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Joshua.Das@mwra.state.ma.us

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WATER QUALITY UPDATE An Analysis of December 2012 Sampling Data

MASSACHUSETTS WATER RESOURCES AUTHORITY
100 First Avenue, Charlestown Navy Yard, Boston, MA 02129



MWRA WATER QUALITY UPDATE

December 2012 Highlights

- **MWRA achieved CT disinfection requirements for the month** at the Ware Disinfection Facility and the Carroll Water Treatment Plant. CT results appear on Page 3. No community violated the Total Coliform Rule criteria. See Page 4.
- **Carroll Water Treatment Plant is undergoing winter maintenance and UV construction.** During this period, half the plant is removed from service. Train B was off-line from October 31, 2012 through December 15, 2012. Train A was removed from service on January 2, 2013 and will remain off-line for approximately six weeks.
- **While MWRA continues to meet all regulatory requirements, MWRA is not always able to fully meet its voluntary *Cryptosporidium* inactivation target while the UV construction project is underway.** DEP reviewed and approved this change as part of its permitting for this project. The lowest PR achieved for December was 0.8, which provides 97.5% *Cryptosporidium* inactivation. See Page 3.
- **Did you know** that MWRA's web site has an archive of Monthly Water Quality Updates from 2001 onward at <http://www.mwra.com/monthly/wqupdate/qual3wq.htm>?
- **MWRA reduced the length of the printed copy of the Monthly Water Quality Update to reduce printing and postage costs.** A longer more detailed version will continue to be posted on the MWRA web site. You can help us save paper and money by requesting an electronic copy of the Update – call (617) 242-5323 or email Joshua.Das@mwra.state.ma.us

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Release Date: January 20, 2013

Source Water – Microbial and Turbidity Results

December 2012

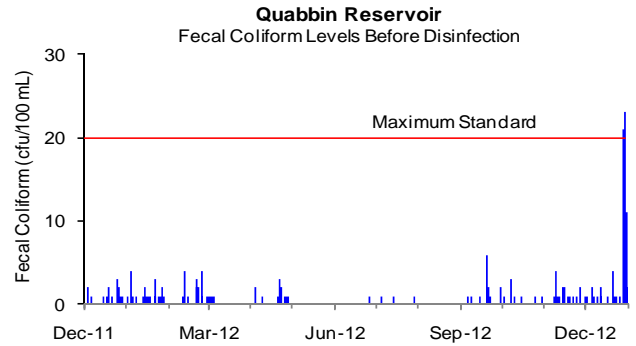
Source Water - Microbial Results

Total coliform bacteria are monitored in both source and treated water to provide an indication of overall bacteriological activity. Most coliforms are harmless. However, fecal coliform, a subclass of the coliform group, are identified by their growth at temperatures comparable to those in the intestinal tract of mammals. They act as indicators of possible fecal contamination. The Surface Water Treatment Rule for unfiltered water supplies allows for no more than 10% of source water samples prior to disinfection over any six-month period to have more than 20 fecal coliforms per 100mL.

Sample Site: Quabbin Reservoir

Quabbin Reservoir water is sampled at the Ware Disinfection Facility (WDF) raw water tap before being treated and entering the CVA system.

Fifteen of the 31 samples were positive during December. Two of the samples exceeded a count of 20 cfu/100mL on December 28 and 29. Snow storms and high winds prevented DCR staff from implementing bird harassment on the reservoir itself. On December 30, DCR used LASER harassment from the shore to prevent the birds from landing on the reservoir. **For the current six-month period, 1.1% of the samples have exceeded a count of 20 cfu/100mL.**

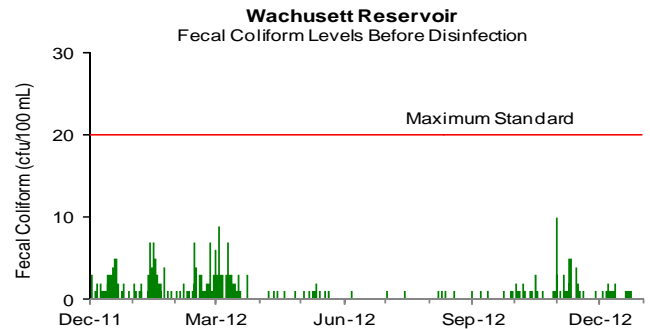


Sample Site: Wachusett Reservoir

Wachusett Reservoir water is sampled at the CWTP raw water tap in Marlborough before being treated and entering the MetroWest/Metropolitan Boston systems.

