



## MONTHLY REPORTING PERIOD - DECEMBER, 2023

### SUMMARY

This document provides a summary of the water quality information collected by BMID in December 2023. Documentation and figures are provided on the following pages to support this submission.

### WATER SUPPLY & USAGE SUMMARY

1. Water usage data for December, 2023 is as follows:

Source	Total (US Gallons)	Total (Mega Litres)
Mission Creek	61,826,181	234.01
Well 4	3,604,600	13.64
Well 5	0	0
Well 6 (Irrigation Only)	0	0
Scotty Creek (Irrigation Only)	0	0
Total	65,430,781	247.66

2. The control gates for all of BMID's high-elevation reservoirs are closed for the season. The reservoirs will be opened after spring freshet 2024, to supplement flows in Mission Creek during the summer/fall;
3. BMID's Scotty Creek source supplying irrigation water to the north-end of the service area, was placed on stand-by mode on September 8<sup>th</sup>. The Scotty Creek source will remain in stand-by until irrigation demands increase in the summer of 2024;
4. Well #5, used as the primary water source in the north-end of the system for both irrigation and domestic consumption, was placed in stand-by mode on September 29<sup>th</sup>. Well #5 will resume operations in the summer of 2024 as irrigation demands increase in the north-end;
5. Well #4, used as a primary source for domestic water in the north-end of the distribution system during low-flow periods, resumed operation on September 27<sup>th</sup>. Well #4 was in operation throughout December and will remain in service until the spring/summer of 2024;
6. Well #6, which supplies water to the north-end irrigation distribution system, was placed in stand-by mode on September 24<sup>th</sup>. Well #6 will resume operations in the summer of 2024;
7. A portion of the BMID's transmission main west of the Mission Creek Intake and east of the tunnel is located on an unstable slope. Slope movement continues to be monitored. It is currently stable and is not moving;

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## WATER QUALITY SUMMARY

1. The WTP was in operation for only one day (Dec 7<sup>th</sup>) as Mission Creek had experienced increased turbidity and colour in the raw water. The WTP remained in stand-by mode for the remainder of December as Mission Creek had acceptable turbidity and colour in the raw water. The WTP will remain in stand-by mode for the remainder of the fall/winter, however, the plant will remain available to treat water if raw water quality diminishes;
2. The UV plant incorrectly recorded 252 cubic meters of Off-Spec water on December 4<sup>th</sup> 2023. The programming at the facility erroneously included an Off-Spec incident while one of the three reactors was shut-down for maintenance. UV disinfection continued, uninterrupted, throughout the incident;
3. Raw water turbidity levels in Mission Creek peaked at 1.46 NTU on December 7<sup>th</sup>. Average daily raw water turbidity for December was 0.64 NTU at the Mission Creek Intake;
4. The highest turbidity level at the Distribution Intake (end of Hadden Reservoir) was 0.66 NTU on December 15<sup>th</sup>, 2023. Average settled water turbidity for December was 0.47 NTU at the Distribution Intake at the lower end of Hadden Reservoir;
5. The highest turbidity level at the first customer (Booster #1) was 0.61 NTU on December 4<sup>th</sup>-5<sup>th</sup>. Average monthly turbidity at the first customer was 0.47 NTU;
6. Average daily turbidity at the UV station peaked at 0.86 NTU on December 12<sup>th</sup> to the 29<sup>th</sup>. The turbidity meter reads consistently higher at this location, however, the turbidity results upstream and downstream of the UV plant have lower turbidity results. Average monthly turbidity at the UV disinfection station was 0.77 NTU;
7. BMID's Ultraviolet Treatment Facility treated 234,037 m<sup>3</sup> of water, 308 m<sup>3</sup> of which was Off-Spec (0.13%). When the December 4<sup>th</sup> recording error is removed, only 56 m<sup>3</sup> of water was "Off Spec (0.024%);
8. Regarding microbiological readings, BMID ceased withdrawing water from the upper elevation reservoirs earlier in the fall. Throughout the remainder of winter, Mission Creek is expected to have stable microbiological readings as freezing conditions continue in the watershed;
9. *E.Coli* levels at Mission Creek's Point-of-Diversion (creek intake prior to WTP) had normal counts for December. The December 27<sup>th</sup> sample had the peak monthly count of 3 coliforms. The average monthly *E.Coli* was 1.5, based on 4 samples;
10. *E.Coli* levels in the raw water at the water distribution system intake at the east end of Hadden Reservoir, immediately prior to disinfection, had zero counts on all 4 samples. Reduction in *E.Coli* levels is due to the effectiveness of the Water Treatment Plant as well as the settling of particles as water passes through Stevens and Hadden Reservoirs;
11. No *E.Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, zero positive samples were detected by BMID's in-house presence/absence testing throughout December;

12. BMID conducted higher level accuracy testing for PFAS on four raw water sources, Mission Creek, Scotty Creek, Well 4 and Cornish Well.

