



## MONTHLY REPORTING PERIOD - APRIL, 2019

### 1. SUMMARY

The list below provides a summary of the water quality information collected by BMID in April, 2019. Documentation and figures are provided on the following pages to support this submission.

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	95,820,209	362.68
Well 4	2,860,000	10.83
Well 5	805,662	3.05
Well 6 (Irrigation Only)	175	0.001
Scotty Creek (Irrigation Only)	218,000	0.83
Total	99,704,046	377.38

1. 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 has been minimal throughout April, continuing the trend seen in the previous months. Groundwater monitoring is showing a steady decline in groundwater levels since the fall. The hillside continues to be continuously monitored going forward. BMID has purchased 300m of flexible 900mm diameter High-density Polyethylene (HDPE) pipe which will be stored on location and may be quickly utilized if a slope failure occurs;
2. In 2018, the hill side slope adjacent to the Kirschner Mountain Booster station experienced surficial sloughing due to high groundwater levels on the mountain. The City of Kelowna has been undertaking remedial action to ensure the security of infrastructure, including BMID's booster station. Groundwater levels are much lower in 2019 and the slope has not moved since the beginning of monitoring in August of 2018. The remedial work by the City is expected to be completed in May;
3. Turbidity levels at the Distribution Intake peaked at 0.67 NTU on April 4 2019. Average turbidity for April was 0.55 NTU. Raw water in the creek was above 25 NTU several times during this period of time;
4. Construction crews hit a looped 200mm water main at 9:50 AM on April 16 at 849 McCurdy Place. During the break, the system flows increased by 6,000 US gallons per minute for half-an-hour until BMID staff could isolate the leak. The spike in flow created increased turbidity throughout the lower distribution system forcing BMID to issue a 24-hour Water Quality Advisory.
5. Subsequent testing after the water main break was undertaken at 5 dedicated sample stations throughout the lower district. All samples were analysed by CARO Analytical for bacteriological testing. All 5 samples came back as negative for both *E.Coli* and *Total Coliforms*;
6. The highest monthly turbidity level recorded at the first customer (Booster #1) was 2.23 NTU on April 16 during the water main break. The next highest turbidity level for the month was on the April 12 at 0.64 NTU. Average monthly turbidity was 0.51 NTU for April;

7. BMID's Ultraviolet Treatment Facility treated 337,202.1m<sup>3</sup> of water, with only 0.014% which was "Off-Spec". Average UVT% was 89.8%. The average inlet chlorine residual was 1.41 mg/L compared to an average of 1.49 mg/L for the outlet after UV treatment;
8. BMID staff began to utilize a new sodium hypo-chlorite injection site downstream of the ultraviolet treatment reactors to increase disinfection redundancy in the system. The hypo-chlorite can also be used to increase free chlorine residual levels after UV treatment;
9. Mission Creek had slightly below average flows for April as the mid-elevation watershed continued to thaw as part of the spring freshet period for 2019;
10. BMID's Scotty Creek source, used for irrigation in the north-end, was brought back on-line on April 17, however the source will remain on stand-by until irrigation flows increase;
11. Well # 4 was the primary source of water for the north-end for most of April. Well #5, began seasonal operation on April 29 as consumption increased later in the month;
12. Well #6 supplies irrigation water to the north-end of the system and was placed on stand-by until late spring. The well was used for a short period in April for testing purposes;
13. *E.Coli* levels at Mission Creek's Point of Diversion had average counts for the season throughout April with a peak count of 22 on the 15th, with an average count of 7.1 per sample during the 9 samples throughout the last month;
14. *E.Coli* levels in the raw water at the distribution system intake, down-stream of the WTP, prior to disinfection, had zero counts throughout most of April, 2019 with the exception of three samples with counts of 1 *E-Coli* on April 17, 23 and 25;
15. No *E.Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, no positive bacteria tests were found from the in-house presence-absence tests during routine testing;
16. The WTP ran throughout April, 2019 as water quality conditions in Mission Creek required chemical treatment to reduce turbidity and colour levels associated with the early stages of spring runoff;

