Regional Water Quality NEWSLETTER

DATE: Report for October 2007

Samples Collected on October 8-9, 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. MIB concentrations in the canals are ~ 10 ng/L, the level noticeable to consumers in finished waters. Water treatment plants not adding PAC or using GAC have MIB concentrations in finished water near 10 ng/L; using activated carbon results in MIB concentrations below 8 ng/L. Facilities using GAC (Glendale) have < 2 ng/L MIB in finished water.
2. Water Treatment plants using GAC (Glendale) and lower alum dosages than other "enhance coagulated" waters (Phoenix) have higher TOC removal and probably lower THM formation in treated waters.
3. The reservoirs on the SRP system are thermally destratified and have higher MIB in their released water than any previous time this year.
4. SRP will switch from Salt River (Saguaro Lake) water as a source to Verde River (Bartlett Lake) in early November 2007. This will result in lower TOC and lower THM levels as predicted by the WTP.exe model.
5. The Verde River system contains arsenic near 20 ug/L, well above the 10 ug/L MCL. Fortunately alum and ferric coagulation effectively remove arsenic.

Table 1 Summary of WTP Operations

	Union Hills	24th Street WTP	N.Tempe J.G. Martinez	Deer Valley	Glendale Cholla WTP	Val Vista	South Tempe	Chandler WTP
Location	**CAP**	**Arizona Canal System**				**South Canal System**		
PAC Type and Dose	None	12 ppm Norit 20B	None	10 ppm Calgon WPH	None		None	
Copper Sulfate	None	0.25 ppm during daylight	None	none	None	0.25 ppm during daytime	None	
PreOxidation	None	None	None	None	1 ppm chlorine 24/7	None	None	
Alum Dose Alkalinity pH	12.6 ppm [1] 134/113 7.05	55 ppm 148/122 6.75	39 ppm 148 7.2	58 ppm 153/97 8.4 / 6.7	35 ppm 140 6.8		30 ppm 148 7.5	
Finished water DOC DOC removal[2]	2.2 mg/L 19%	2.57 mg/L 33%	3.2 mg/L 19%	2.73 mg/: 31%	2.0 mg/L 57%	2.7 mg/L 35%	3.6 mg/L 0%	
WTP plant comments		There is a lot of in-plant growth			T&O noticeable, but with GAC no complaints			
Recommendations								

[1] Ferric chloride instead of alum

[2] Calculated based upon influent and filtered water DOC (note that DOC – not TOC – is used in this calculation)

Table 2 - Water Treatment Plants – October 8, 2007

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet	**8.6**	**4.0**	**<2.0**
24th Street WTP Treated	**7.0**	**<2.0**	**<2.0**
Deer Valley Inlet	**10.2**	**4.9**	**3.7**
Deer Valley WTP Treated	**7.8**	**2.4**	**3.4**
Val Vista Inlet	**10.1**	**3.8**	**<2.0**
Val Vista WTP Treated –East	**8.6**	**3.5**	**<2.0**
Val Vista WTP Treated -West	**7.7**	**4.7**	**<2.0**
Union Hills Inlet	**4.0**	**<2.0**	**<2.0**
Union Hills Treated	**3.5**	**<2.0**	**<2.0**
Tempe North Inlet	**8.1**	**3.8**	**<2.0**
Tempe North Plant Treated	**11.2**	**6.6**	**4.3**
Tempe South WTP	**8.1**	**<2.0**	**2.4**
Tempe South Plant Treated	**8.8**	**3.8**	**<2.0**
Tempe South Plant Treated (Lab)			
Glendale WTP Inlet	**10.1**	**4.8**	**<2.0**
Glendale WTP Treated	**<2.0**	**<2.0**	**<2.0**
Glendale WTP Treated (Lab)			

