

# REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for December 2013 & January 2014

A Tempe, Glendale, Peoria, Chandler, Phoenix, ADEQ, CAP, SRP, Epcor

NSF Central Arizona-Phoenix Long-Term Ecological Research

ASU Regional Water Quality Partnership

<http://faculty.engineering.asu.edu/pwesterhoff/research/regional-water-quality-issues/>

## SUMMARY

1. Geosmin levels are HIGH in the Arizona Canal – around 10 ng/L. We saw a similar trend in winter 2013, so I would expect this to continue for the next 6-8 weeks. We tested Tempe tap water on the ASU campus – and it is 6.5 ng/L. Levels in December 2013 were slightly lower (5-10 ng/L of geosmin) in the Arizona Canal (see data in main report)

2. MIB levels are low throughout the SRP and CAP systems.
3. The reservoirs have low T&O levels right now.
4. DOC in the Verde River reservoirs are somewhat variable and elevated because of the rains and runoff over the past 2 months, but as SRP is utilizing mostly Verde River water in the canal system – the DOC levels are low (around 2.5 mg/L). DOC levels in Saguaro Lake are around 4 mg/L, and 3 mg/L in Lake Pleasant.
5. A feature story on initial survey results regarding the recognition of the public about the extent of de facto wastewater reuse is included, where de facto reuse is when treated wastewater is discharged into a river system upstream of a drinking water intake.
6. Sucralose is being measured quarterly as an indicator of wastewater contributions to our surface waters. A typical treated wastewater will have ~20,000 ppb of sucralose. Data for August and November 2013 had levels of 0.5 to 6.9 ppb in CAP or SRP surface waters. The average sucralose concentrations were lower in November than in August. CAP water had roughly twice the sucralose levels as the Salt or Verde Rivers.

Table - Canal Sampling – January 6, 2014

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	2.9	<2.0
	Union Hills Inlet	<2.0	2.1	<2.0
	CAP Canal at Cross-connect			
AZ Canal	Salt River @ Blue Pt Bridge			
	Verde River @ Beeline			
	AZ Canal above CAP Cross-connect	<2.0	14.6	<2.0
	AZ Canal below CAP Cross-connect			
	AZ Canal at Highway 87	<2.0	11.3	<2.0
	AZ Canal at Pima Rd.	<2.0	11.4	<2.0
	AZ Canal at 56th St.	<2.0	10.9	<2.0
	AZ Canal - Central Avenue	<2.0	7.6	<2.0
	AZ Canal - Inlet to Glendale WTP	<2.0	7.0	<2.0
	Head of the Consolidated Canal	<2.0	<2.0	<2.0
	Middle of the Consolidated Canal	<2.0	<2.0	<2.0
	Tempe Canal - Inlet to Tempe's South Plant			
	Mesa Turnout (Dec)	<2.0	2.5	<2.0
	Salt-Gila Pump (Dec)	2.0	2.5	<2.0
	ISTB4	2.4	6.5	<2.0

## Social Survey Data on Wastewater Reuse

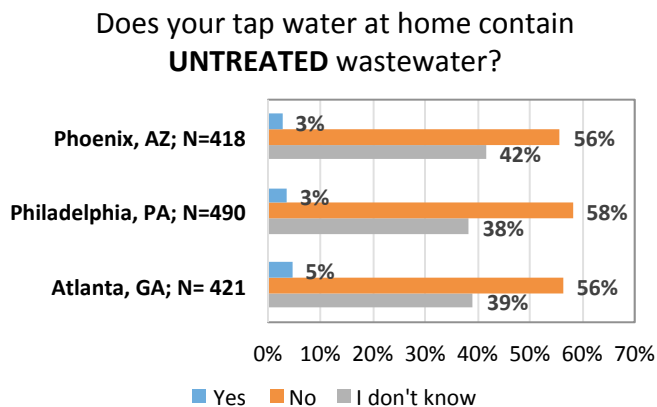
Our research group has performed a survey of 1500 respondents in 3 major US cities: Phoenix, Atlanta and Philadelphia. We asked very simple questions about if there is wastewater (treated or untreated) in their drinking water supply. This work was performed by Jacely Rice – a PhD student in the Westerhoff research group.

In these three cities, our estimates for the percentage of treated wastewater in the drinking water supply ranges from < 3% in Phoenix to 3-8% in Atlanta and 3-12% in Philadelphia (under average streamflow conditions).

