Regional Water Quality NEWSLETTER

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Sampling conducted Dec 3rd and 4th 2007

From the Phoenix, Tempe, Peoria, CAP, SRP – ASU Regional Water Quality Partnership
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SUMMARY: EVALUATION AND RECOMMENDATIONS

1. This week the big story is rain. It is helping the drought, but causes turbidity. Peak turbidity at one water treatment plant was over 600 NTU.
2. A section at the end of this newsletter discusses sources of turbidity and follows on the from the ideas outlined in our November 2007 Regional Water Quality Newsletter.
3. MIB and geosmin concentrations are below 10 ng/L.
4. SRP changed its release strategy during the rainfall event from releasing Bartlett Reservoir water (Verde River) to releasing Saguaro Lake water (Salt River). At its peak, over 1000 cfs of water in the lower Verde River resulted from runoff directly into the river around Fountain Hills.
5. DOC concentrations were slightly elevated during the runoff event.
6. Water quality (pH, alkalinity, TOC) changed rapidly over time in influent water for the water treatment plants. Most plants receiving SRP water responded by increasing chlorine addition and used higher alum dosages.

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	None		None	None	Shut down S. Tempe down until February 2008		
Copper Sulfate	None	None		None	None			
PreOxidation	None	Yes because of high turbidity (1.5ppm Cl2)		Yes because of high turbidity (2 ppm Cl2)	2 ppm Cl2 24/7			
Alum Dose Alkalinity pH	7.33 [1] 130/118 7.9	90 ppm 183/149 6.8		72 ppm 130/148	45-55 130-150 6.8			
Finished water DOC DOC removal[2]	2.6 4%	3.3 63%	3.7 58%	2.9 27%	1.5 [3] 46%			
WTP plant comments		High turbidity event started on Monday and lasted through late tuesday		Raw water turbidity peaked at 624 NT at 12AM on Tuesday (ave = 292 NTU) Alkalinity changed during runoff event				
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)

[3] Sample from finished water includes a blend of surface and ground water sources

Table 2 - Water Treatment Plants – December 3, 2007

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet	**9.6**	**7.7**	**5.1**
24th Street WTP Treated	**5.7**	**7.0**	**3.7**
Deer Valley Inlet	**2.6**	**3.4**	**<2.0**
Deer Valley WTP Treated	**2.6**	**8.9**	**<2.0**
Val Vista Inlet			
Val Vista WTP Treated –East			
Val Vista WTP Treated -West			
Union Hills Inlet	**<2.0**	**<2.0**	**<2.0**
Union Hills Treated	**<2.0**	**<2.0**	**<2.0**
Tempe North Inlet	**8.8**	**5.1**	**2.6**
Tempe North Plant Treated	**6.8**	**4.3**	**<2.0**
Tempe South WTP			
Tempe South Plant Treated			
Tempe South Plant Treated (Lab)			
Chandler WTP Inlet			
Chandler WTP Treated			
Glendale WTP Inlet	**2.2**	**3.4**	**<2.0**
Glendale WTP Treated	**<2.0**	**<2.0**	**<2.0**
Glendale WTP Treated (Lab)			

Table 3 - Canal Sampling – December 3, 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	**<2.0**	**<2.0**	**<2.0**
	CAP Canal at Cross-connect	**<2.0**	**<2.0**	**<2.0**
AZ Canal	Salt River @ Blue Pt Bridge	**2.4**	**<2.0**	**<2.0**
	Verde River @ Beeline	**3.6**	**4.2**	**<2.0**
	AZ Canal above CAP Cross-connect	**4.0**	**4.4**	**<2.0**
	AZ Canal below CAP Cross-connect	**3.9**	**3.6**	**<2.0**
	AZ Canal at Highway 87	**3.8**	**<2.0**	**<2.0**
	AZ Canal at Pima Rd.	**8.8**	**8.0**	**11.0**
	AZ Canal at 56th St.	**10.7**	**6.8**	**<2.0**
	AZ Canal - Inlet to 24th Street WTP	**9.6**	**7.7**	**5.1**
	AZ Canal - Central Avenue	**5.8**	**3.4**	**<2.0**
	AZ Canal - Inlet to Deer Valley WTP	**2.6**	**3.4**	**<2.0**
	AZ Canal - Inlet to Glendale WTP	**2.2**	**3.4**	**<2.0**
South and Tempe Canals	South Canal below CAP Cross-connect			
	South Canal at Val Vista WTP			
	Head of the Tempe Canal			
	Tempe Canal - Inlet to Tempe's South Plant			
	Chandler WTP – Inlet			

