners who expressed interest in testing their well water were contacted individually to further explain the goals of this part of the project and to schedule a convenient time to test their water. Each homeowner was asked to sign a confidentiality agreement, to ensure that neither they, nor the members of H_2O Wakefield divulged any information of a sensitive nature that might lead to repercussions (e.g., concerns about a contaminated well might influence the sale of a property).

H_2O Wakefield followed the guidance of the Québec government regarding key parameters to test when assessing the quality of well water.[1] These are:

Microbiological parameters:

- Escherichia coli bacteria;
- Enterococcal bacteria;
- Total coliform bacteria.

Physico-chemical parameters:

- Arsenic
- Manganese
- Barium
- Nitrates-nitrites
- Chlorides
- Sodium
- Iron
- Sulfates
- Fluorides
- Total hardness based on the calcium and magnesium content

[1] https://www.environnement.gouv.qc.ca/eau/potable/depliant/index-en.htm

Some homeowners enquired whether we would be testing for Radon. As this was not among the list of recommended parameters identified by the Québec government, samples were not evaluated for Radon. However, homeowners were encouraged to test for Radon themselves if they had any concerns.

Wells were sampled between June 29 and August 16, 2021, except for a few wells which required additional testing either due to issues at the laboratory and/or insufficient sample size.

Each well was sampled by a member of H_2O Wakefield, or under the supervision of a member, to ensure that the protocol was applied consistently. The aim was to sample the well water itself, rather than water which may have been subject to treatment before reaching the home's faucets. In most cases, this meant that the water needed to be sampled directly from the pressure tank before reaching the treatment systems, generally in the basement of the property. Once the tap was turned on, the water was allowed to run for five minutes to empty the pressure tank, clear the pipes of any potential contaminants that might have collected, and ensure only fresh water from the well was being tested. While the protocol was followed as closely as possible, often some adjustments needed to be made (e.g., the taps on some tanks were so low to the ground that a disinfected hose had to be used to run the requisite five-minute flow to the nearest drain or outside).

Precautions related to the prevalence of COVID-19 always included wearing masks, maintaining the recommended two-metre distance, and the use of hand sanitizer, to minimize concerns about members of the group infecting the participants in the study, and vice versa.

Well water could only be tested on Monday, Tuesday, or Wednesday mornings. It was necessary to return the samples to R-Cube before noon, so that the samples could be transferred to the laboratory promptly. This is particularly important for the analysis of microbiological parameters, as left too long at a warm temperature the bacteria would multiple and give a false reading.

Microbiological parameters were always analysed first by the laboratory. If any bacterial contamination of the sample was identified, the laboratory forwarded a preliminary report to R-Cube. (While the preliminary report was mainly concerned with bacterial contamination, other physico-chemical parameters were also flagged if they had been tested and found to exceed the Québec government limits.) On receipt of the preliminary report R-Cube contacted the relevant member of H_2O Wakefield by telephone. The H_2O Wakefield member immediately contacted the resident because of the potential health risk. The preliminary report was then forwarded to the homeowner with suggestions on how to remedy the problem.

Homeowners were encouraged to contact R-Cube for advice on how to "shock" their well with bleach. R-Cube then offered a reduced rate to re-test for bacterial contamination. If well-shocking proved to be unsuccessful, R-Cube provided further advice on installation of systems (UV light etc.) that might be needed to destroy any bacterial contamination.

On receipt of the official reports including the results of all microbiological and chemical parameters tested, the homeowners were contacted by email and provided with the copy of the report (see Appendix B for an example), and a copy of the list of the government limits for chemical components in well water (Appendix C). H_2O Wakefield highlighted any issues with their well water and directed homeowners to official government links that provided more information regarding these issues.

A copy of each official report was saved in a separate H_2O Wakefield folder. Results for each of the parameters were then input to a spreadsheet, using the non-identifying random numbers first assigned for the survey of well functionality (Part A of the Report). Use of the same random numbers allowed for cross referencing between well functionality and well water quality data.

Results

Thirty participants who had completed the well water functionality survey responded positively to testing their well water. In addition, three homeowners had tested their wells in 2020 and provided the results of the analysis of the physico-chemical parameters of their well water, and a further homeowner provided the results of a recent analysis of the microbiological analysis of their well water.

Table 1 provides the results obtained from the analysis of the well water from the 30 residences tested, plus the additional four wells.

Microbiological parameters

The results for bacterial contamination showed that 14 wells were contaminated with atypical bacteria; nine of these wells were also contaminated with other types of bacteria (coliform or enterococcal). In addition, a further eight wells were contaminated with coliform or enterococcal bacteria (i.e., no atypical bacteria), resulting in 22 out of 30 wells exhibiting some form of bacterial contamination. On the basis of the Québec government limits for safe drinking water, the water from 14 wells was deemed unsafe to drink.