Surveys had clear definitions presented before survey questions, including: Definitions provided in the survey:

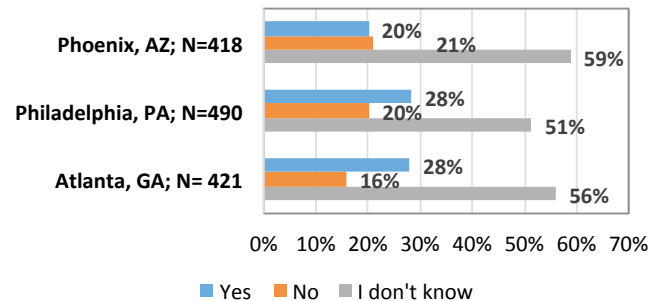
- **UNTREATED WASTEWATER** is sewage from household, municipal and industrial sources.
- **TREATED WASTEWATER** is wastewater that has gone through cleaning processes to improve its quality.

Survey says....



with the most important value being that ~40% of responds do NOT know if untreated wastewater is in their drinking water supply. This is clearly a room for better communication needs to the general public by water utilities.

Does your tap water at home contain **TREATED** wastewater?



Here the striking result is that people some people understand the difference between treated and untreated wastewater (i.e., percentage responding “YES” increases) – or in other words ~25% of responds are AWARE that de facto wastewater (incidental) reuse occurs. However, the percentage responding “I don’t know” increases – implying that the public really does not have or is not aware of reuse practices.

We asked several other questions that will be summarized in a journal paper and presentations, but this is hopefully a “teaser”.

Surprisingly, the metro Phoenix region population responded with similar % responses as regions where there is a lot more water and where reuse is not practiced nearly as intensely as in Arizona.

## Quick Update of Water Supplies for January 2014 (during day of sampling – January 6, 2014 )

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 56% full	8 cfs	127 cfs into <b>Arizona Canal</b>	4.5 mg/L
Verde River	Reservoirs At 50% full	238 cfs	162 cfs into <b>South Canal</b> <b>(97% Verde River Water)</b>	4.2 mg/L
Colorado River	Lake Pleasant is 73% full (Lake Powell is 42% full)	Lake Pleasant is being filled from the CAP canal	3 cfs of <b>CAP water</b> into Arizona Canal	3.0 mg/L
Groundwater	Generally increasing due to recharge	231 cfs pumping by SRP	<b>231cfs Groundwater Pumping</b> into SRP Canals	0.5 to 1 mg/L

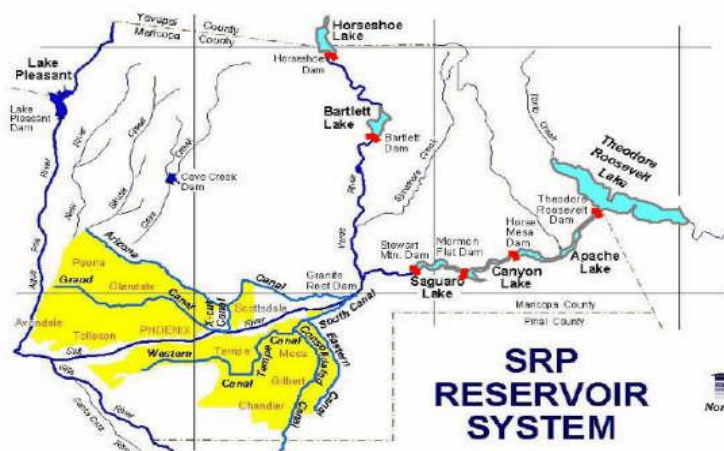
\*Concentration of these taste and odor compounds in the upper [lower] levels of the terminal reservoir (Saguaro Lake on the Salt River; Bartlett Lake on the Verde River; Lake Pleasant on the CAP system)

\*\*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/index.php/departments/water-operations/lake-pleasant>
- <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 – December 3, 2013**

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

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Havasu (Nov)			0.051		
Lake Pleasant (Nov)	Epilimnion	5.2	0.118	2.3	5.8
	Hypolimnion	2.7	0.049	1.8	0.4
Verde River (Nov)	@ Tangle	0.8	0.029	3.8	0.17
Verde River	@ Beeline Hwy	Not Available			
Bartlett Reservoir	Epilimnion	7.4	0.090	1.2	0.5
	Hypolimnion	3.6	0.087	2.4	0.4
Saguaro Lake	Epilimnion	5.4	0.075	1.4	0.6
	Epi - Duplicate	5.0	0.074	1.5	0.6
	Hypolimnion	5.8	0.077	1.3	0.7
Salt River	@ Blue Point Bridge	very low streamflow			