Testing was conducted by ALS Laboratories out of the lower mainland.

A total of 48 PFAS substances were checked for presence with lower limit accuracies typically of 1 part per trillion.

There were two noted occurrences for Well 4 of 1 ppt for PFBS and for PFHxS.

There was once PFAS presence noted for Cornish Well for PFPeA of 0.5 ppt. Cornish is to be used only for irrigation.

Both Mission Creek and Scotty Creek had no measureable PFAS readings.

It is not known if the background PFAS in the two wells is from the well equipment, sampling, or through the natural groundwater movement.

Retesting for the four sources is planned for mid 2024 when BMID tests our sources for full parameters.

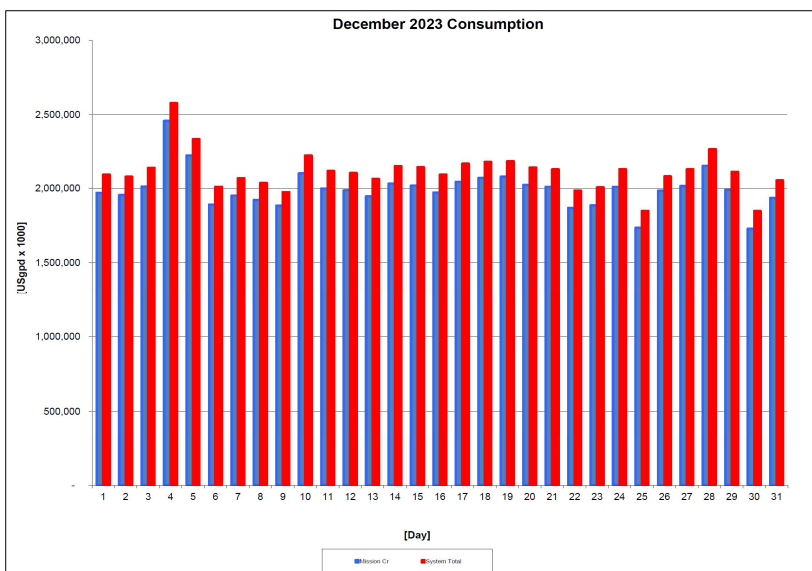
## 1.0 FLOWS - DECEMBER, 2023

The Maximum Daily Flow was on December 4<sup>th</sup>, at 2,578,668 US gallons (9.76 ML)

The Minimum Daily Flow was on December 30<sup>th</sup>, at 1,846,852 US gallons (6.99 ML)

Mission Creek provided just over 94% of domestic flow supplied in December.

