

REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for March 2013

A Tempe, Glendale, Peoria, Chandler, Phoenix, ADEQ, CAP, SRP, Epcor
ASU Regional Water Quality Partnership

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

SUMMARY: EVALUATION AND RECOMMENDATIONS

1. MIB and geosmin levels are < 10 ng/L everywhere – except the Consolidated Canal. The most notable values are related to CHANDLER water treatment plant intake – with values of 27 ng/L of geosmin. Over the past 2 months we have done sampling at Chandler and along the Consolidated Canal. Routinely high values have occurred and they have received T&O complaints from the public. Recent data on geosmin production along the Consolidated canal – Only geosmin is present and it appears to be produced in the Consolidated canal. Data from February 2013 sampling that showed the same trend. A plot of Geosmin over time at two locations in the Consolidated canal shows that after canal dry-up geosmin concentrations increased dramatically. During this period the canal was nearly 100% groundwater. To remove geosmin – Chandler is adding 10 ppm Powder Activated Carbon (PAC) and now can reduce geosmin to < 10 ng/L.
2. We provided quarterly sampling data last month for organics. Samples have also been run for a broad spectrum of metals (ICP-MS), here are some of the interesting trends: Roosevelt lake has Aluminum concentrations roughly 5x higher than Apache or Canyon Lake; and roughly 2x to 3x higher concentrations of Iron. It is probably that Fe and Al precipitate out in Roosevelt lake. This could be sorbing natural organic matter (NOM) and serving as a giant “flocculation/sedimentation” system – consequently the DOC remaining is difficult to coagulate at WTPs.
3. Trends in other metals include: We looked at roughly 50 other metals, and no other major trends were observed as differences between the Salt River lakes. Many differences existed between Salt, Verde and CAP waters – and these will be highlighted in the future. A few observations:
 - a. Lithium levels in Salt River are ~100 ppb compared with 30 ppb in Verde and CAP systems
 - b. Manganese in Salt River are ~15 ppb compared with < 1 ppb in Verde and CAP systems
 - c. Arsenic levels are higher in Verde than Salt or CAP systems
 - d. Molybdenum is higher in CAP (4ppb) than Salt or Verde (1.5 ppb)
 - e. Uranium is slightly higher in Lake Pleasant than other locations
 - f. Sodium levels are 2x to 5x higher in the Salt River system than Verde and CAP systems
 - g. Photographs filters on samples collected from WITHIN the reservoirs. The Roosevelt Lake Samples (Roos) showed high levels of redish-brown-ish particulate. This is consistent with the color of iron (hydr)oxides and could be impacted by forest fires.

Quick Update of Water Supplies for March 2013 (during day of sampling – March 5th)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 55% full	347 cfs	312 cfs into Arizona Canal	4.1 mg/L
Verde River	Reservoirs At 67% full	115 cfs	140 cfs into South Canal (77% Salt River Water)	2.9 mg/L
Colorado River	Lake Pleasant is 77% full (Lake Powell is 49% full)	Lake Pleasant filling; direct Colorado River water is in the CAP canal	17 cfs of CAP water into Arizona Canal	2.8 mg/L
Groundwater	Generally increasing due to recharge	299 cfs pumping by SRP	299 cfs Groundwater Pumping into SRP Canals	0.5 to 1 mg/L

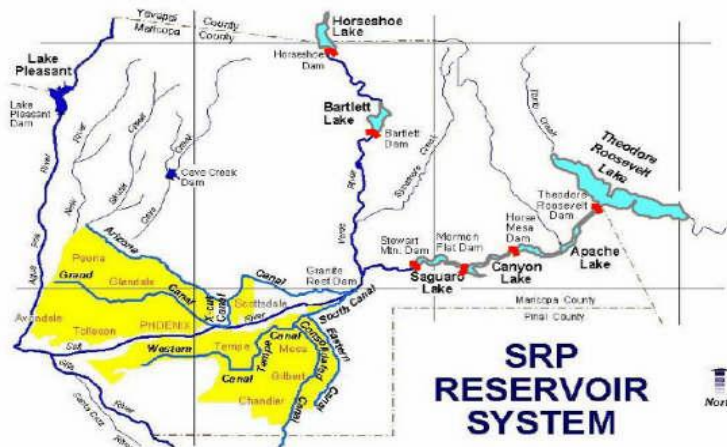
*Concentration of these taste and odor compounds in the upper [lower] levels of the terminal reservoir (Saguaro Lake on the Salt River; Bartlett Lake on the Verde River; Lake Pleasant on the CAP system