Table 4 - Reservoir Samples – December 4, 2007

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant	Eplimnion	samples collected on a different day this month	samples collected on a different day this month	samples collected on a different day this month
Lake Pleasant	Hypolimnio			
Verde River @ Beeline		**3.6**	**4.2**	**<2.0**
Bartlett Reservoir	Epilimnion	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Epi-near dock	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Hypolimnio	**3.0**	**<2.0**	**<2.0**
Salt River @ BluePt Bridge		**2.4**	**<2.0**	**<2.0**
Saguaro Lake	Epilimnion	**6.9**	**<2.0**	**<2.0**
Saguaro Lake	Epi - Duplicate	**4.3**	**<2.0**	**<2.0**
Saguaro Lake	Epi-near doc	**4.3**	**<2.0**	**<2.0**
Saguaro Lake	Hypolimnio	**4.4**	**<2.0**	**<2.0**
Verde River at Tangle				
Havasu				

Table 5 - SRP/CAP OPERATIONS

Values in cfs, for December 4, 2007

System	SRP Diversions	CAP
Arizona Canal	380	0
South Canal	957	0
Pumping	105	0
Total	1442	0

SRP is releasing water from both Verde and Salt River Systems. Salt River release from Saguaro Lake: 297 cfs; Verde River release from Bartlett Lake: 100 cfs.

Table 6 - Water Treatment Plants – December 03, 2007

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
24th Street WTP Inlet	8.96	0.445	5.0	3.530	
24th Street WTP Treated	3.35	0.063	1.9	1.949	63
Deer Valley Inlet	3.92	0.109	2.8	0.794	
Deer Valley WTP Treated	2.88	0.054	1.9	0.678	27
Val Vista Inlet					
Val Vista WTP Treated –East					
Val Vista WTP Treated -West					
Union Hills Inlet	2.72	0.038	1.40	0.555	
Union Hills Treated	2.60	0.023	0.88	0.513	4
Tempe North Inlet	8.81	0.430	4.88	3.301	
Tempe North Plant Treated	3.67	0.074	2.02	2.528	58
Tempe South WTP					
Tempe South Plant Treated					
Chandler WTP Inlet					
Chandler WTP Treated					
Glendale WTP Inlet	2.81	0.086	3.1	0.791	
Glendale WTP Treated	1.52	0.025	1.6	1.820	46

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 – December 3, 2007

System	Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
CAP	Waddell Canal	2.84	0.040	1.4	0.522
	Union Hills Inlet	2.72	0.038	1.40	0.555
	CAP Canal at Cross-connect	2.78	0.038	1.37	0.507
AZ Canal	Salt River @ Blue Pt Bridge	4.59	0.094	2.05	0.421
	Verde River @ Beeline	4.85	0.176	3.63	1.063
	AZ Canal above CAP Cross-connect	4.95	0.166	3.35	1.081
	AZ Canal below CAP Cross-connect	4.99	0.170	3.41	1.089
	AZ Canal at Highway 87	3.17	0.126	3.97	1.149
	AZ Canal at Pima Rd.	7.07	0.335	4.74	2.041
	AZ Canal at 56th St.	8.72	0.439	5.03	3.002
	AZ Canal - Inlet to 24th Street WTP	8.96	0.445	4.97	3.530
	AZ Canal - Central Avenue	7.13	0.330	4.63	2.604
	AZ Canal - Inlet to Deer Valley WTP	3.92	0.109	2.78	0.794
	AZ Canal - Inlet to Glendale WTP	2.81	0.086	3.06	0.791
South and Tempe Canals	South Canal below CAP Cross-connect				
	South Canal at Val Vista WTP				
	Head of the Tempe Canal				
	Tempe Canal - Inlet to Tempe's South Plant				
	Chandler WTP – Inlet				

Table 8 - Reservoir Samples – December 03, 2007

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant	Eplimnion	2.77	0.041	1.48	0.392
Lake Pleasant	Hypolimnio	2.80	0.041	1.46	0.382
Verde River @ Beeline		4.85	0.176	3.63	1.063
Bartlett Reservoir	Epilimnion	2.50	0.069	2.76	0.437
Bartlett Reservoir	Epi-near dock				
Bartlett Reservoir	Hypolimnio	2.42	0.068	2.81	0.443
Salt River @ BluePt Bridge		4.59	0.094	2.05	0.421
Saguaro Lake	Epilimnion	4.72	0.092	1.95	0.518
Saguaro Lake	Epi - Duplicate	4.63	0.093	2.01	0.531
Saguaro Lake	Epi-near doc				
Saguaro Lake	Hypolimnio	4.79	0.093	1.94	0.545
Verde River at Tangle		0.75	0.020	2.67	0.173
Havasu		2.47	0.038	1.54	0.604