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - December 2023 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	System Total	System Total
2023	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Dec	1,969,138	122,839	-	2,091,977	7.92
2-Dec	1,953,790	123,367	-	2,077,157	7.86
3-Dec	2,011,908	124,688	-	2,136,596	8.09
4-Dec	2,459,283	119,405	-	2,578,688	9.76
5-Dec	2,220,392	116,235	-	2,336,627	8.84
6-Dec	1,890,151	119,669	-	2,009,820	7.61
7-Dec	1,950,540	116,763	-	2,067,304	7.82
8-Dec	1,921,085	114,121	-	2,035,207	7.70
9-Dec	1,882,173	91,403	-	1,973,575	7.47
10-Dec	2,100,088	119,933	-	2,220,021	8.40
11-Dec	1,998,171	118,348	-	2,116,519	8.01
12-Dec	1,986,124	116,763	-	2,102,887	7.96
13-Dec	1,945,917	116,235	-	2,062,152	7.81
14-Dec	2,031,351	116,763	-	2,148,114	8.13
15-Dec	2,018,644	122,311	-	2,140,955	8.10
16-Dec	1,970,644	120,990	-	2,091,634	7.92
17-Dec	2,042,684	122,047	-	2,164,730	8.19
18-Dec	2,069,471	107,781	-	2,177,252	8.24
19-Dec	2,077,686	104,347	-	2,182,034	8.26
20-Dec	2,021,523	117,027	-	2,138,551	8.09
21-Dec	2,009,160	118,348	-	2,127,508	8.05
22-Dec	1,867,828	116,235	-	1,984,063	7.51
23-Dec	1,884,577	120,462	-	2,005,038	7.59
24-Dec	2,009,451	118,348	-	2,127,799	8.05
25-Dec	1,734,421	113,593	-	1,848,014	6.99
26-Dec	1,983,218	96,686	-	2,079,905	7.87
27-Dec	2,014,047	112,801	-	2,126,848	8.05
28-Dec	2,150,836	118,877	-	2,269,712	8.59
29-Dec	1,989,030	121,518	-	2,110,548	7.99
30-Dec	1,727,975	118,877	-	1,846,852	6.99
31-Dec	1,934,875	117,820	-	2,052,695	7.77
Totals Usgpd	61,826,181	3,604,600	0.00	65,430,781	247.66
Totals ML	234.01	13.64	0.00		
Avg's	1996376.86	7.56		2,112,602.86	8.00
Max	2459282.82	9.31		2,578,687.66	9.76
Min	1727975.47	6.54		1846851.97	6.99

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

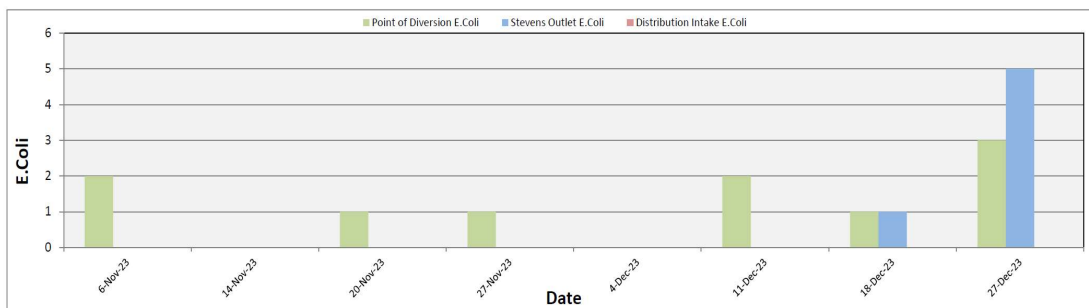
Raw water samples were taken at three points at BMID settling ponds before chlorination.

Samples were taken at the Distribution Intake's Point of Disinfection and at the Mission Creek raw water Point of Diversion and at Stevens Pond outlet (point halfway between WTP Outlet and Distribution Intake).

Samples from the previous month are also provided to show a two-month trend

The control gates on BMID's high-elevation reservoirs were closed throughout December, making for a greater contribution of ground water to the overall flow of Mission Creek leading to reduced E.Coli levels in the raw water.

**Figure 2.1 - Raw Water E.Coli Readings (CARO Lab results) November 2023 - December 2023**



**Table 2.1 - E.Coli Readings (CARO Labs)**

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
6-Nov-23	2	0	0
14-Nov-23	0	0	0
20-Nov-23	1	0	0
27-Nov-23	1	0	0
4-Dec-23	0	0	0
11-Dec-23	2	0	0
18-Dec-23	1	1	0
27-Dec-23	3	5	0

Stevens or WTP Intake (Raw) - Sampling of raw water at intake from Mission Creek

Stevens Outlet (Raw) - Sampling point after exiting 142,000 m<sup>3</sup> 1<sup>st</sup> upper balancing reservoir (Stevens Res.)

Hadden Outlet (Raw) - Sampling point after exiting 75,000 m<sup>3</sup> 2<sup>nd</sup> lower balancing reservoir (Hadden Res.)

