

2023 Annual Report

1.0 - Operator Certification

BMID is administered by Robert Hrasko, P.Eng., who reports directly to the elected Board of Trustees. The EOCP has classified BMID's water distribution (WD) system as a Level IV system, and BMID's Water Treatment (WT) system as a Level IV system.

BMID continues to undertake a continuous, informal program to have Level IV operators for both the Water Distribution System and the Water Treatment Plant. This is a requirement by EOCP for facility classifications. Currently, Bryan Vig, Jeff Clark and Kurt Kover are Level IV Water Distribution certified operators. In addition, Chase Elliott is certified as Level IV Water Treatment Plant operator.

Table 1.1 – BMID Operator Certification

BMID's certified operators are as follows (End of 2023):

Name	WD Level	WT Level	Chlorine Handling
Bryan Vig	IV	I	Yes
Chase Elliott	II	IV	Yes
Keith Jensen	II	I	Yes
Timothy Bauer	I	-	Yes
Geoffrey Caldwell	II	-	Yes
Jeff Clark	IV	I	Yes
Kurt Kover	IV	-	Yes
Shayne Ermel	II	IV	Yes
Logan Archer	I		
Jonathan Bauer	II		
Anthony Bafaro	I		
Scott Alexander	III	-	Yes
Mathew Poynter	II	-	
Tyler Bateman	II	-	
Dustin Pedhery	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. The program is to limit any potential hazards from entering the BMID water distribution system through commercial, industrial and/or institutional connections. 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 an assembly fails a test. When such an event occurs, 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 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 2023 as in previous years. There are 902 backflow assemblies currently found in the BMID system including 26 new installations in 2023. In total, there are 279 individual customers with a backflow prevention assembly located in 405 individual facilities.

3.0 - Water Monitoring Plan

BMID's 2023 water monitoring plan has only minor changes from the current Monitoring Plan. Recent changes to the Monitoring Plan are as follows:

1. For all of 2023, 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 sampled monthly for bacteria while in use.
4. Both THM and HAA sampling in the distribution system were taken at the following locations:
 - a. Kirschner Reservoir – Continuously running sample tap in locked building
 - b. Pearson School – Dedicated sample station
 - c. 2921 Belgo – Dedicated sample station
 - d. Ellison School- Dedicated sample station – Well water
 - e. 3976 Highway 97- Dedicated sample station
5. As in previous years, full parameters were carried out on all raw water sources and in BMID's high elevation drinking water reservoirs. Samples were also collected at the intakes of BMID's drinking water sources. Starting in 2021, Pearson Sample Station replaced Booster No.1 (first customer) as the location of BMID's comprehensive distribution samples for both winter and summer samples. 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 2023. Well 5, used as the high-flow summer source, was sampled in July 2023;
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 (via PRV 10) and ground water (Wells 4 and Well 5) after the water mains were twinned and separated for domestic and irrigation use in 2009;
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 at the present time.

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	CARO - BMID
St. Margaret's Lake				X	Varies	CARO - BMID
Mission Creek Intake			X		Semi-annual	CARO - BMID
Scotty Creek Intake				X	Varies	CARO - BMID
Cornish Well				X	Varies	CARO - BMID
Well No. 4			X		Annual	CARO - BMID
Well No. 5			X		Annual	CARO - BMID
Well No. 6				X	Varies	CARO - BMID
Raw Water Microbiological Monitoring						
Scotty Creek Intake				X	Varies	BMID
WTP Intake	X	X	X		Weekly	CARO-BMID
Stevens – Outlet	X	X	X		Weekly	CARO-BMID
Hadden Outlet (at Screens)	X	X	X		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			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			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					
Well 6	On-line residual chlorine, Well Level					

Table 3.1 – BMID Water Sampling Summary (continued)

Biological Parameters						
Weekly Tests by CARO	<u>Free Chlorine Residual</u> (field) (mg/L)	<u>Temperature</u> (field) (degrees C)	<u>Total Coliforms</u> Colonies/10 0ml	<u>E.Coli</u> colonies/ 100ml		
Chemical Parameters						
Weekly Tests by CARO	<u>Turbidity</u> (NTU)	<u>Colour</u> (TCU)	<u>pH</u> (pH units)	<u>Alkalinity</u> (mg/L Caco3)	<u>Free Chlorine Residual</u> (field) (mg/L)	<u>Temperature</u> (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 strn, 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 MI					
E.Coli Coliforms	CFU/100 MI					

