2022 Annual Report

1.0 - Operator Certification

BMID is administered by Robert Hrasko and has EOCP classified facilities as Water Distribution (WD) Level IV and Water Treatment (WT) Level IV.

As required, BMID has undertaken an internal progression program to have Level IV operators for both the Water Distribution System and the Water Treatment Plant as required by EOCP facility classifications. Currently, Scott Findlay, Bryan Vig and Jeff Clark are Level IV Water Distribution certified operators. In addition, Chase Elliott and Shayne Ermel are certified as Level IV Water Treatment Plant operators.

Table 1.1 – BMID Operator Certification

BMID's certified operators are as follows (End of 2022):

Name	WD Level	WT Level	Chlorine Handling
Bryan Vig	IV	I	Yes
Chase Elliott	II	IV	Yes
Keith Jensen	II	-	Yes
Geoffrey Caldwell	II	-	Yes
Jeff Clark	IV	I	Yes
Kurt Kover	III	-	Yes
Shayne Ermel	II	IV	Yes
Logan Archer	I		
Jonathan Bauer	I		
Scott Alexander	II	-	Yes
Mathew Poynter	II	-	
Tyler Bateman	II	-	
Dustin Pedherny	I	I	Yes

2.0 - Cross-Connection Control Program

Working in partnership with the City of Kelowna, BMID staff help to ensure that all backflow prevention assemblies installed within our service area are tested annually by an approved tester. This is to limit any potential hazards from entering the distribution system from commercial, industrial and institutional customers and their activities. As the program is administered by the City of Kelowna using their Backflow Prevention Monitoring software, BMID is in contact with the City when a backflow assembly is past-due for testing or when a device fails a test. At this point BMID contacts the customer to ensure compliance with the program.

BMID staff are in regular contact with City of Kelowna staff to confirm that all backflow assemblies installed in BMID's service area are tested and functioning. BMID works to maintain 100% compliance within our Cross-Connection program. In addition, new and renovated facilities are inspected by the building and inspection departments at the City of Kelowna to ensure that all backflow prevention assemblies are installed as required. Apart from new and renovated facilities, BMID's cross-connection control program continues to run in the same manner in 2022 as in previous years. There are 876 backflow assemblies currently found in the BMID system including 29 new installations in 2022. In total, there are 260 individual customers with a backflow prevention assembly located in 398 individual facilities.

3.0 - Water Monitoring Plan

BMID's 2022 water monitoring plan had only minor changes from the Monitoring Plan implemented in 2021. Recent changes to the Monitoring Plan are as follows:

1. For all of 2022, sampling only took place at Well No. 4 during the fall/winter when the well provided water for domestic consumption;
2. Sampling took place at Well No. 5 during the spring/summer when the well provided domestic water for the north-end of the system;
3. Well #6, used for irrigation in the north-end, is now sampled annually while in use. The source continues to be sampled for bacteria to verify that the raw water within the well is clean and also to provide a baseline, should the well ever be needed as a domestic water source.
4. Both THM and HAA sampling in the distribution system were taken at the Pearson Road sample station and the UV Treatment Facility downstream of the sodium hypochlorite injection point;
5. As in previous years, full parameters were carried out on all raw water sources and in BMID's upper watershed raw water reservoirs. Samples were also collected at the point of withdrawal intakes of BMID's drinking water sources. Pearson sample station replaced Booster No.1 (first customer) as the location of BMID's comprehensive distribution samples for both February and July. Well water is used as a supplemental drinking water source in the north-end for both domestic use and irrigation use. Well 4, used as the low flow winter source, was sampled in January 2022. Well 5, used as the high-flow summer source, was sampled in August 2022;
6. Weekly raw water samples at the Scotty Creek Intake are no longer being taken as the source is used only for irrigation. All domestic connections in the Scotty Creek subdivision and the north-end of BMID's distribution system are fed off of a combination of Mission Creek system water with supplemented supply well water after the water mains were twinned and separated for domestic and irrigation use in previous years;
7. Weekly raw water samples and comprehensive samples did not take place at the newly commissioned Well 6 as this well is only used as a source for irrigation water.
8. Bench scale testing took place on the groundwater from Cornish Well. The well is being reviewed as a possible irrigation water source. Testing of the well included testing the water with an ortho-phosphate to sequester the manganese in solution in the groundwater.
9. Grab samples were obtained and tested for PFAS substances. Samples were obtained for Mission Creek, for the Scotty Creek wells and for Cornish Well. None were found but BMID is investigating higher resolution testing for future sampling.