Physico-chemical parameters

Most of the physico-chemical parameters evaluated were well within limits for health purposes. However, of particular note: 14 wells had levels of manganese higher than the Canadian Drinking Water Guidelines; and two wells had levels of fluoride above the Québec health limit. Twenty-nine out of the 33 well water tests contained levels of calcium carbonate above the aesthetic limit; 14 well samples had higher levels of iron than the Québec government limit for aesthetic purposes. There are no health limits for either calcium carbonate or iron and these results illustrate the high mineral content that characterizes groundwater in the area.

Table 1: Results of water quality testing, showing the number of wells exceeding recommended levels for health and aesthetic reasons

Parameter	Number of results	Range	Median	Québec limit and/or Canadian Drinking Water Guideline level for health and aesthetic reasons[2]	# wells> limit
Physico-chemical parameters					
Arsenic	32	All <0.002 mg/l	--	0.010mg/l (health)	0
Barium	32	0.02 - 0.13 mg/l	0.03 mg/l	1.0 mg/l (health)	0
Calcium (soluble)	33	40.2 – 118 mg/l	70.3 mg/l	No limit (health) 75 mg/l for aesthetic reasons <75mg/l soft water >300mg/l hard water	13 wells >75mg/l 1 well >300mg/l
Chromium	32	All < 0.005 mg/l	--	0.050 mg/l (health)	0
Calcium Carbonate (hardness)	33	142 – 460 mg/l	251.5 mg/l	No limit (health) 180 mg/l aesthetic reasons	29 wells >180mg/l
Iron	33	0.1 – 6.1 mg/l	0.5 mg/l	No limit (health) 0.3 mg/l aesthetic reasons	14 wells >0.3 mg/l
Magnesium	33	2.7 – 39.9 mg/l	18.55 mg/l	No limit (health) 25 mg/l aesthetic reasons	8 wells >25 mg/l
Manganese	33	0.003 – 1.55 mg/l	0.16 mg/l	0.12 mg/l (health)	14 wells >0.12 mg/l
Sodium	33	3.6 – 218 mg/l	23.5 mg/l	No limit (health) 200 mg/l aesthetic reasons	1 well >200 mg/l

[2] Québec Regulation respecting the quality of drinking water Québec Regulation respecting the quality of drinking water (mandatory), http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2040;
Canadian Drinking Water Quality Guidelines (voluntary) https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html#t2

Nitrites + Nitrates	31	0.02 – 0.6 mg/l	0.35mg/l	10 mg/l (health)	0
Chloride	27	2.0 – 179 mg/l	17 mg/l	No limit (health) 250 mg/l aesthetic reasons	0
Fluoride	29	0.2 – 2.2 mg/l	0.5 mg/l	1.5 mg/l (health)	2 wells >1.5 mg/l
Sulphate	27	5 – 185 mg/l	20.5 mg/l	No limit for health reasons 500 mg/l aesthetic reasons	0
Microbiological parameters					
Atypical Bacteria	28	0 - >200 UFC/100ml		200 (health)	3 wells had > 200UFC/100ml (14 wells had some level of contamination) 4 wells could not be assessed due to high levels of other bacteria
Total Coliforms	30	0 - >80 UFC/100ml		10 (health)	9 wells had > 10 UFC/100ml 11 wells had some level of contamination 3 wells could not be assessed due to high levels of other bacteria
Escherichia coli	30	0 – 4 UFC/100ml		0 (health)	4 wells >0 UFC/100ml
Enterococcus	30	0 - >60 UFC/100ml		0 (health)	12 wells >0 UFC/100ml

We had initially thought that depth of well might show some correlation with bacterial contamination. We hypothesized that shallower wells might be more readily contaminated by surface run off. However, there appeared to be no discernable link between the well depth and the bacterial contamination levels.

Table 2: Well depth, Bacterial Contamination and Manganese

	Atypical bacteria (UFC/100ml)	Total coliforms (UFC/100ml)	Escherichia coli (UFC/100ml)	Enterococcus (UFC/100ml)	Manganese mg/l
Limits (health)	>200	>80	0	0	0.12 mg/l
Well depth (metres)					
4.62-6.15	25	0	0	0	0.306
9	1	0	0	0	1.03
9.23	82	1	0	0	0.005
21.54	11	0	0	0	0.465
21.54	7	0	0	0	0.604
21.54	15	0	0	0	0.412
30.77	no data	>80	0	>60	0.104
30.77	no data	>80	4	2	0.218
40	0	0	0	0	0.661
43.8	no data	no data	no data	no data	0.275
46.15	>200	no data	0	1	<0.003
49.23	1	12	0	0	<0.003
49.23	no data	no data	no data	no data	<0.003
52.31	0	0	0	0	0.038
60	0	0	0	0	<0.003
61.54	no data	>80	4	>60	0.022
61.54	1	0	0	0	1.01
61.54	no data	>80	1	15	0.833
61.54	0	0	0	0	0.031
70.77	no data	no data	no data	no data	<0.003
75.08	0	0	0	0	0.085
76.92	0	0	0	>60	1.55
107.38	>200	no data	0	4	0.731
124.6	0	0	0	0	0.06