TURBIDITY

It rained – and turbidity came. Last months newsletter had a section on "where does our turbidity come from?" (November 2007). So – this month we have information to show where the water comes from during these types of rain events. This runoff:

- Changes water quality rapidly
- Cause high turbidity spikes

Most of the runoff affecting turbidity last weekend came from the lower Verde River Basin (see Figure 1). SRP reduced releases from Bartlett Reservoir from >200 cfs on Friday (before the rain) to 100 cfs since then (Table 9). These flows are significantly lower than what were measured at the USGS gauging station new fountain hills (Figure 2). Therefore – ***most of the water (and associated turbidity) in the Verde River was from runoff downstream of Bartlett Reservoir***. There is a USGS gauging station on Sycamore Creek, a tributary to the Verde River near Fountain Hills (Figure 1). The flow at the gauging station was only 15 cfs – far less than the >1000 cfs increase in the Verde River downstream of Bartlett Reservoir associated with runoff. Therefore, turbidity entering the SRP canal system originated in the lower Verde River basin (including lower parts of Sycamore Creek) which flowed into the Salt River at Granite Reef Dam and into the AZ and South Canals.

Table 9

Day	**Bartlett Release (cfs)** VERDE RIVER upstream of Fountain Hills	**Horseshoe Release (cfs)*** Upstream of Bartlett Lake on the Verde River	**Stewart Mnt Release (cfs)** SALT RIVER – final reservoir
Fri (11/30)	217	200	105
Sat (12/1)	100	200	300
Sun (12/2)	100	200	300
Mon (12/3)	100	400	300
Tues (12/4)	100	800	297
Wed (12/5)	100	800	275

*** Increased upstream release from Horseshoe Lake into Bartlett Lake will start to bring in more total organic carbon (TOC)**

