

The background features a close-up of water splashing from a faucet, with a bowl of fresh fruit (raspberries, blackberries, and red grapes) in the lower-left corner. The overall color palette is dominated by blues and greens, with a dark teal curved shape framing the text on the right side.

# ANNUAL WATER QUALITY REPORT

WATER TESTING  
PERFORMED IN 2015

*Presented By*  
**Manchester Water Works**

## Meeting the Challenge

Once again we are proud to present our annual drinking water report, covering all drinking water testing performed between January 1 and December 31, 2015. Over the years, we have dedicated ourselves to producing drinking water that meets or exceeds all state and federal standards. We continually strive to adopt new methods for delivering the best-quality drinking water to your homes and businesses. As new challenges to drinking water safety emerge, we remain vigilant in meeting the goals of source water protection, water conservation, and community education while continuing to serve the needs of all of our water users.

Please remember that we are always available to assist you, should you ever have any questions or concerns about your water.

## Community Participation

You are invited to attend our Water Board meetings and participate in discussions about your drinking water. A schedule of meeting times is posted on our Web site at [www.manchesternh.gov/wtr](http://www.manchesternh.gov/wtr). Please call our office at (603) 624-6494 to confirm your intent to attend.

## Important Health Information

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as those with cancer undergoing chemotherapy, those who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants may be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The U.S. EPA/CDC (Centers for Disease Control and Prevention) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at (800) 426-4791 or <http://water.epa.gov/drink/hotline>.

Your public water supply is fluoridated. According to the Centers for Disease Control and Prevention, if your child under the age of 6 months is exclusively consuming infant formula reconstituted with fluoridated water, there may be an increased chance of dental fluorosis. Consult your child's health care provider for more information.



## Substances That Could Be in Water

To ensure that tap water is safe to drink, the U.S. EPA prescribes regulations limiting the amount of certain contaminants in water provided by public water systems. U.S. Food and Drug Administration regulations establish limits for contaminants in bottled water that must provide the same protection for public health. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of these contaminants does not necessarily indicate that the water poses a health risk.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, in some cases, radioactive material, and substances resulting from the presence of animals or from human activity. Substances that may be present in source water include:

**Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, or wildlife;

**Inorganic Contaminants**, such as salts and metals, which can be naturally occurring or may result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming;

**Pesticides and Herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses;

**Organic Chemical Contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production and may also come from gas stations, urban stormwater runoff, and septic systems;

**Radioactive Contaminants**, which can be naturally occurring or may be the result of oil and gas production and mining activities.

For more information about contaminants and potential health effects, call the U.S. EPA's Safe Drinking Water Hotline at (800) 426-4791.



## Source Water Assessment

In compliance with a federal mandate, the NH Department of Environmental Services performed a Source Water Assessment on Lake Massabesic in September of 2002. The assessment looked at the drainage area for the lake and ranked its vulnerability to contamination. Lake Massabesic received four high and four medium vulnerability ratings, while it ranked at low vulnerability for five additional categories. Concern was raised over the detection of MTBE, now prohibited, which came from reformulated gasoline. Concern was also raised over Potential Contamination Sources (PCSs) on the watershed such as highways. Overall, the report presents a positive picture of Manchester's water source and its condition. While Manchester Water Works has done its best to protect Lake Massabesic, we understand more than ever that we rely heavily upon the standards and practices of each citizen and each community on the watershed for their continued efforts to preserve this precious resource.

The complete Assessment Report is available for review at our Web site or at the NH DES Drinking Water Source Water Assessment page at <http://des.nh.gov/organization/divisions/water/dwgb/dwspp/dwsap.htm>.

## Community Water Fluoridation

The safety and benefits of fluoride are well documented. For over 70 years, U.S. citizens have benefited from drinking water containing fluoride, leading to better dental health. Drinking fluoridated water keeps the teeth strong and has reduced tooth decay by approximately 25 percent in children and adults.

Over the past several decades, there have been major improvements in oral health. Still, tooth decay remains one of the most common chronic diseases of childhood. Community water fluoridation has been identified as the most cost-effective method of delivering fluoride to all members of the community, regardless of age, educational attainment, or income level.