Unknown depth
(9 wells). Parameters not reported in this table

Levels exceeding recommended health limits

Figure 1: Bacteria levels according to well depth

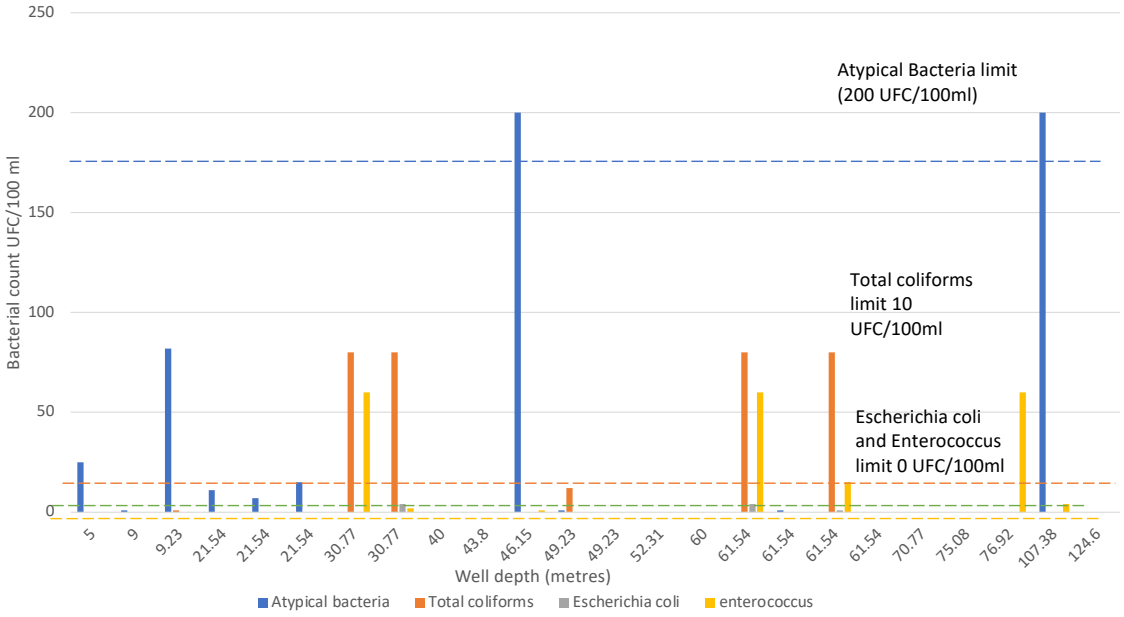
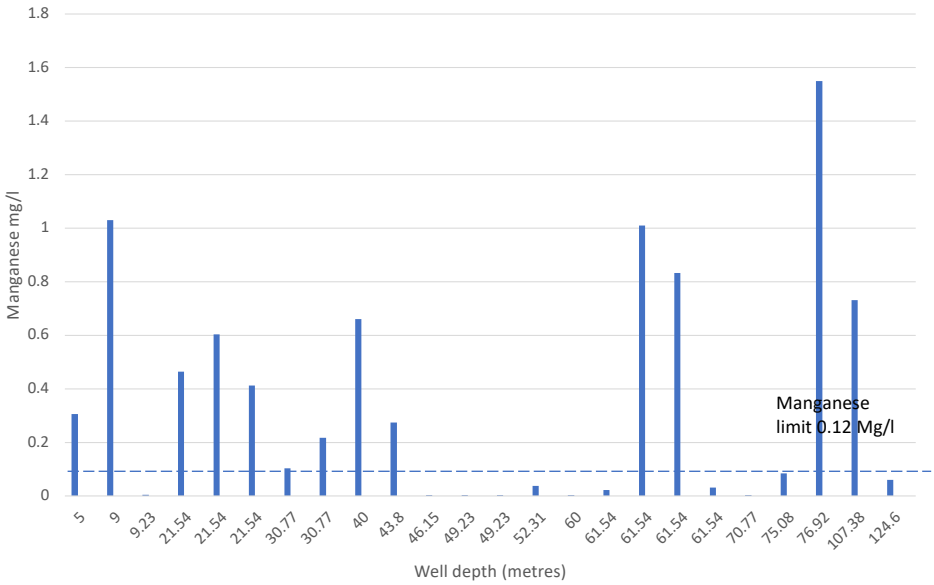


Figure 2: Manganese levels according to well depth



To further examine the reasons for the bacterial contamination, we obtained rainfall data for the two days prior to the collection of each of the samples from Pablo Sanchez, who operates a local weather station. These were cross referenced to the levels of bacterial contamination in the sample; however, no link was found.

Table 2 also shows the levels of manganese related to well depth. Manganese was assessed as being the main physico-chemical parameter related to potential health concerns. Fluoride levels were also of concern, but levels higher than the Québec government limit were found only in two of the wells tested.

