# Regional Water Quality NEWSLETTER

**DATE: Report for June2011**
**Sampling conducted January – April 2011**
**A Tempe, Glendale, Peoria, CAP, SRP – ASU Regional Water Quality Partnership**

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

## What effects will the massive forest fires have on water quality?

Based upon impacts from the Rodeo-Chediski fires we could expect the following impacts on water quality in the Salt River flowing into Roosevelt Lake for the 1 year after the fire:

| Constituent | % Change 1 year post-fire<br>Salt River |
|---|---|
| Total Organic Carbon | 2x to 10x increase |
| Dissolved Organic Carbon | 2x to 10x increase |
| Total Phosphorus | >10x increase |
| Dissolved Phosphorus | 2x to 10x increase |
| Total Nitrogen | >10x increase |
| Ammonia | >10x increase |
| Nitrate-Nitrite | 2x to 10x increase |
| Suspended Sediment | 2x to 10x increase |
| Stream Discharge | Slight decrease |

Source: Darla Gill MS Thesis ASU-2004 (supported by regional T&O funding)
Downloadable from: http://enpub.fulton.asu.edu/pwest/tasteandodor.htm

**Quick Update of Water Supplies for June 2011**
**(during day of sampling – June 7, 2011)**

| Source | Trend in supply | Discharge to water supply system | Flow into SRP Canal System | **MIB** * (Geosmin) [Cyclocitrol] Concentration (ng/L) | Dissolved organic carbon Concentration (mg/L) *** |
|---|---|---|---|---|---|
| Salt River | Reservoirs at 90% full | 1393 cfs | 791 cfs into **Arizona Canal** 692 cfs into **South Canal** | **9 / 3** (4 / < 2) [<2 / < 2] | 5.3 mg/L |
| Verde River | Reservoirs At 34% full | 150 cfs | | **<2** (<2) [<2] | 3.5 mg/L |
| Colorado River | Reservoirs at near historic lows (Lake Pleasant is nearly full) | 3601 cfs from Colorado River (Lake Pleasant filling slowly at 5 cfs) | 34 cfs of **CAP water** into Arizona Canal | **<2** (<2) [<2] < 2 ** | 3.5 mg/L |
| Groundwater | Generally increasing due to recharge | 76 cfs pumping by SRP | 117 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 these taste and odor compounds in the CAP canal near 7th Street (Phoenix, AZ)

*****Concentration of DOC in the terminal reservoir

## SUMMARY: EVALUATION AND RECOMMENDATIONS

1. MIB plus geosmin levels above 10 ng/L in finished water lead to noticeable earthy-musty odors by customers. Currently MIB+geosmin levels are below 10 ng/L in the canals and treated water. However, concentrations are increasing already in Saguaro Lake. Cyclocitrol has been 5 to 10 ng/L for the past 3 months.

2. We discuss the effects of forest fires on water quality in the Salt River

3. We show long term trends in DOC concentrations in the reservoir systems as some cities consider ordering more CAP water, with lower DOC, into the SRP canal system.

## Taste and Odor Data

MIB plus geosmin levels above 10 ng/L in finished water lead to noticeable earthy-musty odors by customers. Currently MIB+geosmin levels are above 10 ng/L in the canals.

Water Supply Sources

June 7, 2011

| Sample Description | Location | MIB (ng/L) | Geosmin (ng/L) |
|---|---|---|---|
| Lake Pleasant (May11) | Eplimnion | <2.0 | <2.0 |
| Lake Pleasant (May11) | Hypolimnion | <2.0 | <2.0 |
| Verde River @ Beeline | | | |
| Bartlett Reservoir | Epilimnion | 9.0 | 3.3 |
| Bartlett Reservoir | Epi-near dock | 6.9 | 2.6 |
| Bartlett Reservoir | Hypolimnion | <2.0 | <2.0 |
| Salt River @ BluePt Bridge | | <2.0 | <2.0 |
| Saguaro Lake | Epilimnion | 9.4 | 4.5 |
| Saguaro Lake | Epi - Duplicate | 9.0 | 4.2 |
| Saguaro Lake | Epi-near dock | 7.0 | 3.4 |
| Saguaro Lake | Hypolimnion | 2.8 | <2.0 |
| Lake Havasu (May11) | | <2.0 | <2.0 |