3.2 – BMID Water Sampling Summary (continued)

BMID staff take weekly samples from 10 locations in the distribution system. For 2023, 317 samples were collected and taken to CARO Analytical for testing. Of the 317 samples collected all came back negative for *E.Coli* representing 100% of the total samples taken. Of the 317 samples taken for Total Coliforms, all 317 came back as negative for Total Coliforms representing 100.0% 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 119 PA samples were collected and incubated with zero positive samples showing the presence of bacteria. Therefore, 100% of the samples came back as negative for 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 by the WTP, and as the water moves through Stevens Reservoir and Hadden Reservoir. Only *E.Coli* results for these samples are as follows:

Location	Average <i>E.Coli</i> counts per sample	Max <i>E.Coli</i> count
Creek Intake	22.4	590
Stevens Outlet	1.46	11
Hadden Outlet	0.79	13

4.0 – Water Quality Events of Note

Water advisories, positive samples, loss of service, off-spec water and customer complaints were rare throughout 2023. However, BMID noted the following occurrences when water quality issues/changes did arise.

1. An Off-Spec incident occurred in January 2023, when one of the UV cells was drained as part of the maintenance work on the transmission main. The empty cell led to a programming issue that registered as an off-spec reading while the cell was in bypass. The UV plant continued to function properly throughout the event as there are multiple cells capable of treating water independently of one another.
2. Turbidity entering the distribution system at the Screen Works averaged below 1.00 NTU throughout April. However, the highest turbidity level at the first customer (Booster #1) was 1.09 NTU on April 28th. The increase in turbidity is a result of increased system flows stirring up sediment already present in the water main. However, the increased turbidity was after disinfection took place downstream of the chlorination and UV facilities.
3. An “off spec” incident occurred at the UV treatment plant at 6:49 PM on May 18, 2023. A lightning storm caused a power outage that triggered the PLC to operate the UV reactors isolation valves in unintended ways. As a result, the plant closed the isolation valves downstream of the reactors stopping the water supply at the UV station. Water flow was restored about an hour after the event. Moreover, refilling the reactors and the water main resulted in a brief isolated spike in turbidity and the reactors were not able to adequately meet the required dose while refilling the water mains. Therefore, BMID called a voluntary Water Quality Advisory for 24 hours after the incident.
4. The May 29th bacterial sample at Kirschner Reservoir had background colonies present in the sample. However, there were no detectable *E.Coli* or *Total Coliforms* present in the sample. Subsequent retesting of the same sample location did not show any background colonies present.
5. The highest turbidity level at the first customer (Booster #1) was 1.11 NTU on May 12th. The increase in turbidity is primarily a result of increased system flows stirring up sediment in the water main. However, the increased turbidity was after disinfection took place downstream of the chlorination and UV facilities.
6. Throughout July, BMID’s Ultraviolet Treatment Facility treated 2,451,356.9 m³ of water, 4,539.4 m³ of which was “Off-Spec” (0.18%). The “Off-Spec” readings at the UV plant were a result of a programming issue during the daily reactor switchover. In each case, adequate primary disinfection was maintained throughout each incident.
7. Disinfection by-product (THM and HAA) testing took place at Pearson School and BMID’s UV treatment plant for the first quarter of 2023. In order to comply with guidelines, BMID increased its by-product testing to four locations at the end of the distribution system and an additional test from BMID’s north-end which is serviced by groundwater wells. All tests (15 THM and 15 HAA) were found to be within acceptable ranges.
8. None of BMID’s comprehensive testing results exceeded the Maximum Acceptable Concentrations as detailed in the Guidelines for Canadian Drinking Water Quality. Only the July sample at the Pearson School had an exceedance of the operational guidance value for Aluminum (OG limit of 0.10 mg/L) BMID’s sampling indicated 0.202 mg/L of Aluminum (MAC limit of 2.9mg/L).

