

**Mount Washington Alpine Resort Water
System Annual Report 2018**
Mount Washington Utilities Department

Table of Contents

1. Introduction	3
2. Mt Washington Alpine Resort Water System	3
3. Water Sampling & Testing Program.....	4
4. Water Quality - Source Water and Distribution System.....	4
A. Source Water & Distribution System.....	4
B. UV Disinfection as Second Form of Treatment.....	7
5. Water Quality Inquiries and Complaints.....	7
6. Water Leaks and Repairs.....	8
7. Water Consumption	9
8. Maintenance Program.....	10
9. Water System Projects	10
10. Emergency Response Plan.....	11
11. Cross Connection Control	11
12. Dam Safety and Maintenance	11
13. Closing	11

1. Introduction

The following annual report describes the Mt Washington Alpine Resort (MWAR) Water System and summarizes the water quality and production data from 2018. This report also includes a summary of any inquiries and complaints, completed and proposed maintenance activities, the Emergency Response Plan and the Cross Connection Control program. It is an example of the utility's continuous efforts towards achieving excellence through continued responsible management, operation, evaluation, and maintenance of the water system. This report demonstrates that the utility is striving to meet or exceed all regulations and also identifies potential areas of improvement, in an effort to increase operational efficiency and consumer confidence.

A copy of this report will be submitted to the Vancouver Island Health Authority and posted online on the MWAR website.

2. Mt Washington Alpine Resort Water System

The MWAR Water System was established in 1979 when the ski resort was first built. As the resort has increased in size over the years, so has the water distribution system. Additional sources have been licensed and new reservoirs were built. Extensions were made to the existing distribution system to service new developments. Over the years, and especially recently, regulatory amendments have been introduced reflecting the increased importance of water quality and service in the mind of the general population. Mt. Washington is perpetually adapting to meet the needs and increasing expectations of our community.

The resort's water supply, treatment and distribution are completely self-contained. We do not depend on a separate purveyor for water delivery, and we are completely independent of the Comox Valley Regional District's other water utilities. Because of this isolation and the nature of operations at the Resort, the water utility has its own unique set of challenges to contend with. However, we are still subject to the same local, provincial and federal regulations and standards.

The water supply originates from three springs on the southwest face of Mount Washington, on resort property. The water from each spring is collected, then funneled to two raw water open reservoirs, the Middle and East reservoirs. From these reservoirs, the water is transported via gravity to the Water Treatment Facility, where it is treated with ultra violet light and chlorinated. It is then pumped into a 4th reservoir, a covered storage tank. From there, the water is transported via gravity throughout the distribution system. In 2018, the MWAR Water System consisted of 623 water service customers. A backup generator is available and wired to turn on immediately during a power outage.

Provincial water withdrawal licensing allows the water utility to divert water from 5 different sources. Currently, only 3 of the sources are actively being used. Except for a few isolated occurrences, the maximum daily volumes consistently fall below the allowable withdrawal limits. Higher than maximum draws typically occur when one source is taken offline for scheduled maintenance. The annual volumes are well below the allowable limits.

Source	Max. Daily Volume Allowed (m ³)	Max. Daily Volume Used (m ³)	Max. Annual Volume Allowed (m ³)	Annual Volume Used (m ³)
West Spring	455	419	62046	43955
Middle Spring	455	312	62046	31458
East Spring	200	486	73000	22584
Duckenfield Creek	389	0	141852	0
Goss Creek	3845	0	145000	0

3. Water Sampling & Testing Program

Regularly scheduled water sampling and testing is performed on the distribution system. The following table includes a summary of all testing:

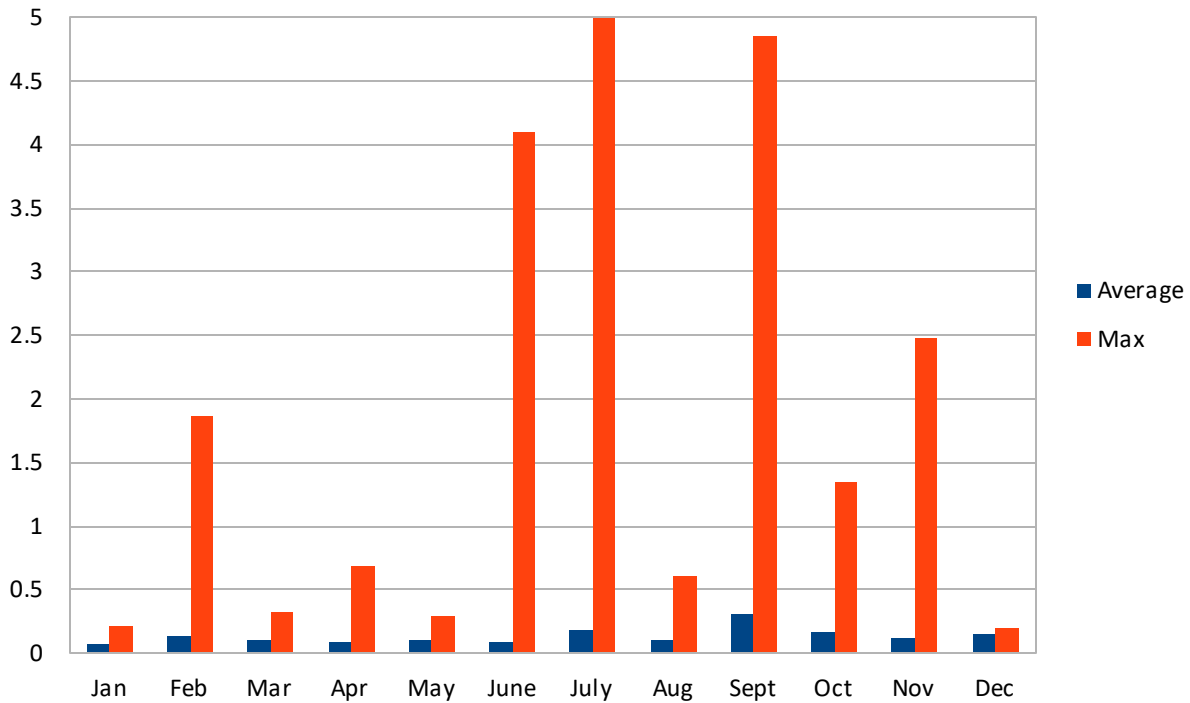
Frequency	Location	Tests
Daily	On site (Water Treatment Facility, Raven Lodge ¹)	Temperature, Turbidity, Chlorine Residual
Weekly	On site (Water Treatment Facility)	pH
Twice monthly System Water Testing	Vancouver Island Health Authority	Total coliforms, E. coli
Monthly Source Water Testing	Vancouver Island Health Authority	Total coliforms, E. coli

4. Water Quality - Source Water and Distribution System

A. Source Water & Distribution System

Up to date water quality reports and lab data are always available from the Utilities Department. Some of the more important parameters tested are turbidity, and chlorine residuals at the beginning and end of the distribution system.

Turbidity is a measurement of the cloudiness of water. Reported in nephelometric turbidity units (NTU), it is an optical measurement of water's ability to scatter and absorb light rather than transmit it in straight lines. Turbidity is caused by fine suspended particles of clay, silt, organic and inorganic matter, plankton, and other microscopic organisms that are picked up by water as it passes through a watershed. It is an important water quality indicator because contaminants such as bacteria and viruses can attach themselves to the suspended particles in turbid water. These particles can interfere with disinfection.