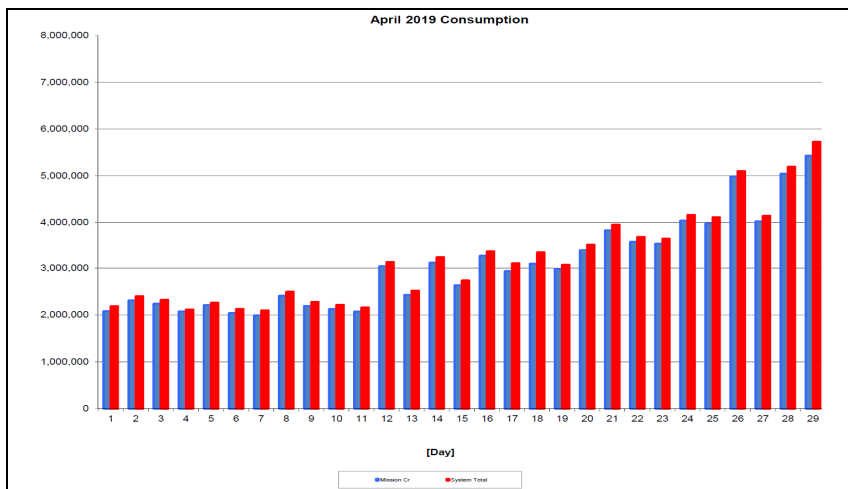
## 1.0 FLOWS - APRIL, 2019

Maximum Daily Flow was on April 30, 2019 at 7,206,323 US gallons (27.28 ML)

Minimum Daily Flow was on April 7, 2019 at 2,101,303 US gallons (7.95 ML)

Mission Creek provided 96% of domestic flow throughout April.

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - April 2019 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	Well #6	Scotty Creek	System Total	System Total
2019	Usgpd	Usgpd	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Apr	2,086,288	104,000	2	0	0	2,190,290	8.29
2-Apr	2,313,681	91,000	3	0	0	2,404,684	9.10
3-Apr	2,244,478	84,000	5	0	0	2,328,483	8.81
4-Apr	2,078,409	42,000	7	0	0	2,120,416	8.03
5-Apr	2,214,919	52,000	8	0	0	2,266,927	8.58
6-Apr	2,043,864	90,000	10	0	0	2,133,874	8.08
7-Apr	1,993,291	108,000	12	0	0	2,101,303	7.95
8-Apr	2,414,550	87,000	13	0	0	2,501,563	9.47
9-Apr	2,193,883	89,000	15	0	0	2,282,898	8.64
10-Apr	2,131,315	88,000	17	0	0	2,219,332	8.40
11-Apr	2,076,127	88,000	18	0	0	2,164,145	8.19
12-Apr	3,042,979	89,000	20	0	0	3,131,999	11.85
13-Apr	2,431,473	91,000	22	0	0	2,522,495	9.55
14-Apr	3,121,024	117,000	23	0	0	3,238,047	12.26
15-Apr	2,637,385	104,000	25	0	0	2,741,410	10.38
16-Apr	3,266,731	95,000	27	0	0	3,361,758	12.72
17-Apr	2,937,194	91,000	28	0	80,000	3,108,222	11.76
18-Apr	3,098,274	104,000	30	1	138,000	3,340,305	12.64
19-Apr	2,983,547	91,000	32	1	0	3,074,580	11.64
20-Apr	3,405,458	120,000	33	1	0	3,525,492	13.34
21-Apr	3,829,117	125,000	35	1	0	3,954,153	14.97
22-Apr	3,585,459	104,000	37	1	0	3,689,497	13.96
23-Apr	3,544,898	110,000	38	1	0	3,654,937	13.83
24-Apr	4,040,230	121,000	40	1	0	4,161,271	15.75
25-Apr	3,975,161	137,000	42	1	0	4,112,204	15.56
26-Apr	4,981,269	118,000	43	1	0	5,099,313	19.30
27-Apr	4,024,393	120,000	45	1	0	4,144,439	15.69
28-Apr	5,043,222	152,000	47	121	0	5,195,390	19.66
29-Apr	5,428,978	48,000	251,315	3	0	5,728,296	21.68
30-Apr	6,652,612	0	553,670	41	0	7,206,323	27.28
Totals Usgpd	95,820,209	2,860,000	805,662	175	218,000	99,704,046	377.38
Totals ML	362.68	10.83	3.05	0.00	0.83		
Avg's	3,194,007	12.09				3,323,468	12.58
Max	6,652,612	25.18				7,206,323	27.28
Min	1,993,291	7.54				2,101,303	7.95