**Concentration of DOC in the terminal reservoir

*** On paper cities are receiving CAP water in the SRP canals, but as a method of “paying back” from the last drought for excess CAP deliveries – SRP is delivering wet water only from the Salt and Verde Rivers

Data from the following websites:

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



Dissolved Organic Carbon In Reservoirs and Treatment Plants

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)

Reservoir Samples

Table 4 - Reservoir Samples – March 5, 2013

Reservoir sampling conducted monthly. CAP is sampling Lake Pleasant and Havasu, and USGS is sampling Verde River at Tangle on different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Havasu (January)		3.1	0.040	1.3	0.4
Lake Pleasant (February)	Epilimnion	3.2	0.045	1.4	0.5
	Hypolimnion	3.3	0.047	1.4	0.4
Verde River (February)	@ Tangle	4.4	0.151	3.4	0.5
Verde River	@ Beeline Hwy	2.9	0.050	1.7	0.4
Bartlett Reservoir	Epilimnion	3.7	0.123	3.3	0.3
	Hypolimnion	3.0	0.092	3.1	0.4
Saguaro Lake	Epilimnion	4.0	0.068	1.7	0.4
	Epi - Duplicate	5.0	0.070	1.4	0.4
	Hypolimnion	4.1	0.066	1.6	4.2
Salt River	@ Blue Point Bridge	3.8	0.067	1.8	1.8

Organic Matter in Canal

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	3.1	0.044	1.4	0.5
Anthem WTP Inlet	3.1	0.044	1.4	0.5
Union Hills Inlet	2.6	0.044	1.7	0.5
CAP Salt-Gila Pump Station (February)	2.6	0.046	1.7	0.5
CAP Mesa Turnout (February)	2.6	0.045	1.7	0.5
CAP Canal at Cross-connect	3.2	0.047	1.5	0.5
Salt River @ Blue Pt Bridge	3.8	0.1	1.8	0.3
Verde River @ Beeline	2.9	0.050	1.7	0.4
AZ Canal above CAP Cross-connect	3.3	0.085	2.6	0.4
AZ Canal below CAP Cross-connect	3.1	0.074	2.4	0.4
AZ Canal at Highway 87	3.1	0.063	2.0	0.3
AZ Canal at Pima Rd.	3.2	0.063	2.0	0.3
AZ Canal at 56th St.	3.1	0.062	2.0	0.5
AZ Canal - Central Avenue	3.0	0.060	2.0	0.5
AZ Canal - Inlet to Glendale WTP	3.8	0.062	1.6	0.4
AZ Canal - Inlet to GreenwayWTP	2.9	0.058	2.0	1.3
South Canal below CAP Cross-connect	3.1	0.064	2.1	0.4
Head of the Tempe Canal	1.3	0.031	2.4	1.4
Tempe Canal - Inlet to Tempe's South Plant	0.6	0.011	1.9	1.9
Head of the Consolidated Canal	1.3	0.027	2.1	1.4
Middle of the Consolidated Canal	0.9	0.027	3.0	3.3
Chandler WTP – Inlet	1.4	0.026	1.9	4.2

Organics at the Water Treatment Plants

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
Union Hills Inlet	2.6	0.044	1.7	0.5	
Union Hills Treated	2.2	0.023	1.1	0.5	19
Tempe North Inlet	Offline				
Tempe North Plant Treated					
Tempe South Inlet	0.6	0.011	1.9	3.1	
Tempe South Plant Treated	0.5	0.008	1.5	2.8	5
Greenway WTP Inlet	2.9	0.058	2.0	1.3	
Greenway WTP Treated	1.9	0.016	0.8	2.1	34
Glendale WTP Inlet	3.8	0.062	1.6	0.4	
Glendale WTP Treated	Offline				
Anthem WTP Inlet	3.1	0.044	1.4	0.5	
Anthem WTP Treated	2.7	0.040	1.5	0.5	13
Chandler WTP Inlet	1.4	0.026	1.9	4.2	
Chandler WTP Treated	0.8	0.015	1.9	3.9	43

Taste and Odor

MIB, Geosmin and Cyclocitral are compounds naturally produced by algae in our reservoirs and canals, usually when the water is warmer and algae are growing/decaying more rapidly. They are non toxic, but detectable to consumers of water because of their earthy-musty-moldy odor. The human nose can detect these in drinking water because the compounds are semi-volatile. Since compounds are more volatile from warmer water, these tend to be more noticeable in the summer and fall. The human nose can detect roughly 10 ng/L of these compounds. Our team collects samples from the water sources and raw/treated WTP samples. We usually present all the data when concentrations start to exceed 5 ng/L.