We investigated whether the bacterial contamination or indeed high levels of chemical parameters were related to the location of the wells. There were two distinct areas where all wells were contaminated with bacteria, and one area where the manganese levels were above the limit in each of the wells tested. For reasons of confidentiality these areas are not identified in this report. However, there were also high levels of bacteria and manganese found in wells outside these areas.

Discussion

The goals of the H_2O Wakefield project are to:

- develop awareness of water as a human right and a shared community resource;
- encourage residents to understand their wells, in particular, how to protect and maintain them;
- obtain a better understanding of groundwater and well water sources in Wakefield;
- support growth that is sustainable and equitable; and
- engage all levels of government to facilitate their role in understanding our groundwater sources and ensuring these are protected.

For this stage (Part B) of the project, H_2O Wakefield focussed on the second of these goals: encouraging homeowners to become more knowledgeable about their well water.

During the water sampling process, homeowners were asked to carry out, or at least participate in the sampling process, so that they would be aware of how to sample their well water in the future (this included understanding how to bypass any treatment systems in place). As we provided the information about acceptable limits for various water parameters, homeowners gained an understanding of the importance of water quality. This project also provided the opportunity for homeowners to gain confidence in looking after their wells, the importance of regular testing for microbiological parameters, and how to remedy problems, including an understanding of the various treatment systems available.

Upon receipt of a notice from the laboratory that there was bacterial contamination, homeowners were informed immediately that their well water was not potable. This was the case for 13 of the 30 wells tested during the summer/fall of 2021 i.e., 43% of the wells were contaminated. As the samples were taken directly from the well, bypassing any treatment systems in place, for those residents with a sterilization system, the bacterial contamination is less of a concern, in addition, some residents do not drink the well water, preferring to obtain their water from the Wakefield spring. However, there were a significant number of residences where the high levels of bacteria were a concern. For these residents, advice was provided by R-cube on how to "shock" their wells by the addition of bleach. Residents were then advised to re-test their well water. For the participants in this study R-cube offered a reduced rate to re-test their well water for the microbiological parameters ($38 + tax).

Thirty wells were tested during the period June 29 to August 16, 2021. We also obtained data for rainfall during that period as we thought that the rain might lead to seepage into the wells, or that there might be leakage from the septic beds, left behind after the village moved to a sewage system in the late 1990s. There did not appear to be any link with the rainfall immediately prior to sampling. However, the fact that there were two localized areas where all the wells tested were contaminated with bacteria, may point to seepage from septic beds or other localized sources of contamination.

As a significant number of wells proved to be contaminated with bacteria we cross-referenced the data with the depth of the wells, hypothesizing that the surface wells would likely show a greater level of contamination. This proved not to be the case.

All residents who participated expressed their gratitude to have had the opportunity to test their well water. Until we contacted them, some homeowners were unaware of the need to test their wells, or how to test them. Residents with wells showing bacterial contamination followed the advice to stop drinking their well water and sought further advice regarding how to "shock" their wells with bleach. Residents were also grateful for the opportunity to re-test their well at a reduced rate, to ensure that the treatment had been successful. In some instances, shocking the well did not have the desired effect, and the homeowners decided to install treatment systems, or switch to drinking water from the Wakefield spring. We are aware of at least two cases where, due to high levels of bacteria found in their well water, residents have taken further remedial action to address the potential source of contamination through the well casing.

The other key parameter of concern was manganese. There appeared to be high levels of manganese in many of the wells sampled; 14 wells out of 33 wells for which we have physico-chemical data, i.e., 42%. An H_2O Wakefield member whose well exhibited high levels of manganese retested the well water for the complete spectrum of microbiological (the water also had bacterial contamination) and chemical parameters, without bypassing the water treatment systems in place. This demonstrated that the activated charcoal filter which had been installed to reduce the iron levels in the water, also successfully reduced the levels of manganese to well below the recommended limit

At the beginning of this project, many homeowners in the neighbourhood were expressing concern about the potential impact of the nearby housing developments on the supply of well water. While we have no reason to expect that the developments will necessarily adversely impact the water table, the results of the survey of water quantity (Part A of the Report) and water quality (outlined in this, Part B of the report) should serve as a benchmark, if questions emerge in future regarding access to potable water.

Challenges and Limitations

Challenges

1) Tests and testing

Access to test kits from R-Cube proved to be problematic at times, due to supply chain issues. This meant that the testing period was longer than anticipated as we had to wait for test kits, and scheduling of sampling had to be adjusted.

2) Homeowners

For the most part, homeowners were willing to participate and assist in the sampling process; however, we did experience some difficulties in contacting homeowners and in setting up acceptable times for testing.

Most homeowners welcomed the opportunity to learn how to test their well water, including how to bypass any treatment systems (as applicable). However, a few others were reluctant to observe or participate in the water testing, or to learn how to test their wells themselves, preferring to leave it to the H_2O Wakefield member. For some, this was because the testing occurred while they were busy with work, but for others there was a hesitancy to participate in something they deemed very technical.

