H_2O REPORT

H_2O Report is an annual publication of Beaver Water District Summer 2016

It's Easy … Just Turn the Handle!

For Safe, Clean Drinking Water

We are pleased to provide you with this annual report on the quality of your drinking water. For more than 50 years, Beaver Water District (BWD) has cleaned water from Beaver Lake and then sold it to Fayetteville, Springdale, Rogers, and Bentonville. The cities then sell the water to retail customers, as well as wholesaling water to smaller communities. Inside this report are some of the most critical water quality data. To help you understand the report, we have included useful definitions related to common water quality parameters.

We are proud to report that in 2015, BWD achieved 100% compliance with state and federal drinking water regulations. While Beaver Lake's raw water quality varies throughout the year, the drinking water that is pumped to your home or business must be of consistent quality at all times. The conventional treatment processes utilized by the BWD – coagulation, sedimentation, filtration, and chlorine disinfection — are quite effective in treating water from Beaver Lake. Our staff is well trained and committed to ensuring that the drinking water we produce is exceptional and is safe for you to drink. For more data, visit bwdh2o.org and download the 2015 Water Quality Report. If you have questions, please e-mail awilson@bwdh2o.org or call 479-756-3651.

Alan D. Fortenberry P.E., CEO, Beaver Water District

Mission

To serve our customers' needs by providing high quality drinking water that meets or exceeds all regulatory requirements and is economically priced consistent with our quality standards.

2015 State of the Lake Report

By Bob Morgan, P.E., Ph.D.
Manager of Environmental Quality

Beaver Water District pumps and purifies water from Beaver Lake, a U.S. Army Corps of Engineers multi-purpose reservoir. The lake was created in the 1960s by damming the White River near the community of Beaver, AR. The multiple uses for which the lake was created included flood control, hydroelectric power, and domestic water supply. Other uses such as recreation and fish and wildlife management are allowed, but the lake is not specifically managed for those uses. The U.S. Army Corps of Engineers divides the lake into three pools based on their management objectives. The flood pool consists of the space in the reservoir between elevation 1120.4 above sea level and elevation 1130. The conservation pool, sometimes referred to as the power pool, is between elevations 1077 and 1120.4. Below elevation 1077 is referred to as the inactive pool. Beaver Lake covers an area of 28,220 acres at the top of the conservation pool (elevation 1120.4), and 31,700 acres at the top of the flood pool (elevation 1130).

The weather during 2015 was characterized by extreme events. The year started out with

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pH

pH is the measurement of how acidic or basic the water is. The pH scale is from 0 to 14. A pH of less than 7.0 means the water is acidic while a pH of greater than 7.0 is basic. A pH of 7.0 is considered neutral.

Hardness and Alkalinity

Hardness in water is caused by the presence of calcium and magnesium ions. Hard water can cause an increase in soap and detergent usage and increase mineral deposits (scaling) in hot water tanks and plumbing systems. The light colored ring that forms in a pan after boiling water is a result of the hardness of the water. Soft water doesn't require as much soap to work up a lather; however, if the water is too soft you will have trouble rinsing the soap off and may be left with a slimy feeling. The 2015 average hardness of the water distributed by Beaver Water District was 65 parts per million (ppm) which is moderately hard according to the table below.

Water Hardness Scale		
Grains Per Gallon	*Parts Per Million (ppm)*	*Classification*
less than 1.0	*less than 17.1*	*Soft*
1.0 - 3.5	*17.1 – 60*	*Slightly Hard*
3.5 - 7.0	*60 – 120*	*Moderately Hard*
7.0 - 10.5	*120 – 180*	*Hard*
over 10.5	*over 180*	*Very Hard*

Alkalinity is the quantitative capacity of water to neutralize an acid; that is, the measure of how much acid can be added to a liquid without causing a significant pH change. Automatic dishwasher detergents, most cleansers and hard surface cleaners utilize alkalinity for their cleaning ability. Hardness and alkalinity are often talked about together because many chemical substances contribute to both hardness and alkalinity.