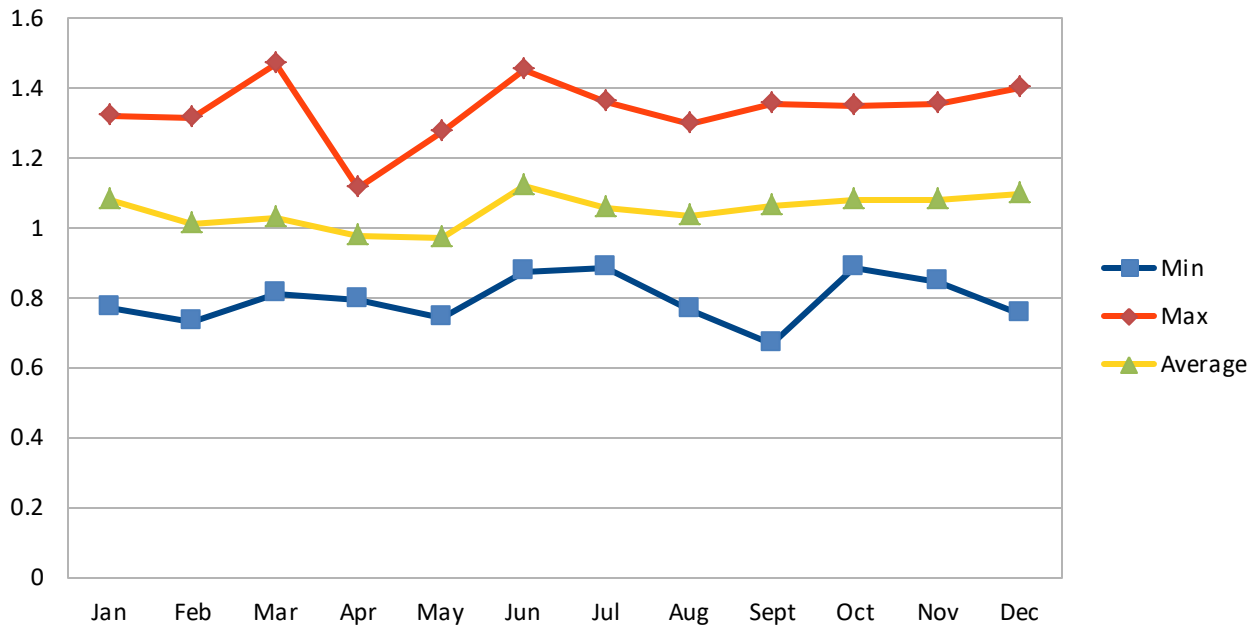


Due to the remote nature of the environment and the quality of the water from our springs, we have consistently low turbidity levels. Occasional high readings are observed, which typically coincide with heavy rain events, storms or rapid spring melts. The very high maximum readings in June, July, and September were caused by servicing and flushing the turbidity meter after events that caused a spike in the turbidity meter. As shown in the graph above, average values are always below 0.35 NTU.

Chlorine is one of the most commonly used disinfectants for drinking water and is very effective in the deactivation of pathogenic microorganisms. We use sodium hypochlorite in liquid form as our primary disinfectant. Relative to larger city operations, our raw drinking water is of excellent quality, so a smaller amount of chlorine is needed as disinfectant.

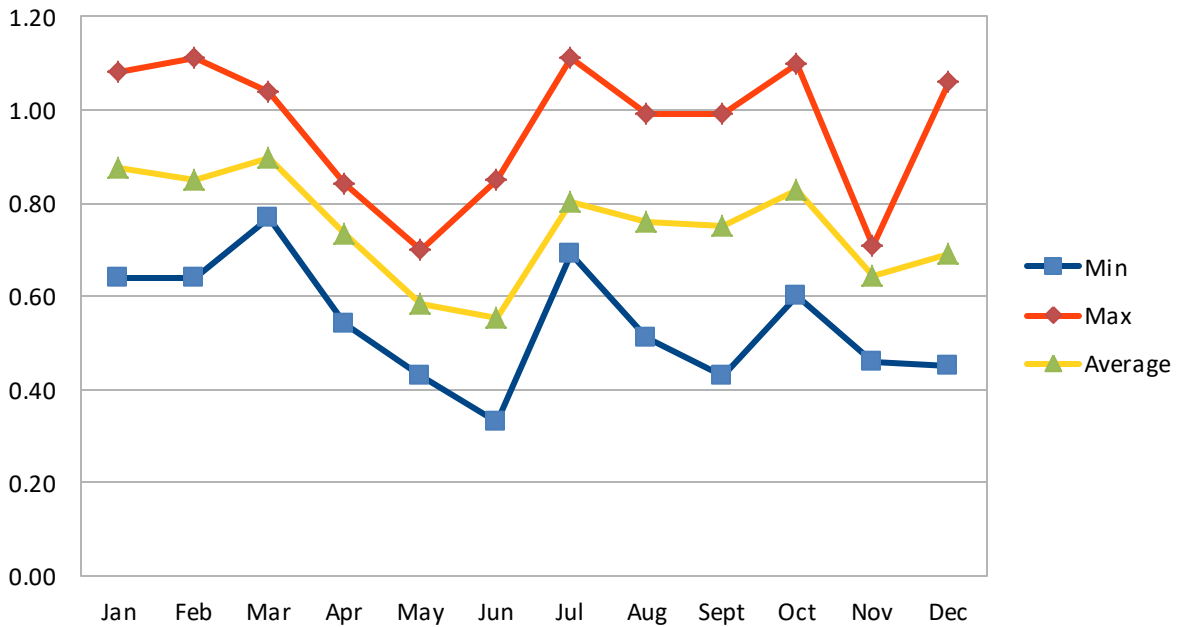
Sodium hypochlorite is injected into the raw water as it is pumped up to the treated water storage tank. Allowing the solution to mix thoroughly in this tank provides sufficient contact time between the disinfectant and the water. Some of the chlorine is used up in the disinfection process. The residual chlorine is measured continuously by an online analyzer at the water treatment facility, the first tap on the distribution system. Our goal is to meet the 4-3-2-1 guidelines set out by Island Health. We do this in part by maintaining a minimum chlorine residual of 0.50mg/L or ppm at this point at all times. The following graph displays the maximum, minimum and average measured residuals for each month in 2018.