We tried to maintain close control of the process, so that all wells were sampled in the same manner. This proved difficult in many cases, as each residence had a different type of set-up. For example, in some instances, the tap on the pressure tank was so close to the ground that it was impossible to fit the sampling container under the tap, and so a hose was disinfected and used to run the sample from the pressure tank to the container.

The protocol required water to be run from the pressure tank for five minutes to ensure that there was no contamination other than the levels of chemicals and bacteria in the water itself. Some basements had earthen floors or drains, in which case it was simple to run the water and let it exit through the ground or drain. Other basement floors were sealed, requiring the use of a hose to run inside to a bucket, or where possible through a basement window to drain outside.

In at least one instance, running the water for five minutes resulted in the water running out, requiring the pump to be restarted.

3) Laboratory

Once the samples had been taken, they were taken immediately to R-Cube to be sent off to Eurofins, the laboratory that carried out the testing. The laboratory always tested the microbiological parameters quickly and notified R-Cube if they identified any problems. Quite frequently the official results, including the physico-chemical parameters took a significant length of time to receive.

In some instances, the official report did not include results for all parameters. We decided to seek re-testing for those parameters likely to be a health concern. In consultation with R-Cube, we were able to arrange to re-sample wells where parameters were missing, and to resubmit for testing. The laboratory agreed to test these samples free of charge.

4) COVID

All testing was carried out following a strict COVID protocol. Both the member of H_2O Wakefield who was performing the testing, and the homeowner wore masks and tried to maintain a social distance of 2 metres. This was challenging due to the situation of some of the pressure tanks, and where assistance was needed to run the water from the tank.

Limitations

Fifty-three homeowners participated in Part A of the H_2O Wakefield project to assess access to sufficient quantities of safe drinking water. Of these, 30 individuals expressed a willingness to participate in Part B to have test their well water tested. It would have been helpful to involve all 53 homeowners, as this would have given us a clearer picture of whether water problems were occurring in particular locations. In addition, it represented a missed opportunity to engage homeowners in understanding how and when to test their well water.

We are unsure of the actual barriers to participating in Part B of this project; however, we are concerned that it might have been related to the cost of testing. Even with the reduced fee offered by R-Cube and the subsidy provided by the Green Fund, the cost of $62 may well have been prohibitive for some homeowners. In a few instances friends or family members paid for the tests. A few others were only able to participate because we could offer a complete subsidy, so that the cost to them was $0. (The cost for a complete test panel of water parameters [as recommended by the Québec government] is $214.00 plus tax. R-Cube offered a reduced price to H_2O Wakefield of $180 + tax [i.e., $206.96]).

We would have preferred to involve more homeowners in the study; however, had there been a greater take-up of tests, the subsidized cost would, of necessity, have been greater than $62.

We remain concerned that some homeowners expressed a lack of interest in testing their water because they drink it (and hence presume it to be safe).

Case Studies

1. Already aware of problems with water quality

One of the homeowners in this study was already aware that there were problems with the drinking water supply. This individual had experienced health issues for several months before having the water tested. It had not occurred to them that their water might be a problem as the family had been using it for more than 40 years.

The test results indicated that the water was not potable. This individual had already switched to using the Wakefield spring as a source of drinking water; however, they were still using the well water to make tea, rice, and ice cubes, to brush their teeth and to wash vegetables etc.

As this individual noted, it is inconvenient to have to carry the extra water for those additional uses but avoiding the well water has greatly improved the individual's physical health, enabling them to enjoy social activities, which were otherwise impossible.

2. Home with young children

This homeowner was completely unaware that there were any problems with their well water. On receiving the report showing levels of bacteria higher than the standard for acceptable drinking water, the homeowner reached out to R-Cube for advice on how to shock the well with bleach. Despite following the "shocking" protocol, the subsequent re-test gave no better results. Although hoping to avoid the purchase of a UV sterilization unit, because of the cost, the individual is strongly considering purchasing a unit because of concerns for the family's health.

3. Elderly homeowner

This homeowner was unaware of any problems with the well water, as they have always drunk the water from the well. They were not experiencing any health issues related to the water (as far as they were aware) and were surprised to learn that their well was showing higher than recommended levels of bacterial contamination. This individual would not have tested the water of their own accord, believing that the water was safe. Having the results from the H_2O Wakefield project has sensitized them to the need to test their water regularly, and to reach out to family members, should they need to be provided with a clean source of water.

Conclusion and Next Steps

The results of this study have shown that many of the wells in the areas tested are contaminated with bacteria. We would encourage residents to ensure that their well water is tested for microbiological contamination on a regular basis (at least once a year). Physico-chemical parameters should be tested at least once during the ownership of the property.

As a follow up to the study, H_2O Wakefield is establishing a website, to serve as a place where information can be shared concerning wells and well water.

The information gleaned from this study of well water quality as well as from the survey of the functionality of wells in the same area will be shared with the Municipality of La Pêche as well as with the MRC to encourage their participation in the maintenance of ground water quality for all residents.