Nearly all water contains some fluoride, but usually not enough to help prevent tooth decay or cavities. Public water systems can add the right amount of fluoride to the local drinking water to prevent tooth decay.

Community water fluoridation is recommended by nearly all public health, medical, and dental organizations in the U.S. Because of its contribution to the dramatic decline in tooth decay, the Centers for Disease Control and Prevention (CDC) named community water fluoridation one of the greatest public health achievements of the 20th century. (Courtesy of CDC: [cdc.gov/fluoridation](http://cdc.gov/fluoridation))

## Lead in Home Plumbing

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We are responsible for providing high-quality drinking water, but we cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at [www.epa.gov/lead](http://www.epa.gov/lead).

## Tap vs. Bottled

Thanks in part to aggressive marketing, the bottled water industry has successfully convinced us all that water purchased in bottles is a healthier alternative to tap water. However, according to a four-year study conducted by the Natural Resources Defense Council, bottled water is not necessarily cleaner or safer than most tap water. In fact, about 25 percent of bottled water is actually just bottled tap water (40 percent, according to government estimates).

The Food and Drug Administration is responsible for regulating bottled water, but these rules allow for less rigorous testing and purity standards than those required by the U.S. EPA for community tap water. For instance, the high mineral content of some bottled waters makes them unsuitable for babies and young children. Furthermore, the FDA completely exempts bottled water that's packaged and sold within the same state, which accounts for about 70 percent of all bottled water sold in the United States.

People spend 10,000 times more per gallon for bottled water than they typically do for tap water. If you get your recommended eight glasses a day from bottled water, you could spend up to \$1,400 annually. The same amount of tap water would cost about 49 cents. Even if you installed a filter device on your tap, your annual expenditure would be far less than what you'd pay for bottled water.

For a detailed discussion on the NRDC study results, check out their Web site at [www.nrdc.org/water/drinking/bw/exesum.asp](http://www.nrdc.org/water/drinking/bw/exesum.asp).

## QUESTIONS?

For more information about this report, or for any questions relating to your drinking water, please call David G. Miller, P.E., Deputy Director - Water Supply, at (603) 792-2851.

## Water Treatment Process

### Raw Water Pumping

Raw water from Lake Massabesic is conveyed through a 60-inch high-density polyethylene pipeline intake that extends 430 feet from the shoreline into a newer low-lift pump station constructed in 1997. The original intake and pump station, built in 1906 and renovated for raw water service in 1974, is maintained for redundancy. A combination of four variable speed pumps delivers raw water through a 48-inch pipeline to the rapid mix chambers. This pipeline is equipped with a soda ash feed point at which alkalinity is boosted prior to coagulation.

### Rapid Mixing (Mixers were replaced during the plant upgrade in 2003 - 2006.)

In the rapid mix chamber, the primary treatment chemical, aluminum sulfate, is added to begin the process of coagulation. Two rapid mix chambers are configured in series with the capability of adding the coagulants into either or both chambers. High speed mixers ensure complete dispersion of these chemicals, enabling them to react with the natural dissolved and particulate matter in the water, causing them to collide and form larger particles.

### Flocculation

Flow from the rapid mix chambers is distributed evenly into each of the four flocculation basins. The flocculation basins are configured in two stages separated by a baffle wall, with the second stage mixers set at a slightly slower speed than the first stage mixers.

### Sedimentation (Sludge removal process was improved during the plant upgrade in 2003 - 2006.)

The sedimentation process is achieved by allowing the water to flow slowly through a long, deep, quiescent basin that allows sufficient time for the floc particles to settle to the bottom, forming sludge, a treatment process by-product. Sludge is periodically removed by isolating one of the four basins each week, decanting, and pumping the sludge layer to a lagoon where it is eventually dried and moved to a landfill.