2018 Chlorine Residuals



As chlorinated water travels through the distribution system, the chlorine available for disinfection will decrease. It is either used up by any organics or contaminants found in the distribution system, or it dissipates if water sits around for too long. It is important that potable water maintains a measurable chlorine residual throughout the entire system.

2018 Raven Lodge Residual



The Raven Lodge is the last connection on the distribution system. On a daily basis, we manually test the chlorine residual there with the use of a chlorimeter. The chlorimeter is

used to measure the degree of coloring, and correlates that to a measurement of residual in mg/L or ppm.

Our goal is to maintain a minimum chlorine residual of 0.2mg/L at this point, the bottom end of the system, at all times. Occasionally, during the off-season months, there is very little flow at the end of the distribution system, since the Raven Lodge and many other buildings in the area are closed. If the chlorine residual measured falls below the target of 0.2mg/L, we will briefly flush a hydrant in the area to pull fresher water into the end of the system. This typically happens once in June and again in October or November, as shown in the above graph.

B. UV Disinfection as Second Form of Treatment

Vancouver Island Health Authority (VIHA) has implemented a '4-3-2-1' drinking water quality initiative. All water systems that use surface water sources will be required to maintain the following treatment specifications:

- 4 log removal/inactivation of viruses
- 3 log removal/inactivation of Giardia cysts and Cryptosporidium oocysts
- 2 treatment processes, usually filtration and disinfection
- 1 NTU maximum turbidity in finished water

Our water meets the turbidity requirements for filtration deferral. That is, a daily average source water turbidity of 1 NTU or less 95% of the time and not above 5 NTU on more than 2 days in a 12 month period. Therefore instead of filtration as a second form of treatment, we are using an ultraviolet disinfection system in our existing water treatment building. Incoming raw water is subject to UV disinfection before being chlorinated.

5. Water Quality Inquiries and Complaints

We received no complaints regarding water quality during 2018. There were several complaints lodged with our accounting department, all to do with high water bills. We investigated the source of the high water bills and found that plumbing issues or running toilets within the units were responsible for the high water usage. Once a year, we include a list of reminders with utility bills. Checking for leaky toilets or faucets is always on this list.

A few times a year, we receive calls from customers who have found water pooling on the ground and are concerned that a water main has been broken. These calls typically happen in spring and early summer, and this year was no exception. As snow melts, water follows the path of least resistance and often collects in unusual areas, dammed by snowbanks and ice jams. We always investigate these calls to confirm that the water is not originating from our distribution system.

6. Water Leaks and Repairs

We dealt with 10 instances of leaks in the distribution system this year. The 2" pipe that was initially installed with the water system, specifically on the top side of the village, is continuing to degrade and causing us to have more numerous and frequent breaks. The summer of 2018 also saw us actively replacing these service lines in sections of the village where we have had numerous breaks over the previous seasons.

We were fortunate during the 2018 season that all of our breaks occurred during the summer and fall, during times when we did not have deal with several meters of snow on the ground. Winter leaks are significantly harder to find and isolate due to the snow coverage, and impact the customers and their rental customers much more during the winter season.