Coliform

Coliforms are a group of non-pathogenic bacteria that are naturally present in the environment as well as in feces. Total Coliforms are not a health threat in itself but are used to indicate if other potentially harmful bacteria may be present.

Turbidity

Soil runoff is one of the main sources of turbidity. Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites, and some bacteria.

Trihalomethanes and Haloacetic Acids

Disinfection byproducts are compounds that are formed when disinfectants like chlorine combine with organic matter in the water. Trihalomethanes (THMs) and Haloacetic Acids (HAA5) are two classes of these byproducts that are regulated because of potential negative health effects and have limits established by the Environmental Protection Agency (EPA) of 80 ppb and 60 ppb respectively.

Cryptosporidium and Giardia

Cryptosporidium and Giardia are microscopic parasites that are resistant to chlorine disinfection. They cause gastrointestinal illness including nausea, vomiting, and diarrhea. Cases are most prevalent in younger children in daycare facilities, workers or parents caring for infected children, hikers who drink unfiltered water, and international travelers. These microorganisms can be transmitted through ingestion of infected water; recreational waters like fountains and water parks are common sources of outbreaks. Beaver Water District will complete a required two year Cryptosporidium sampling period in June 2016. Cryptosporidium and Giardia are not prevalent at our source water intake structure in Beaver Lake.

2015 Water Quality Results

* For the full Water Quality Report, go to *www.bwdh2o.org*

PRIMARY STANDARDS - *Health Related and Mandated by U.S. EPA & ADH*

Disinfectant	Units	MCLG	MCL	BWD
Total Residual Chlorine* (Average)	ppm	4.0	4.0	1.42
Range of Results	ppm			1.15 – 1.85
Clarity	**Units**	**MCLG**	**MCL**	**BWD**
Turbidity * (Finished Water)			>0.3 NTU in	
Highest yearly sample result	NTU	n/a	>5% of samples	0.15
Average NTU	NTU		or any 1	0.07
Lowest % of samples meeting	%		sample>1 NTU	100
Microbiological	**Units**	**MCLG**	**MCL**	**BWD**
Total Coliform Bacteria	P/A	0	1/month	0
Fecal Coliform or *Escherichia coli*	P/A	0	0	0
Inorganic Chemicals	**Units**	**MCLG**	**MCL**	**BWD**
Fluoride (Average)	ppm	4.0	4.0	0.67
Range of Results	ppm			0.52 – 0.84
Volatile Organic Contaminants (VOC's)- Regulated	**Units**	**MCLG**	**MCL**	**BWD**
Total Trihalomethanes (TTHMs)				
Highest Running Annual	ppb	N/A	80	47
Range of quarterly samples				14.0 – 62.7
Haloacetic Acids 5 (HAA5)				
Highest Running Annual	ppb	N/A	60	25
Range of quarterly samples				7.9 - 36.1

SECONDARY STANDARDS - *Aesthetic Standards Recommended by EPA & ADH*

Physical Parameters	Units	MCLG	BWD
Apparent Color	units	15	0
pH * (Average)	units	6.5 - 8.5	8.3
Inorganic Chemicals	**Units**	**MCLG**	**BWD**
Chloride	ppm	250	8.1

UNREGULATED CONSTITUENTS - *Monitored by ADH and BWD **

Physical and Chemical Parameters	Units	BWD
Alkalinity (Total) *	ppm as $CaCO_3$	49 (avg)
Conductivity *	µS/cm	185 (avg)
Hardness (Total) *	ppm as $CaCO_3$	65 (avg)
Range of Results	ppm as $CaCO_3$	30-84
Sodium	ppm	8.16

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below average rainfall through the winter followed by a really wet spring then by a late summer drought. Fall turned wet again and then a massive flood hit the week after Christmas. We ended the year with over 65 inches of precipitation, more than 19 inches above average. The flood gates at Beaver Dam were opened on two separate occasions. The wild weather was responsible for high variability in the lake surface elevation as well as water quality.