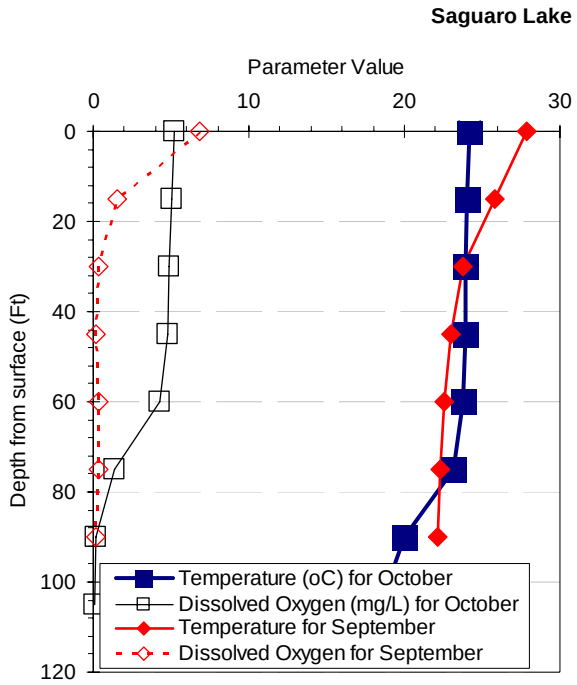
MIB concentrations in the Arizona and South Canal systems are approximately 10 ng/L (the threshold for human detection in drinking water). WTPs not adding PAC or using GAC (Tempe facilities) are not removing MIB. Limited removal (~25%) is occurring at other facilities, by the concentrations are below 10 ng/L in finished water.

Table 3 - Canal Sampling – October 8, 2007

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	**<2.0**	**<2.0**	**<2.0**
	Union Hills Inlet	**4.0**	**<2.0**	**<2.0**
	CAP Canal at Cross-connect	**2.2**	**<2.0**	**<2.0**
AZ Canal	Salt River @ Blue Pt Bridge	**12.5**	**5.1**	**<2.0**
	Verde River @ Beeline	**13.1**	**2.9**	**<2.0**
	AZ Canal above CAP Cross-connect	**11.2**	**3.0**	**<2.0**
	AZ Canal below CAP Cross-connect	**11.2**	**2.2**	**<2.0**
	AZ Canal at Highway 87	**10.5**	**3.5**	**<2.0**
	AZ Canal at Pima Rd.	**9.3**	**4.3**	**<2.0**
	AZ Canal at 56th St.	**5.4**	**2.8**	**<2.0**
	AZ Canal - Inlet to 24th Street WTP	**8.6**	**4.0**	**<2.0**
	AZ Canal - Central Avenue	**8.7**	**6.0**	**<2.0**
	AZ Canal - Inlet to Deer Valley WTP	**10.2**	**4.9**	**3.7**
	AZ Canal - Inlet to Glendale WTP	**10.1**	**4.8**	**<2.0**
South and Tempe Canals	South Canal below CAP Cross-connect	**9.3**	**2.2**	**<2.0**
	South Canal at Val Vista WTP	**10.1**	**3.8**	**<2.0**
	Head of the Tempe Canal	**7.7**	**<2.0**	**<2.0**
	Tempe Canal - Inlet to Tempe's South Plant	**8.1**	**<2.0**	**2.4**
	Chandler WTP – Inlet			

There does NOT appear to be any in-canal MIB or geosmin production this month. In previous years this was a significant issue. The profile of MIB in the Arizona canal is NOT due to SRP pumping.

The SRP reservoirs (Saguaro Lake and Bartlett Lake) have recently underwent thermal destratification where the lake is nearly uniformly mixed with depth, as evident by a lack of a thermal profile with depth. Consequently, MIB concentrations are above 20 ng/L in Bartlett Lake and Verde River downstream. Saguaro Lake is between 10 and 20 ng/L. SRP will be shifting to the Verde River system in early November. In the past we have observed a MIB loss rate of approximately 1 ng/L/day – so by early November the MIB concentrations in Bartlett Lake should be lower than currently present.