Table 3.1 – BMID Water Sampling Summary

Watershed & Sources	Biological	Chemical	Full Parameters	Special Testing	Frequency	Sample By
Graystoke Reservoir			X		Annual	LARRATT
Fishhawk Reservoir			X		Annual	LARRATT
Loch Long			X		Annual	LARRATT
Belgo Reservoir			X		Annual	LARRATT
James Lake Reservoir			X		Annual	LARRATT
Mission (Crescent) Lake				X	Varies	BMID
St. Margaret's Lake				X	Varies	BMID
Mission Creek Intake			X		Semi-annual	CARO
Scotty Creek Intake				X	Varies	BMID
Cornish Well				X	Varies	BMID
Well No. 4			X		Annual	CARO
Well No. 5			X		Annual	CARO
Well No. 6				X	Varies	CARO
Raw Water Microbiological Monitoring						
Scotty Creek Intake					Varies	BMID
WTP Intake					Bi-Weekly	CARO-BMID
Stevens – Outlet					Weekly	CARO-BMID
Hadden Outlet (at Screens)					Bi-Weekly	CARO-BMID
Distribution System Monitoring						
Booster No. 1	X				Weekly	CARO
Screen Works	X	X			Weekly	CARO
2921 Belgo	X	X		X	Weekly	CARO
Ellison Blow-Off	X				Weekly	CARO
Pearson Rd	X	X	X	X	Weekly	CARO
3976 Hwy 97	X				Weekly	CARO
Prospect Reservoir	X				Weekly	CARO
Tower's Ranch Reservoir	X				Weekly	CARO
Kirschner Reservoir	X	X		X	Weekly	CARO
Ellison School	X				Weekly	CARO
Well 4	X		X		Weekly	CARO
Well 5	X		X		Weekly	CARO
Well 6	X			X	Varies	CARO
UV Treatment Plant		X		X	Varies	CARO
7 Sites through WD System on a 3-week rotation		Sampled for Presence Absence			Rotation	BMID
On-Line Monitoring						
Point of Diversion (Mission Creek Intake)	On-line turbidity meter					
Water Treatment Plant	Parameters of turbidity, water consumption and particle charge (streaming current monitor) are all operating on-line at WTP					
Distribution Intake (Hadden Outlet at Screens)	On-line residual chlorine downstream of dosing location, pH and turbidity					
Surge Tower	On-line residual chlorine					
Booster Station No.1	On-line residual chlorine, pH, and turbidity					
BMID UV Reactor	On-line upstream/downstream chlorine, UV transmissivity, turbidity, pH and pressure					
Towers Reservoir	On-line residual chlorine					
Kirschner Reservoir	On-line residual chlorine					
Prospect Reservoir	On-line residual chlorine					
PRV No. 24	On-line residual chlorine					
Well 4	On-line residual chlorine, Well Level					
Well 5	On-line residual chlorine, Well Level					

Table 3.1 – BMID Water Sampling Summary (continued)