1. June 13th - The 1 inch service line for unit #64 burst open. This was a bit tricky to find due to the water running underground for some distance before coming to the surface. Original line was not buried with bedding sand, and a very large rock had compressed the line and caused a crack, which eventually burst open. The service line was patched with a section of new pipe and reburied with bedding sand
2. June 18th - The 1 inch service line cracked for unit 36. This was not a large leak, and was likely leaking for some time before it was located. Locating the leak was again difficult as the water was traveling in rock below ground into the perimeter drain of a unit downhill from it. This unit also did not have a proper curb stop. We initially started this repair by installing a proper curb stop for this service line, and dug back along the line towards the unit until we located the leak. The leak was a 2 inch crack along the length of the pipe, caused by rocks in an area where there was no bedding sand used during the lines initial installation. The section between the new curb stop and the leak was patched with a new section of line and buried with bedding sand.
3. June 19th - During the clean up of the above repair, the weight of the excavator pushed a rock unto to the 4 inch blue brute line that fed the service lines in this area, causing a 3.5 foot crack along the top of the line. Digging in this area was difficult due to the amount of rock that was there, and it was evident that no bedding sand was used when this line was initially laid in the ground. The cracked section was removed and replaced, and secured with 2 Robar compression couplers.
4. June 26th - Break in the service line for unit #94. Very difficult to located as this water was running 50 feet underneath the road before coming to ground. The leak was eventually located, a 5 foot section of line was replaced and buried with sand.
5. July 3rd - Break in the Service line for unit #95. Easy to locate as this came to ground at the leak location. Two foot section of line replaced and buried. Identified that this unit did not have a curb stop or shutoff for the specific unit, and one should eb added when we replace these service lines later in the summer.
6. August 1st - The 2 inch service line for unit #78 broke open in between units 78 and

79. This line was located and dug up, and a 3 feet section of the service line here was replaced. This was a prime example of the failure of the older service lines that will be need to be replaced in the future.

7. Sept 5th - The 2 inch service line for unit #95 ruptured, on the customers side of the curb stop shut off. As this was on the customers side of the shut off, this was not repaired by us.

8. Sept 20th - The 2 inch service line for unit #79 cracked. This was located in approximately the same location as the repair at #78, and was located 3 feet from the previous repair. Rocks pressed into the line created a 6 inch length ways crack. This section was replaced, and re buried with bedding sand. This was a quick repair as we had already had a repair in the previous month.

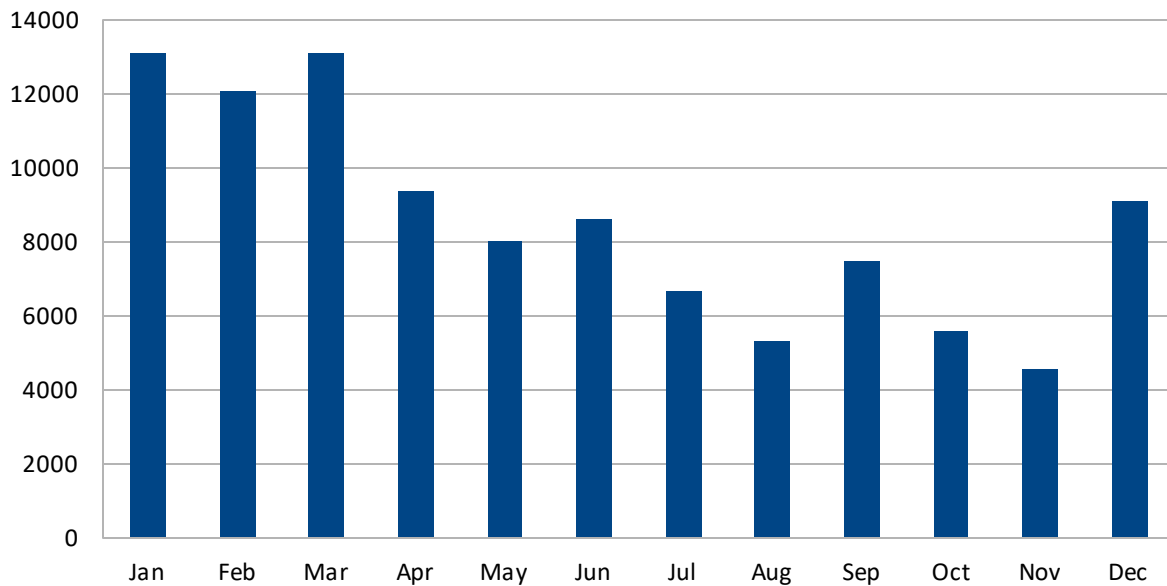
9. Oct 17th - While replacing power poles in the village, BC Hydro struck the service line for unit #91. This was a 2 inch service, that had been replaced the summer before. The line was fully severed, located and the broken section was patched and re buried. Since it had been already replaced, the line was in proper bedding sand but had been broken when hit by the excavator. Repair was more difficult due to the proximity to the power that had not yet been properly buried and set into the ground.