May 3, 2011

| Sample Description | Location | MIB (ng/L) | Geosmin (ng/L) | Cyclocitral (ng/L) |
|---|---|---|---|---|
| Lake Pleasant (April11) | Eplimnion | <2.0 | <2.0 | <2.0 |
| Lake Pleasant (April11) | Hypolimnion | <2.0 | <2.0 | <2.0 |
| Verde River @ Beeline | | <2.0 | 2.3 | 4.9 |
| Bartlett Reservoir | Epilimnion | 2.3 | 6.0 | <2.0 |
| Bartlett Reservoir | Epi-near dock | <2.0 | <2.0 | <2.0 |
| Bartlett Reservoir | Hypolimnion | 2.3 | 4.2 | <2.0 |
| Salt River @ BluePt Bridge | | <2.0 | <2.0 | <2.0 |
| Saguaro Lake | Epilimnion | | | |
| Saguaro Lake | Epi - Duplicate | | | |
| Saguaro Lake | Epi-near dock | 13.0 | <2.0 | <2.0 |
| Saguaro Lake | Hypolimnion | | | |
| Lake Havasu (April11) | | <2.0 | <2.0 | <2.0 |
| Verde River at Tangle Creek (Mar11) | | <2.0 | 2.2 | <2.0 |

## Concentrations of MIB in canals WTP locations were < 3 ng/L

(data available upon request)

## Other T&O levels:

| System | Sample Description | May-11 | Jun-11 |
|---|---|---|---|
| CAP | Waddell Canal | <2.0 | <2.0 |
| | Union Hills Inlet | | |
| | CAP Canal at Cross-connect | | |
| | Salt River @ Blue Pt Bridge | <2.0 | 3.4 |
| | Verde River @ Beeline | <2.0 | |
| AZ | AZ Canal above CAP Cross-connect | <2.0 | 5.0 |
| Canal | AZ Canal below CAP Cross-connect | <2.0 | 7.1 |
| | AZ Canal at Highway 87 | <2.0 | 12.2 |
| | AZ Canal at Pima Rd. | <2.0 | 6.3 |
| | AZ Canal at 56th St. | <2.0 | 6.6 |
| | AZ Canal - Central Avenue | <2.0 | 5.1 |
| | AZ Canal - Inlet to Glendale WTP | 6.0 | <2.0 |
| South | South Canal below CAP Cross-connect | 6.1 | 6.7 |
| Tempe | Head of the Tempe Canal | <2.0 | 4.2 |
| Canals | Tempe Canal - Inlet to Tempe's South Plant | <2.0 | <2.0 |

## Organic Matter in Water Treatment Plants

**Table 2 - Water Treatment Plants –June 06, 2011**

| Sample Description | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN | | DOC removal (%) |
|---|---|---|---|---|---|---|
| Union Hills Inlet | 3.40 | 0.05 | 1.45 | 0.45 | | |
| Union Hills Treated | 2.99 | 0.03 | 0.99 | 0.42 | | 12 |
| Tempe North Inlet | 4.65 | 0.09 | 1.86 | 0.35 | | |
| Tempe North Plant Treated | 3.08 | 0.04 | 1.24 | 0.30 | | 34 |
| Tempe South WTP | 4.28 | 0.08 | 1.96 | 0.28 | | |
| Tempe South Plant Treated | 3.25 | 0.04 | 1.27 | 0.24 | | 24 |
| Greenway WTP Inlet | 4.30 | 0.08 | 1.86 | 0.51 | | |
| Greenway WTP Treated | 3.78 | 0.03 | 0.75 | 0.41 | | 12 |
| Glendale WTP Inlet | 4.89 | 0.09 | 1.77 | 0.50 | | |
| Glendale WTP Treated | 3.09 | 0.03 | 0.91 | 0.41 | | 37 |