Fecal coliform levels tend to increase during the winter because, when water bodies near Wachusett ice over, waterfowl seek open water. Many roost at Wachusett, which tends to freeze later in the year than smaller ponds nearby.

Eleven of the 31 samples were positive during December. None of the samples exceeded a count of 20 cfu/100mL. **For the current six-month period, 0.0% of the samples have exceeded a count of 20 cfu/100mL.**

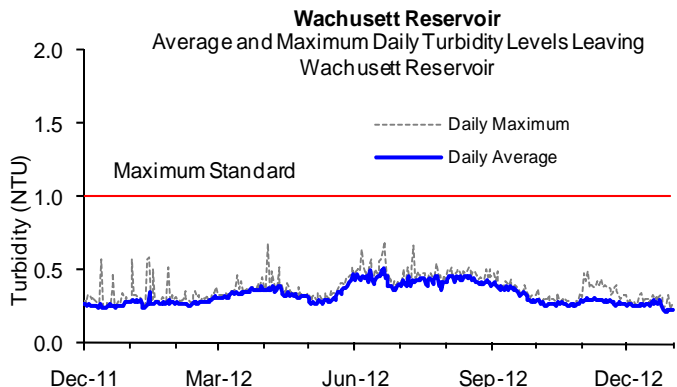
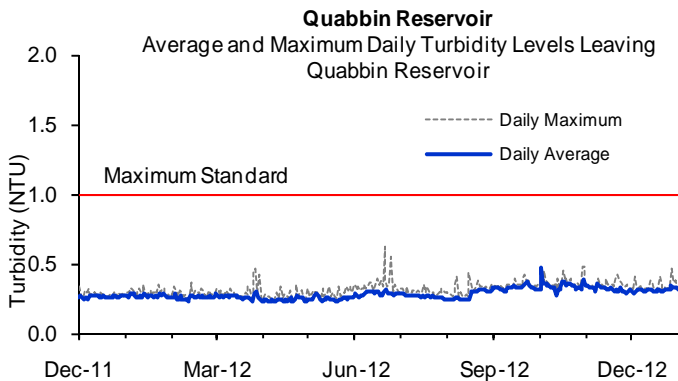


Source Water – Turbidity Results

Turbidity is a measure of suspended and colloidal particles including clay, silt, organic and inorganic matter, algae and microorganisms. The effects of turbidity depend on the nature of the matter that causes the turbidity. High levels of particulate matter may have a higher chlorine demand or may protect bacteria from the disinfectant effects of chlorine, thereby interfering with the disinfectant residual throughout the distribution system.

There are two standards for turbidity: all water must be below 5 NTU (Nephelometric Turbidity Units), and water only can be above 1 NTU if it does not interfere with effective disinfection.

Turbidity of Quabbin Reservoir water is monitored continuously at the Ware Disinfection Facility (WDF) before chlorination. Turbidity of Wachusett Reservoir is monitored continuously at the Carroll Water Treatment Plant (CWTP) before ozonation. Maximum turbidity results at Quabbin and Wachusett were within standards for the month.