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

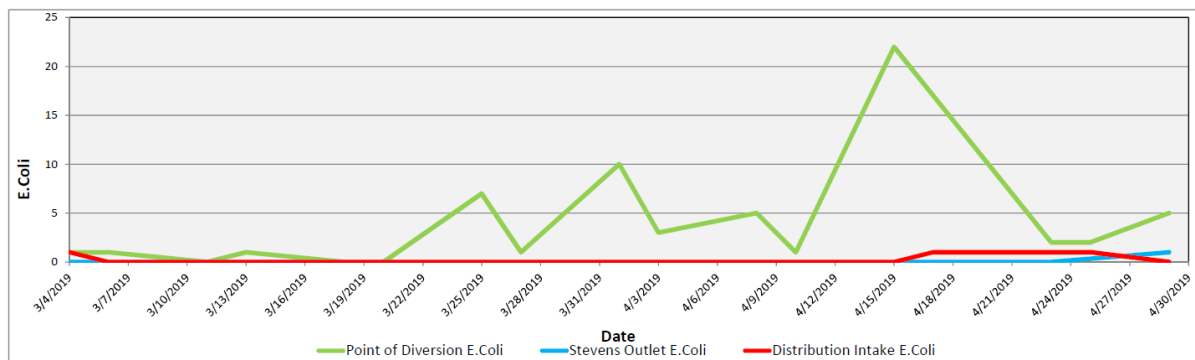
Raw water samples were taken at three points at BMID settling ponds before chlorination

Samples were taken twice per week at the Distribution Intake's Point of Disinfection and at the Mission Creek raw water Point of Diversion; one sample is taken per week 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 E.Coli readings clearly show the effectiveness in risk reduction from the Water Treatment Plant and extended settling times in Stevens and Hadden Reservoirs.

**Figure 2.1 - Raw Water *E.Coli* Readings (CARO Lab results) March-April 2018/2019**



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

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
4-Mar-19	1	0	1
6-Mar-19	1	0	0
11-Mar-19	0	0	0
13-Mar-19	1	0	0
18-Mar-19	0	0	0
20-Mar-19	0	0	0
25-Mar-19	7	0	0
27-Mar-19	1	0	0
1-Apr-19	10	0	0
3-Apr-19	3	0	0
8-Apr-19	5	0	0
10-Apr-19	1	0	0
15-Apr-19	22	0	0
17-Apr-19	17	1	1
23-Apr-19	2	0	1
25-Apr-19	2	1	1
29-Apr-19	5	1	0

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

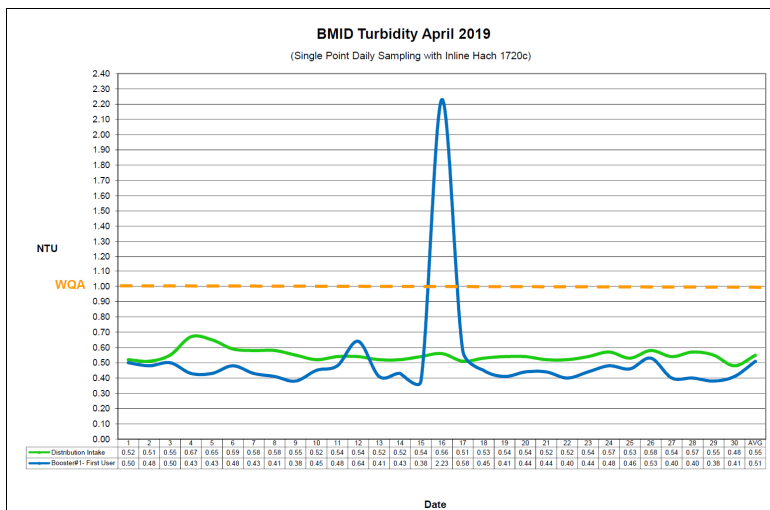
Stevens Outlet (Raw) - Sampling point after exiting 142,000 m<sup>3</sup> 1<sup>st</sup> upper balancing reservoir (Stevens Res.)

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

Turbidity for the Mission Creek source was measured at Booster Station No. 1 on Gallagher's Road, the first-customer, through April 2019. The highest turbidity recorded at this location was 2.23 NTU on April 16 during a water main break that morning. The average turbidity for the month was 0.51 NTU during April.