Acknowledgments

H_2O Wakefield expresses its gratitude to the following:

- Municipality of La Pêche Green Fund for the grant which enabled us to subsidize the water testing;
- R-Cube for assistance in obtaining the well water-testing kits, managing the interface with the testing laboratory, and offering reduced fees for this project;
- Linda Miller for assistance with water testing;
- Louis Molgat for assistance with translation;
- Pablo Sanchez, for sharing his weather station data;
- Wendy Stephens for assistance with the graphic design; and
- Homeowners who agreed to test their well water

Appendix A

H_2O Wakefield Project – Protocol and Logistics for Water Testing

Members of H_2O Wakefield are grateful for the financial support of the Municipality of La Pêche Green Fund. This funding is being used to assist in determining a baseline of water quality for the Burnside, Elmdale, and Legion neighbourhood.

Before Testing:

1. Set up an appointment with residents (owners) who have expressed and confirmed their interest in having their water tested (comprehensive or basic). Appointments should be an hour long (probably less, but this avoids rushing) on Monday, Tuesday, or Wednesday between 8:30-11:30. There will be a maximum of 3 residences tested per team member per day.

2. Explain to owners orally what will happen on the day and that they will be asked to sign the Agreement. Tell them how much they will need to pay, and explain that payment will be required before they receive their water testing results.

3. Ask the homeowners whether they have water treatment system(s), as it is important that only untreated water be tested; if yes, then
    a. Are they able to bypass the treatment system?
    b. If they are unable to bypass their water treatment system, is the water running from their outside tap treated or untreated?
    c. Do they have a spigot/tap attached to the outflow from their blue pressure tank?

4. Based on the answers to #3 above, determine which faucet(s) to use. The faucet next to the blue pressure tank is likely to be the best option for most. If the homeowner is unable to answer any of the questions, decide whether it might be worth visiting in advance to do a reconnaissance of the options.

The Day before Testing Day:

5. Send participants a reminder (email, phone) that the test will be happening the next day at the appointed time. If necessary, ask them to bypass their treatment systems and/or remove the aerator from the faucet. Ask them to make sure the faucet can be easily accessed (the area around it should be uncluttered) and to have a bucket or basin ready if necessary.

On Testing Days:

6. Get together everything you need:
    - Mask, hand cleaner/gel, shoes (for basement)
    - Bottle of Javex and a cloth
    - Large bucket (shallow if possible) if you will be flushing water from the spigot next to the blue pressure tank (in case participant is unable to provide one)
    - Adjustable wrench (to remove aerator on faucet, if required and homeowner is unable to do so)
    - Copy of Agreement for homeowner to sign
    - Pen, clipboard/hard surface, reading glasses, headlamp
    - Phone/camera to photograph signed Agreement (so we have a copy)

    Ensure you have not been smoking, are not wearing bug repellant, and that you have not handled any petrochemical products, as all these can contaminate the samples. Ensure your hands are clean.

7. Nancy should have dropped off your sample bottles and coolers first thing in the morning.

8. Visit the first residence. Put on a mask and disinfect your hands. Based on your earlier conversation with the homeowner, identify the faucet(s) you will be using. Ask the homeowner to accompany you so they can watch what you are doing, while maintaining a 2m distance at all times. It is essential the faucet bypass any treatment system and provide untreated water, e.g., be next to the blue water pressure tank or possibly the outside faucet. If applicable, check that the homeowner has removed the faucet aerator and/or bypassed the treatment system.

9. Ask the participant to disinfect the exterior and interior of the faucet nozzle with a clean cloth drenched with a commercial solution of domestic bleach.

10. Run the cold-water faucet at high flow for 5 minutes. This is important as it washes away the disinfectant, flushes out any stale water from the pipes and the pressure tank, and ensures you will be sampling fresh water directly from the well. If the faucet is in the basement you might need to catch the flow in a bucket or basin to prevent flooding. Once flushed, reduce the water flow.

11. When sampling, only open and fill one bottle at a time. Hold the cap in one hand and the bottle in the other. Do not touch the inside of the cap or the bottle, and do not let the bottle touch the faucet.

12. **a) For the microbiological parameters**: Fill the bottle to the neck. It is important that there be an air space at the top of the container. Replace the cap tightly on the bottle.

b) For the physico-chemical parameters: Fill the bottle to the rim unless otherwise specified. For some chemical parameters, it is important that there not be any air gaps or bubbles in the container. Replace the cap tightly on the bottle.

13. Mark on the label all required information (e.g., date, name, sampling location). Do not write directly on the bottles, only on the labels.