Treated Water – Disinfection, pH and Alkalinity Results

December 2012

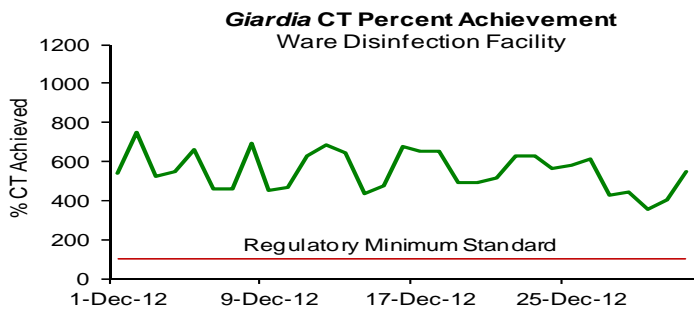
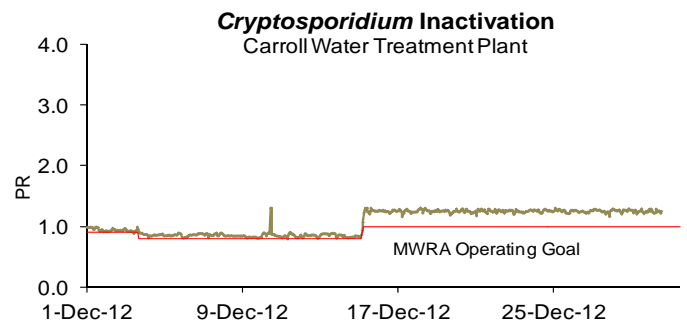
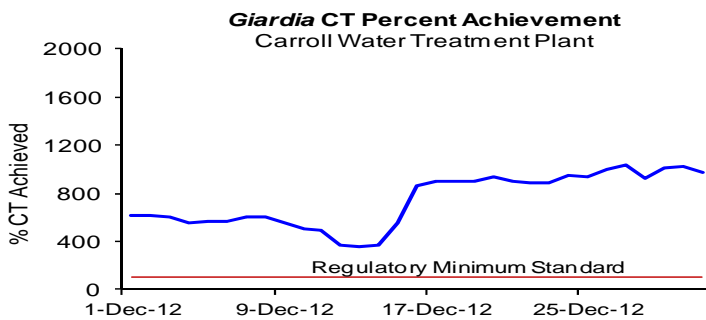
Treated Water - Primary Disinfection

At the Carroll Water Treatment Plant (CWTP), MWRA reports on both regulatory required 99.9% inactivation for *Giardia* (reported as "CT"), and its voluntary operating goal of 99% inactivation for *Cryptosporidium* (reported as "PR"). MWRA calculates hourly CT inactivation rates and reports daily CT inactivation rates at maximum flow, as specified by EPA regulations. The concentration (C) of the disinfectant over time (T) yields a measure of the effectiveness of disinfection. CT achievement for *Giardia* assures CT achievement for viruses, which have a lower CT requirement. The required CT for ozonated water varies with water temperature.

Compliance with the *Giardia* standard is expressed as percent of required CT achieved; 100% is the minimum allowed. To avoid confusion with the regulatory requirements, inactivation of *Cryptosporidium* is reported as Performance Ratio (PR). A PR of 1 demonstrates inactivation of 99% of *Cryptosporidium* based on site-specific data.

Wachusett Reservoir – MetroWest/MetroBoston Supply:

- Ozone dose at the CWTP varied between 2.0 to 3.0 mg/L for December.
- Giardia* CT was maintained above 100% at all times the plant was providing water into the distribution system for December.
- MWRA will not be able to fully meet the voluntary *Cryptosporidium* inactivation target at all times during the UV construction project. This change in treatment was reviewed and approved by the Massachusetts Department of Environmental Protection as part of its permitting for this project.
- The lowest PR achieved was 0.8, which provides 97.5% *Cryptosporidium* inactivation.



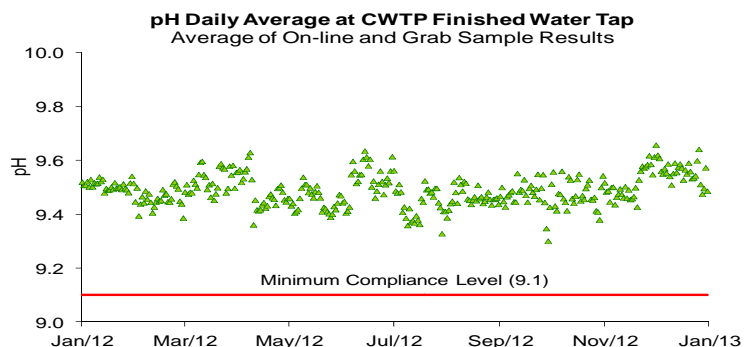
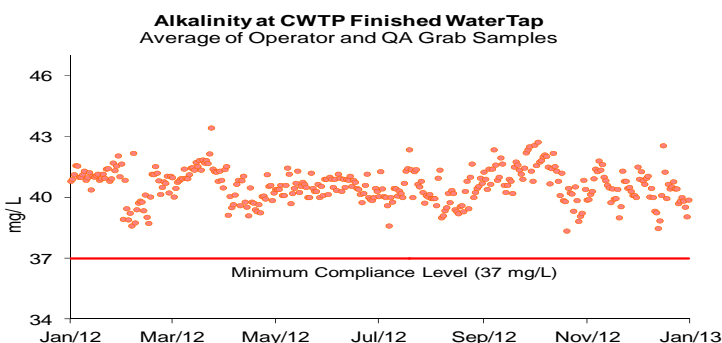
Quabbin Reservoir at Ware Disinfection Facility (CVA Supply):