**Figure 3.1 – Daily Turbidity Readings (Distribution Intake and Booster Station 1)**



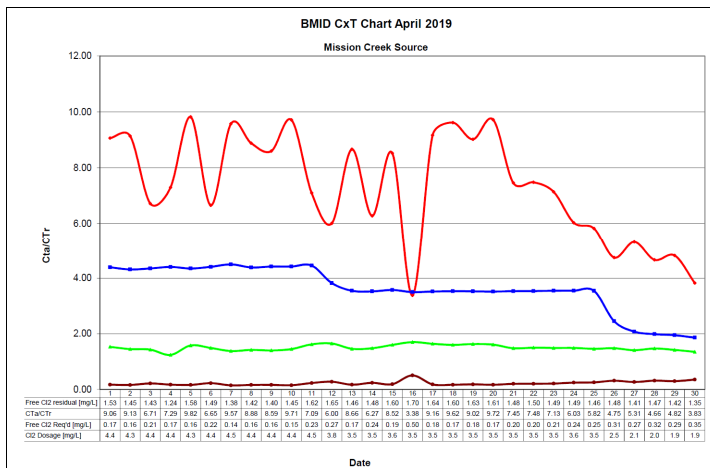
**Table 3.1 - Daily Monitoring Record – Turbidity at Distribution Intake & Bst Stn 1**

Turbidity Point Sampling for April 2019		
Date	Distribution Intake	Booster#1- First User
	Daily Average NTU	Daily Average NTU
1	0.52	0.50
2	0.51	0.48
3	0.55	0.50
4	0.67	0.43
5	0.65	0.43
6	0.59	0.48
7	0.58	0.43
8	0.58	0.41
9	0.55	0.38
10	0.52	0.45
11	0.54	0.48
12	0.54	0.64
13	0.52	0.41
14	0.52	0.43
15	0.54	0.38
16	0.56	2.23
17	0.51	0.58
18	0.53	0.45
19	0.54	0.41
20	0.54	0.44
21	0.52	0.44
22	0.52	0.40
23	0.54	0.44
24	0.57	0.48
25	0.53	0.46
26	0.58	0.53
27	0.54	0.40
28	0.57	0.40
29	0.55	0.38
30	0.48	0.41
AVG	0.55	0.51

## 4.0 CHLORINE CONTACT TIME

Temperature, pH, current 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 April, 2019.