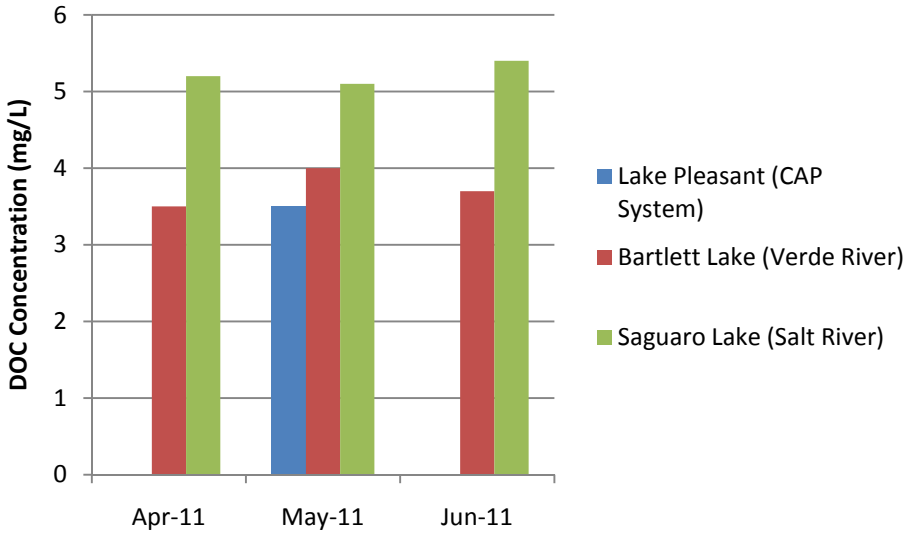
**DOC = Dissolved organic carbon**
**UV254 = ultraviolet absorbance at 254 nm (an indicator of aromatic carbon content)**
**SUVA = UV254/DOC**
**TDN = Total dissolved nitrogen (mgN/L)**

| Sample Description | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN |
|---|---|---|---|---|
| Waddell Canal | 3.40 | 0.05 | 1.45 | 0.45 |
| Union Hills Inlet | | | | |
| CAP Canal at Cross-connect | | | | |
| Salt River @ Blue Pt Bridge | 4.88 | 0.09 | 1.82 | 0.36 |
| Verde River @ Beeline | | | | |
| AZ Canal above CAP Cross-connect | 4.71 | 0.09 | 1.84 | 0.32 |
| AZ Canal below CAP Cross-connect | 4.32 | 0.08 | 1.82 | 0.32 |
| AZ Canal at Highway 87 | 4.69 | 0.08 | 1.78 | 0.30 |
| AZ Canal at Pima Rd. | 4.74 | 0.09 | 1.80 | 0.35 |
| AZ Canal at 56th St. | 4.57 | 0.08 | 1.86 | 0.35 |
| AZ Canal - Inlet to 24$^{th}$ Street WTP | | | | |
| AZ Canal - Central Avenue | 4.63 | 0.09 | 1.84 | 0.36 |
| AZ Canal - Inlet to Deer Valley WTP | | | | |
| AZ Canal - Inlet to Glendale WTP | 4.89 | 0.09 | 1.77 | 0.50 |
| AZ Canal - Inlet to Greenway WTP | 4.30 | 0.08 | 1.86 | 0.51 |
| South Canal below CAP Cross-connect | 4.44 | 0.09 | 1.96 | 0.31 |
| South Canal at Val Vista WTP | | | | |
| Head of the Tempe Canal | 4.36 | 0.08 | 1.93 | 0.44 |
| Tempe Canal - Inlet to Tempe's South Plant | 4.28 | 0.08 | 1.96 | 0.28 |