Biological Parameters						
Weekly Tests by CARO	Free Chlorine Residual (field) (mg/L)	Temperature (field) (degrees C)	Total Coliforms Colonies/100ml	E.Coli colonies/ 100ml		
Chemical Parameters						
Weekly Tests by CARO	Turbidity (NTU)	Colour (TCU)	pH (pH units)	Alkalinity (mg/L Caco3)	Free Chlorine Residual (field) (mg/L)	Temperature (field) (degrees C)
Quarterly Tests By CARO	Disinfection Byproducts	Trihalomethanes	Haloacetic Acids			
Special Water Quality Parameters						
Mission Creek Source	UV Trans					
Mission Creek Source	TOC					
Screen Works	TOC					
Stevens Reservoir	Metals					
Full Parameters						
Carried out at Pearson School sample stn, on all raw water sources for consumption and on watershed drinking water reservoirs						
Parameter	Units					
Alkalinity (total)	mg/L as CaCO3					
Calcium (total)	mg/L					
Colour (true)	Colour units					
Conductivity	Umhos/cm					
Hardness	mg/L as CaCO3					
Iron (total)	mg/L					
Magnesium (total	mg/L					
Manganese (total)	mg/L					
Nitrate & Nitrite	mg/L as N					
pH	pH units					
Potassium (total)	mg/L					
Sodium (total)	mg/L					
Sulfate	mg/L					
Total Dissolved Solids	mg/L					
Turbidity	NTU					
Ortho Phosphate	mg/L as P					
Dissolved Phosphorus	mg/L as P					
Total Phosphorus	mg/L as P					
Total Organic Carbon	mg/L					
Total Coliform	MPN/100ml					
E.Coli Coliform	MPN/100ml					
UV Transmissivity @ 254u	%/cm					
Ammonia	mg/L as N					
Total Kjeldahl Nitrogen	mg/L as N					
Chloride	mg/L					
Fluoride	mg/L					
Cyanide	mg/L					
Aluminum	mg/L					
Antimony	mg/L					
Arsenic	mg/L					
Barium	mg/L					
Boron	mg/L					
Cadmium	mg/L					
Calcium	mg/L					
Chromium	mg/L					
Cobalt	mg/L					
Copper	mg/L					
Lead	mg/L					
Mercury	mg/L					
Molybdenum	mg/L					
Nickel	mg/L					
Selenium	mg/L					
Uranium	mg/L					
Zinc	mg/L					
Total Coliforms	CFU/100 Ml					
E.Coli Coliforms	CFU/100 Ml					

3.2 – BMID Water Sampling Summary (continued)

BMID staff take weekly samples from 10 locations in the distribution system. For 2022, 327 samples were collected and taken to CARO Analytical for testing. Of the 337 samples collected all came back negative for *E.*Coli representing 100% of the total samples taken. Of the 327 samples taken for Total Coliforms, 326 came back as negative for Total Coliforms representing r99.964% of samples. The inactivation of total coliforms and E.Coli coliforms in the distribution system demonstrates the effectiveness of the Water Treatment Plant, Primary Chlorination works, Ultraviolet Disinfection Plant and the secondary sodium hypochlorite top up system currently employed by BMID.

In addition to the testing conducted by CARO, BMID staff also sampled for Presence/Absence (PA) of bacteria and incubated the samples in-house. These samples took place throughout the distribution system at 7 locations. In total 125 PA samples were collected and incubated with only 1 positive sample showing the presence of bacteria. Therefore, 99.2% of the samples coming back as negative for bacteria. The sample that was positive were retested by CARO analytical and the sample was found to be free of bacteria.

BMID staff also collected raw-water samples from three locations between Mission Creek and the point of chlorination. Samples at the Point of Diversion Intake (WTP intake or Stevens Pond intake depending on time of the year), Stevens Pond Outlet and the Distribution Intake at Hadden Pond Outlet (just prior to chlorination) are taken weekly. There is a substantive reduction in the number of *E.Coli* colonies present between the Mission Creek Intake and the Distribution Intake which demonstrates the effective settling of particles as the water moves through the Water Treatment Plant, then Stevens Reservoir and finally Hadden Reservoir. Only *E.Coli* results for these samples are as follows:

Location	**Average *E.Coli* counts per sample**	**Max *E.Coli* count**
Creek Intake	7.00	53
Stevens Outlet	1.48	30
Hadden Outlet	0.69	11

4.0 – Water Quality Events of Note

Water advisories, positive samples, loss of service, off-spec water and customer complaints were rare throughout 2022. However, BMID noted the following occurrences when water quality issues/changes did arise.