Table 4.1 – Disinfection By-Product Testing

Sample	THM		HAA	
	Mission Creek Source	Groundwater Source	Mission Creek Source	Groundwater source
Q1 Average	0.0629	-	0.0387	-
Q2 Average	0.0614	<0.0040	0.0586	<0.0020
Q3 Average	0.0588	0.00986	0.0506	0.0519
Q4 Average	0.0725	<0.00400	0.0659	<0.0020
Average	0.0645	<0.0179	0.05504	<0.02463

5.0 - Annual Consumption Data

CONSUMPTION: Total annual consumption was 11,946 ML which was 102% of the five-year average of 11,707 ML. The average daily flow for 2023 was 32.73 ML/day. The maximum daily flow was on July 4, 2023, when 98.31 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 mid-July, a few 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. To accommodate dam maintenance work, Fish Hawk and James Reservoirs were drained completely in 2023.

The reservoir levels at 2023 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	6,816	1,919	28%
Graystoke Reservoir	5,096	1,059	21%
Fishhawk Reservoir	2,107	0	0%
Loch Long Reservoir	625	446	71%
James Lake Reservoir	1,776	49	3%
TOTAL	16,420	3,480	21%

Graph 5.2 – Monthly Consumption

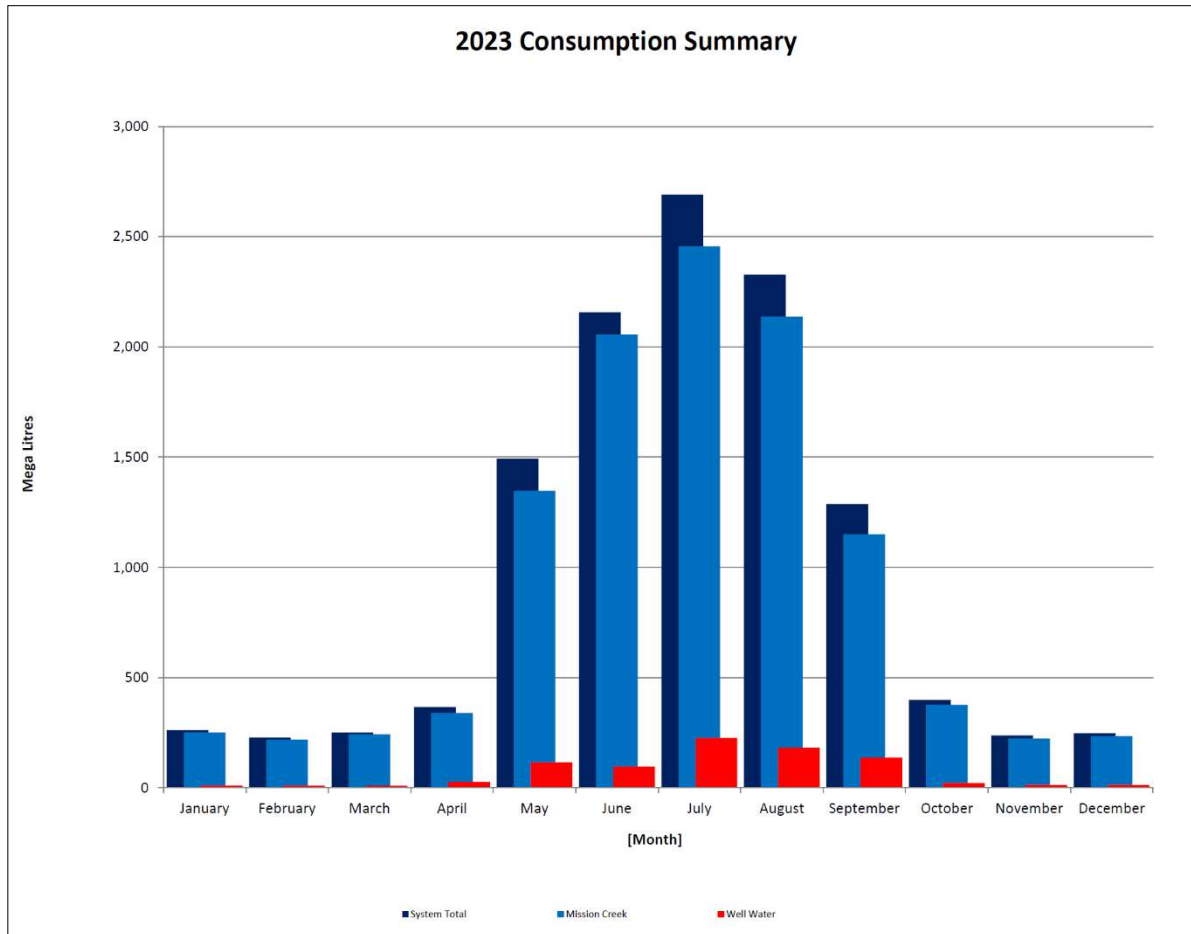


Table 5.3 – Monthly Consumption

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
2023	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres
January	251.49	10.61	0.00	0.00	0.00	10.61	10.61	251.49	262.11
February	218.60	10.42	0.00	0.00	0.00	10.42	10.42	218.60	229.02
March	242.34	9.16	0.00	0.00	0.00	9.16	9.16	242.34	251.50
April	339.91	13.74	13.09	0.00	0.00	26.83	26.83	339.91	366.74
May	1,347.04	14.67	63.06	37.74	29.38	144.86	115.47	1,376.42	1,491.89
June	2,055.57	0.00	90.27	6.10	4.28	100.64	96.37	2,059.85	2,156.21
July	2,455.63	0.00	194.04	32.06	8.60	234.69	226.10	2,464.23	2,690.32
August	2,136.34	11.95	143.70	26.20	8.31	190.16	181.85	2,144.65	2,326.50
September	1,150.01	2.76	125.74	7.89	0.79	137.18	136.39	1,150.81	1,287.19
October	376.86	22.52	0.00	0.00	0.00	22.52	22.52	376.86	399.38
November	223.30	13.83	0.00	0.00	0.00	13.83	13.83	223.30	237.12
December	234.01	13.64	0.00	0.00	0.00	13.64	13.64	234.01	247.66