In 2015, the lake was in the conservation pool for 117 days and in the flood pool for 248 days (68% of the time). The maximum volume stored occurred on December 28th (1,997,622 acre-ft.) and the minimum was on February 20th (1,461,822 acre-ft.) The difference between maximum and minimum volume stored is equivalent to over 260,000 Olympic sized swimming pools. The maximum one day increase in elevation was 6.22 ft. and the maximum one day decrease was -1.08 ft. During 2015, a total of 1,642,677 acre feet (535.3 billion gallons) were removed from the lake. This volume was removed categorically as, 350 billion gallons to produce power, 122 billion gallons released over the spillway, 31 billion gallons lost to evaporation, 24.5 billion gallons used by drinking water suppliers, and 8.3 billion gallons unaccounted for (seepage etc.). During the year there was also a total of more than 657 billion gallons of inflow into the lake. The surface water elevation peaked December 28 at elevation 1131.44. The minimum surface elevation was 1112.97 February 20

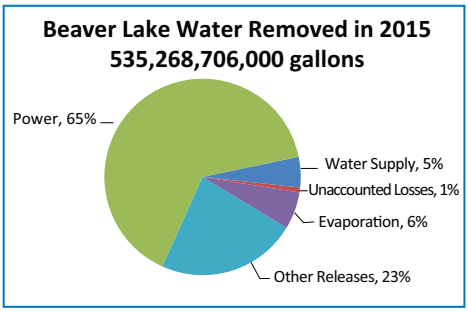

Figure 1: Usage of water from Beaver Lake during 2015

Hydraulic retention time, defined as average annual reservoir volume divided by outflow rate, strongly influences water quality and other processes in lakes. In 2015, the average volume stored in Beaver Lake was 1,734,308 acre-ft. The total outflow in 2015 (including power, water supply, evaporation, other releases, and unaccounted losses) was 1,642,677 acre-ft. This results in a hydraulic retention time of 1.06 years, 1.39 years less than 2014. That implies that the roughly the entire volume of the lake was replaced during the year with inflowing water.

Beaver Lake is a monomictic lake. This simply means that it stratifies (divides into layers based on temperature) once per year and then turns over or mixes once each fall. The lake fully stratified April 22, one day later than in 2014. Typically, stratification occurs in late April or even early May. During 2015, fall turn-over was complete on or around October 29. Once stratification occurs, dissolved oxygen in the hypolimnion (bottom layer) is depleted by decomposition of organic matter in the water. By mid-June, at Beaver Water District's intake near Hickory Creek, all of the dissolved oxygen in the hypolimnion had been depleted, a condition called anoxia. Once hypolimnitic anoxia occurs, fish and other organisms are forced to live in the epilimnion (surface layer) in order to get the oxygen they need for life. Water quality in the hypolimnion also degrades with the loss of dissolved oxygen. Dissolved oxygen did not return to the hypolimnion until the fall turn-over was complete.

Unlike the two previous years, water quality in Beaver was highly variable during 2015. Unusually large rainfall events were likely responsible. Turbidity is a measure of the murkiness of water. During 2015 turbidity peaked at 310 units December 29. The average turbidity during the year for water at Beaver Water District's intake was 11.38 units. By comparison, during the floods of 2011, turbidity at the District's intake rose to over 600 units. Turbidity was less than 2 units 86 days, less than 5 units 177 days and less than ten 285 days during the year.

Total Algae in 2015 from the integrated photic zone peaked at 27,530 units/mL on April 30th. Some algae may release the metabolic products MIB or Geosmin. These products are responsible for the musty flavor that occurs in Beaver water during early fall. MIB was above the threshold detection limit of 5 ng/L for 64 days in 2015. Geosmin was above the threshold detection limit of 5 ng/ for 54 days in 2015. . Compared to other years, the taste and odor event for 2015 was relatively mild. The maximum concentration of MIB was just below 20 ng/L around Labor Day. The maximum concentration of Geosmin was 13 ng/l in early July.