Giardia CT was maintained above 100% at all times the plant was providing water into the distribution system for December. The chlorine dose at Ware Disinfection Facility (WDF) is adjusted in order to achieve MWRA's target of ≥ 0.75 mg/L at Ludlow Monitoring Station. The chlorine dose at WDF was 1.4 mg/L for December.

pH and Alkalinity Compliance:

MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity which minimizes the leaching of lead and copper from service lines and home plumbing systems into the water. MWRA's target for distribution system pH is 9.3; the target for alkalinity is 40 mg/L. Per DEP requirements, samples from the CWTP Fin B tap have a minimum compliance level of 9.1 for pH and 37 mg/L for alkalinity. Samples from 27 distribution system taps have a minimum compliance level of 9.0 for pH and 37 mg/L for alkalinity. Results must not be below this level for more than 9 days in a six-month period. MWRA tests finished water pH and alkalinity daily at the CWTP Fin B sampling tap. Distribution system samples are collected in March, June, September, and December. Distribution system samples were collected on December 10, 2012. Distribution system sample pH ranged from 9.4 to 9.7 and alkalinity ranged from 40 to 42 mg/L.

In December and over the past six months, no sample results were below the target levels.



Bacteria & Chlorine Residual Results for Communities in MWRA Testing Program December 2012

While all communities collect bacteria samples for the Total Coliform Rule (TCR), 42 systems (including Deer Island and Westboro State Hospital) use MWRA's Laboratory for TCR compliance testing. These systems collect samples for bacteriological analysis and measure water temperature and chlorine residual at the time of collection.

There are 139 sampling locations for which MWRA is required to report TCR results. These locations include a subset of the community TCR locations, as well as sites along MWRA's transmission system, water storage tanks and pumping stations.

The TCR requires that no more than 5% of all samples may be total coliform positive in a month (or that no more than one sample be positive when less than 40 samples are collected each month). Public notification is required if this standard is exceeded.

Escherichia coli (*E.coli*) is a specific coliform species that is almost always present in fecal material and whose presence likely indicates potential contamination of fecal origin. If *E.coli* are detected in a drinking water sample, this is considered evidence of a critical public health concern. Public notification is required if follow-up tests confirm the presence of *E.coli* or total coliform. A disinfectant residual is intended to maintain the sanitary integrity of the water; MWRA considers a residual of 0.2 mg/L a minimum target level at all points in the distribution system.

Highlight

Two of the 1,830 community samples (0.1%) system-wide tested positive for total coliform during the month of December. Two of the 599 MWRA samples (0.3%) tested positive for total coliform. No sample tested positive for *E.coli*. Only 5.3% of the samples had results lower than 0.2 mg/L.