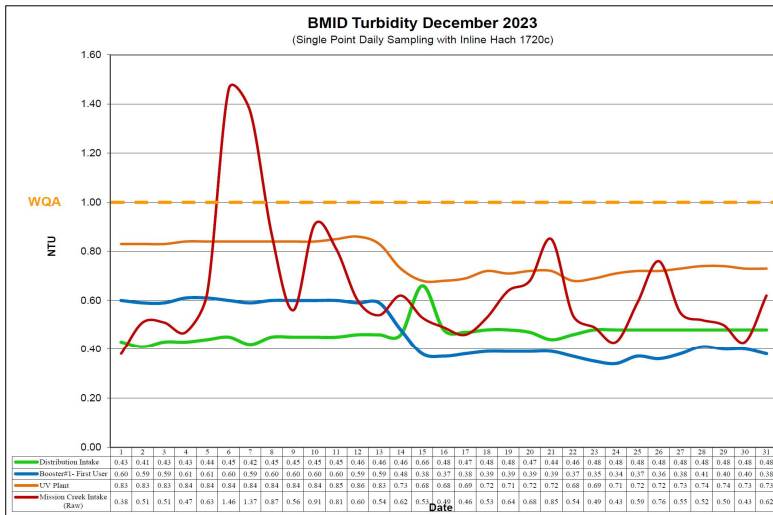
*(Hadden Outlet = Distribution Intake - Point of Disinfection)*

### 3.0 RAW AND TREATED WATER TURBIDITY

Through December 2023, turbidity for the Mission Creek source was measured at Booster Station No. 1 on Gallagher’s Road, which is the approximate location of the first-customer. The highest turbidity level recorded at this location was 0.61 NTU on December 4-5<sup>th</sup> 2023. The lowest turbidity level was 0.34 NTU and the average turbidity was 0.47 NTU.

The distribution intake is where the water leaves Hadden Reservoir and enters a closed conduit. Turbidity levels are greatly reduced through the settling process as Mission Creek water makes its way through the reservoirs.

**Figure 3.1 – Daily Turbidity Readings (Mission Creek Raw - Distribution Intake - Booster Station 1 and UV Plant)**



**Table 3.1 - Daily Monitoring Record – Turbidity at On-Line Turbidity Analysers**

Turbidity Point Sampling for December 2023				
Date	Mission Creek Intake (Raw) Daily Average NTU	Distribution Intake Daily Average NTU	Booster#1- First User Daily Average NTU	UV Plant Daily Average NTU
1	0.38	0.43	0.60	0.83
2	0.51	0.41	0.59	0.83
3	0.51	0.43	0.59	0.83
4	0.47	0.43	0.61	0.84
5	0.63	0.44	0.61	0.84
6	1.46	0.45	0.60	0.84
7	1.37	0.42	0.59	0.84
8	0.87	0.45	0.60	0.84
9	0.56	0.45	0.60	0.84
10	0.91	0.45	0.60	0.84
11	0.81	0.45	0.60	0.85
12	0.60	0.46	0.59	0.86
13	0.54	0.46	0.59	0.83
14	0.62	0.46	0.48	0.73
15	0.53	0.66	0.38	0.68
16	0.49	0.48	0.37	0.68
17	0.46	0.47	0.38	0.69
18	0.53	0.48	0.39	0.72
19	0.64	0.48	0.39	0.71
20	0.68	0.47	0.39	0.72
21	0.85	0.44	0.39	0.72
22	0.54	0.46	0.37	0.68
23	0.49	0.48	0.35	0.69
24	0.43	0.48	0.34	0.71
25	0.59	0.48	0.37	0.72
26	0.76	0.48	0.36	0.72
27	0.55	0.48	0.38	0.73
28	0.52	0.48	0.41	0.74
29	0.50	0.48	0.40	0.74
30	0.43	0.48	0.40	0.73
31	0.62	0.48	0.38	0.73
AVG	0.64	0.47	0.47	0.77

### 4.0 CHLORINE CONTACT TIME

Temperature, pH, peak flow and chlorine residual levels are recorded to determine the CT levels that are required to provide 3 log inactivation of *Giardia*. Chlorine Contact times exceeded the CT levels required to provide 3 log (99.9%) inactivation of *Giardia Lamblia* throughout the month of December, 2023.