1. A single positive Presence/Absence bacteriological sample was found at the Campion Rd sample station on January 17, 2022. BMID crews resampled the location for third-party analysis. The third-party analysis did not indicate the presence of either Total Coliforms or E.Coli bacteria.
2. A large fire in a commercial warehouse occurred on February 15, 2022. Flows increased from 75 L/s to 345 L/s as fire crews fought the blaze. The result was a slight rise in system turbidity and a lowering of disinfection contact time during the firefighting efforts.
3. The BMID distribution system experienced a short-term spike of turbidity above 1.00 NTU at Booster 1 on April 25, 2022. This event was caused by a dramatic rise in system flows which stirred up any sediments in the water mains that had settled during winter. The turbidity readings reduced back to normal levels after the initial spike with the event only lasting less than 12 hours.
4. BMID's Ultraviolet Treatment Facility had an "Off-Spec" event on April 11 and April 25, 2022. This was caused by an instrumentation error in the on-line UVT meter during normal maintenance. Adequate disinfection was maintained at all times during the event.
5. A May 30, 2022 Kirschner Reservoir sample had background bacterial colonies present. However, there were no detectable *E.Coli* bacteria or *Total Coliform* bacteria. Subsequent resampling in June did not indicate any background colonies at this location. It is assumed that the sample in question was a result of operator error.
6. BMID's Ultraviolet Treatment Facility experienced an "Off-Spec" event on July 2 and July 26. This "Off-Spec" incident was the result of a temporary lag in the UV dose during the daily reactor changeover from one reactor to another. In both cases, the issue lasted a matter of minutes before quickly reverting back to normal treatment operations.
7. The August 2nd bacterial sample taken at 3976 Highway 97 was found to have a single colony of Total Coliform bacteria. Once the sample was confirmed positive, the area was flushed, bringing in fresh water, and re-sampled on August 4th. The August 4th resample was found to be free of any bacteria. It is assumed that the positive sample was a result of sampling error.
8. An "Off-Spec" incident occurred on August 29th at BMID's Ultraviolet disinfection facility. The incident was the result of operator error resulting the shut-down of one of the UV reactors. The error was noticed immediately, however, it took several minutes for the reactivated lamps to warm up and resume normal operation. Throughout the incident, primary disinfection (chlorination upstream of the UV facility) as well as re-chlorination after UV remained in operation.
9. A Water Quality Advisory was called on September 27th and was rescinded on October 5th. The scheduled WQA was called to allow BMID to undertake a planned inspection of its infrastructure which required the UV Plant to be bypassed for limited periods on September 27th and September 28th.

Table 4.1 – Disinfection By-Product Testing

	THM		HAA	
Sample	UV Plant	Pearson School	UV Plant	Pearson School
Q1	0.0685	0.0670	0.0551	0.0860
Q2	0.0568	0.0743	0.0496	0.0406
Q3	0.0392	0.0537	0.0294	0.0420
Q4	0.0522	0.0699	0.0377	0.0479
Average	**0.0542**	**0.0662**	**0.0430**	**0.0541**

5.0 - Annual Consumption Data

CONSUMPTION: Total annual consumption was 11,392 ML which was 94% of the five year average of 12,066 ML. The average daily flow for 2022 was 31.2 ML/day. The maximum daily flow was on July 1, 2022, when 123.7 ML of water was consumed.

WATERSHED: Graystoke, Fishhawk and Loch Long Reservoirs are normally used to keep water quality as high as possible through the summer months. BMID was required to utilize water from the high elevation storage reservoirs In July, weeks earlier than normal, as high consumption levels in early summer were above the natural flow of Mission Creek. Belgo Reservoir is utilized in early summer when the Water Treatment Plant is running because of the high levels of colour found in the water source. Water from James Lake Reservoir is only used as an irrigation source for the Scotty Creek area of the distribution network in BMID's north-end.

The reservoir levels at 2022 year-end are summarized below. At year end 21% of storage remained in place.

Table 5.1 – Watershed Reservoir Data

Reservoir	**Capacity (ML)**	**Volume at Yr End (ML)**	**% Full**
Belgo Reservoir	6,815	1,344	20%
Graystoke Reservoir	5,095	325	6%
Fishhawk Reservoir	2,106	622	30%
Loch Long Reservoir	625	594	95%
James Lake Reservoir	1,775	595	34%
TOTAL	**16,416**	**3,480**	**21%**