## Organic Matter In Reservoirs

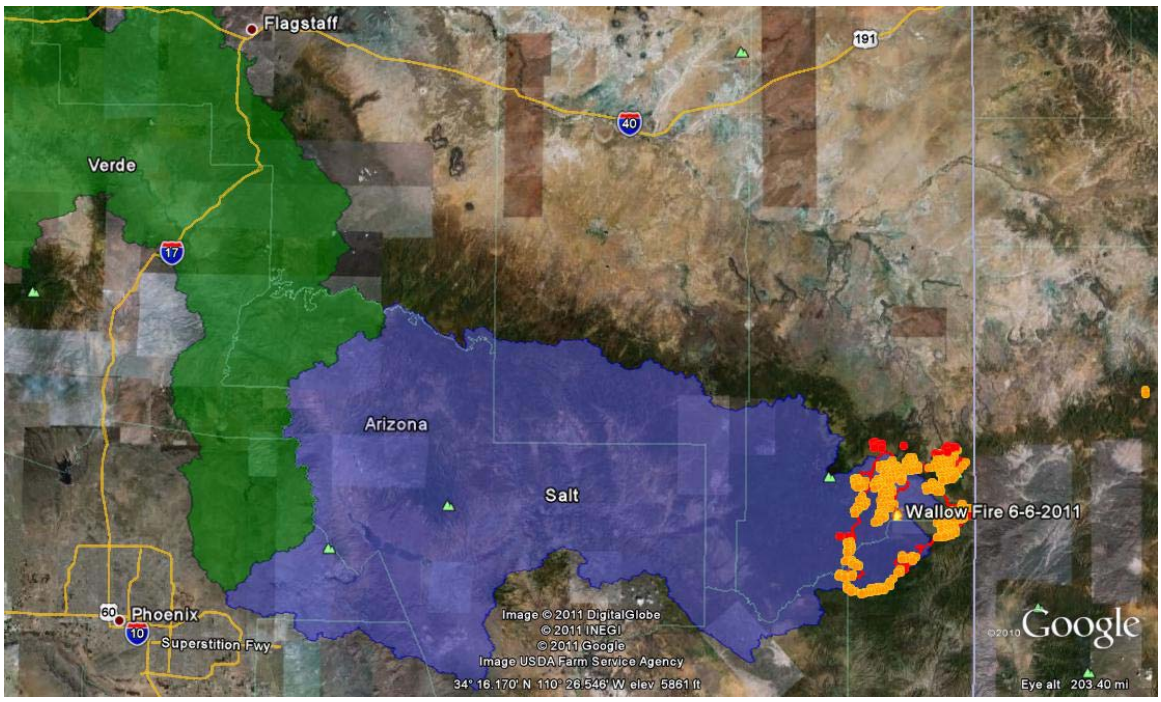
| Sample Description | Location | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN |
|---|---|---|---|---|---|
| Lake Pleasant (May 2011) | Eplimnion | **3.41** | **0.05** | **1.44** | **0.46** |
| Lake Pleasant (May 2011) | Hypolimnion | **3.51** | **0.05** | **1.39** | **0.40** |
| Verde River @ Beeline | | | | | |
| Bartlett Reservoir | Epilimnion | **3.62** | **0.07** | **1.93** | **0.27** |
| Bartlett Reservoir | Epi-near dock | | | | |
| Bartlett Reservoir | Hypolimnion | **3.71** | **0.07** | **2.02** | **0.38** |
| Salt River @ BluePt Bridge | | **4.88** | **0.09** | **1.82** | **0.36** |
| Saguaro Lake | Epilimnion | **5.60** | **0.09** | **1.61** | **0.42** |
| Saguaro Lake | Epi - Duplicate | **5.39** | **0.09** | **1.65** | **0.42** |
| Saguaro Lake | Epi-near doc | | | | |
| Saguaro Lake | Hypolimnion | **5.06** | **0.09** | **1.77** | **0.38** |
| Verde River at Tangle | | | | | |
| Havasu (May 2011) | | **3.02** | **0.05** | **1.51** | **0.58** |