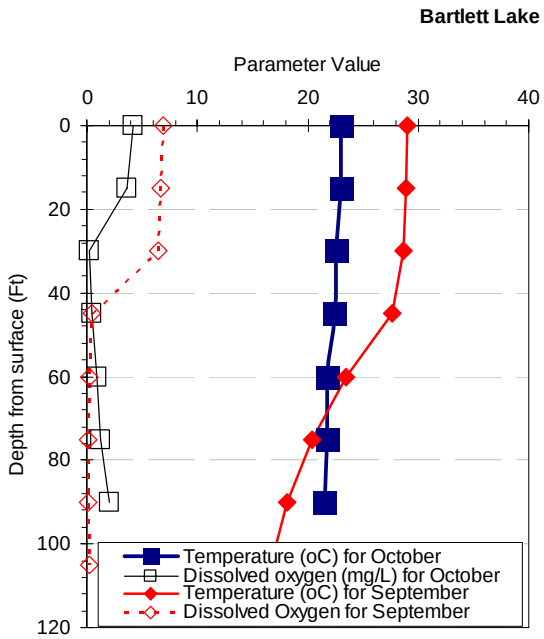


Table 4 - Reservoir Samples – October 9, 2007

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (2Oct07)	Eplimnion	25.7	<2.0	<2.0
Lake Pleasant (2Oct07)	Hypolimnion	5.6	<2.0	<2.0
Verde River @ Beeline		13.1	2.9	<2.0
Bartlett Reservoir	Epilimnion	24.3	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	24.3	<2.0	<2.0
Bartlett Reservoir	Hypolimnion	30.6	<2.0	<2.0
Salt River @ BluePt Bridge		12.5	5.1	<2.0
Saguaro Lake	Epilimnion	25.5	2.3	<2.0
Saguaro Lake	Epi - Duplicate	22.3	3.6	<2.0
Saguaro Lake	Epi-near doc	19.0	2.1	<2.0
Saguaro Lake	Hypolimnion	16.8	5.0	<2.0
Verde River at Tangle (26Sept07)		5.0	<2.0	<2.0
Havasu (2Oct07)		<2.0	<2.0	<2.0

Table 5 - SRP/CAP OPERATIONS
Values in cfs, for October 8, 2007

System	SRP Diversions	CAP
Arizona Canal	539	75
South Canal	526	0
Pumping	188	0
Total	1253	75

SRP is releasing water from both Verde and Salt River Systems. Salt River release from Saguaro Lake: 975 cfs; Verde River release from Bartlett Lake: 105 cfs.

Table 6 - Water Treatment Plants – October 08, 2007

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
24th Street WTP Inlet	**3.83**	**0.084**	**2.2**	**0.357**
24th Street WTP Treated	**2.57**	**0.038**	**1.5**	**0.302**
Deer Valley Inlet	**3.96**	**0.092**	**2.3**	**0.364**
Deer Valley WTP Treated	**2.73**	**0.043**	**1.6**	**0.303**
Val Vista Inlet	**4.08**	**0.093**	**2.28**	**0.329**
Val Vista WTP Treated –East	**2.71**	**0.041**	**1.51**	**0.296**
Val Vista WTP Treated -West	**2.66**	**0.041**	**1.54**	**0.290**
Union Hills Inlet	**2.69**	**0.041**	**1.52**	**0.501**
Union Hills Treated	**2.18**	**0.020**	**0.92**	**0.453**
Tempe North Inlet	**3.89**	**0.084**	**2.16**	**0.388**
Tempe North Plant Treated	**3.16**	**0.057**	**1.80**	**0.330**
Tempe South WTP	**3.58**	**0.081**	**2.26**	**0.779**
Tempe South Plant Treated	**3.57**	**0.069**	**1.93**	**0.381**
Glendale WTP Inlet	**4.68**	**0.099**	**2.1**	**0.348**
Glendale WTP Treated	**2.02**	**0.022**	**1.1**	**1.170**