Graph 5.2 – Monthly Consumption

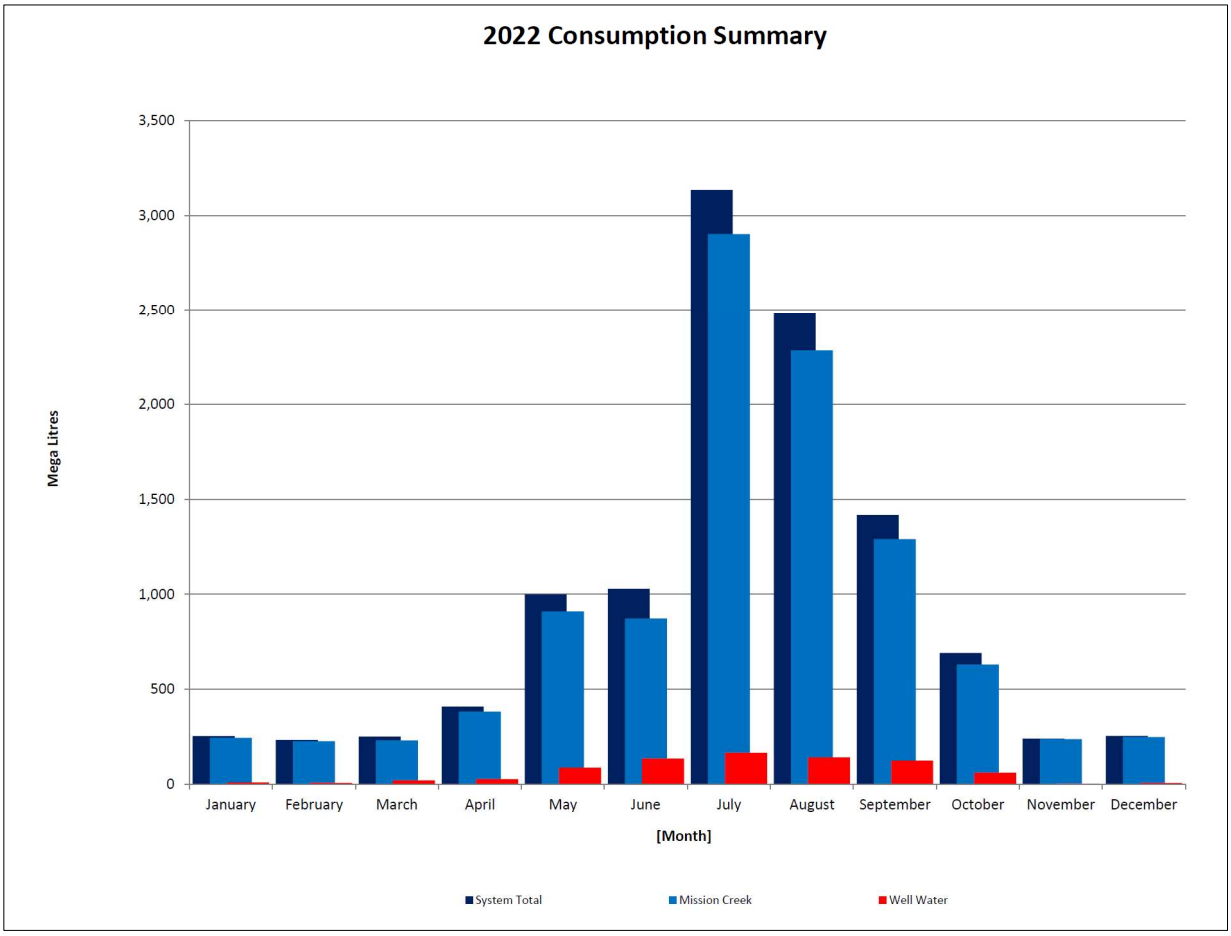


Table 5.3 – Monthly Consumption

BLACK MOUNTAIN IRRIGATION DISTRICT									
MONTHLY CONSUMPTION TOTALS AND YEAR END SUMMARY									
Year	Mission Creek	Well #4	Well #5	Well #6	Scotty Creek	NE Production	Well Water	Surface Water	System Total
2022	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres
January	244.04	8.57	0.00	0.00	0.00	8.57	8.57	244.04	252.61
February	226.04	6.95	0.00	0.00	0.00	6.95	6.95	226.04	232.99
March	231.21	20.19	0.00	0.00	0.00	20.19	20.19	231.21	251.39
April	381.84	12.85	13.41	0.00	0.00	26.27	26.27	381.84	408.11
May	909.52	20.37	63.06	3.34	3.06	89.83	86.77	912.58	999.36
June	872.14	20.15	36.70	78.66	21.44	156.95	135.51	893.59	1,029.09
July	2,902.69	36.06	21.88	107.66	67.17	232.77	165.60	2,969.86	3,135.46
August	2,283.52	1.96	117.22	21.82	56.56	197.56	141.00	2,340.08	2,481.08
September	1,290.61	11.19	89.96	22.32	2.73	126.21	123.48	1,293.34	1,416.82
October	630.72	9.32	51.19	0.00	0.00	60.50	60.50	630.72	691.22
November	236.76	2.75	0.00	0.00	0.00	2.75	2.75	236.76	239.51
December	248.43	6.02	0.00	0.00	0.00	6.02	6.02	248.43	254.45
Total	10,457.53	156.37	393.42	233.81	150.96	934.56	783.60	10608.50	11,392.09

6.0 – Completed and Ongoing Water Infrastructure Projects

- BMID staff and Pure Technologies worked together to undertake a comprehensive condition/risk assessment of the primary transmission main (4.8Km) between the Surge Tower and PRV #2. The assessment showed that the main is in good condition, with only one suspected leak and two distress points. BMID will work to remedy any deficiencies identified in the assessment.
- BMID continues to work on a detailed design of a two phased project that will mitigate risk to an unstable slope located on BMIDs primary transmission main downstream of the chlorine injection intake. The first phase will consist of a 1500mm pipeline that will span 500 meters and connect our existing Screening Works building to the new tunnel portal. The second phase is the extension of the existing McDougall rock tunnel by 1650 meters. The design, permitting and financing is expected to be completed by mid 2023.
