# REGIONAL WATER QUALITY NEWSLETTER

**DATE: Report for January 2009**
**Sampling conducted January 5-6 2009**
**A Phoenix, Tempe, Glendale, 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. Welcome to 2009. We are fortunate to continue our project with funding from all supporting agencies. This newsletter includes some of our planned focuses for 2009.
2. WTPs on South canal are mostly down for maintenance.
3. T&O levels are low now in the winter
4. Water is being released from both Salt and Verde Rivers. DOC levels are roughly 3 mg/L in the SRP canals on the day of sampling, but rainfalls affected when/where the water was released from.
5. Some very high turbidity was observed during the late December rains. Snowpack levels are above average in the watershed too.
6. Our research focuses for 2009 are described.
7. Size exclusion chromatograms of organic carbon are presented with the aim of comparing watershed TOC sources to aid in improving TOC for reductions in DBP formation.
8. Breakfast with Quagga Mussels – see last page of this months newsletter

## Table 1 Summary of WTP Operations

| | Verde WTP | Union Hills | 24th Street WTP | N.Tempe J.G. Martinez | Deer Valley | Glendale Cholla WTP [3] | Peoria Greenway WTP | Val Vista | South Tempe |
|---|---|---|---|---|---|---|---|---|---|
| | Verde River | CAP Canal | Arizona Canal | | | | | South Canal | |
| PAC Type and Dose | | None | 10 ppm Calgon WPH | | 7.5 ppm Norit | | | | None |
| Copper Sulfate | | None | None | | None | | | | None |
| PreOxidation | | 0.5 ppm | None | | None | | | | None |
| Alum Dose<br>Alkalinity<br>pH | | 8.0 [1]<br>124<br>7.6 | 50<br>153/136<br>7.05 | | 48<br>162/130<br>8.4/7.2 | | | | 20<br>156<br>7.7 |
| Finished water DOC<br>DOC removal[2] | | | | | | | | | |
| Average turbidity over last 7 days | | 0.4 ntu | 9 to 24 ntu | | 10 to 173 ntu (peak up to 370 nt) | | | | 4.9 ntu |
| Recommendations | | | | | | | | Down until April 15th | |

[1] Ferric chloride instead of alum; plus 2.25 ppm sulfuric acid
[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 1**
**SRP/CAP OPERATIONS** - Values in cfs, for January 5, 2009

| System | SRP Diversions | CAP |
|---|---|---|
| Arizona Canal | 203 | 0 |
| South Canal | 114 | 0 |
| Pumping | 60 | 0 |
| Total | 377 | 0 |

- **SRP is releasing water from both Verde and Salt River Systems**. Salt River release from Saguaro Lake: 179 cfs; it is unusual to be releasing Salt River water this time of year. Verde River release from Bartlett Lake: 100 cfs.

The Snowpack in Arizona is above average this year (see table below from: http://www.wcc.nrcs.usda.gov/reports/UpdateReport.html?textReport=Arizona&textRptKey=2&textFormat=SNOTEL+Snowpack+Update+Report&StateList=2&RegionList=Select+a+Region+or+Basin&SpecialList=Select+a+Special+Report&MonthList=January++++++++&DayList=6&YearList=2009&FormatList=N&OutputFormatList=HTML&textMonth=January++++++++&textDay=6&CompYearList=select+a+year )

## Arizona SNOTEL Snowpack Update Report

Based on Mountain Data from NRCS SNOTEL Sites

**Provisional data, subject to revision**

Data based on the first reading of the day (typically 00:00) for Tuesday, January 06, 2009