	# Coliform Samples (a)	Total Coliform # (%) Positive	E.coli # Positive	Public Notification Required?	December 2012 Minimum Chlorine Residual (mg/L)	December 2011 Minimum Chlorine Residual (mg/L)	December 2012 Average Chlorine Residual (mg/L)	December 2011 Average Chlorine Residual (mg/L)
MWRA Sampling Locations (d)	599	2 (0.3%)	0	No	0.06	0.02	1.98	1.89
ARLINGTON	54	0 (0%)	0		0.01	0.07	1.41	1.65
BELMONT	32	0 (0%)	0		1.00	0.39	1.93	1.53
BOSTON	246	2 (1.1%)	0	No	1.26	0.24	2.15	2.19
BROOKLINE	68	0 (0%)	0		1.04	0.08	2.26	1.93
CHELSEA	52	0 (0%)	0		1.12	0.39	1.85	1.78
DEER ISLAND	16	0 (0%)	0		1.92	1.77	2.21	2.01
EVERETT	40	0 (0%)	0		0.96	1.01	1.11	1.10
FRAMINGHAM	63	0 (0%)	0		0.19	0.22	1.93	1.84
LEXINGTON	36	0 (0%)	0		0.51	0.80	2.05	1.99
LYNNFIELD	6	0 (0%)	0		0.48	0.21	0.87	0.69
MALDEN	72	0 (0%)	0		1.38	1.30	1.52	1.46
MARBLEHEAD	24	0 (0%)	0		0.12	0.17	1.63	1.48
MEDFORD	68	0 (0%)	0		1.09	0.58	1.85	1.71
MELROSE	36	0 (0%)	0		0.05	0.01	0.87	0.79
MILTON	32	0 (0%)	0		1.24	0.94	1.77	1.56
NAHANT	10	0 (0%)	0		0.09	0.09	1.39	1.20
NEWTON	92	0 (0%)	0		0.25	0.21	1.90	1.68
NORWOOD	36	0 (0%)	0		0.02	0.01	1.50	1.41
QUINCY	92	0 (0%)	0		0.09	0.09	1.82	1.72
READING	40	0 (0%)	0		0.07	0.02	1.63	1.12
REVERE	60	0 (0%)	0		1.01	1.09	1.90	1.90
SAUGUS	32	0 (0%)	0		1.41	1.34	1.93	1.80
SOMERVILLE	81	0 (0%)	0		1.08	0.98	1.80	1.91
SOUTHBOROUGH	10	0 (0%)	0		0.70	0.13	2.06	1.40
STONEHAM	28	0 (0%)	0		0.40	0.21	2.05	1.91
SWAMPSCOTT	17	0 (0%)	0		0.01	0.09	1.09	1.18
WALTHAM	69	0 (0%)	0		0.68	0.17	2.16	1.74
WATERTOWN	40	0 (0%)	0		0.58	0.69	1.79	1.92
WESTBORO HOSPITAL	5	0 (0%)	0		0.02	0.01	0.03	0.34
WESTON	16	0 (0%)	0		1.55	1.22	2.33	1.93
WINTHROP	24	0 (0%)	0		0.05	0.31	1.02	1.13
Total: Fully Served	1497	2 (0.1%)						
CVA & Partially Served (b)								
BEDFORD	20	0 (0%)	0		0.05	0.01	0.79	0.62
HANSCOM AFB	9	0 (0%)	0		0.06	0.03	1.06	0.87
MARLBORO	42	0 (0%)	0		0.49	0.04	2.07	1.22
NEEDHAM	41	0 (0%)	0		0.03	0.04	0.35	0.57
NORTHBORO	16	0 (0%)	0		0.14	0.02	1.74	1.18
WAKEFIELD	44	0 (0%)	0		0.20	0.28	1.40	1.27
WELLESLEY	36	0 (0%)	0		0.02	0.04	0.53	0.48
WILMINGTON	29	0 (0%)	0		0.09	1.02	1.64	1.83
WINCHESTER	20	0 (0%)	0		0.19	0.19	1.39	0.95
WOBURN	60	0 (0%)	0		0.02	0.20	0.98	1.05
SOUTH HADLEY FD1 (c)	16	0 (0%)	0		0.22	0.07	0.49	0.44
Total: CVA & Partially Served	333							
Total: Community Samples	1830	2 (0.1%)						

(a) The number of samples collected depends on the population served and the number of repeat samples required.

(b) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.

(c) Part of the Chicopee Valley Aqueduct System. Free chlorine system.

(d) MWRA total coliform and chlorine residual results include data from 125 community pipe locations as described above. In most cases these community results are accurately indicative of MWRA water as it enters the community system; however, some are clearly strongly influenced by local pipe conditions. Residuals in the MWRA system are typically between 1.0 and 2.8 mg/L.