**Table 4 - Reservoir Samples – January 6, 2014**

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Havasu (Dec)			0.041		
Lake Pleasant (Dec)	Epilimnion	3.0	0.052	1.7	0.4
	Hypolimnion	3.0	0.042	1.4	0.4
Verde River (Dec)	@ Tangle	0.7	0.019	2.8	0.07
Verde River	@ Beeline Hwy	Not Available			
Bartlett Reservoir	Epilimnion	3.8	0.078	2.0	0.4
	Hypolimnion	4.9	0.078	1.6	0.4
Saguaro Lake	Epilimnion	3.8	0.067	1.8	0.4
	Epi - Duplicate	4.2	0.065	1.5	0.6
	Hypolimnion	4.5	0.064	1.4	0.5
Salt River	@ Blue Point Bridge	Very low streamflow			

## Organic Matter in Canal & Water Treatment Plants

**Table 2 - Water Treatment Plants – January 6, 2014**

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Union Hills Inlet	2.6	0.034	1.3	0.5
Union Hills Treated	2.2	0.015	0.7	0.4
Tempe North Inlet	2.4	0.054	2.2	0.6
Tempe North Plant Treated	2.2	0.019	0.9	0.7
Tempe South Inlet	Offline			
Tempe South Plant Treated	Offline			
Greenway WTP Inlet	Offline			
Greenway WTP Treated	Offline			
Glendale WTP Inlet	2.5	0.051	2.1	1.9
Glendale WTP Treated	Offline			
Anthem WTP Inlet	2.8	0.029	1.0	0.5
Anthem WTP Treated	2.4	0.029	1.2	0.5
Chandler WTP Inlet	Offline			
Chandler WTP Treated	Offline			

DOC removal (%)
16
9
15

**Table 3 - Rivers and Canals – January 6, 2014**

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	3.0	0.033	1.1	0.5
Anthem WTP Inlet	2.8	0.029	1.0	0.5
Union Hills Inlet	2.6	0.034	1.3	0.5
CAP Salt-Gila Pump Station (Dec)	2.6	0.042	1.6	0.5
CAP Mesa Turnout (Dec)	2.6	0.043	1.7	2.6
CAP Canal at Cross-connect	Offline			
Salt River @ Blue Pt Bridge	Offline			
Verde River @ Beeline	Not Available			
AZ Canal above CAP Cross-connect	2.7	0.068	2.6	0.3
AZ Canal below CAP Cross-connect	2.7	0.068	2.6	0.3
AZ Canal at Highway 87	2.7	0.071	2.6	0.5
AZ Canal at Pima Rd.	3.8	0.068	1.8	2.5
AZ Canal at 56th St.	2.5	0.054	2.2	0.7
AZ Canal - Central Avenue	2.8	0.060	2.1	0.5
AZ Canal - Inlet to Glendale WTP	2.5	0.051	2.1	1.9
AZ Canal - Inlet to GreenwayWTP	Offline			
South Canal below CAP Cross-connect	2.6	0.063	2.4	0.3
Head of the Tempe Canal	Offline			
Tempe Canal - Inlet to Tempe's South Plant	Offline			
Head of the Consolidated Canal	0.5	0.008	1.7	2.9
Middle of the Consolidated Canal	0.6	0.010	1.8	2.6
Chandler WTP – Inlet	Offline			

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## 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 noticable 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.

**Table 2 - Water Treatment Plants – December 2, 2013**

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	2.1	3.8	<2.0
Union Hills Treated			
Tempe North Inlet	2.3	5.7	<2.0
Tempe North Plant Treated	<2.0	<2.0	<2.0
Tempe South WTP			
Tempe South Plant Treated			
Anthem Inlet	<2.0	<2.0	<2.0
Anthem Treated	<2.0	<2.0	<2.0
Chandler Inlet			
Chandler Treated			
Greenway WTP Inlet	3.4	10.6	<2.0
Greenway WTP Treated			
Glendale WTP Inlet	<2.0	<2.0	<2.0
Glendale WTP Treated	<2.0	2.8	<2.0
24th St. WTP Inlet			
24th St. WTP Outlet			

