# **REGIONAL WATER QUALITY NEWSLETTER**

DATE: Report for December 2011 A Tempe, Glendale, Peoria, Chandler, CAP, SRP, Arizona American Water– ASU Regional Water Quality Partnership

http://enpub.fulton.asu.edu/pwest/tasteandodor.htm

Sampling dates: December 5, 2011

### SUMMARY: EVALUATION AND RECOMMENDATIONS

- SRP is currently releasing Verde River water and <u>MIB levels are not low</u>. They are around 14 ng/L in Bartlett Reservoir, and MIB+geosmin levels are above 10 ng/L in the SRP canal system. It appears Geosmin formed in the lower reaches of the Arizona Canal, but was treatable in the Glendale WTP. Tempe JMM North plant is removing MIB and geosmin well. Geosmin levels are elevated (~10 ng/L) in the CAP system too and is not being removed at the two WTPs treating CAP water.
- 2. A discussion of how runoff from the most recent storm may impact TOC in the Verde River is discussed, and levels could increase if a warmer precipitation storm this weekend melts snow on the ground.

### Quick Update of Water Supplies for December 2011 (during day of sampling – December 5, 2011)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	MIB * Concentration (ng/L)	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 70% full	8 cfs	262 cfs into <b>Arizona</b> Canal	20 ng/l [15 ng/L]	4.8 mg/L
Verde River	Reservoirs At 28% full	400 cfs	199 cfs into South Canal (98% Verde River Water)	23 ng/L [23 ng/L]	3.7 mg/L
Colorado River	Lake Pleasant is 45% full (Lake Powell is 70% full)	2082 cfs from Colorado River (Lake Pleasant NOT releasing water)	0 cfs of <b>CAP</b> water into Arizona Canal	4 ng/L	3.3 mg/L
Groundwater	Generally increasing due to recharge	84 cfs pumping by SRP	79 cfs Groundwater Pumping into SRP Canals		0.5 to 1 mg/L

\*Concentration of these taste and odor compounds in the upper [lower] levels of the terminal reservoir (Saguaro Lake on the Salt River; Bartlett Lake on the Verde River; Lake Pleasant on the CAP system \*\*Concentration of DOC in the terminal reservoir

Data from the following websites:

- <u>http://www.srpwater.com/dwr/</u>
- <u>http://www.cap-az.com/Operations/LakePleasantOps.aspx</u>

In November 2011 SRP switched from Salt River to Verde River water sources. In early November 2011 the SRP system had 88% Salt River water, now it is >95% Verde River water.



Let it Snow?

We have received nice amounts of precipitation. Will it affect TOC levels? Answering this question has several parts:

- 1. Immediate Impact Because of the large amount of storage and long residence time (years) on the Salt River reservoirs, no immediate impact will be noticed.
- 2. Immediate impact The Verde River has far less reservoir storage capacity compared to the Salt River system, so immediate impacts like 2005 winter storms are possible. The questions become:
  - a. Did streamflow in the Verde River increase?
  - b. How much water is this relative to the volume of water in Bartlett Lake?
  - c. Will another warmer precipitation event occur that melts snow and increase streamflow even more?
- 3. Long-term impact Any precipitation even will transport organics from the watershed into the reservoir system, thus increasing TOC. This is true on the Verde River watershed and also the Salt River watershed. In the Salt River watershed, runoff from Wallow forest fire areas will likely have a greater impact on TOC levels in the rivers above the reservoirs on the Salt River compared with the Verde River.

Let's focus on answering the 3 questions for the Immediate impact:

a. Did streamflow in the Verde River increase?

Answer: Yes. The hydrograph below shows increase streamflow in the Verde River above Horseshoe Reservoir.



 b. How much water is this relative to the volume of water in Bartlett Lake? Answer: A relatively small amount from the last storm because it mostly fell as snow. The area under the hydrograph represents the volume of water which flows into Horseshoe Reservoir. By day, the approximate inflow volumes are as follows:

Dec 8	525 ac-ft
Dec 9	525 ac-ft
Dec 10	500 ac-ft
Dec 11	500 ac-ft
Dec 12	550 ac-ft
Dec 13	1400 ac-ft
Dec 14	1200 ac-ft
Dec 15	1000 ac-ft

Over the same period, there is consider available storage capacity in Horseshoe and Bartlett Reservoirs on the Verde River:

Date	Current Storage volume (ac-ft)	Available Storage (ac-ft)
12/6	79,700	207,713

12/8	78,731	208,672
12/10	77,811	209,592
12/11	77,690	209,713
12/12	77,886	209,517
12/13	78,504	208,900
12/14	79,421	207,982

As you can see by this data, there is considerable storage in Verde Reservoir system. So this runoff event will likely be completely captured and stored. The inflow of a 1000 to 2000 ac-ft per day represents only a few percentage of the current stored volume, so is unlikely to impact the TOC of reservoirs.

c. Will another warmer precipitation event occur that melts snow and increase streamflow even more?