### Intermediate Ozone (This was added during the plant upgrade in 2003 - 2006.)

Settled water flows into an intermediate pump station, where it is lifted into the ozone contact chambers. Ozone is a powerful oxidant and disinfectant that removes color, taste, and odor, along with killing or inactivating harmful organisms in the water. Ozone is generated on-site by passing a high-voltage electric current across a dielectric discharge gap through a pure oxygen stream. A combination of three, 500-pound-per-day ozone generators produces the required ozone gaseous stream that is injected into each of four ozone contact chambers through fine bubble diffusers. The contact chambers provide the necessary time for completion of the ozone reaction. Residual (excess) ozone is removed from the water by applying sodium bisulfite. The water then leaves the contact chambers and continues on to the filters. Excess ozone gas that accumulates above the ozone contact chambers is removed under vacuum through a thermal-catalytic ozone destruct process and vented to the atmosphere.

### Anthracite and Granular Activated Carbon Filtration (We replaced the original ABW filters as part of the upgrade in 2003 - 2006.)

Following the intermediate ozone process, the water passes through either one of four deep-bed anthracite filters or one of four deep-bed granular activated carbon (GAC) filters. Each filter contains six feet of biologically active media that completes the physical removal process. While both filter media have proven to be effective, they are being studied side-by-side to determine which will be the most beneficial and economical in the long term. Anthracite is an excellent filter media but does not have the adsorption capability of GAC. However, GAC requires periodic reactivation or replacement to restore its adsorption characteristics. Comparing the performance of each side-by-side will enable Manchester Water Works to make an informed decision as to which will most benefit our customers in the future.

### Clearwell and Finished Water Pumping (We expanded the clearwell and replaced pumps during the plant upgrade in 2003 - 2006.)

From the hydraulic control structure, water flows into a 700,000 gallon clearwell and finished water pumping station. A series of seven vertical turbine pumps (three for the Low Service pressure zone and four for the High Service pressure zone) lifts finished water into the distribution system.

## Where Does My Water Come From?

For more than 135 years, Lake Massabesic has served as the water supply for Manchester and portions of six surrounding communities. In order to satisfy stringent state and federal drinking water regulations, the lake water is purified at Manchester's Water Treatment Plant. This facility was completed in 1974 and has since been routinely updated with state-of-the-art equipment to improve quality control and operational efficiency; it was significantly upgraded in 2003 - 2006. Located adjacent to Lake Massabesic, the plant treats all of the city's water before it is pumped into a 500-mile piping network for distribution to homes and industries.

## What's Your Water Footprint?

You may have some understanding about your carbon footprint, but how much do you know about your water footprint? The water footprint of an individual, community, or business is defined as the total volume of fresh water that is used to produce the goods and services that are consumed by the individual or community or produced by the business. For example, 11 gallons of water are needed to irrigate and wash the fruit in one half-gallon container of orange juice. Thirty-seven gallons of water are used to grow, produce, package, and ship the beans in that morning cup of coffee. Two hundred and sixty-four gallons of water are required to produce one quart of milk, and 4,200 gallons of water are required to produce two pounds of beef.

According to the U.S. EPA, the average American uses over 180 gallons of water daily. In fact, in the developed world, one flush of a toilet uses as much water as the average person in the developing world allocates for an entire day's cooking, washing, cleaning, and drinking. The annual American per capita water footprint is about 8,000 cubic feet, twice the global per capita average. With water use increasing six-fold in the past century, our demands for fresh water are rapidly outstripping what the planet can replenish.

To check out your own water footprint, go to [www.goo.gl/QMoIXT](http://www.goo.gl/QMoIXT).

## What's a Cross-connection?

Cross-connections that contaminate drinking water distribution lines are a major concern. A cross-connection is formed at any point where a drinking water line connects to equipment (boilers), systems containing chemicals (air conditioning systems, fire sprinkler systems, irrigation systems), or water sources of questionable quality. Cross-connection contamination can occur when the pressure in the equipment or system is greater than the pressure inside the drinking water line (backpressure). Contamination can also occur when the pressure in the drinking water line drops due to fairly routine occurrences (main breaks, heavy water demand), causing contaminants to be sucked out from the equipment and into the drinking water line (backsiphonage).

