Regional Water Quality NEWSLETTER

DATE: Report for February 2007
Samples Collected on February 5-6, 2007
From the Phoenix, Tempe, Peoria, CAP, SRP – ASU Regional Water Quality Partnership

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

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SUMMARY: EVALUATION AND RECOMMENDATIONS

1. SRP is releasing nearly 100% Verde River water into the SRP canals.
2. The Arizona Canal is coming back on-line this week and WTPs on the canal are also coming back online.
3. The Arizona Canal is coming back on-line and there appears to be some cyclocitral in the water . This odorant can cause earthy-musty odors.
4. Shut-down of the Arizona Canal has appeared to result in a gradient of DOC concentrations. As this "slug" of water moves through the canal lower DOC water should be supplied to N. Tempe, 24th street, Deer Valley, and Peoria WTPs.
5. Currently SRP is releasing Verde River water from Bartlett Lake. However when SRP shifts back to Salt River water from Saguaro Lake in the spring there may be a pulse of Geosmin in the water. This may require PAC treatment at the water treatment plants.
6. **When SRP shifts back to Salt River water in the spring, there will be higher DOC that needs to be treated and the potential for higher chlorine demand and more THM formation. This summer could see quite high THM levels.**
7. As part of an ongoing project funded by SRP and CAP samples of water from the local reservoirs are collected and used in jar tests with alum dosages of 0 to 80 mg/L. These data are building towards a dataset that will be used to calibrate THM formation models to give "early-warning" capabilities regarding the "difficulty to coagulate water" and "potential for form DBPs" during water treatment.

Table 1 Summary of WTP Operations

	Union Hills	24th Street WTP	N.Tempe J.G. Martinez	Deer Valley	Greenway WTP	Val Vista	South Tempe	Chandler WTP
Location	**CAP**	**Arizona Canal System**				**South Canal System**		
PAC Type and Dose	None	None				None	None	
Copper Sulfate	None	None				None	None	
PreOxidation	None	Yes during start-up				0.5 ppm	None	
Alum Dose Alkalinity pH	7.7 [1] 134/124 8.0	30 ppm 158-200 7.3				60 206 7.45	32 222 7.4	
Finished water DOC DOC removal[2]	2.49 mg/L 6%					1.33 mg/L 17%	1.50 mg/L <5%	
WTP plant comments		Off-line until tuesday		Off-line	Off-line			

[1] **Ferric chloride instead of alum**
[2] Calculated based upon influent and filtered water DOC
[3] also adding 1.4 ppm floc aid

Table 2 - Water Treatment Plants – February 5, 2007

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet			
24th Street WTP Treated			
Deer Valley Inlet			
Deer Valley WTP Treated			
Val Vista Inlet	**<2.0**	**<2.0**	**12.1**
Val Vista WTP Treated –East	**<2.0**	**<2.0**	**6.3**
Val Vista WTP Treated -West	**<2.0**	**<2.0**	**3.7**
Union Hills Inlet	**<2.0**	**<2.0**	**6.2**
Union Hills Treated	**<2.0**	**<2.0**	**<2.0**
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	**<2.0**	**<2.0**	**2.2**
Tempe South Plant Treated	**<2.0**	**<2.0**	**2.9**
Tempe South Plant Treated (Lab)			
Chandler WTP Inlet			
Chandler WTP Treated			
Greenway WTP Inlet			
Greenway WTP Treated			

Table 3 - Canal Sampling – February 5, 2007

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	<2.0	5.9
	Union Hills Inlet	<2.0	<2.0	6.2
	CAP Canal at Cross-connect	<2.0	<2.0	2.4
AZ Canal	Salt River @ Blue Pt Bridge	<2.0	3.4	2.2
	Verde River @ Beeline	<2.0	<2.0	3.8
	AZ Canal above CAP Cross-connect	<2.0	2.4	3.5
	AZ Canal below CAP Cross-connect	<2.0	<2.0	3.6
	AZ Canal at Highway 87	<2.0	<2.0	5.3
	AZ Canal at Pima Rd.	2.0	<2.0	5.0
	AZ Canal at 56th St.	<2.0	5.8	21.2
	AZ Canal - Inlet to 24th Street WTP			
	AZ Canal - Central Avenue	<2.0	5.1	3.3
	AZ Canal - Inlet to Deer Valley WTP			
	AZ Canal - Inlet to Greenway WTP			
South and Tempe Canals	South Canal below CAP Cross-connect	<2.0	<2.0	5.9
	South Canal at Val Vista WTP	<2.0	<2.0	12.1
	Head of the Tempe Canal	<2.0	<2.0	9.4
	Tempe Canal - Inlet to Tempe's South Plant	<2.0	<2.0	2.2
	Chandler WTP – Inlet			