- Work continued on a large multi-phase project in the Mission Creek watershed. The Provincial Dam Safety Regulations require that BMID improve the access to the Fish Hawk Reservoir as well as to install rock armoring on the Dam face. In 2022, BMID continued to work with R. Smith Contracting to complete the road resurfacing between Mission Creek and Fish Hawk reservoir. In addition, approximately 1600 m3 of rock was stockpiled near the dam and will be put in place in 2023.
- A new chlorine gas ventilation system was installed at the primary chlorinator which is located at the Screening Works facility adjacent to Hadden Pond. This upgrade was a requirement of Work Safe BC and will provide protection for our Operators in the unlikely event that a chlorine leak occurs.
- BMID staff continue the process of winterizing as many aspects of the Water Treatment Plant as possible to ensure that the facility can remain on stand-by throughout the winter.
- Completion of two new sludge drying lagoons above the WTP to aid in sludge removal post treatment.
- Completion of installation of new emergency back up generator, adequately sized to run the WTP at full capacity.
- BMID staff completed the renewal of approximately 9 connections to our primary transmission main between Band Rd ad PRV #2. These air valves, low point drains, and services were 50+ years old and were at the end of their service life. We are continuing this renewal program for the next several years to replace all the original connections to the PCCP transmission mains. This will reduce the risk of a widespread service disruption in the event of a failure.

7.0 - WTP OPERATIONS

The Black Mountain Irrigation District's Class IV Water Treatment Plant (WTP) performed very well throughout the 2022 treatment season. Improved water quality was achieved in all water quality measurements, especially in the reduction of color, turbidity, total organic carbon levels, and disinfection by-products (Trihalomethanes and Haloacetic acids).