Answer: Possibly. When streamflows exceed 5,000 cfs for one day, then over 10,000 acft per day of runoff would be entering the reservoirs and would likely change the TOC concentration. Rainfall is possible this weekend, which will have a slightly higher snow level. If rain falls ontop of snow, then high runoff could occur and impact streamflow. This would also bring a "flush" of TOC into the Verde River reservoirs.

Data on the next page shows that when streamflows are high (left y-axis) that DOC concentrations in Bartlett Reservoir (right y-axis) can increase as runoff brings DOC into the reservoir. The highest DOC loading occurs at the beginning of runoff event. As the runoff event continues, DOC levels in the streams decrease because the organics were already "flushed" from the watershed. Therefore near the end of the high runoff events, the DOC is lower. If the runoff events fills and overflows the reservoir (exceeds storage capacity), then the low DOC water coming in displaces the higher DOC delivered into the reservoir earlier in the runoff event.



## **Dissolved Organic Carbon In Reservoirs and Treatment Plants**

### Table 4 - Reservoir Samples – December 2011

Reservoir sampling will be conducted only monthly.

CAP is sampling Lake Pleasant on slightly different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant - Nov '11	Eplimnion	2.79	0.04	1.6	0.33
Lake Pleasant - Nov '11	Hypolimnion	2.90	0.05	1.6	0.38
Verde River @ Beeline		1.7	0.0410	2.4	0.3
Bartlett Reservoir	Epilimnion	2.6	0.0517	2.0	0.4
Bartlett Reservoir	Hypolimnion	3.2	0.0532	1.7	0.4
Saguaro Lake	Epilimnion	4.3	0.0761	1.8	0.4
Saguaro Lake	Epi - Duplicate	4.5	0.0762	1.7	0.5
Saguaro Lake	Hypolimnion	4.7	0.0767	1.6	0.5
Verde River at Tangle	Nov'11	0.81	0.02	2.8	0.10
Havasu	Nov'11	2.57	0.04	1.7	0.43



■ Lake Pleasant (CAP System) ■ Bartlett Lake (Verde River) ■ Saguaro Lake (Salt River)

#### **Organic Matter in Canal and WTPs**

DOC = Dissolved organic carbon UV254 = ultraviolet absorbance at 254 nm (an indicator of aromatic carbon content) SUVA = UV254/DOC TDN = Total dissolved nitrogen (mgN/L)

Sample Description	DOC	UV254	SUVA	TDN	
	(mg/L)	( <b>1/cm</b> )	(L/mg-m)	IDN	
Waddell Canal	2.7	0.0438	1.6	0.4	
Anthem WTP Inlet	2.7	0.0421	1.5	0.4	
Union Hills Inlet	2.8	0.0421	1.5	0.4	
CAP Canal at Cross-connect					
Salt River @ Blue Pt Bridge					
Verde River @ Beeline	1.7	0.0410	2.4	0.3	
AZ Canal above CAP Cross-connect	1.8	0.0446		0.0	
AZ Canal below CAP Cross-connect	1.8	0.0431	2.4	0.2	
AZ Canal at Highway 87	1.9	0.0444	2.3	0.2	
AZ Canal at Pima Rd.	1.9	0.0461	2.4	0.2	
AZ Canal at 56th St.	1.9	0.0458	2.4	0.4	
AZ Canal - Inlet to 24 <sup>th</sup> Street WTP					
AZ Canal - Central Avenue	2.1	0.0476	2.3	0.6	
AZ Canal - Inlet to Deer Valley WTP					
AZ Canal - Inlet to Glendale WTP	2.2	0.0502	2.3	0.8	
AZ Canal - Inlet to GreenwayWTP	1.8	0.0429	2.4	0.3	
South Canal below CAP Cross-connect	1.9	0.0446	2.4	0.2	