The Arizona Canal is coming back on-line and there appears to be some cyclocitral in the water . This odorant can cause earthy-musty odors.

Table 4 - Reservoir Samples – Febraury 6, 2007

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant	Eplimnion	<2.0	<2.0	2.7
Lake Pleasant	Hypolimnion	<2.0	<2.0	3.9
Verde River @ Beeline		<2.0	<2.0	3.8
Bartlett Reservoir	Epilimnion	<2.0	<2.0	2.9
Bartlett Reservoir	Epi-near dock	<2.0	<2.0	4.2
Bartlett Reservoir	Hypolimnion	<2.0	<2.0	6.3
Salt River @ BluePt Bridge		<2.0	3.4	2.2
Saguaro Lake	Epilimnion	<2.0	16.7	8.8
Saguaro Lake	Epi - Duplicate	<2.0	21.3	5.8
Saguaro Lake	Epi-near doc	<2.0	24.9	11.1
Saguaro Lake	Hypolimnion	<2.0	<2.0	3.2
Verde River at Tangle Havasu		<2.0	<2.0	5.6

Currently SRP is releasing Verde River water from Bartlett Lake. However when SRP shifts back to Salt River water from Saguaro Lake in the spring there may be a pulse of Geosmin in the water. This may require PAC treatment at the water treatment plants.

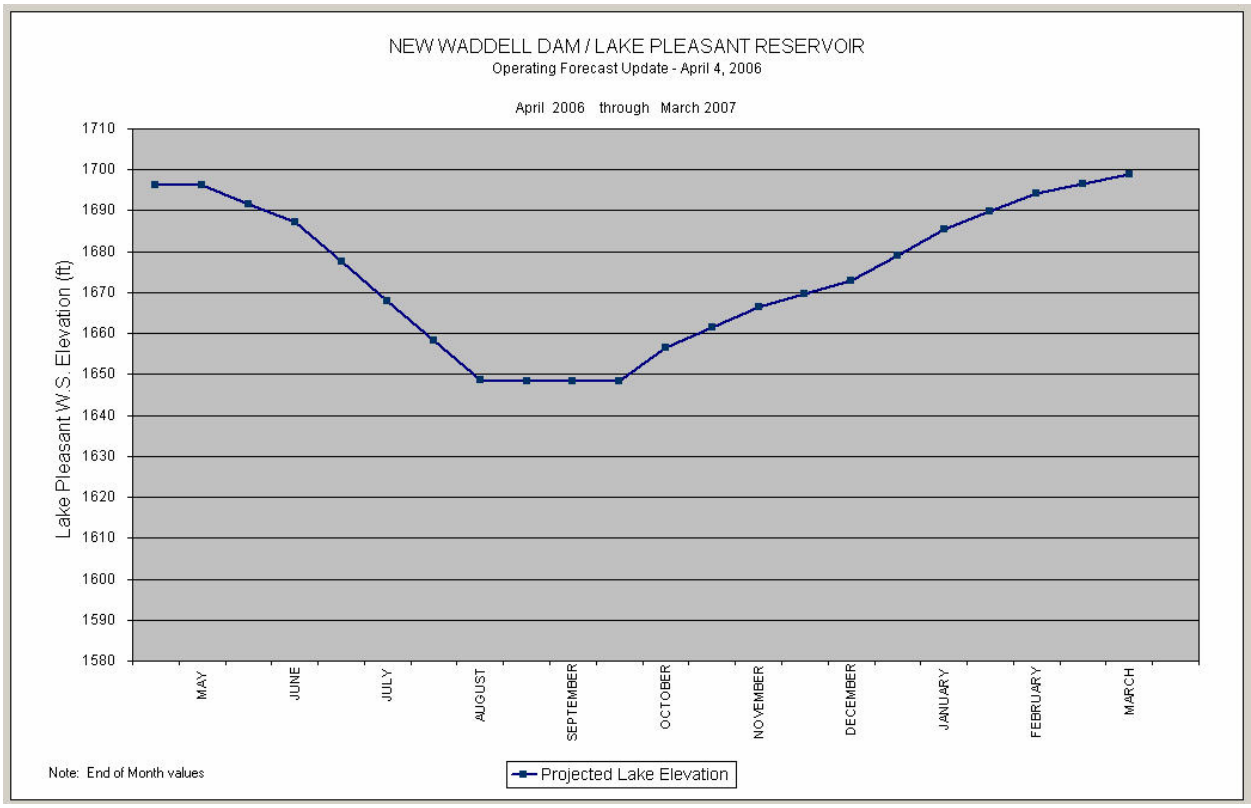
Table 5 - SRP/CAP OPERATIONS
Values in cfs, for February 6, 2006