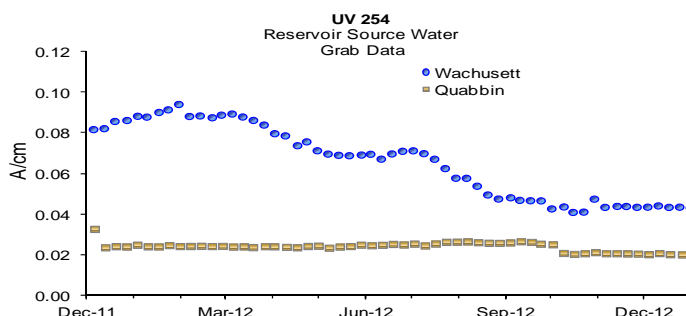
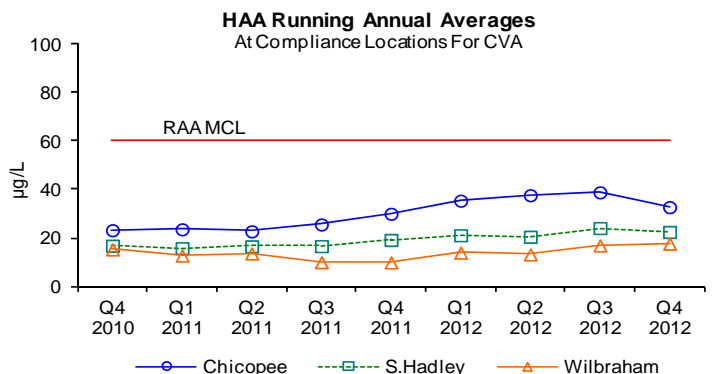
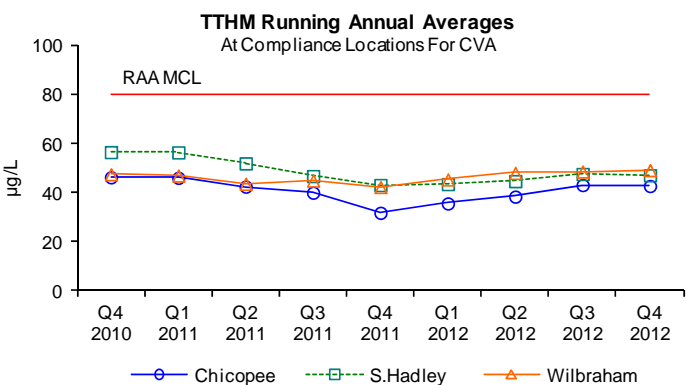
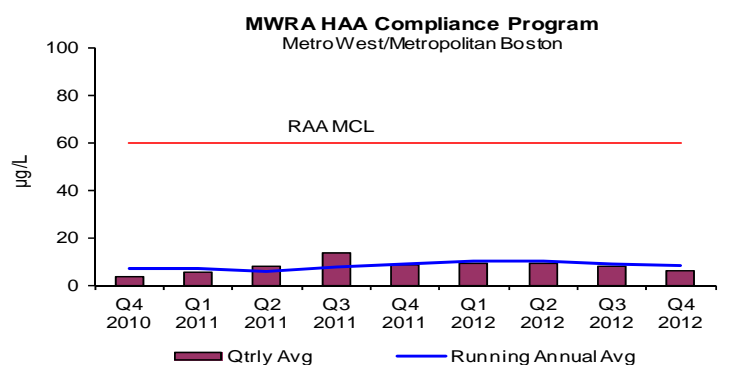
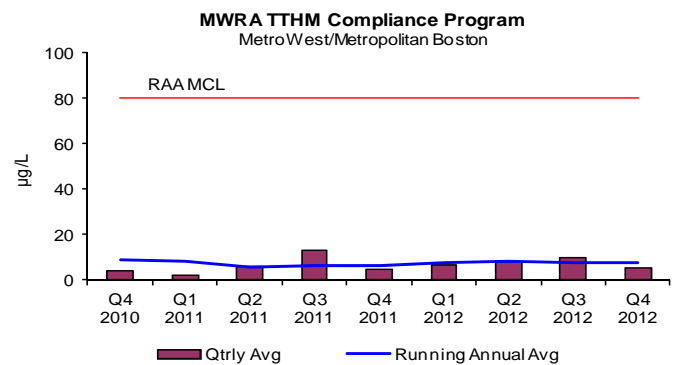
Treated Water - Disinfection By-Product (DBP) Levels in Communities December 2012

Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAA5s) are by-products of disinfection treatment with chlorine. TTHMs and HAA5s are of concern due to their potential adverse health effects at high levels. EPA's running annual average (RAA) standard is 80 µg/L for TTHMs and 60 µg/L for HAA5s. Effective Q2 2013, under the Stage 2 DBPR compliance will be based on a LOCATIONAL running annual average, rather than an overall average. MWRA initiated monitoring under this new Stage 2 rule May 2012. Sampling locations have increased from 16 to 32 each quarter. Until May 2013, MWRA will continue to report an overall quarterly and running annual average. After May 2013, LRAA's will be reported for each site. Partially served communities are responsible for their own compliance monitoring and reporting and must be contacted directly for their results.

UV Absorbance at 254nm wavelength (UV-254), is a measure of the amount and reactivity of natural organic material in source water. Higher UV-254 levels cause increased ozone and chlorine demand resulting in the need for higher ozone and chlorine doses, and can increase the level of DBPs. UV-254 is impacted by the amount of Quabbin transfer, and the quality and quantity of tributary flows into the Wachusett. Hurricanes can have a significant and long lasting impact.

Bromate is tested monthly per DEP requirements for water systems that treat with ozone. Bromide in the raw water may be converted into bromate following ozonation. EPA's RAA Maximum Contaminant Level (MCL) standard for bromate is 10 µg/L.

The RAA for TTHMs and HAA5s for MWRA's Compliance Program (represented as the line in the top two graphs below) remain below current standards. The RAA for TTHMs = 7.6 µg/L; HAA5s = 8.1 µg/L. CVA's DBP levels continue to be below current standards. UV-254 levels are currently around 0.04 A/cm for Wachusett and 0.02 A/cm for Quabbin. The current RAA for Bromate = 0.0 µg/L.



MWRA Monthly Water Quality Analysis

December 2012

This page provides information on water quality at four locations in the MWRA transmission system. Results reflect a "snapshot" in time and may not represent typical conditions. Monitoring for parameters indicated in bold is quarterly as they either have minimal variability or are always below detection limits. The "Wachusett System" locations represent raw water from the Wachusett Reservoir (CWTP inlet) and finished water leaving the treatment plant (CWTP Finished water tap). The "CVA System" locations represent raw water from the Quabbin Reservoir (WDF) and finished water after all treatment (LMS). See www.mwra.com for additional information on other parameters which are monitored less frequently.