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 Samples October 8, 2007

System	Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
CAP	Waddell Canal	2.85	0.041	1.4	0.525
	Union Hills Inlet	2.69	0.041	1.52	0.501
	CAP Canal at Cross-connect	2.74	0.040	1.46	0.498
AZ Canal	Salt River @ Blue Pt Bridge	4.00	0.095	2.38	0.353
	Verde River @ Beeline	1.62	0.050	3.09	0.456
	AZ Canal above CAP Cross-connect	4.11	0.092	2.24	0.333
	AZ Canal below CAP Cross-connect	3.54	0.077	2.18	0.392
	AZ Canal at Highway 87	3.89	0.084	2.16	0.410
	AZ Canal at Pima Rd.	3.87	0.083	2.14	0.371
	AZ Canal at 56th St.	3.81	0.084	2.20	0.363
	AZ Canal - Inlet to 24th Street WTP	3.83	0.084	2.19	0.357
	AZ Canal - Central Avenue	3.78	0.084	2.22	0.353
	AZ Canal - Inlet to Deer Valley WTP	3.96	0.092	2.32	0.364
	AZ Canal - Inlet to Glendale WTP	4.68	0.099	2.12	0.348
South and Tempe Canals	South Canal below CAP Cross-connect	4.02	0.092	2.29	0.337
	South Canal at Val Vista WTP	4.08	0.093	2.28	0.329
	Head of the Tempe Canal	3.95	0.093	2.35	0.355
	Tempe Canal - Inlet to Tempe's South Plant	3.58	0.081	2.26	0.779
	Chandler WTP – Inlet				

Table 8 - Reservoir Samples – October 08, 2007

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant	Eplimnion	3.02	0.041	1.36	0.245
Lake Pleasant	Hypolimnion	2.73	0.041	1.50	0.444
Verde River @ Beeline		1.62	0.050	3.09	0.456
Bartlett Reservoir	Epilimnion	2.65	0.078	2.94	0.338
Bartlett Reservoir	Epi-near dock				
Bartlett Reservoir	Hypolimnion	2.49	0.074	2.97	0.338
Salt River @ BluePt Bridge		4.00	0.095	2.38	0.353
Saguaro Lake	Epilimnion	4.40	0.092	2.09	0.393
Saguaro Lake	Epi - Duplicate	4.79	0.094	1.96	0.437
Saguaro Lake	Epi-near doc				
Saguaro Lake	Hypolimnion	4.09	0.092	2.25	0.403
Verde River at Tangle		1.74	0.087	5.00	
Havasu		2.47	0.038	1.54	0.502

Data from previous tables is used with the wtp.exe model described at the September 2007 workshop to predict the following THM conditions when SRP switches from Salt River to Verde River water in early November 2007. *The Verde River water will have lower TOC before and after alum coagulation, compared against Saguaro Lake water which is now being treated, and have lower Total THM concentrations (TTHM).*

Alum Dose (ppm $Al_2(SO_4)_3$-$14H_2O$)	**TOC (mg/L)**	**pH**	**Chlorine residual (mg/L)**	**TTHM (ug/L) in water leaving plant**
Bartlett Lake (chlorine dose of 2.7 mg/L after filtration)				
0	2.6	8.4	0.9	**80**
20	2.3	7.7	1.0	**60**
30	2.2	7.5	1.1	**55**
30+ 10 ppm H2SO4	2.1	7.3	1.2	**53**
40	2.0	7.4	1.2	**52**
50	1.9	7.3	1.2	**49**
Saguaro Lake (chlorine dose of 3.0 mg/L after filtration)				
0	4.4	8.1	0.7	**104**
20	3.9	7.4	1.0	**78**
30	3.7	7.3	1.0	**73**
40	3.5	7.1	1.1	**68**
50	3.2	7.0	1.2	**63**

Bartlett Lake Alkalinity = 218 ppm pH = 8.2 Br = 70 ug/L (assumed)
Saguaro Lake Alkalinity = 139 ppm pH = 7.8 Br = 70 ug/L (assumed)
Assumed temperature of 23 C

Arsenic

When SRP changes from Salt River to Verde River source water in early November 2007 the WTPs will have to treat water containing 15 to 25 ug/L of arsenic, which is higher than in the Salt River system (~ 6 ug/L). Alum and Iron coagulation effectively remove arsenic, as is demonstrated in the table below by low arsenic levels in finished water.