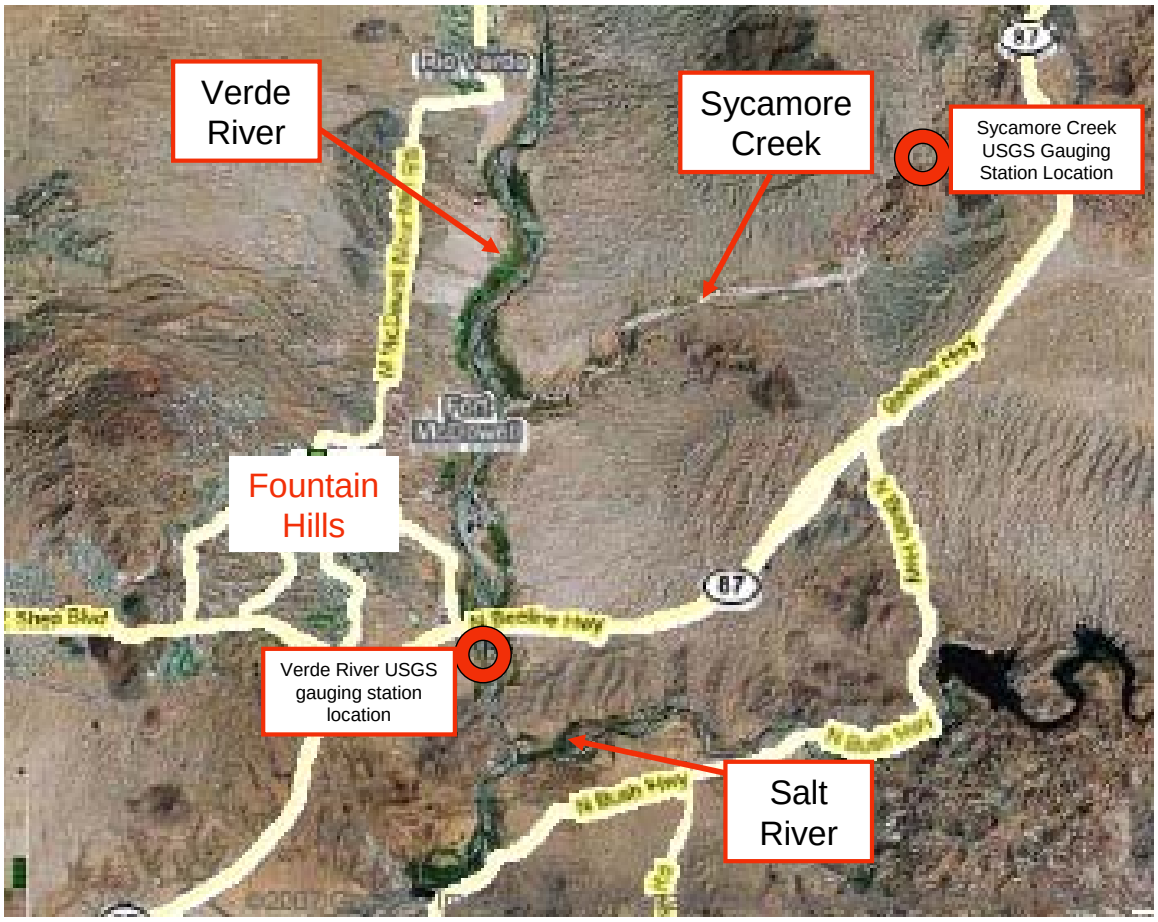

Figure 1 – Locations of key features in lower Verde River drainage

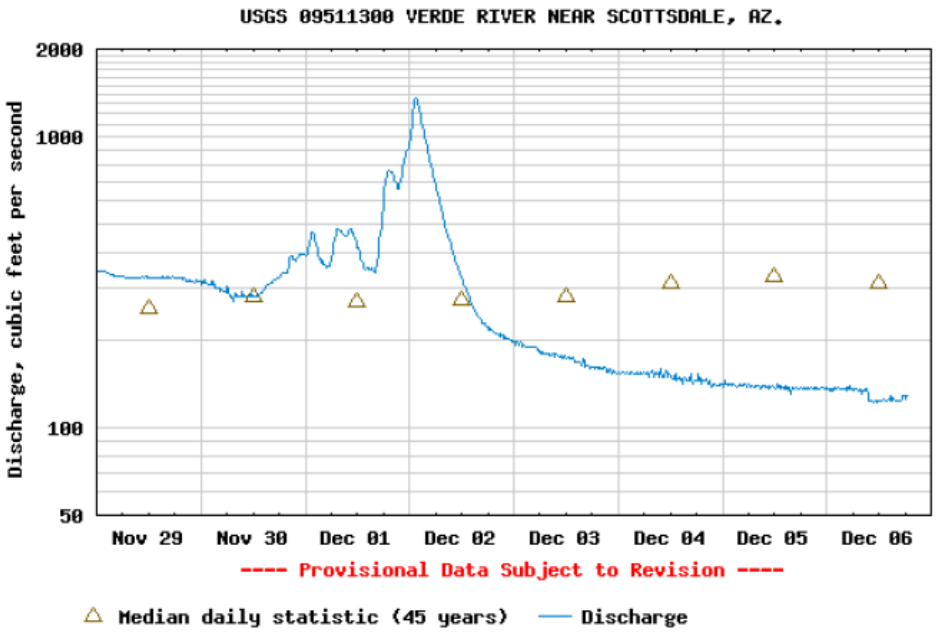

Figure 2 - SRP was only releasing 100 cfs during this period. Flows reached 1360 cfs in Verde River. This added flow came from runoff below Bartlett Lake entering the Verde River. This is the water that delivers turbidity to the City WTPs.

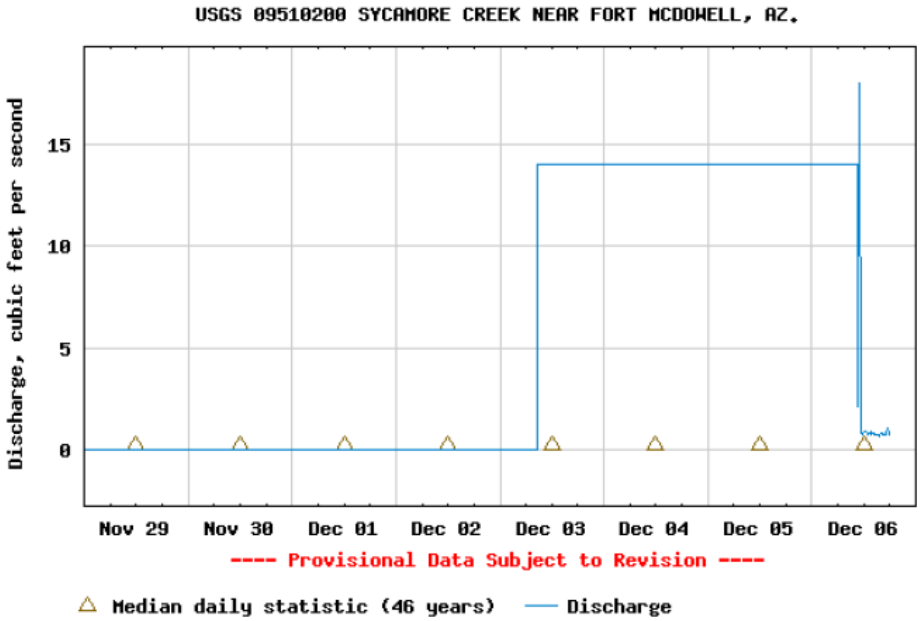

Figure 3 – streamflow in Sycamore creek at USGS gauging station illustrated in Figure 1