System	SRP Diversions	CAP
Arizona Canal	147	58
South Canal	298	0
Pumping	297	0
Total	742	58

SRP is releasing water from both Verde and Salt River Systems. Salt River release from Saguaro Lake: 8 cfs; Verde River release from Bartlett Lake: 368 cfs.

Canal Dry-up season is coming:
We will be working on portions of the Southside canals from Nov. 17 to Dec. 17 and CANAL WORK STARTS IN NOVEMBER portions of Northside canals from Jan. 5 to Feb. 4. Southside and Northside canals refer to major SRP canals south and north of the Salt River, respectively.

From the SRP Waterways Newsletter
(http://www.srpnet.com/water/pdfx/WATERWAYS1006.pdf) :



Planned operation of Lake Pleasant through March of 2007

Table 6 - Water Treatment Plants – February 5, 2007

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA	TDN
24th Street WTP Inlet				
24th Street WTP Treated				
Deer Valley Inlet				
Deer Valley WTP Treated				
Val Vista Inlet	**1.63**	**0.0413**	**2.54**	**0.3327**
Val Vista WTP Treated –East	**1.34**	**0.0205**	**1.53**	**0.2543**
Val Vista WTP Treated -West	**1.33**	**0.0183**	**1.38**	**0.236**
Union Hills Inlet	**2.67**	**0.039**	**1.46**	**0.6672**
Union Hills Treated	**2.49**	**0.023**	**0.91**	**0.645**
Tempe North Inlet				
Tempe North Plant Treated				
Tempe South WTP	**1.50**	**0.0402**	**2.67**	**0.951**
Tempe South Plant Treated	**1.50**	**0.0330**	**2.19**	**0.9513**
Chandler WTP Inlet				
Chandler WTP Treated				
Greenway WTP Inlet				
Greenway WTP Treated				

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)

Table 7 - Canal Sampling – February 5, 2007

System	Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA	TDN
CAP	Waddell Canal	2.67	0.0383	1.43	0.7067
	Union Hills Inlet	2.67	0.0390	1.46	0.6672
	CAP Canal at Cross-connect	3.09	0.0395	1.28	0.6789
AZ Canal	Salt River @ Blue Pt Bridge	3.75	0.0794	2.12	0.2994
	Verde River @ Beeline	1.72	0.0450	2.62	0.252
	AZ Canal above CAP Cross-connect	3.75	0.0430	1.15	0.2994
	AZ Canal below CAP Cross-connect	2.05	0.0449	2.19	0.384
	AZ Canal at Highway 87	2.21	0.0447	2.02	0.368
	AZ Canal at Pima Rd.	2.56	0.0366	1.43	0.735
	AZ Canal at 56th St.	3.35	0.0657	1.96	0.617
	AZ Canal - Inlet to 24th Street WTP				
	AZ Canal - Central Avenue	4.68	0.1290	2.76	0.641
	AZ Canal - Inlet to Deer Valley WTP				
	AZ Canal - Inlet to Greenway WTP				
South and Tempe Canals	South Canal below CAP Cross-connect	1.90	0.0508	2.67	0.381
	South Canal at Val Vista WTP	1.63	0.0414	2.54	0.333
	Head of the Tempe Canal	1.68	0.0446	2.66	0.292
	Tempe Canal - Inlet to Tempe's South Plant	1.50	0.0402	2.67	0.292
	Chandler WTP – Inlet				

Shut-down of the Arizona Canal has appeared to result in a gradient of DOC concentrations. As this "slug" of water moves through the canal lower DOC water should be supplied to N. Tempe, 24th street, Deer Valley, and Peoria WTPs.