Figure 4.1 - CT Trending – BMID Mission Creek Source – December 2023

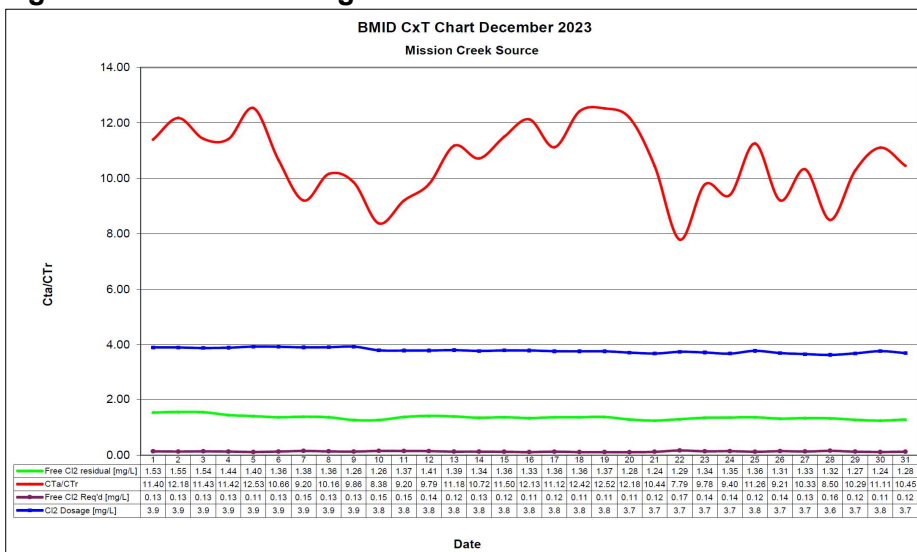


Table 4.2 - CT Table – Mission Creek Source

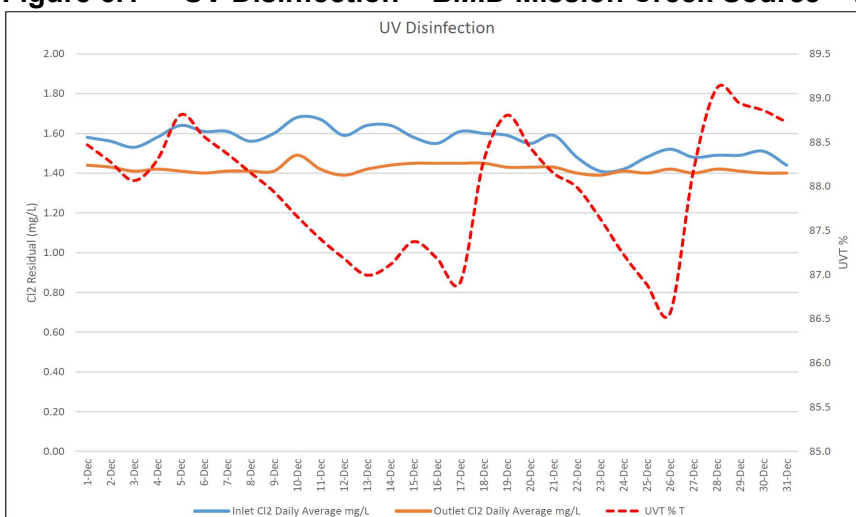
BMID December 2023 Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl2	CT	CT	CTa/CTr	Free Cl2	Cl2	VOLUME	TIME	FLOW	Cl2 DOSAGE
	(Average)	Present	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL	[mins]	Daily Average	Average
December		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]		[USGPM]	[PPD]
1	7.57	8.1	2105	1.53	1925.9	168.9	11.40	0.13	3.9	2649600	1259	1385	65
2	7.57	8.0	1979	1.55	2075.3	170.4	12.18	0.13	3.9	2649600	1339	1379	65
3	7.57	8.6	2186	1.54	1866.8	163.3	11.43	0.13	3.9	2649600	1212	1420	66
4	7.57	9.0	2125	1.44	1795.7	157.3	11.42	0.13	3.9	2649600	1247	1392	65
5	7.57	9.1	1903	1.40	1949.4	155.5	12.53	0.11	3.9	2649600	1392	1319	62
6	7.51	8.5	2139	1.36	1684.6	158.0	10.66	0.13	3.9	2649600	1239	1329	63
7	7.44	6.7	2271	1.38	1610.4	174.9	9.20	0.15	3.9	2649600	1167	1373	65
8	7.42	7.7	2194	1.36	1642.6	161.7	10.16	0.13	3.9	2649600	1208	1354	64
9	7.47	7.7	2080	1.26	1604.8	162.8	9.86	0.13	3.9	2649600	1274	1326	63
10	7.48	6.7	2276	1.26	1466.8	175.1	8.38	0.15	3.8	2649600	1164	1477	68
11	7.48	6.9	2257	1.37	1608.2	174.9	9.20	0.15	3.8	2649600	1174	1407	64
12	7.48	7.2	2218	1.41	1684.2	172.0	9.79	0.14	3.8	2649600	1194	1398	64
13	7.48	9.4	2236	1.39	1646.8	147.3	11.18	0.12	3.8	2649600	1185	1372	63
14	7.48	9.6	2292	1.34	1549.1	144.5	10.72	0.13	3.8	2649600	1156	1413	64
15	7.48	9.6	2163	1.36	1666.1	144.8	11.50	0.12	3.8	2649600	1225	1415	65