Lake water quality is largely determined by the quality of water

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in the tributaries. The District monitors seven tributary sites on a monthly basis. A water quality index (WQI) is a simple and concise method for expressing water quality information and a useful tool for describing the state of the water column, sediments and aquatic life, and for ranking the suitability of water for use by humans. More specifically, the District uses a modified version of the Canadian Council of Ministers of the Environment WQI to evaluate tributary condition. Additionally, the District's WQI is based on the Assessment Criteria for White River of the Arkansas Department of Environmental Quality. The WQI produces a single value between 0 and 100, with increasing values indicating better water quality. So it's a sort of grading system. Values of 95 to 100 are excellent, 80 to 94 good, 65 to 79 fair, 45 to 64 marginal, and 0 to 44 poor. In 2015, the average WQI values from what the District refers to as its "long run sites" were fair to good, ranging from 68.4 at the White River site near Fayetteville to 83.7 on the Middle Fork of White River at Black Oak. Beaver Water District has been tracking the WQI since 2006. WQIs during 2015 were considerably lower than the last several years. Extreme weather events likely explain the decline in quality.

In the last update of its ambient water quality standards, the Arkansas Department of Environmental Quality established standards for Chlorophyll_a (a measure of the amount of algae present) and Secchi Depth (a measure of transparency) for Beaver Lake. Chlorophyll_a is supposed to stay below 8 parts per billion measured as the geometric mean of samples taken from May through October. Secchi Depth is supposed to be greater than 1.1 meters based on an average of monthly samples taken throughout the year. Sampling for both standards occurs in the deepest part of the lake near Hickory Creek. During 2015, Chlorophyll_a was 6.1 ng/l and Secchi Depth was 1.23 meters. 2015 was the second year in a row that the standard was met. However, it was only the 4th year out of 7 years measured where Chlorophyll met the standard and only the third year when the Secchi Depth standard was met.

A complete water quality report for 2015 is provided on BWD's website, www.bwdh2o.org.

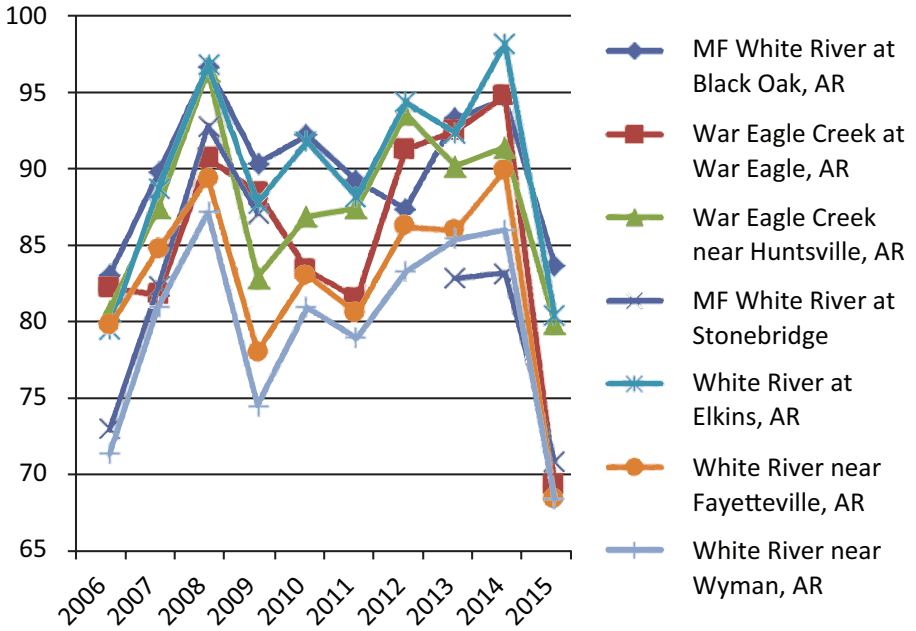

Figure 2: The Water Quality Index for tributaries of Beaver Lake from 2006 through 2015.