**Figure 4.1 - CT Trending – BMID Mission Creek Source – April 2019**



**Table 4.2 - CT Table – Mission Creek Source**

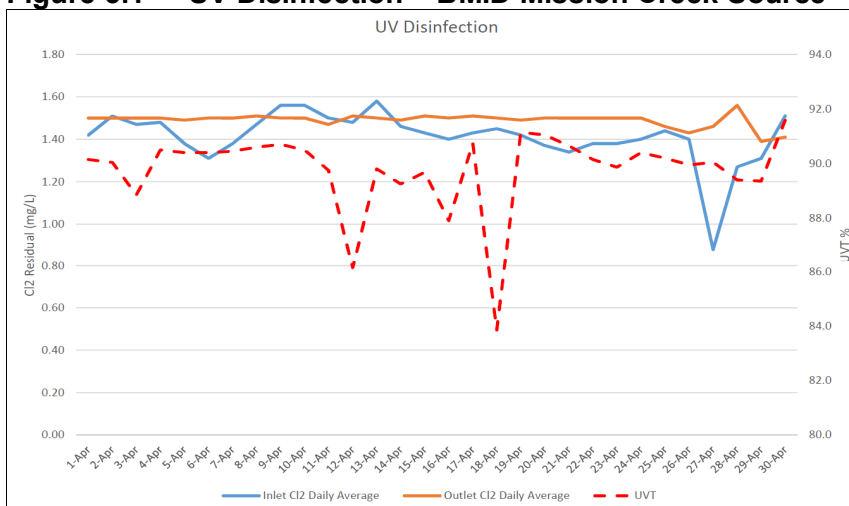
BMID April 2019 Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl <sub>2</sub>	CT	CT	CTa/CTr	Free Cl <sub>2</sub>	Cl <sub>2</sub>	VOLUME	TIME	FLOW	CL <sub>2</sub> DOSAGE
	(highest)	(lowest)	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL		AVERAGE	AVERAGE
April		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]	[mins]	[USGPM]	[PPD]
1	7.67	7.5	2,453	1.53	1652.6	182.4	9.06	0.17	4.4	2649600	1080	1,449	76.5
2	7.67	7.7	2,357	1.45	1630.0	178.5	9.13	0.16	4.3	2649600	1124	1,607	83.3
3	7.68	7.5	3,114	1.43	1216.7	181.2	6.71	0.21	4.4	2649600	851	1,559	81.5
4	7.69	6.9	2,429	1.24	1352.6	185.6	7.29	0.17	4.4	2649600	1091	1,443	76.4
5	7.69	7.5	2,310	1.58	1812.3	184.6	9.82	0.16	4.3	2649600	1147	1,538	80.4
6	7.70	7.7	3,277	1.49	1204.7	181.1	6.65	0.22	4.4	2649600	809	1,419	75.2
7	7.70	8.1	2,194	1.38	1666.6	174.1	9.57	0.14	4.5	2649600	1208	1,384	74.8
8	7.70	7.8	2,373	1.42	1585.5	178.6	8.88	0.16	4.4	2649600	1117	1,677	88.4
9	7.69	8.1	2,482	1.40	1494.5	173.9	8.59	0.16	4.4	2649600	1068	1,524	80.9
10	7.69	8.4	2,311	1.45	1662.4	171.2	9.71	0.15	4.4	2649600	1147	1,480	78.6
11	7.68	7.9	3,369	1.62	1274.1	179.6	7.09	0.23	4.5	2649600	786	1,442	77.2
12	7.68	8.1	4,099	1.65	1066.6	177.6	6.00	0.27	3.8	2649600	646	2,113	97.1
13	7.67	8.7	2,680	1.46	1443.4	166.7	8.66	0.17	3.5	2649600	989	1,689	72
14	7.67	8.4	3,665	1.48	1070.0	170.5	6.27	0.24	3.5	2649600	723	2,167	91.8
15	7.67	8.7	2,945	1.60	1439.5	169.0	8.52	0.19	3.6	2649600	900	1,832	78.7
16	7.66	9.0	7,995	1.70	563.4	166.4	3.38	0.50	3.5	2649600	331	2,269	95.4
17	7.66	10.0	3,070	1.64	1415.4	154.5	9.16	0.18	3.5	2649600	863	2,040	86.3
18	7.65	10.2	2,915	1.60	1454.3	151.2	9.62	0.17	3.5	2649600	909	2,152	91.3
19	7.65	11.0	3,339	1.63	1293.5	143.5	9.02	0.18	3.5	2649600	794	2,072	87.8
20	7.64	11.6	3,206	1.61	1330.6	136.9	9.72	0.17	3.5	2649600	826	2,365	100
21	7.64	11.5	3,865	1.48	1014.6	136.1	7.45	0.20	3.5	2649600	686	2,659	112.9
22	7.63	11.4	3,884	1.50	1023.3	136.9	7.48	0.20	3.5	2649600	682	2,490	105.8
23	7.62	11.2	4,006	1.49	985.5	138.1	7.13	0.21	3.5	2649600	661	2,462	105
24	7.61	11.6	4,793	1.49	807.1	133.9	6.03	0.24	3.6	2649600	553	2,806	119.7
25	7.61	11.2	4,844	1.46	798.6	137.2	5.82	0.25	3.5	2649600	547	2,761	117.6
26	7.61	12.1	6,397	1.48	613.0	129.2	4.75	0.31	2.5	2649600	414	3,459	102
27	7.62	11.8	5,352	1.41	698.0	131.4	5.31	0.27	2.1	2649600	495	2,795	69.8
28	7.58	11.3	6,189	1.47	629.3	135.0	4.66	0.32	2.0	2649600	428	3,502	83.6
29	7.55	11.7	6,043	1.42	622.6	129.2	4.82	0.29	1.9	2649600	438	3,770	88.3
30	7.53	10.6	6,804	1.35	525.7	137.4	3.83	0.35	1.9	2649600	389	4,620	103.3
Averages	7.65	9.5	3825	1.50	1178.22	158.4	7.34	0.221	3.6169		790	2,218	89.39

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 337,202.1 m<sup>3</sup> 100%  
On-Spec Water: 337,197.4 m<sup>3</sup> 99.999%  
Off-Spec Water: 4.7 m<sup>3</sup> 0.014%

Average monthly chlorine residual before UV Treatment was 1.41 mg/L compared to 1.49 mg/L after UV disinfection and re-chlorination.