Outside water taps and garden hoses tend to be the most common sources of cross-connection contamination at home. The garden hose creates a hazard when submerged in a swimming pool or when attached to a chemical sprayer for weed killing. Garden hoses that are left lying on the ground may be contaminated by fertilizers, cesspools, or garden chemicals. Improperly installed valves in your toilet could also be a source of cross-connection contamination.

Community water supplies are continuously jeopardized by cross-connections unless appropriate valves, known as backflow prevention devices, are installed and maintained. We have surveyed all industrial, commercial, and institutional facilities in the service area to make sure that all potential cross-connections are identified and eliminated or protected by a backflow preventer. We also inspect and test each backflow preventer to make sure that it is providing maximum protection.

For more information, call the Safe Drinking Water Hotline at (800) 426-4791.

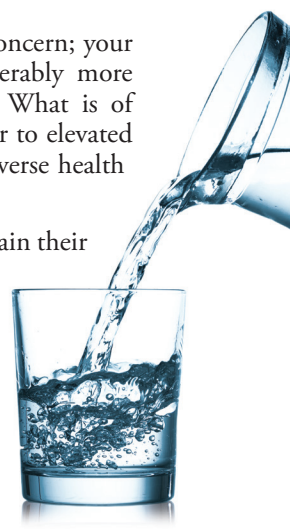
## Failure in Flint

The national news coverage of water conditions in Flint, Michigan, has created a great deal of confusion and consternation over the past year. The water there has been described as being corrosive; images of corroded batteries and warning labels on bottles of acids come to mind. But is corrosive water necessarily bad?

Corrosive water can be defined as a condition of water quality that will dissolve metals (iron, lead, copper, etc.) from metallic plumbing at an excessive rate. There are a few contributing factors but, generally speaking, corrosive water has a pH of less than 7; the lower the pH, the more acidic, or corrosive, the water becomes. (By this definition, many natural waterways throughout the country can be described as corrosive.) While all plumbing will be somewhat affected over time by the water it carries, corrosive water will damage plumbing much more rapidly than water with low corrosivity.

By itself, corrosive water is not a health concern; your morning glass of orange juice is considerably more corrosive than the typical lake or river. What is of concern is that exposure in drinking water to elevated levels of the dissolved metals increases adverse health risks. And there lies the problem.

Public water systems are required to maintain their water at optimal conditions to prevent it from reaching corrosive levels. Rest assured that we routinely monitor our water to make sure that what happened in Flint never happens here. For more information on how corrosivity impacts water quality, download this informative pamphlet: <http://goo.gl/KpTmXv>.



## Sampling Results

During the past year, we have taken hundreds of water samples in order to determine the presence of any radioactive, biological, inorganic, volatile organic, or synthetic organic contaminants. The tables below show only those contaminants that were detected in the water. The state requires us to monitor for certain substances less often than once per year because the concentrations of these substances do not change frequently. In these cases, the most recent sample data are included, along with the year in which the sample was taken.

We participated in the 3rd stage of the EPA's Unregulated Contaminant Monitoring Rule (UCMR3) program by performing additional tests on our drinking water. UCMR3 benefits the environment and public health by providing the EPA with data on the occurrence of contaminants suspected to be in drinking water, in order to determine if the EPA needs to introduce new regulatory standards to improve drinking water quality. Contact us for more information on this program.