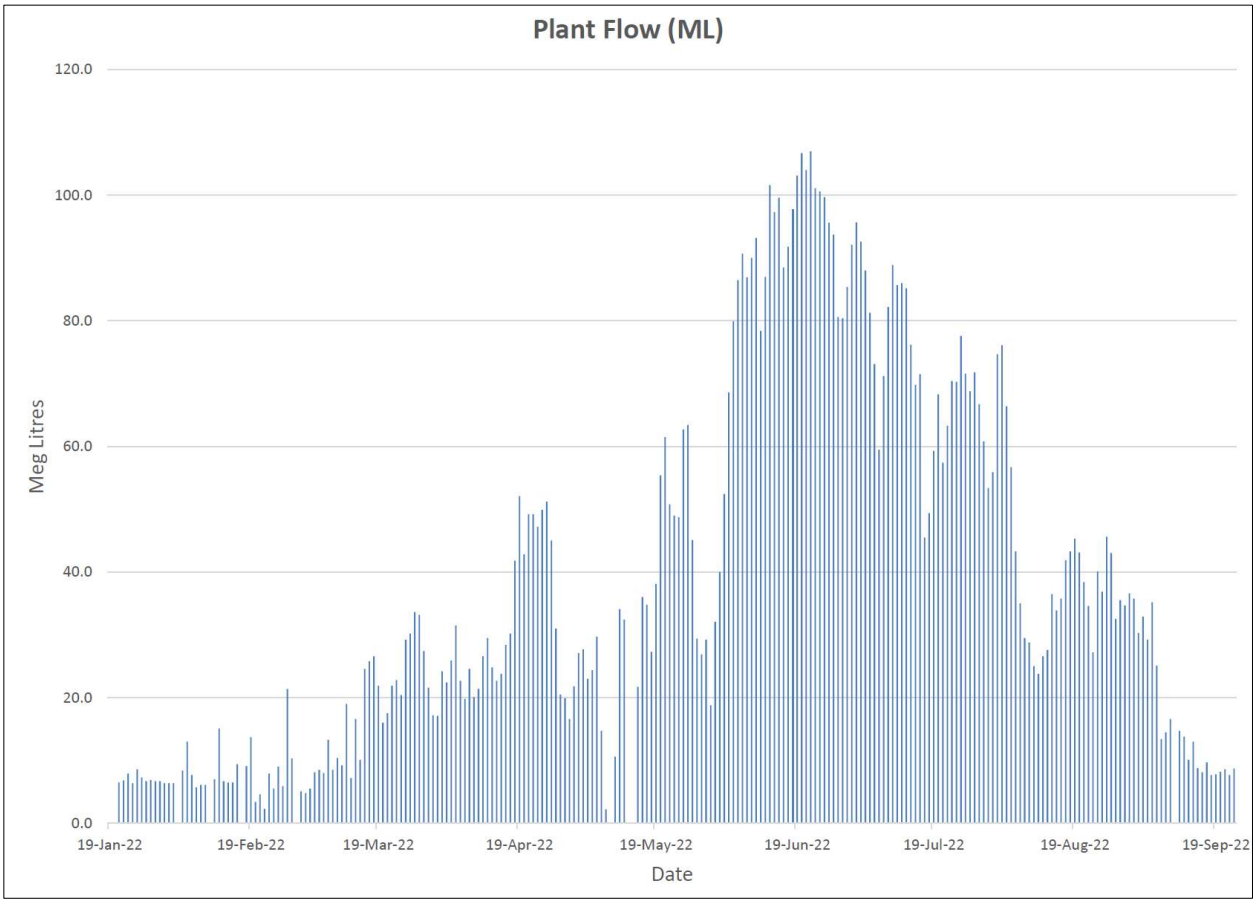
The BMID WTP began yearly operations on January 19th and the plant continued to run until October 31st when the water quality in Mission Creek no longer required chemical treatment to remove turbidity and colour. In total, the WTP was in operation for 258 days during the 2022 treatment season. The plant was open for 281 days the previous year and the five-year average is 237 days of treatment annually.

Turbidity spikes during freshet in Mission Creek were common, as experienced in the past. However, the 2022 season had much higher creek flows compared to the 2020 and 2021 treatment seasons. Fortunately, Mission Creek did not encounter the same significant flooding and high turbidity events that occurred in the 2017 and 2018 seasons. Nevertheless, turbidity spikes were more severe than during the 2021 treatment season. The Water Treatment Plant was able to maintain turbidity levels below 1.0 NTU (Nephelometric Turbidity Units) at the point of disinfection for the entire time in which the WTP was in operation.

7.1 - PLANT FLOW

For the Mission Creek source, peak daily water production of 107 ML (28,266,409 US gallons) occurred on July 30, 2022. The peak instantaneous demand was recorded at 1,227 L/s. For the 2022 season, 9,296 ML of water was treated compared to an average of 9,694 ML over the past five years. In 2022, the Water Treatment Plant was open for 258 days, down from the 281 days during the 2021 season. The Water Treatment Plant was started on January 19th, 2022, and ended on October 31st, 2022, when the raw water quality had improved enough to no longer require chemical treatment.