| Basin Site Name | Elev (ft) | Snow Water Equivalent | | | | Percent of | |
|---|---|---|---|---|---|---|---|
| | | Current (in) | Today's Average (in) | Avg Peak (in) | Avg Peak Date | Today's Average | Avg Peak |
| **VERDE RIVER BASIN** | | | | | | | |
| BAKER BUTTE | 7300 | 7.3 | 2.7 | 5.9 | Feb 24 | 270 | 124 |
| FORT VALLEY | 7350 | 4.9 | N/A | N/A | N/A | * | * |
| FRY | 7200 | 8.6 | 3.2 | 7.2 | Feb 19 | 269 | 119 |
| HAPPY JACK | 7630 | 7.0 | 2.4 | 6.4 | Mar 09 | 292 | 109 |
| MORMON MOUNTAIN | 7500 | 8.4 | 2.9 | 6.9 | Mar 06 | 290 | 122 |
| MORMON MTN SUMMIT | 8500 | 10.8 | N/A | N/A | N/A | * | * |
| WHITE HORSE LAKE | 7180 | 7.1 | 2.5 | 5.4 | Feb 23 | 284 | 131 |
| **Basin-wide percent of average** | | | | | | **280** | **121** |
| **SAN FRANCISCO PEAKS** | | | | | | | |
| SNOWSLIDE CANYON | 9730 | 15.8 | 7.4 | 14.4 | Apr 04 | 214 | 110 |
| **Basin-wide percent of average** | | | | | | **214** | **110** |
| **CENTRAL MOGOLLON RIM** | | | | | | | |
| BAKER BUTTE | 7300 | 7.3 | 2.7 | 5.9 | Feb 24 | 270 | 124 |
| HEBER | 7640 | 9.3 | 2.9 | 5.5 | Feb 13 | 321 | 169 |
| PROMONTORY | 7930 | 14.0 | 5.4 | 13.1 | Mar 08 | 259 | 107 |
| **Basin-wide percent of average** | | | | | | **278** | **125** |
| **LITTLE COLORADO - SOUTHERN HEADWATERS** | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BALDY | 9125 | 8.4 | 3.9 | 8.3 | Mar 08 | 215 | 101 |
| MAVERICK FORK | 9200 | 11.5 | 4.7 | 10.3 | Mar 05 | 245 | 112 |
| **Basin-wide percent of average** | | | | | | **231** | **107** |
| **UPPER SALT RIVER BASIN / WHITE MOUNTAINS** | | | | | | | |
| BALDY | 9125 | 8.4 | 3.9 | 8.3 | Mar 08 | 215 | 101 |
| BEAVER HEAD | 7990 | 3.6 | 2.1 | 3.3 | Feb 11 | 171 | 109 |
| CORONADO TRAIL | 8400 | 3.9 | 2.2 | 3.5 | Feb 21 | 177 | 111 |
| HANNAGAN MEADOWS | 9020 | 6.8 | 6.1 | 12.5 | Mar 10 | 111 | 54 |
| MAVERICK FORK | 9200 | 11.5 | 4.7 | 10.3 | Mar 05 | 245 | 112 |
| NUTRIOSO | 8500 | 1.3 | N/A | N/A | N/A | * | * |
| WILDCAT | 7850 | 4.9 | 2.1 | 4.4 | Mar 02 | 233 | 111 |
| **Basin-wide percent of average** | | | | | | **185** | **92** |
| **SAN FRANCISCO RIVER BASIN** | | | | | | | |
| BEAVER HEAD | 7990 | 3.6 | 2.1 | 3.3 | Feb 11 | 171 | 109 |
| CORONADO TRAIL | 8400 | 3.9 | 2.2 | 3.5 | Feb 21 | 177 | 111 |
| HANNAGAN MEADOWS | 9020 | 6.8 | 6.1 | 12.5 | Mar 10 | 111 | 54 |
| FRISCO DIVIDE | 8000 | 3.3 | 1.6 | 3.1 | Feb 19 | 206 | 106 |
| SILVER CREEK DIVIDE | 9000 | 5.8 | 4.8 | 10.6 | Mar 16 | 121 | 55 |
| **Basin-wide percent of average** | | | | | | **139** | **71** |
| **UPPER GILA RIVER BASIN** | | | | | | | |
| LOOKOUT MOUNTAIN | 8500 | 1.7 | 3.0 | 3.5 | Jan 27 | 57 | 49 |
| SIGNAL PEAK | 8360 | 3.5 | 2.9 | 5.6 | Feb 19 | 121 | 63 |
| SILVER CREEK DIVIDE | 9000 | 5.8 | 4.8 | 10.6 | Mar 16 | 121 | 55 |
| **Basin-wide percent of average** | | | | | | **103** | **56** |

-M = Missing data.; * = Analysis may not provide a valid measure of conditions.
N/A = No average available.

The Snow Water Equivalent PERCENT OF AVERAGE represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day.
The Snow Water Equivalent PERCENT OF MAXIMUM AVERAGE represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the maximum average value for those sites.

Reference period for average conditions is 1971-2000.

## Table 2 - Water Treatment Plants – January 5, 2009

| Sample Description | MIB (ng/L) | Geosmin (ng/L) | Cyclocitral (ng/L) |
|---|---|---|---|
| 24th Street WTP Inlet | **<2.0** | **2.1** | **8.1** |
| 24th Street WTP Treated | **<2.0** | **<2.0** | **5.7** |
| Deer Valley Inlet | **<2.0** | **<2.0** | **5.7** |
| Deer Valley WTP Treated | **<2.0** | **<2.0** | **7.5** |
| Val Vista Inlet | **<2.0** | **<2.0** | **<2.0** |
| Val Vista WTP Treated –East | | | |
| Val Vista WTP Treated -West | | | |
| Union Hills Inlet | **2.3** | **<2.0** | **3.1** |
| Union Hills Treated | **<2.0** | **<2.0** | **<2.0** |
| Tempe North Inlet | | | |
| Tempe North Plant Treated | | | |
| Tempe South WTP | **2.5** | **2.0** | **2.6** |
| Tempe South Plant Treated | **2.5** | **2.0** | **2.3** |
| Greenway WTP Inlet | | | |
| Greenway WTP Treated | | | |
| Glendale WTP Inlet | **2.2** | **2.0** | **<2.0** |
| Glendale WTP Treated | **<2.0** | **<2.0** | **3.4** |
| Glendale WTP Treated (Lab) | | | |