16	7.48	9.6	2013	1.33	1750.6	144.4	12.13	0.11	3.8	2649600	1316	1386	63
17	7.48	10.3	2348	1.36	1534.5	138.0	11.12	0.12	3.8	2649600	1128	1444	65
18	7.48	10.3	2103	1.36	1713.2	138.0	12.42	0.11	3.8	2649600	1260	1460	66
19	7.48	10.6	2143	1.37	1693.9	135.3	12.52	0.11	3.8	2649600	1236	1465	66
20	7.48	10.8	2108	1.28	1608.8	132.1	12.18	0.11	3.7	2649600	1257	1424	64
21	7.48	8.9	2098	1.24	1566.2	150.0	10.44	0.12	3.7	2649600	1263	1405	62
22	7.48	6.8	2514	1.29	1359.7	174.5	7.79	0.17	3.7	2649600	1054	1312	59
23	7.48	7.0	2098	1.34	1692.5	173.1	9.78	0.14	3.7	2649600	1263	1329	60
24	7.48	7.7	2305	1.35	1551.5	165.1	9.40	0.14	3.7	2649600	1149	1419	63
25	7.48	7.9	1964	1.36	1834.9	163.0	11.26	0.12	3.8	2649600	1349	1225	56
26	7.48	7.4	2247	1.31	1544.9	167.8	9.21	0.14	3.7	2649600	1179	1393	62
27	7.48	7.9	2101	1.33	1677.3	162.4	10.33	0.13	3.7	2649600	1261	1425	63
28	7.48	8.1	2571	1.32	1360.4	160.0	8.50	0.16	3.6	2649600	1031	1519	66
29	7.48	8.2	2071	1.27	1624.9	158.0	10.29	0.12	3.7	2649600	1279	1402	62
30	7.48	8.0	1853	1.24	1773.2	159.6	11.11	0.11	3.8	2649600	1430	1224	56
31	7.48	8.3	2065	1.28	1642.1	157.1	10.45	0.12	3.7	2649600	1283	1367	61
Averages	7.49	8.41	2162.12	1.35	1667.9	158.37	10.60	0.13	3.79	2649600	1231	1386	63

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated:	234,037 m <sup>3</sup>	100.00%
On-Spec Water:	233,729 m <sup>3</sup>	99.87%
Off-Spec Water:	308 m <sup>3</sup>	0.13%

Average monthly chlorine residual before UV Treatment was 1.56 mg/L  
The average monthly chlorine residual after UV treatment and re-chlorination was 1.42 mg/L.