- Data for this month on the next pages
- The most notable values are related to CHANDLER water treatment plant intake – with values of 27 ng/L of geosmin. Over the past 2 months we have done sampling at Chandler and along the Consolidated Canal. Routinely high values have occurred and they have received T&O complaints from the public. Below is more information
 - Recent data on geosmin production along the Consolidated canal – Only geosmin is present and it appears to be produced in the Consolidated canal

5-Mar-13

	MIB ng/L	Geosmin ng/L	Cyclocitral ng/L
Consolidated Canal @ Elliot	<2.0	5.4	<2.0
Consolidated Canal @ Warner	<2.0	7.3	<2.0
Consolidated Canal @ Ray	<2.0	7.4	<2.0
Consolidated Canal @ Chandler	<2.0	10.4	<2.0
Consolidated Canal @ Pecos	<2.0	16.3	<2.0
Chandler WTP Inlet	<2.0	27.2	<2.0
Chandler WTP Treated	<2.0	5.2	<2.0

- Here is data from February 2013 sampling that showed the same trend

Chandler Water Treatment Plant- February 13, 2013

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Basin #1	<2.0	21.8	<2.0
Basin #3	<2.0	25.9	<2.0
MOC	<2.0	<2.0	<2.0
Screens-Intake	<2.0	58.0	<2.0
Pueblo/Lindsay Bridge	<2.0	<2.0	<2.0

Frye Rd. Canal	<2.0	49.9	<2.0
Pre Sed #1 V notches	<2.0	21.4	<2.0
BF	<2.0	28.5	<2.0
Finished	<2.0	24.7	<2.0

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- Here is a plot of Geosmin over time at two locations in the Consolidated canal. It shows that after canal dry-up geosmin concentrations increased dramatically. During this period the canal was nearly 100% groundwater. To remove geosmin – Chandler is adding 10 ppm Powder Activated Carbon (PAC) and now can reduce geosmin to < 10 ng/L.
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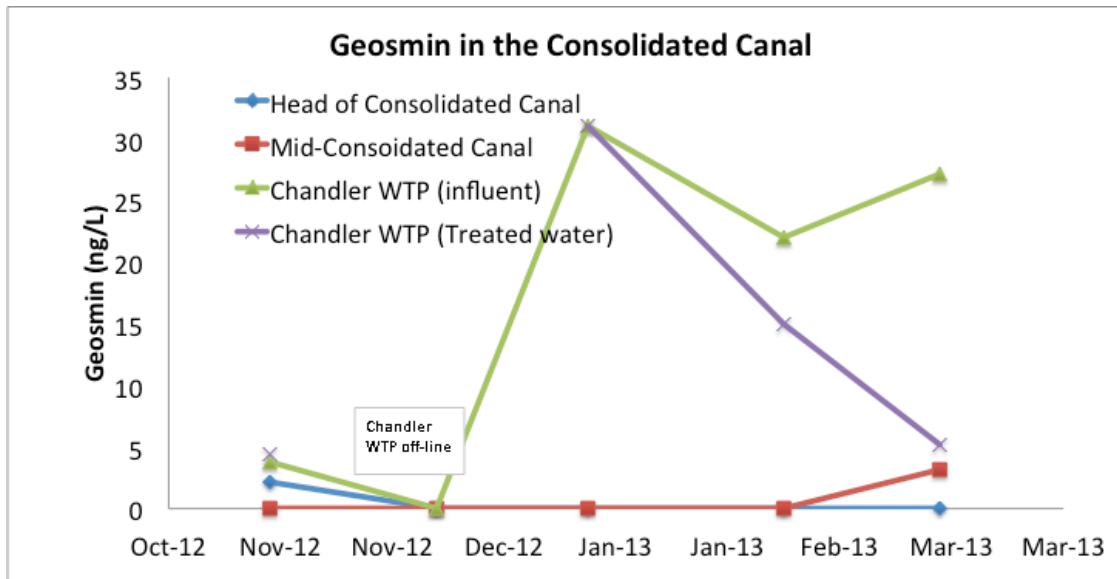