Total	11,031.11	123.30	629.90	109.98	51.36	914.53	863.17	11082.47	11,945.64

6.0 – Completed and Ongoing Water Infrastructure Projects

- In the Mission Creek watershed, Provincial Dam Safety Regulations require that BMID improve access to the Fish Hawk reservoir and to enhance the rock armoring on the dam face.
- Anderson Instrumentation and BMID staff completed an upgrade to the primary chlorinator. The new system consists of four 500lb/day chlorinators that replaced the older 200lb/day and 2000lb/day chlorinators. This allows for better chlorination control during changing conditions, while providing improved redundancy.
- BMID staff completed the renewal of approximately 12 connections to the primary transmission main between PRV 1 and 2. These air valves, low point drains and services were 50+ years old and were at the end of their service life.
- Approximately 65 agricultural water meters were replaced as part of ongoing renewal work to replace approximately 400 agricultural meters that are now 15 years old.
- The existing 10” and 12” Roll Seal valves in PRV #14 and #15 were changed out for new Cla-Val valves to improve reliability of the PRVs and reduce the risk of over pressurizing the system.
- James Lake reservoir low level outlet gate was replaced in 2023. The old gate, at the end of its usable service life, will be replaced by a new stainless steel gate that should provide service for 75 years.
- PRV #13 was rebuilt and brought above ground into a kiosk. In addition, PRV #4 was eliminated through the installation of a higher pressure rated pipeline. In completing these works, two confined spaces were eliminated in the BMID distribution system.
- Two small diameter mag-meters were installed at the Water Treatment Plant to more accurately dose coagulant at the point of injection in the treatment process.

7.0 - WTP OPERATIONS

The Black Mountain Irrigation District's Class IV Water Treatment Plant (WTP) performed very well throughout the 2023 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).