Table 8 - Reservoir Samples – February 5, 2007

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA	TDN
Lake Pleasant	Eplimnion	2.99	0.0467	1.56	0.383
Lake Pleasant	Hypolimnion	3.14	0.0468	1.49	0.418
Verde River @ Beeline		1.72	0.0450	2.62	0.914
Bartlett Reservoir	Epilimnion	2.06	0.0552	2.68	0.269
Bartlett Reservoir	Epi-near dock				
Bartlett Reservoir	Hypolimnion	2.14	0.0529	2.48	0.342
Salt River @ BluePt Bridge		3.75	0.0794	2.12	0.299
Saguaro Lake	Epilimnion	5.01	0.1072	2.14	0.383
Saguaro Lake	Epi - Duplicate	4.89	0.1031	2.11	0.307
Saguaro Lake	Epi-near doc				
Saguaro Lake	Hypolimnion	5.02	0.1073	2.14	0.534
Verde River at Tangle					
Havasu		2.57	0.0397	1.55	0.710

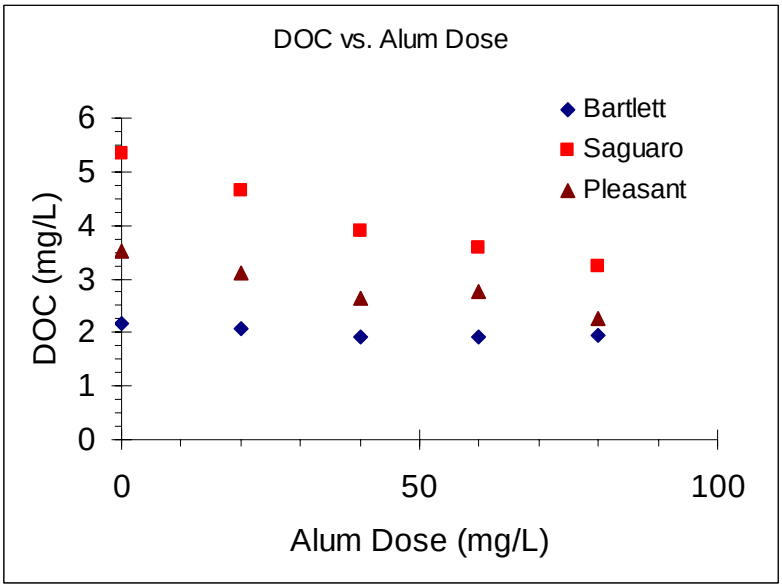
When SRP shifts back to Salt River water in the spring, there will be higher DOC that needs to be treated and the potential for higher chlorine demand and more THM formation. This summer could see quite high THM levels.

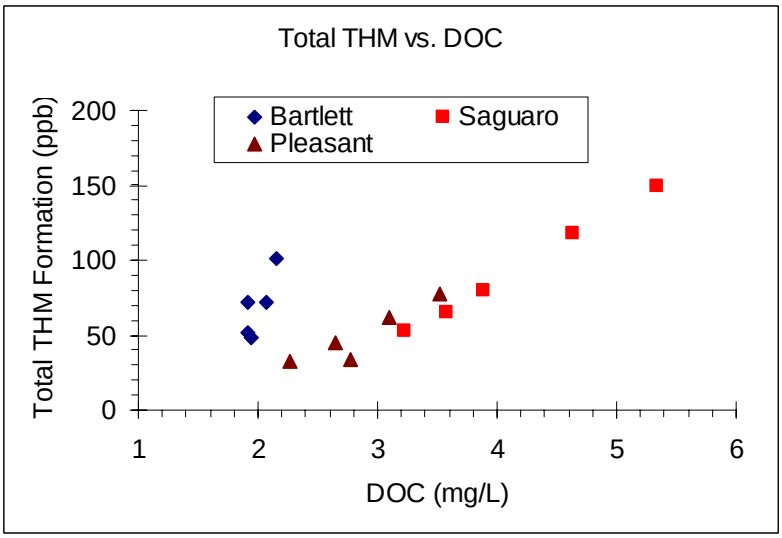
Coagulation of Reservoir Water and Disinfection By-product Formation