Table 2 - Water Treatment Plants – March 4, 2013

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	<2.0	<2.0
Union Hills Treated	<2.0	<2.0	<2.0
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	<2.0	<2.0	<2.0
Tempe South Plant Treated	<2.0	<2.0	<2.0
Anthem Inlet	<2.0	<2.0	<2.0
Anthem Treated	<2.0	<2.0	<2.0
Chandler Inlet	<2.0	27.2	<2.0
Chandler Treated	<2.0	5.2	<2.0
Greenway WTP Inlet	<2.0	8.4	<2.0
Greenway WTP Treated	<2.0	<2.0	<2.0
Glendale WTP Inlet	2.8	8.3	<2.0
Glendale WTP Treated	<2.0	<2.0	<2.0

Table 3 - Canal Sampling – March 4, 2013

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	2.1	<2.0
	Union Hills Inlet	<2.0	<2.0	<2.0
	CAP Canal at Cross-connect	<2.0	2.0	<2.0
AZ Canal	Salt River @ Blue Pt Bridge	<2.0	3.2	<2.0
	Verde River @ Beeline	2.2	2.2	<2.0
	AZ Canal above CAP Cross-connect	<2.0	2.0	<2.0
	AZ Canal below CAP Cross-connect	2.3	2.5	<2.0
	AZ Canal at Highway 87	<2.0	2.3	<2.0
	AZ Canal at Pima Rd.	2.6	2.3	<2.0
	AZ Canal at 56th St.	2.7	2.2	<2.0
	AZ Canal - Central Avenue	<2.0	2.4	<2.0
	AZ Canal - Inlet to Glendale WTP	2.8	8.3	<2.0
	Head of the Consolidated Canal	<2.0	<2.0	<2.0
	Middle of the Consolidated Canal	<2.0	3.1	<2.0
South Tempe Canals	South Canal below CAP Cross-connect	2.2	2.4	<2.0
	Head of the Tempe Canal	<2.0	<2.0	<2.0
	Tempe Canal - Inlet to Tempe's South Plant			
	Mesa Turnout	<2.0	<2.0	<2.0
	Salt-Gila Pump	<2.0	<2.0	<2.0

Table 4 - Reservoir Samples – March 5, 2013

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (Feb)	Eplimnion	2.3	<2.0	<2.0
Lake Pleasant	Hypolimnion	<2.0	<2.0	<2.0
Verde River @ Beeline		2.2	2.2	<2.0
Bartlett Reservoir	Epilimnion	<2.0	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	<2.0	<2.0	<2.0
Bartlett Reservoir	Hypolimnion	<2.0	<2.0	<2.0
Salt River @ BluePt Bridge		<2.0	3.2	<2.0
Saguaro Lake	Epilimnion	<2.0	3.1	<2.0
Saguaro Lake	Epi -duplicate	<2.0	3.2	<2.0
Saguaro Lake	Epi-near dock	<2.0	3.9	<2.0
Saguaro Lake	Hypolimnion	<2.0	3.5	<2.0
Lake Havasu (Feb)		<2.0	<2.0	<2.0
Verde River at Tangle Creek (Feb)		<2.0	<2.0	<2.0
Roosevelt at Salt River Inlet		2.0	3.6	<2.0

Data from Quarterly Sampling

We provided quarterly sampling data last month for organics. Samples have also been run for a broad spectrum of metals (ICP-MS), here are some of the interesting trends:

- Roosevelt lake has Aluminum concentrations roughly 5x higher than Apache or Canyon Lake; and roughly 2x to 3x higher concentrations of Iron. It is probably that Fe and Al precipitate out in Roosevelt lake.
- We looked at roughly 50 other metals, and no other major trends were observed as differences between the Salt River lakes. Many differences existed between Salt, Verde and CAP waters – and these will be highlighted in the future. A few observations:
 - Lithium levels in Salt River are ~100 ppb compared with 30 ppb in Verde and CAP systems
 - Manganese in Salt River are ~15 ppb compared with <1 ppb in Verde and CAP systems
 - Arsenic levels are higher in Verde than Salt or CAP systems
 - Molybdenum is higher in CAP (4ppb) than Salt or Verde (1.5 ppb)
 - Uranium is slightly higher in Lake Pleasant than other locations
 - Sodium levels are 2x to 5x higher in the Salt River system than Verde and CAP systems
- The photograph below shows filters on samples collected from WITHIN the reservoirs. The Roosevelt Lake Samples (Roos) showed high levels of redish-brown-ish particulate. This is consistent with the color of iron (hydr)oxides and could be impacted by forest fires.