## Four month Trend in DOC levels in the Reservoirs



# Effects of 2011 Forest Fires on Water Quality

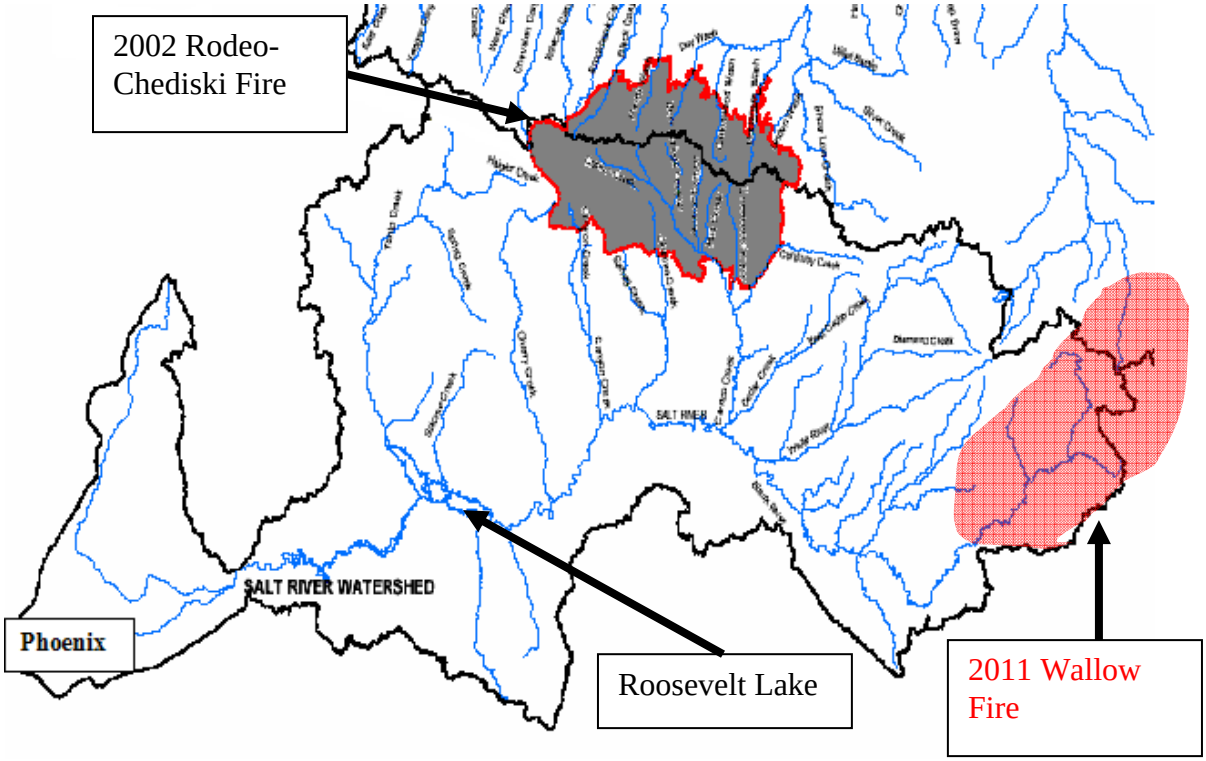
**The map below shows the portion of the Salt River watershed burning as of June 6, 2011.** The first has spread north and slightly southwest over the past week and burned more internal to the red outlined area. The Wallow fire is mostly within the Salt River watershed, and in the Black River subwatershed specifically. The Black River watershed is a productive area for water drainage from snowmelt and monsoons. This watershed is further away from Roosevelt Lake than the 2002 Rodeo-Chediski fire, but is still expected to release a "slug" of highly concentrated runoff when the monsoons start in July-September. As with the 2002 fires, there will not be a "slug" of nasty water coming to water treatment plants. Instead the "slug" will be diluted with water in Roosevelt and the other 4 reservoirs on the Salt River before being released into the Valley.




As a result of the Rodeo-Chediski fires in 2002 our team, funded by the regional water quality project, was able to conduct a 2 year study on the impacts of water quality on the Salt River watershed. Dramatic increases in DOC in the Salt River have been recognized (see next section) before/after these fires. This is due to two reasons. First, the drought itself kept organic matter on the watershed and out of the reservoir. When it rains organics are normally flushed into reservoirs. Prior to 2002 a prolonged drought had delivered less DOC essentially to the reservoirs. Second, runoff of nutrients, carbon and metals were definitely higher in the forest catchment on the Salt River than on the Verde River after the 2002 fires during the first few monsoon events. Then the watershed rapidly vegetated and started retaining sediments and nutrients. So moisture is good at solving the runoff problems. Details of our findings, and findings from a study we did

with partners in Colorado after a fire are available on our website as a MS thesis from Darla Gill 2004 (http://enpub.fulton.asu.edu/pwest/tasteandodor.htm )

Boundaries of the Rodeo-Chediski Fire in 2002 and area currently burning in the 2011 Wallow Fire. Runoff from the Wallow Fire will flow into the Black River which then enters the Salt River and flows into Roosevelt Reservoir.




## Table – Impacts of 2002 Rodeo-Chediski Fire on loadings into the Salt River Reservoir System

| Constituent | % Change 1 year post-fire<br>Salt River |
|---|---|
| Total Organic Carbon | 2x to 10x increase |
| Dissolved Organic Carbon | 2x to 10x increase |
| Total Phosphorus | >10x increase |
| Dissolved Phosphorus | 2x to 10x increase |
| Total Nitrogen | >10x increase |
| Ammonia | >10x increase |
| Nitrate-Nitrite | 2x to 10x increase |
| Suspended Sediment | 2x to 10x increase |
| Stream Discharge | Slight decrease |

# Long Term Trends in DOC
# For the Terminal Water Supply Reservoirs in metro-Phoenix

The graph below shows annual statistics in DOC levels for the 3 primary reservoir supplies. The bar and wisker diagrams show averages (middle line in box) and then different percentiles. Lake Pleasant is fairly constant, except in 2005 when heavy rains brought water and organics down the Aqua Fria River into Lake Pleasant. Bartlett Lake on the Verde River shows the greatest annual variability because of a lake of significant upstream storage to attenuate fluctuations from runoff. A gradual increase in DOC concentrations in Saguaro Lake, which is the lower most reservoir of 5 on the Salt River, has occurred since 2001.