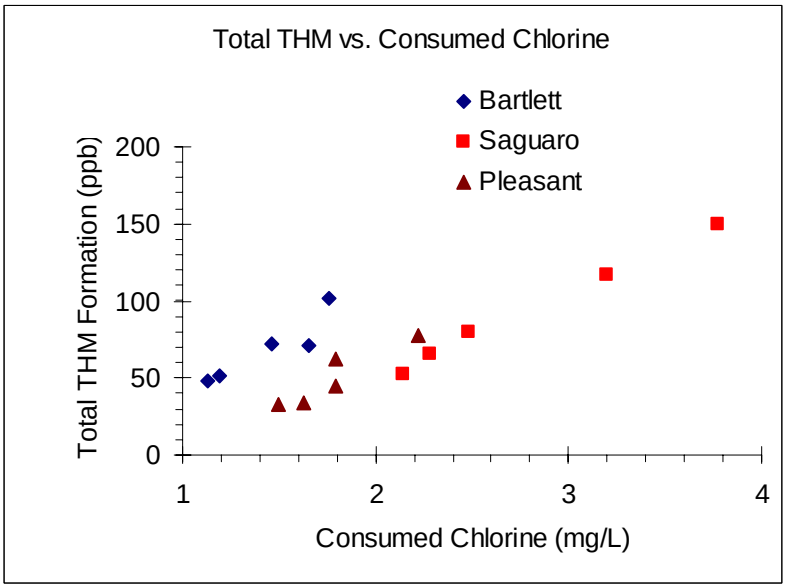
As part of an ongoing project funded by SRP and CAP samples of water from the local reservoirs are collected and used in jar tests with alum dosages of 0 to 80 mg/L. At the highest alum dosage the pH was between 6.9 and 7.2. The removal of DOC and DBP precursors are assessed. Chlorine is added to provide a 1±0.2 $mgCl_2/L$ chlorine residual after 24 hours (i.e., SDS test). The results for January 2006 are shown on the following page. The following conclusions can be made:

- Salt River water (Saguaro Lake) is the easiest water to coagulate, with alum leading significant DOC removal. However, even at the highest alum dosage the Saguaro Lake water has more DOC than the other sources. Alum coagulation is very poor at removing DOC from the Verde River (Bartlett Reservoir water).
- The difficulty in coagulating Verde River water in the jar tests shown on the next page is reflected in the current difficulty for the full-scale WTPs to remove DOC now (Table 1) when SRP is releasing Verde River water into the canals.
- Upon chlorination trihalomethanes (THMs) form in each water. For any given water there is a relationship between lower DOC (removed by alum coagulation) and THM formation. For a given DOC the THM formation is similar for Saguaro Lake and Lake Pleasant. However, Bartlett Lake water yields more THM per unit of DOC.
- In each water sample, in order to achieve 1±0.2 $mgCl_2/L$ chlorine residual after 24 hours (which is representative of most water treatment plant) different chlorine dosages were applied. Consequently different amounts of chlorine were consumed. As a result, more chlorine consumption (chlorine dose minus chlorine residual after 24 hours) produces more THMs. Here THM formation among the three water sources begin to converge a little more than the relationship between THMs and DOC.

These data are building towards a dataset that will be used to calibrate THM formation models to give “early-warning” capabilities regarding the “difficulty to coagulate water” and “potential for form DBPs” during water treatment.


DOC vs. Alum Dose
Bartlett
Saguaro
Pleasant
DOC (mg/L)
0
1
2
3
4
5
6
0
50
100
Alum Dose (mg/L)


Total THM vs. DOC
Bartlett
Saguaro
Pleasant
Total THM Formation (ppb)
0
50
100
150
200
1
2
3
4
5
6
DOC (mg/L)


Total THM vs. Consumed Chlorine
Bartlett
Saguaro
Pleasant
Total THM Formation (ppb)
0
50
100
150
200
1
2
3
4
Consumed Chlorine (mg/L)