14. Put the bottles into the cooler.

15. Visit the second residence, and repeat steps 8-14.

16. Repeat again for the third residence.

17. Return to Rona before noon with the filled bottles.

18. Relax!

Appendix B

Example of an Official Report

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4495, boul. Wilfrid-Hamel, suite 150, Québec (Québec) G1P 2J7 (418) 977-1220
2325, boul. Fernand-Lafontaine, Longueuil (Québec) J4N 1N7 (514) 332-6001
3705, boul. Industriel, Sherbrooke (Québec) J1L 1X8 (819) 481-1469
Sans frais : 1 (877) 977-1220

CERTIFICAT D'ANALYSES OFFICIEL

Quincaillerie,Centre Rénov R Cube Inc.
Rémi Robert
924, Chemin Riverside
La Pêche, Québec
J0X 3G0
Tél.: (819) 459-1133

Certificat : [redacted]
Demande d'analyse : NA
Date du rapport: 2021-08-17
Projet client : Générale 2020
Bon de commande : Non fourni
Chargé de projets : NA
Adresse courriel : NA

Données sur le prélèvement
Échantillon EnvironeX : 5649411
Identification client : NA
Nature : Eau potable
Nom du préleveur :
Date de prélèvement:
Date de réception:
Lieu du prélèvement :
Info. supplémentaires :

Chlore résiduel libre : NA
Chlore résiduel total : NA
Chloramine : NA
Résultat pH : NA
Température à la réception (°C) : 15.5

Paramètres	Accr. *	Méthode Interne	Résultats	Unités	Date d'analyse	Critères Min	Critères Max	Laboratoire
Arsenic soluble à l'acide	Oui	CHM35/ILCE69			2021-08-04			QC
Arsenic (As)			<0.002	mg/L			0.010	
Baryum soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04			QC
Baryum (Ba)			0.03	mg/L			1.0	
Calcium soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04			QC
Calcium (Ca)			118	mg/L			75	
Chrome soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04			QC
Chrome (Cr)			<0.005	mg/L				
Dureté	Non	ENVX-CHM-35			2021-08-04			QC
Résultat			460	mg CaCO3/L			180	
Fer soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04			QC
Fer (Fe)			0.3	mg/L			0.3	

= Avertissement = Hors critères

Accr. * : Accréditation du MELCC -- NA : Non-Applicable -- TNI: Colonies trop nombreuses pour être identifiées -- TNC : Colonies trop nombreuses pour être comptées
Laboratoire traitant : QC : Québec; LG : Longueuil; SH :Sherbrooke; ST : Sous-traitance externe / Méthode interne : CHM ou MBIO (méthodes QC) ; ILCE ou ILME (méthodes LG)

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4495, boul. Wilfrid-Hamel, suite 150, Québec (Québec) G1P 2J7 (418) 977-1220
2325, boul. Fernand-Lafontaine, Longueuil (Québec) J4N 1N7 (514) 332-6001
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CERTIFICAT D'ANALYSES OFFICIEL

Quincaillerie,Centre Rénov R Cube Inc.
Rémi Robert
924, Chemin Riverside
La Pêche, Québec
J0X 3G0
Tél.: (819) 459-1133

Certificat : **3035358**
Demande d'analyse : NA
Date du rapport: 2021-08-17
Projet client : Générale 2020
Bon de commande : Non fourni
Chargé de projets : NA
Adresse courriel : NA

Données sur le prélèvement
Échantillon EnvironeX : 5649411

Magnésium soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04		QC
Magnésium (Mg)			39.9	mg/L		25	
Manganèse soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04		QC
Manganèse (Mn)			0.306	mg/L		0.13	
Sodium soluble à l'acide	Oui	ENVX-CHM-35			2021-08-04		QC
Sodium (Na)			44.7	mg/L		200	
Nitrites et nitrates EP	Oui	ENVX-CHM-02			2021-08-03		QC
Résultat			<0.1	mg/L		10.0	
Analyse microbiologique							
Dénombrement coliformes totaux/Escherichia coli	Oui	MBIO07/ILME40			2021-08-03		QC
Bactéries atypiques			25	UFC/100ml		200	
Coliformes totaux			0	UFC/100ml		10	
Escherichia coli			0	UFC/100ml		0	
Entérocoques	Oui	MBIO04/ILME40			2021-08-03		QC
Entérocoques			0	UFC/100ml		0	
Chlorures	Oui	PC-EN-CHI-PON028			2021-08-09		LG
Résultat			106	mg/L		250	
Fluorures EP	Oui	CHM10/PC-EN-CHI-PON028			2021-08-09		LG

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À moins d'une demande explicite du client, les échantillons d'analyse chimiques seront entreposés au maximum 21 jours après l'émission du certificat pour les paramètres dont le délai analytique le permet.

Tous les résultats d'analyse provenant de matrice solide sont calculés sur une base sèche, à moins d'avis contraires.