### REGULATED SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	MCL [MRDL]	MCLG [MRDLG]	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
<b>Alpha Emitters</b> (pCi/L)	2015	15	0	3.0	NA	No	Erosion of natural deposits
<b>Barium</b> (ppm)	2015	2	2	0.0114	0.0103–0.0125	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
<b>Benzo(a)pyrene [PAH]</b> (ppb)	2015	200	0	0.281	NA	No	Leaching from linings of water storage tanks and distribution lines
<b>Beta/Photon Emitters<sup>1</sup></b> (pCi/L)	2015	50	0	1.4	NA	No	Decay of natural and man-made deposits
<b>Chloramines</b> (ppm)	2015	[4]	[4]	2.38	1.9–3.3	No	Water additive used to control microbes
<b>Combined Radium</b> (pCi/L)	2015	5	0	0.5	NA	No	Erosion of natural deposits
<b>Fluoride</b> (ppm)	2015	4	4	0.76	0.57–0.8	No	Erosion of natural deposits; Water additive that promotes strong teeth; Discharge from fertilizer and aluminum factories
<b>Haloacetic Acids [HAAs]</b> (ppb)	2015	60	NA	4.3	3.6–5.7	No	By-product of drinking water disinfection
<b>TTHMs [Total Trihalomethanes]</b> (ppb)	2015	80	NA	3.4	3.3–3.5	No	By-product of drinking water disinfection
<b>Total Organic Carbon</b> (ppm)	2015	TT	NA	1.9	1.4–2.4	No	Naturally present in the environment
<b>Turbidity<sup>2</sup></b> (NTU)	2015	TT	NA	0.072	0.031–0.072	No	Soil runoff
<b>Turbidity</b> (Lowest monthly percent of samples meeting limit)	2015	TT = 95% of samples < 0.3 NTU	NA	100	NA	No	Soil runoff

Tap water samples were collected for lead and copper analyses from sample sites throughout the community.

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AL	MCLG	AMOUNT DETECTED (90TH%TILE)	SITES ABOVE AL/TOTAL SITES	VIOLATION	TYPICAL SOURCE
<b>Copper</b> (ppm)	2015	1.3	1.3	0.05	0/38	No	Corrosion of household plumbing systems; Erosion of natural deposits
<b>Lead</b> (ppb)	2015	15	0	1.5	0/38	No	Corrosion of household plumbing systems; Erosion of natural deposits

### SECONDARY SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	SMCL	MCLG	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
<b>Aluminum</b> (ppb)	2015	200	NA	24	15–29	No	Erosion of natural deposits; Residual from some surface water treatment processes
<b>Chloride</b> (ppm)	2015	250	NA	47.5	45–50	No	Runoff/leaching from natural deposits
<b>Manganese</b> (ppb)	2015	50	NA	5.5	1.1–8.5	No	Leaching from natural deposits
<b>pH</b> (Units)	2015	6.5–8.5	NA	7.75	7.62–7.96	No	Naturally occurring
<b>Sulfate</b> (ppm)	2015	250	NA	14.7	13–18	No	Runoff/leaching from natural deposits; Industrial wastes



## UNREGULATED AND OTHER SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AMOUNT DETECTED	RANGE LOW-HIGH	TYPICAL SOURCE
Alkalinity (ppm)	2015	22.5	6–35	Naturally occurring and/or added for pH adjustment
Orthophosphate as P (ppm)	2015	0.361	0.307–0.406	Treatment additive for corrosion control
Sodium (ppm)	2015	41.5	39.5–44.4	Road deicing application
Total Hardness (ppm)	2015	17.3	16.6–17.7	Naturally occurring

<sup>1</sup>The MCL for beta particles is 4 mrem/year. The U.S. EPA considers 50 pCi/L to be the level of concern for beta particles.

<sup>2</sup>Turbidity is a measure of the cloudiness of the water. It is monitored by surface water systems because it is a good indicator of water quality and thus helps measure the effectiveness of the treatment process. High turbidity can hinder the effectiveness of disinfectants.

## Definitions

**AL (Action Level):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

**LRAA (Locational Running Annual Average):** The average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters. Amount Detected values for TTHMs and HAAs are reported as LRAAs.

**MCL (Maximum Contaminant Level):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

**MCLG (Maximum Contaminant Level Goal):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

**MRDL (Maximum Residual Disinfectant Level):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

**MRDLG (Maximum Residual Disinfectant Level Goal):** The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

**NA:** Not applicable

**NTU (Nephelometric Turbidity Units):** Measurement of the clarity, or turbidity, of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

**pCi/L (picocuries per liter):** A measure of radioactivity.

**ppb (parts per billion):** One part substance per billion parts water (or micrograms per liter).

**ppm (parts per million):** One part substance per million parts water (or milligrams per liter).

**SMCL (Secondary Maximum Contaminant Level):** SMCLs are established to regulate the aesthetics of drinking water like taste and odor.

**TT (Treatment Technique):** A required process intended to reduce the level of a contaminant in drinking water.