**Figure 5.1 - UV Disinfection – BMID Mission Creek Source – December 2023**



**Table 5.2 - UV Disinfection Table – Mission Creek Source**

Date	Inlet Cl2	Outlet Cl2	UVT	Turbidity	In Spec Water	Off Spec	Off Spec %	
	Daily	Daily						Volume
	mg/L	mg/L	% T	NTU	Cubic Meters	Cubic Meters	Percentage	
1-Dec	1.58	1.44	88.5	0.83	7,454	0	0.00%	
2-Dec	1.56	1.43	88.3	0.83	7,396	0	0.00%	
3-Dec	1.53	1.41	88.1	0.83	7,616	0	0.00%	
4-Dec	1.58	1.42	88.3	0.84	9,058	252	2.78%	
5-Dec	1.64	1.41	88.8	0.84	8,393	13	0.15%	
6-Dec	1.61	1.40	88.6	0.84	7,155	0	0.00%	
7-Dec	1.61	1.41	88.4	0.84	7,384	0	0.00%	
8-Dec	1.56	1.41	88.2	0.84	7,272	0	0.00%	
9-Dec	1.60	1.41	87.9	0.84	7,125	0	0.00%	
10-Dec	1.68	1.49	87.7	0.84	7,950	0	0.00%	
11-Dec	1.67	1.42	87.4	0.85	7,564	0	0.00%	
12-Dec	1.59	1.39	87.2	0.86	7,518	0	0.00%	
13-Dec	1.64	1.42	87.0	0.83	7,366	0	0.00%	
14-Dec	1.64	1.44	87.1	0.73	7,648	42	0.55%	
15-Dec	1.58	1.45	87.4	0.68	7,639	2	0.03%	
16-Dec	1.55	1.45	87.2	0.68	7,460	0	0.00%	
17-Dec	1.61	1.45	86.9	0.69	7,732	0	0.00%	
18-Dec	1.60	1.45	88.3	0.72	7,834	0	0.00%	
19-Dec	1.59	1.43	88.8	0.71	7,865	0	0.00%	
20-Dec	1.55	1.43	88.4	0.72	7,652	0	0.00%	
21-Dec	1.59	1.43	88.2	0.72	7,606	0	0.00%	
22-Dec	1.48	1.40	88.0	0.68	7,071	0	0.00%	
23-Dec	1.41	1.39	87.6	0.69	7,134	0	0.00%	
24-Dec	1.42	1.41	87.2	0.71	7,607	0	0.00%	
25-Dec	1.48	1.40	86.9	0.72	6,566	0	0.00%	
26-Dec	1.52	1.42	86.6	0.72	7,507	0	0.00%	
27-Dec	1.48	1.40	88.2	0.73	7,624	0	0.00%	
28-Dec	1.49	1.42	89.1	0.74	8,142	0	0.00%	
29-Dec	1.49	1.41	88.9	0.74	7,529	0	0.00%	
30-Dec	1.51	1.40	88.9	0.73	6,541	0	0.00%	
31-Dec	1.44	1.40	88.7	0.73	7,324	0	0.00%	
<b>Average</b>	<b>1.56</b>	<b>1.42</b>	<b>87.95</b>		<b>Total</b>	<b>233,729</b>	<b>308</b>	<b>0.132%</b>

\*The December 4<sup>th</sup> Off-Spec water was a result of a programming error during routine maintenance.



## 6.0 WATER DISTRIBUTION SAMPLING (TREATED)

### Third Party Analysis (CARO Analytical Services)

- Samples taken once per week at ten locations around the BMID service area
- 24 samples were found to be absent of Coliforms.
- 24 samples were found to be absent of *E. Coli*.

**Table 6.1 - CARO Independent Lab Testing – Total Coliforms – *E. Coli***

Date	2921 Belgo Rd		Booster 1		Elison Blow-Off		Elison School		3976 Highway 97		Prospect Reservoir		Tower Reservoir		Well #4		Kirschner Res		Pearson School	
	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli
6-Nov-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Nov-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Nov-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Nov-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Dec-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Dec-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Dec-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Dec-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### In-House Analysis (BMID Staff)

- Presence/Absence samples taken on a three-week cycle at seven sites around the BMID service area.
- All 7 samples were found to be absent of both *Total Coliforms* and *E. Coli*.

**Table 6.2 - BMID In-house Testing – Presence Absence**

Location	12/4/2023				12/11/2023				12/27/2023			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres									0.81	10.2	-	X
170 Kneller Rd									0.99	7.6	-	X
2105 Morrison					0.64	7.8	-	X				
Staymen Rd					0.67	9.4	-	X				
260 Campion Rd	0.23	4.6	-	X								
Fenwick Rd	0.68	9.6	-	X								
Solly Ct									0.87	9.2	-	X

- BMID Population = 28,000

#### RECOMMENDED TESTS

- Recommended number of samples per month = 28  
(as per Guide for Canadian Drinking Water Quality)

#### ACTUAL TESTS

- Total tests by BMID staff (presence/absence) = 7
- Total tests sampled by BMID and tested by Caro Labs 24
- Total tests sampled in BMID treated distribution system = 31
- 0 Positive *E. Coli* and Total Coliform Samples