10. Oct 19th - While the above power pole was being buried, the large rocks being placed by BC Hydro to secure the power pole caused the repair to sever once again. Due to the proximity to the power pole, the BC Hydro foreman was called and supervised the digging to access the previous repair point. The initial patch was replaced and extended slightly, before being reburied. Again this repair was difficult due to the new power pole being closer to the service line than the previous pole.

7. Water Consumption

The 2018 winter season was a good winter for snow sports, with a good snow base and favorable weather. The result was higher visitor numbers both in day visits and stays in the village. We also saw an increase in the number of weddings and events being held at the resort during the shoulder and summer seasons, and an increase in the number of mountain bike riders throughout the mountain bike season.

2018 Annual Water Consumption in Cubic Meters



8. Maintenance Program

Inspections of the springs, reservoirs, chlorination equipment and pumps are conducted on an almost daily basis (approx. 4-5 times a week). This is done to decrease the risk of equipment failure and contamination of the water, and to ensure the consistent application of chlorine for disinfection. All of the gate valves in the distribution system are exercised once per year to ensure they will function properly in an emergency. Water mains are flushed once per year, and all hydrants are serviced at this point as well. Our treated water storage tank was inspected by a dive crew in 2009 and was cleaned and inspected in 2013. The next cleaning and inspection of the treated water storage tank will be in the spring or summer of 2019. An operator is always on call 24 hours a day to respond to any emergencies.

9. Water System Projects

2018 Completed Projects

- updated the Drinking Water Emergency Response Plan
- completed annual fire hydrant maintenance and distribution system flushing program
- maintained excellent customer complaint and service request response times
- continued quality control through regular testing and monitoring of our water systems
- continued work with water audit looking for illegal connections and potential sources of water loss
- removed trees and shrubs from shores of raw water reservoirs

- completed additional operator education
- performed repairs to collection points above the Middle Spring reservoir
- installed concrete barriers around the hydrants in front of Deer Lodge
- updated Watershed Protection Plan
- continued with project of servicing, repairing, and replacing water meter displays and readers that did not seem to be functioning properly
- replaced aging service lines in 2 of the arms in the village that have been causing us the most leak issue over the recent years

10. Emergency Response Plan

The resort's utility department has an Emergency Response Plan (ERP) that contains procedures and contact information to efficiently respond to water system emergencies such as contamination of water supply, loss of supply, and pump failure. The ERP is reviewed and updated every year. Copies are available in the Water Reclamation Facility, the Water Treatment Facility, and on the company's internal computer network.

11. Cross Connection Control

A Cross Connection Control (CCC) Program was initiated in 2011 and expanded this year. This is now performed by the contractor Caledonia Fire Protection Ltd for all resort buildings and fire suppression systems. The requirement for backflow prevention devices is stressed for all new buildings being built by customers. This requirement is also reinforced with the owners of existing buildings in the village.

12. Dam Safety and Maintenance Program

The Dam Safety Auditor visited us in the fall of 2018 to review the requirements of the necessary Dam Safety and Maintenance program and the changes made to the program. All of our operators completed a Dam Safety course put on by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development in the late fall. Due to the early snow fall burying our dam location, we were not able to complete the update of our Dam Safety program, but we will definitely be revisiting this once that area is clear of snow once again.

13. Closing

An annual report for the year 2018 will be prepared and submitted to the Vancouver Island Health Authority. The annual report will also be posted on our website.