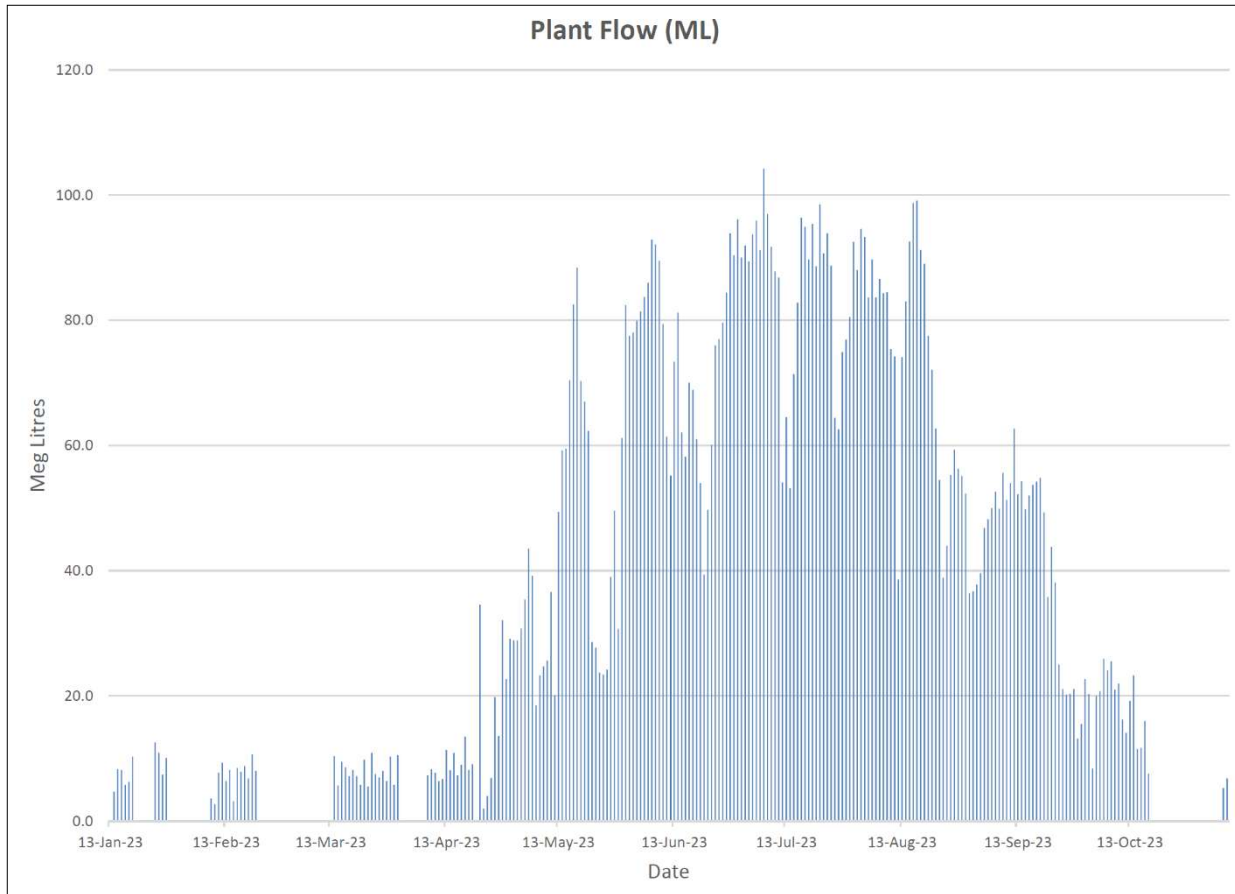
The BMID WTP began yearly operations on January 13th and the plant continued to run until November 8th when the water quality in Mission Creek no longer required chemical treatment to remove turbidity and colour. In total, the WTP was in operation for 239 days during the 2023 treatment season. The plant was open for 258 days the previous year and the five-year average is 246 days of treatment annually.

Turbidity spikes during freshet in Mission Creek were common, as experienced in the past. However, the 2023 season had lower peak run-off levels compared to the 2022 treatment season, and fortunately, Mission Creek did not encounter the same significant flooding and high turbidity events that occurred in the 2017 and 2018 seasons. 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 104.2 ML occurred on July 7, 2023. The peak instantaneous demand was recorded at 1,235 L/s. For the 2023 season, 10,691.5 ML of water was treated compared to an average of 8964.8 ML over the past five years. In total, the WTP produced 89.5% of all water that entered the BMID distribution system. The Water Treatment Plant was placed in stand-by mode on November 8th, 2023, 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 2023 combined total for both trains