**Figure 5.1 - UV Disinfection – BMID Mission Creek Source – April 2019**



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

	Inlet Cl2 Daily	Outlet Cl2 Daily	UVT	In Spec Water Volume	Off Spec Water	Off Spec % of Water
Date	mg/L	mg/L	% T	Cubic Meters	Cubic Meters	Percentage
1-Apr	1.42	1.50	90.2	7956.5	0	0.00%
2-Apr	1.51	1.50	90.0	8796.1	0	0.00%
3-Apr	1.47	1.50	88.9	8536.6	0	0.00%
4-Apr	1.48	1.50	90.5	7930.4	0	0.00%
5-Apr	1.38	1.49	90.4	8431.1	0	0.00%
6-Apr	1.31	1.50	90.4	7772.2	0	0.00%
7-Apr	1.38	1.50	90.5	7603.1	0	0.00%
8-Apr	1.47	1.51	90.6	9185.9	0	0.00%
9-Apr	1.56	1.50	90.7	8335.0	0	0.00%
10-Apr	1.56	1.50	90.5	8122.1	0	0.00%
11-Apr	1.50	1.47	89.8	7584.3	45.4	0.60%
12-Apr	1.48	1.51	86.2	22685.9	2.3	0.01%
13-Apr	1.58	1.50	89.8	9190.0	0	0.00%
14-Apr	1.46	1.49	89.3	9822.1	0	0.00%
15-Apr	1.43	1.51	89.7	10497.7	0	0.00%
16-Apr	1.40	1.50	87.9	10462.7	0	0.00%
17-Apr	1.43	1.51	90.8	9203.3	0	0.00%
18-Apr	1.45	1.50	83.9	9833.2	0	0.00%
19-Apr	1.42	1.49	91.2	9365.8	0	0.00%
20-Apr	1.37	1.50	91.1	10915.1	0	0.00%
21-Apr	1.34	1.50	90.7	12507.7	0	0.00%
22-Apr	1.38	1.50	90.2	11623.8	0	0.00%
23-Apr	1.38	1.50	89.9	11523.1	0	0.00%
24-Apr	1.40	1.50	90.4	13329.7	0	0.00%
25-Apr	1.44	1.46	90.2	13076.3	0	0.00%
26-Apr	1.40	1.43	90.0	16333.4	0	0.00%
27-Apr	0.88	1.46	90.1	12191.5	0	0.00%
28-Apr	1.27	1.56	89.4	15381.7	0	0.00%
29-Apr	1.31	1.39	89.4	17374.3	0	0.00%
30-Apr	1.51	1.41	91.6	21626.8	0	0.00%
Average	1.41	1.49	89.8	337197.4	47.7	0.014%



## 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
- 50 samples were found to be absent of Coliforms.
- 50 samples were found to be absent of *E. Coli*.

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

Date	2921 Belgo Rd Coliforms	2921 Belgo Rd E.coli	Booster 1 Coliforms	Booster 1 E.coli	Elison Blow-Off Coliforms	Elison Blow-Off E.coli	Elison School Coliforms	Elison School E.coli	3876 Highway 97 Coliforms	3876 Highway 97 E.coli	Prospect Reservoir Coliforms	Prospect Reservoir E.coli	Tower Reservoir Coliforms	Tower Reservoir E.coli	Well #5 Coliforms	Well #5 E.coli	Well #4 Coliforms	Well #4 E.coli	Kirschner Ries Coliforms	Kirschner Ries E.coli	Pearson School Coliforms	Pearson School E.coli
4-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Mar-19	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Apr-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Apr-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Apr-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Apr-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Apr-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Apr-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-

**Table 6.2 – Disinfection By-Products - THM and HAA Results**

By-Product	19-Nov-18	12-Dec-18	11-Jan-19	5-Feb-19	4-Mar-19	1-Apr-19
THM mg/L	<b>0.132</b>	0.0974	<b>0.131</b>	<b>0.107</b>	0.0921	0.088
HAA mg/L	<b>0.0852</b>	0.037	0.0359	<b>0.122</b>	<b>0.0898</b>	0.0726

### In-House Analysis (BMID Staff)

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

**Table 6.3 - BMID In-house Testing – Presence Absence**

Location	4/1/2019				4/8/2019				4/15/2019				4/23/2019				4/30/2019			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres					0.94	9.8	-	X									1.12	12.8	-	X
170 Kneller Rd					1.12	9.4	-	X									1.12	9.6	-	X
2105 Morrison	0.61	9.8	-	X									0.56	16.8	-	X				
Staymen Rd	0.72	8.6	-	X									0.91	13.2	-	X				
260 Campion Rd									0.76	9.6	-	X								
Fenwick Rd									0.51	11.8	-	X								
Solly Ct					1.24	9.4	-	X									1.72	11	-	X

- BMID Population = 25,000

#### RECOMMENDED TESTS

- Recommended number of samples per month = 25  
  
(as per Guide for Canadian Drinking Water Quality)

#### ACTUAL TESTS

- Total tests by BMID staff (presence/absence) = 12
- Total tests sampled by BMID and tested by Caro Labs = 50
- Total tests sampled in BMID treated distribution system = 62 (Zero Positive Samples)