Graph 7.2 – WTP Plant Flow



Daily plant flow ML for 2022 combined total for both trains

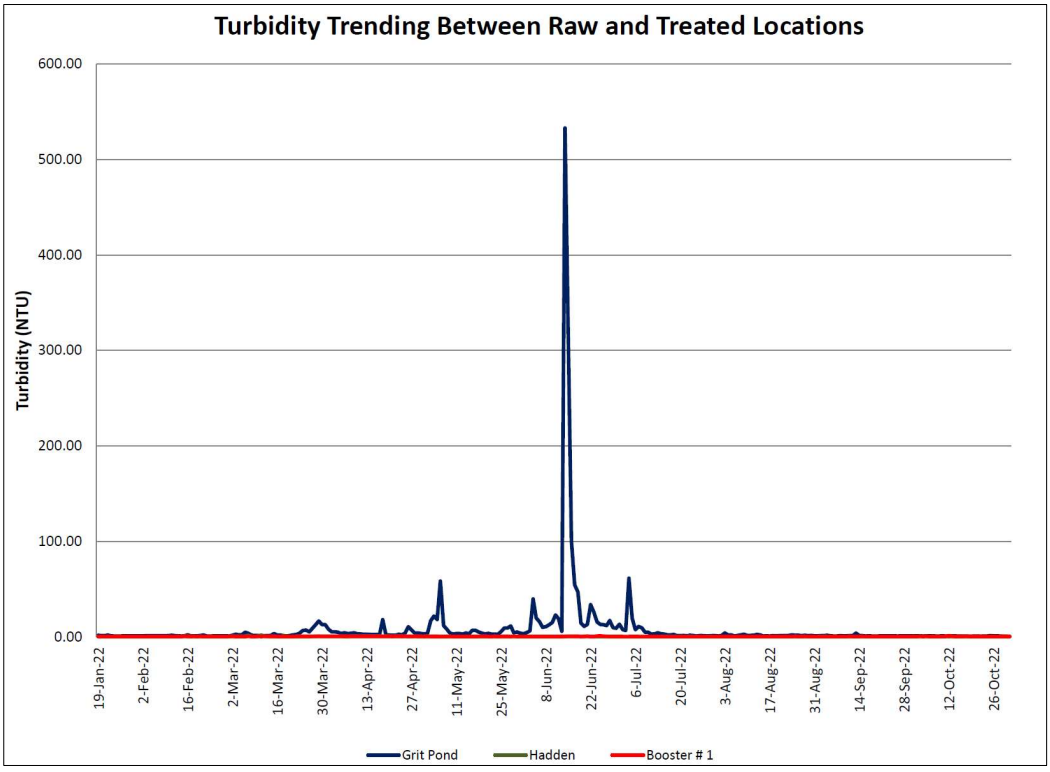
7.3 – TURBIDITY RESULTS

As set by the Canadian Drinking Water Guidelines, Black Mountain's system turbidity is to be less than 1.0 NTU at its first customer (Booster 1). Throughout the treatment season, the Water Treatment Plant was able to maintain acceptable turbidity below this guideline. Turbidity at the first customer peaked at 1.20 NTU on June 25th. This result is taken from a single grab-sample. The average daily turbidity at this location on June 25th was 0.34 NTU on the on-line turbidity analyser. During spring freshet, raw water turbidity at the Grit Pond peaked at 533 NTU on June 14, 2022. The WTP was unable to adequately treat turbidity levels in this range, therefore BMID operators closed the headgates at the creek and relied on treated water storage in Stevens and Hadden Reservoirs.

Average turbidity levels over the treatment period at locations in the water supply system are as follows:

Location	Lab (NTU)	On-line (NTU)
Raw Grit Pond	7.69	-
Stevens Intake	0.46	-
Stevens Outlet	0.47	-
Hadden Outlet	0.43	-
Screen Works	0.45	0.46
Booster Stn No. 1	0.47	0.41

Graph 7.3 – WTP Turbidity Results



Daily turbidity (NTU) results between raw water (Grit Pond) and treated water (Steven's Intake and Booster 1)