7.3 – TURBIDITY RESULTS

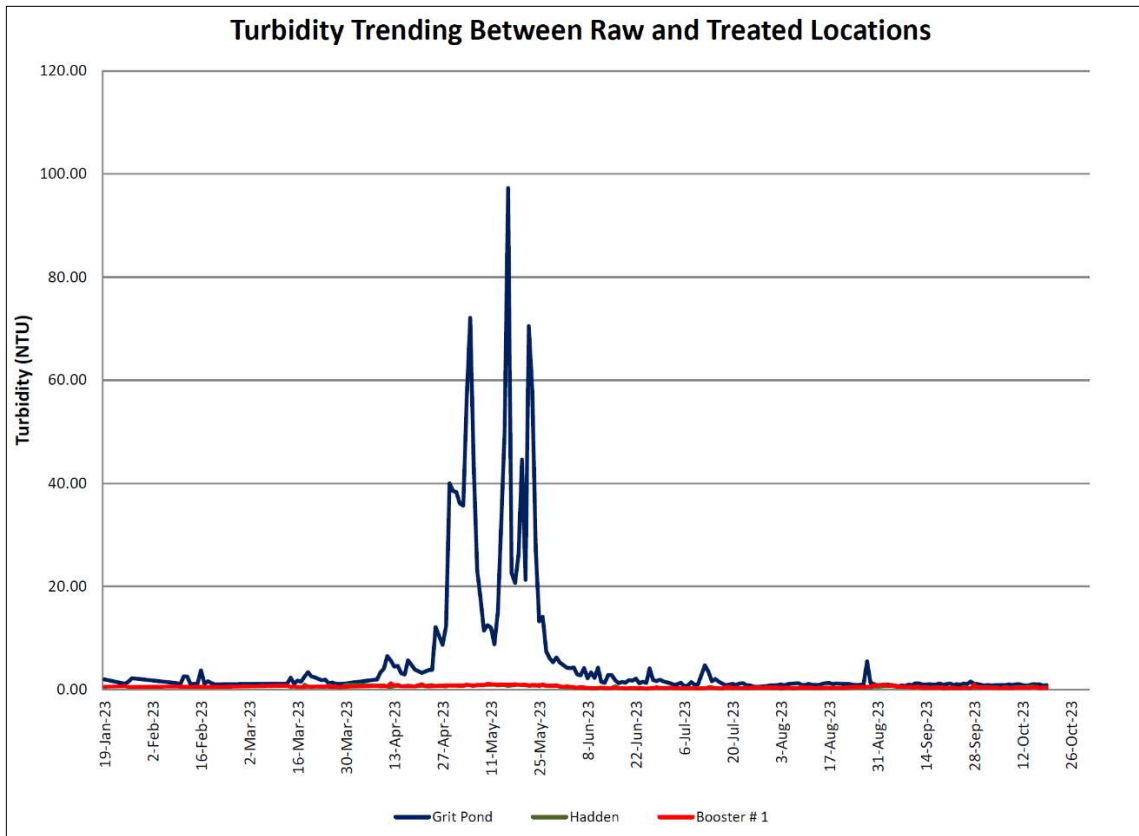
As set by the Canadian Drinking Water Guidelines, Black Mountain’s system turbidity is to be less than at 24-hour average of 1.0 NTU at its first customer (Booster 1). Throughout the treatment season, the Water Treatment Plant was able to maintain acceptable turbidity below this guideline. Turbidity at the first customer peaked at 1.20 NTU on April 12th. This result is taken from a single grab-sample. The average daily turbidity at this location on April 12th was 0.39 NTU on the on-line turbidity analyzer. However, as flows increased within the distribution system in the spring, settled light-weight sediments in the water main began to become resuspended in the distribution system. This led to a rise in system turbidity at Booster #1 where the average daily turbidity exceeded 1.00 NTU at several times in late April and early May. This however, is an expected operational condition where no Water Quality Advisory was necessary as all of the water supplied was below 1.00 NTU at the time of disinfection. During spring freshet, raw water turbidity at the Grit Pond peaked at 97.3 NTU on May 16, 2023. This is near the maximum range that the WTP is able to adequately treat, however, the WTP was able to successfully maintain acceptable turbidity at the distribution intake.

In addition, the recorded highest turbidity at the Distribution Intake, Hadden Pond, was 0.95 NTU on May 8, 2023, with the data obtained through a single point grab sample.

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	5.83	-
Stevens Intake	0.41	-
Stevens Outlet	0.44	-
Hadden Outlet	0.44	-
Screen Works	0.46	0.50
Booster Stn No. 1	0.50	0.44

Graph 7.3 – WTP Turbidity Results



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