CVA System Wachusett System
Metro-Boston Standards

Component	Quabbin Res. at Ware Disinfection Facility (Raw)	Ludlow Monitoring Station (Treated)	Carroll Water Treatment Plant Inlet (Raw)	Carroll Water TP Fin. Water Tap A (Treated)	Health Standard	Aesthetics or Other Standards	Units	Method Reporting Limit
Alkalinity	3.3	4.2	6.6	40.6			MG/L	0.05
Aluminum	U	U	U	U		50-200 (c)	UG/L	15.0
Ammonia-N, Total	U	U	0.01	0.36			MG/L	0.005
Antimony	U	U	U	U	6 (b)		UG/L	0.4
Arsenic	U	U	U	U	10 (b)		UG/L	1.0
Barium	6.7	7.3	7.3	7.7	2000 (b)		UG/L	2.0
Beryllium	U	U	U	U	4 (b)		UG/L	0.3
Bromate	U	U	U	U	10 (b)		UG/L	5.0
Bromide	10.1	5.7	14.5	13.6			UG/L	5.0
Cadmium ⁽¹⁾	U	U	U	U	5 (b)		UG/L	0.5
Calcium	2010	2120	3940	3960			UG/L	20
Chloride	7.3	8.9	17.3	18.9		250 (c)	MG/L	0.5
Chlorine, Free		0.85			4 (b)(d)		MG/L	0.02
Chlorine, Total				3.2	4 (b)(d)		MG/L	0.02
Chromium, Total	U	U	U	U	100 (b)		UG/L	1.0
Coliform, Fecal, MF Method	U		U		20 (a)		CFU/100 mL	1
Coliform, Total, MF Method ^(e)	196	U	11	U	100 (a) 0 (b)		CFU/100 mL	1
Copper **	3.2	U	U	U		1300 (f) 1000 (g)	UG/L	3.0
Cyanide	U	U	U	U	0.2 (b)		MG/L	0.01
Fluoride ⁽³⁾	U	0.04	0.04	0.99	4 (b)		MG/L	0.02
Hardness ⁽²⁾	7.2	7.4	13.1	12.4			MG/L	0.194
Iron **	14.2	13.0	14.5	17.3		300 (c)	UG/L	6.0
Lead	U	U	U	U		15 (f)	UG/L	0.05
Magnesium	525	519	811	768			UG/L	35
Manganese	4.43	2.13	10.20	10.80		50 (c)	UG/L	0.1
Mercury ⁽¹⁾	U	U	U	U	2 (b)		UG/L	0.05
Nickel	U	U	U	U			UG/L	0.5
Nitrate-N	U	U	0.011	0.034	10 (b)		MG/L	0.005
Nitrite	U	U	U	U	1 (b)		MG/L	0.005
Orthophosphate	0.004	0.004	0.009	0.011			MG/L	0.0025
pH	6.6	7.1	7.1	9.7			S.U.	
Potassium	575	497	858	804			UG/L	200
Selenium	U	U	U	U	50 (b)		UG/L	1.0
Silica (SiO2)	1590	1600	2640	3210			UG/L	200.0
Silver	U	U	U	U		100 (c)	UG/L	1.0
Sodium	5.0	6.1	11.3	31.3			MG/L	0.2
Specific Conductance	47	53	92	179			UMHO/cm	0.3
Standard Plate Count, HPC	17		8	U	500 (b)		CFU/mL	1
Sulfate (SO4)	4.2	4.2	5.9	8.5		250 (c)	MG/L	1.0
Thallium	U	U	U	U	2 (b)		UG/L	0.3
Total Dissolved Solids	32.0	37.0	59.0	89.0		500 (c)	MG/L	13
Total Organic Carbon	1.9	2.1	2.1	2.0			MG/L	0.3
Total Phosphorus	U	U	U	U			MG/L	0.05
UV-254	0.020	0.018	0.043	0.032			A/cm	0.000965
Zinc **	3.3	2.6	U	U		5000 (c)	UG/L	1.5

- (a) = Primary MCL standard (health related), applies to source (raw) water only. DEP "Drinking Water Regulations", 310CMR 22.00. Fecal standard takes precedence when both fecal and total coliform are tested.
- (b) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00. Applies to samples of treated water downstream of Wachusett and Quabbin Reservoirs. Most based on annual average.
- (c) = Secondary MCL standard (aesthetic related). DEP "Drinking Water Regulations", 310CMR 22.00.
- (d) = Maximum Residual Disinfectant Level. DEP "Drinking Water Regulations", 310CMR 22.00. Based on annual average.
- (e) = Confirmed results only are reported.
- (f) = Refers to 90th percentile Action Level.
- (g) = Refers to a single sample, secondary MCL.

U = Less than method reporting limit
MCL = Maximum Contaminant Level
 = Not Applicable
CFU = Colony Forming Unit
S.U. = Standard Units

UG/L = micrograms per liter = parts per billion
MG/L = milligrams per liter = parts per million
NTU = Nephelometric Turbidity Unit
HPC = Heterotrophic Plate Count (48 Hrs @ 35 °C)
** = Metal results may be elevated due to local plumbing at the sample tap.

Bold Italics = Samples from December
Regular Font = Samples from October

Most results are based on single grab samples collected on December 3 and 4, 2012 and analyzed by MWRA and contract laboratories.

- NOTES:**
- (1) Due to MWRA lab equipment having higher sensitivity, MWRA's tests for several parameters are more sensitive than the EPA-set levels of detection and reporting. For example, the EPA minimum detection limit for cadmium is 1 ug/L and 0.2 ug/L for mercury, and MWRA lab tests and reports at lower than these detection limits.
 - (2) MWRA water is considered soft. Water is measured by hardness - which is the amount of dissolved minerals in the water. MWRA water has a hardness of about 15-20 mg/l or about 1 grain/gallon (1 grain/gallon = 17.1 mg/L). For comparison, hard water would have greater than 75 mg/l hardness.
 - (3) Fluoride dose is 1.0 mg/L with a desired range of 0.8 to 1.2 mg/L.