### Organics at the Water Treatment Plants

Table 2 - Water Treatment Plants -					
Sample Description	DOC	UV254	SUVA	TDN	DOC
	(mg/L)	(1/cm)	(L/mg-m)		removal
					(%)
Union Hills Inlet	2.77	0.04	1.5	0.4	
Union Hills Treated	2.31	0.03	1.1	0.3	17
Tempe North Inlet	2.01	0.05	2.3	0.4	
Tempe North Plant Treated	1.14	0.02	1.7	0.3	44
Greenway WTP Inlet	1.80	0.04	2.4	0.3	
Greenway WTP Treated	1.74	0.02	1.2	1.4	4
Glendale WTP Inlet	2.22	0.05	2.3	0.8	
Glendale WTP Treated	1.42	0.02	1.7	0.4	36
Anthem WTP Inlet	2.75	0.04	1.5	0.4	
Anthem WTP Treated	2.41	0.04	1.7	0.4	12

#### **Taste and Odor Data**

MIB plus geosmin levels above 10 ng/L in finished water lead to noticeable earthy-musty odors by customers. Currently MIB+geosmin levels are above 10 ng/L in the canals.

Reservoir Samples – December 6,	2011			
Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (November)	Eplimnion	2.6	2.0	<2.0
Lake Pleasant (November)	Hypolimnion	2.1	4.7	<2.0
Verde River @ Beeline		7.3	4.2	<2.0
Bartlett Reservoir	Epilimnion	15.2	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	14.7	<2.0	<2.0
Bartlett Reservoir	Hypolimnion	13.3	<2.0	<2.0
Salt River @ BluePt Bridge				
Saguaro Lake	Epilimnion	4.1	<2.0	<2.0
Saguaro Lake	Epi - Duplicate	4.1	<2.0	<2.0
Saguaro Lake	Epi-near dock	3.8	2.0	<2.0
Saguaro Lake	Hypolimnion	5.1	<2.0	<2.0
Lake Havasu (November)		<2.0	2.9	13.1
Verde River at Tangle Creek (October)		11.3	3.9	<2.0
Verde River at Tangle Creek (November)		<2.0	3.2	<2.0

#### Water Supply Sources

SRP is currently releasing Verde River water and MIB levels are not low. They are around 14 ng/L in Bartlett Reservoir, and MIB+geosmin levels are above 10 ng/L in the SRP canal system. It appears Geosmin formed in the lower reaches of the Arizona Canal, but was treatable in the Glendale WTP. Tempe JMM North plant is removing MIB and geosmin well. Geosmin levels are elevated (~10 ng/L) in the CAP system too and is not being removed at the two WTPs treating CAP water.

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	11	<2.0
	Union Hills Inlet	<2.0	9.8	6.5
	CAP Canal at Cross-connect			
	Salt River @ Blue Pt Bridge			
	Verde River @ Beeline	7.3	4.2	<2.0
AZ	AZ Canal above CAP Cross-connect	9.2	4.9	<2.0
Canal	AZ Canal below CAP Cross-connect	8.9	6.2	<2.0
	AZ Canal at Highway 87	7.5	5.7	<2.0
	AZ Canal at Pima Rd.	7.2	5.7	<2.0
	AZ Canal at 56th St.	8.3	5.9	5.9
	AZ Canal - Central Avenue	7.0	7.0	<2.0
	AZ Canal - Inlet to Glendale WTP	9.1	20.4	3.6
	Head of the Consolidated Canal			
	Middle of the Consolidated Canal			
South	South Canal below CAP Cross-connect	5.9	4.5	<2.0
Tempe	Head of the Tempe Canal			
Canals	Tempe Canal - Inlet to Tempe's South Plant			

# Canal Sampling –December 6, 2011

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	9.8	6.5
Union Hills Treated	<2.0	9.9	<2.0
Tempe North Inlet	7.3	6.0	<2.0
Tempe North Plant Treated	<2.0	<2.0	<2.0
Anthem Inlet	<2.0	4.9	<2.0
Anthem Treated	<2.0	5.9	<2.0
Greenway WTP Inlet	3.3	4.3	<2.0
Greenway WTP Treated	3.7	4.0	6.3
Glendale WTP Inlet	9.1	20.4	3.6
Glendale WTP Treated	<2.0	<2.0	<2.0

# Water Treatment Plants – December 6, 2011

The lakes are completely thermally destratified – which has lead to mixing with depth of MIB and geosmin, such that MIB and geosmin are exiting the reservoirs through the bottom release gates in Bartlett and Saguaro Lakes. MIB also biodegrades in the reservoir at a rate of about 1 ng/L/day, and has been occurring in Saguaro Lake.