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4495, boul. Wilfrid-Hamel, suite 150, Québec (Québec) G1P 2J7 (418) 977-1220
2325, boul. Fernand-Lafontaine, Longueuil (Québec) J4N 1N7 (514) 332-6001
3705, boul. Industriel, Sherbrooke (Québec) J1L 1X8 (819) 481-1459
Sans frais : 1 (877) 977-1220

CERTIFICAT D'ANALYSES OFFICIEL

Quincaillerie,Centre Rénov R Cube Inc.
Rémi Robert
924, Chemin Riverside
La Pêche, Québec
J0X 3G0
Tél.: (819) 459-1133

Certificat : **3035358**
Demande d'analyse : NA
Date du rapport: 2021-08-17
Projet client : Générale 2020
Bon de commande : Non fourni
Chargé de projets : NA
Adresse courriel : NA

Données sur le prélèvement
Échantillon EnvironeX : 5649411

Résultat			0.2	mg/L		1.50
Sulfates	Oui	PC-EN-CHI-PON028			2021-08-09	LG
Résultat			28	mg/L		500

Commentaires de l'échantillon 819-459-1306

Appréciation microbiologique: L'EAU EST POTABLE selon les paramètres analysés en vertu du Règlement sur la qualité de l'eau potable du Québec. Le Ministère recommande les indicateurs suivants pour établir la potabilité d'une eau de consommation d'un puits : coliformes totaux (colonies atypiques), Escherichia coli et entérocoques.

Pour les paramètres physico-chimiques analysés le manganèse et la dureté dépassent les concentrations maximales acceptables. Par conséquent, votre eau peut tacher surtout en présence de javellisant, donner mauvais goût aux boissons et causer des problèmes d'entartrage. La dureté élevée s'explique par les concentrations élevées en calcium et en magnésium.

Commentaires du certificat :

Approuvé par : Gatya Dimitrova Minkova, Ph. D. B. Sc.
Chimiste, Site de Québec

CHIMISTE Gatya Dimitrova Minkova 2011-115 QUÉBEC

Approuvé par : Joël Provost, M. Sc.
Microbiologiste, Site de Québec

= Avertissement = Hors critères

Accr. * : Accréditation du MELCC -- NA : Non-Applicable -- TNI: Colonies trop nombreuses pour être identifiées -- TNC : Colonies trop nombreuses pour être comptées
Laboratoire traitant : QC : Québec; LG : Longueuil; SH :Sherbrooke; ST : Sous-traitance externe / Méthode interne : CHM ou MBIO (méthodes QC) ; ILCE ou ILME (méthodes LG)

Appendix C

Summary of Water Quality Standards Provided to Homeowners with the Official Results from the Analysis of their Well Water

DRINKING WATER QUALITY STANDARDS – MICROBIOLOGICAL ORGANISMS

The table below has been designed to help you interpret your well water test results. The table is based on information in the Québec Regulation respecting the quality of drinking (see link at the bottom of this page).
The table provides the maximum permitted concentrations of microbiological organisms in drinking water for health reasons.
If any of your water test results exceed the maximum levels for microbiological organisms, please consult the Québec Ministry of the Environment guidance on what to do next:
https://www.environnement.gouv.qc.ca/eau/potable/depliant/index-en.htm#presence2

Microbiological Organism	Maximum concentration for health reasons (Coliform Units (CFU)/100 mL)
Atypical bacteria	200
Total coliforms	10
E. coli	0
Enterococcus	0

Source:
Québec Regulation respecting the quality of drinking water (mandatory),
http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2040

DRINKING WATER QUALITY STANDARDS – INORGANIC SUBSTANCES

The table below has been designed to help you interpret your well water test results. The table is based on information in the Québec Regulation respecting the quality of drinking water and the Canadian Drinking Water Guidelines (see links to these references at the bottom of this page).

The table provides the maximum permitted concentrations of inorganic substances in drinking water for health reasons, as well as guideline maximum concentrations for aesthetic reasons (colour, taste, etc.).

If any of your water test results exceed the maximum level for aesthetic reasons, but do not exceed the level for health reasons, your water has an acceptable quality from a health point of view. You only need to be concerned from a health point of view if your test results exceed the maximum permitted concentration for health reasons.

Inorganic substances	**Maximum concentration for health reasons (unless otherwise specified) (mg/L)**
Arsenic (As)	0.010
Barium (Ba)	1.0
Calcium (Ca)	No limit for health reasons 75 for aesthetic reasons (under 75 is considered soft water; over 300 is considered hard water)
Chromium (Cr)	0.050
Hardness	No limit for health reasons 180 for aesthetic reasons
Iron (Fe)	No limit for health reasons 0.3 for aesthetic reasons
Magnesium (Mg)	None for health reasons 25 for aesthetic reasons
Manganese (Mn)	0.12
Sodium (Na)	None for health reasons* 200 for aesthetic reasons
Nitrates + nitrites (expressed as N)	10.0
Chlorides	None for health reasons 250 for aesthetic reasons
Fluorides (F)	1.50
Sulphates (S)	None for health reasons 500 for aesthetic reasons

* For persons on strict sodium reduced diets applying to all sources, levels in drinking water should be below 20 mg/L (Canadian Drinking Water Quality Guidelines)

Sources:

Québec Regulation respecting the quality of drinking water (mandatory), http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2040 (for As, Ba, Cr, N, F)

Canadian Drinking Water Quality Guidelines (voluntary) https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html#t2 (for Ca, Hardness, Fe, Mg, Mn, Na, Chlorides, S)