	Samples Collected on:	9-Jul-07	6-Aug-07	10-Sep-07
Acronym	**Sample Description**	**Arsenic ug/L**	**Arsenic ug/L**	**Arsenic ug/L**
R3	Waddell Canal	**2.6**	**3.4**	**3.7**
R10	Salt River below Saguaro (Blue Point Bridge)	**5.5**	**6.3**	**6.4**
R11	CAP Canal at Cross-connect	**3.0**	**3.4**	**2.7**
R12	AZ Canal above CAP Cross-connect		**6.4**	
R13	AZ Canal below CAP Cross-connect	**5.4**	**6.5**	**5.3**
R14	AZ Canal - Inlet to Squaw Peak WTP	**6.7**	**7.1**	**5.2**
R15	Squaw Peak WTP treated water	**<2.0**	**<2.0**	**<2.0**
R16	AZ Canal - Inlet to Deer Valley WTP	**5.9**	**6.9**	**4.9**
R17	Deer Valley WTP treated water	**<2.0**	**<2.0**	**<2.0**
R18	South Canal at Val Vista WTP	**6.0**	**7.0**	**6.3**
R19	Val Vista WTP treated water	**<2.0**	**<2.0**	**<2.0**
R21	AZ Canal at Central Av.	**6.7**	**5.5**	**5.2**
R22	AZ Canal - 56th St. (Alma School Road)	**6.9**	**6.2**	**6.0**
R25	verde river at beeline highway	**16.7**	**15.4**	**14.4**
Hwy 87	AZ Canal at Highway 87	**5.7**	**5.5**	**5.2**
Pima	AZ Canal at Pima Rd.	**6.3**	**6.3**	**5.5**
UH In	Union Hills Inlet		**3.8**	**2.9**
UH Out	Union Hills Treated Water		**<2.0**	**<2.0**
NP In	Cross-Cut Canal - Inlet to Tempe's North Plant	**6.1**	**6.8**	**6.5**
NP Out	Tempe's North Plant treated water	**3.3**	**<2.0**	**2.1**
SOCA	South Canal below CAP Cross-conect	**5.8**	**5.3**	**6.5**
HTC	Head of the Tempe Canal	**6.8**	**4.9**	**5.8**
SPT In	Tempe Canal - Inlet to Tempe's South Plant	**6.3**	**7.7**	**6.9**
SPT Out	Tempe's South Plant treated water	**3.5**	**2.6**	**2.2**
Green In	Greenway WTP Inlet	**6.8**	**6.5**	
Green Out	Greenway WTP Outlet	**<2.0**	**2.8**	
Glen In	Glendale WTP Inlet			**5.2**
Glen Out	Glendale WTP Outlet			**2.0**
R2A	Lake Pleasant integrated sample	**5.0**	**4.1**	**4.8**
R2B	Lake Pleasant integrated sample	**5.0**	**3.4**	**2.8**
R6A	Bartlett Reservoir near outlet	**28.5**	**25.5**	**25.7**
R6B	Bartlett Reservoir near outlet	**25.9**	**15.5**	**19.2**
R9A	Saguaro Lake near inlet	**8.5**	**6.7**	**5.8**
R9A-Dup	Saguaro Lake near inlet	**9.2**	**6.3**	**6.6**
R9B	Saguaro Lake near inlet	**5.8**	**5.9**	**5.9**
R20	Verde River at Tangle	**30.2**	**28.9**	**32.6**
Havasu 1	Havasu lake Sample	**2.7**		**<2.0**