**Table 2 - Water Treatment Plants – January 6, 2014**

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	2.1	<2.0
Union Hills Treated			
Tempe North Inlet	<2.0	11.1	<2.0
Tempe North Plant Treated	2.1	10.7	<2.0
Tempe South WTP			
Tempe South Plant Treated			
Anthem Inlet	<2.0	2.8	<2.0
Anthem Treated	<2.0	2.6	<2.0
Chandler Inlet			
Chandler Treated			
Greenway WTP Inlet			
Greenway WTP Treated			
Glendale WTP Inlet	<2.0	7.0	<2.0
Glendale WTP Treated			
24th St. WTP Inlet			
24th St. WTP Outlet			

**Table 3 - Canal Sampling – December 2, 2013**

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	2.0	<2.0
	Union Hills Inlet	2.1	3.8	<2.0
	CAP Canal at Cross-connect			
AZ Canal	Salt River @ Blue Pt Bridge	2.2	6.8	<2.0
	Verde River @ Beeline			
	AZ Canal above CAP Cross-connect			
	AZ Canal below CAP Cross-connect			
	AZ Canal at Highway 87			
	AZ Canal at Pima Rd.			
	AZ Canal at 56th St.			
	AZ Canal - Central Avenue			
	AZ Canal - Inlet to Glendale WTP			
	Head of the Consolidated Canal			
	Middle of the Consolidated Canal			
	Tempe Canal - Inlet to Tempe's South Plant	3.9	2.0	<2.0
	Mesa Turnout (Nov)			
	Salt-Gila Pump (Nov)			
	ISTB4			

**Table - Canal Sampling – January 6, 2014**

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	2.9	<2.0
	Union Hills Inlet	<2.0	2.1	<2.0
	CAP Canal at Cross-connect			
AZ Canal	Salt River @ Blue Pt Bridge	<2.0	14.6	<2.0
	Verde River @ Beeline			
	AZ Canal above CAP Cross-connect			
	AZ Canal below CAP Cross-connect			
	AZ Canal at Highway 87			
	AZ Canal at Pima Rd.			
	AZ Canal at 56th St.			
	AZ Canal - Central Avenue			
	AZ Canal - Inlet to Glendale WTP			
	Head of the Consolidated Canal			
	Middle of the Consolidated Canal			
	Tempe Canal - Inlet to Tempe's South Plant	<2.0	2.5	<2.0
	Mesa Turnout (Dec)			
	Salt-Gila Pump (Dec)			
	ISTB4			

**Table 4 - Reservoir Samples – January 7, 2014**

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (Dec)	Epilimnion	3.2	<2.0	<2.0
Lake Pleasant (Dec)	Hypolimnion	4.1	<2.0	<2.0
Verde River @ Beeline				
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				
Saguaro Lake	Epilimnion	<2.0	<2.0	<2.0
Saguaro Lake	Epi - Duplicate	<2.0	<2.0	<2.0
Saguaro Lake	Epi-near dock	<2.0	<2.0	<2.0
Saguaro Lake	Hypolimnion	<2.0	<2.0	<2.0
Lake Havasu (Dec)		<2.0	2.5	3.0
Verde River at Tangle Creek (Dec)		<2.0	<2.0	<2.0
Roosevelt at Salt River Inlet (Dec)		<2.0	<2.0	<2.0

**Table 4 - Reservoir Samples – December 3, 2013**

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (Nov)	Epilimnion	2.9	<2.0	<2.0
Lake Pleasant	Hypolimnion	3.9	2.0	<2.0
Verde River @ Beeline				
Bartlett Reservoir	Epilimnion	2.7	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	3.3	<2.0	<2.0
Bartlett Reservoir	Hypolimnion	3.3	<2.0	<2.0
Salt River @ BluePt Bridge				
Saguaro Lake	Epilimnion	3.3	<2.0	<2.0
Saguaro Lake	Epi - Duplicate	3.4	<2.0	<2.0
Saguaro Lake	Epi-near dock	3.2	<2.0	<2.0
Saguaro Lake	Hypolimnion	3.9	<2.0	<2.0
Lake Havasu (Nov)		3.0	3.2	<2.0
Verde River at Tangle Creek (Nov)		<2.0	2.6	<2.0
Roosevelt at Salt River Inlet (Sept)		<2.0	<2.0	<2.0