## Table 3 - Canal Sampling – January 5, 2009

| System | Sample Description | MIB (ng/L) | Geosmin (ng/L) | Cyclocitral (ng/L) |
|---|---|---|---|---|
| CAP | Waddell Canal | **<2.0** | **<2.0** | **<2.0** |
| | Union Hills Inlet | **2.3** | **<2.0** | **3.1** |
| | CAP Canal at Cross-connect | | | |
| AZ Canal | Salt River @ Blue Pt Bridge | | | |
| | Verde River @ Beeline | **2** | **<2.0** | **2.2** |
| | AZ Canal above CAP Cross-connect | **2.5** | **<2.0** | **2.4** |
| | AZ Canal below CAP Cross-connect | **2.0** | **<2.0** | **2.7** |
| | AZ Canal at Highway 87 | **2.1** | **<2.0** | **2.2** |
| | AZ Canal at Pima Rd. | **<2.0** | **2.2** | **4.7** |
| | AZ Canal at 56th St. | **<2.0** | **<2.0** | **9.3** |
| | AZ Canal - Inlet to 24th Street WTP | **<2.0** | **2.1** | **8.1** |
| | AZ Canal - Central Avenue | **2.2** | **<2.0** | **4** |
| | AZ Canal - Inlet to Deer Valley WTP | **<2.0** | **<2.0** | **5.7** |
| | AZ Canal - Inlet to Glendale WTP | **2.2** | **2.0** | **<2.0** |
| South and Tempe Canals | South Canal below CAP Cross-connect | | | |
| | South Canal at Val Vista WTP | **<2.0** | **<2.0** | **<2.0** |
| | Head of the Tempe Canal | **2.2** | **2.0** | **3.6** |
| | Tempe Canal - Inlet to Tempe's South Plant | **2.5** | **2.0** | **2.6** |

## Table 4 - Reservoir Samples – January 6, 2009

| Sample Description | Location | MIB (ng/L) | Geosmin (ng/L) | Cyclocitral (ng/L) |
|---|---|---|---|---|
| Lake Pleasant (Dec08) | Eplimnion | **4.4** | **<2.0** | **<2.0** |
| Lake Pleasant (Dec08) | Hypolimnio | **4.5** | **<2.0** | **<2.0** |
| Verde River @ Beeline | | **2.0** | **3.6** | **2.2** |
| Bartlett Reservoir | Epilimnion | **<2.0** | **<2.0** | **2.2** |
| Bartlett Reservoir | Epi-near dock | **<2.0** | **<2.0** | **<2.0** |
| Bartlett Reservoir | Hypolimnio | **<2.0** | **<2.0** | **4.4** |
| Salt River @ BluePt Bridge | | | | |
| Saguaro Lake | Epilimnion | **2.0** | **<2.0** | **<2.0** |
| Saguaro Lake | Epi - Duplicate | **2.1** | **<2.0** | **2.5** |
| Saguaro Lake | Epi-near doc | **2.3** | **<2.0** | **2.2** |
| Saguaro Lake | Hypolimnio | **<2.0** | **<2.0** | **2.4** |
| R20 (Oct/08) | | **8.6** | **<2.0** | **<2.0** |
| R20 (Nov/08) | | **<2.0** | **<2.0** | **<2.0** |

## Organic Matter Status In the Treatment Plants

**Table - Water Treatment Plants – January 05, 2009**

| Sample Description | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN | DOC removal (%) |
|---|---|---|---|---|---|
| 24th Street WTP Inlet | **3.08** | **0.069** | **2.25** | **0.66** | |
| 24th Street WTP Treated | **2.27** | **0.034** | **1.48** | **0.60** | **26** |
| Deer Valley Inlet | **3.33** | **0.078** | **2.33** | **0.64** | |
| Deer Valley WTP Treated | **2.41** | **0.041** | **1.68** | **0.54** | **27** |
| Val Vista Inlet | **3.02** | **0.076** | **2.52** | **0.54** | |
| Val Vista WTP Treated –East | | | | | |
| Val Vista WTP Treated -West | | | | | |
| Union Hills Inlet | **2.69** | **0.041** | **1.53** | **0.58** | |
| Union Hills Treated | **2.20** | **0.023** | **1.03** | **0.49** | **18** |
| Tempe North Inlet | | | | | |
| Tempe North Plant Treated | | | | | |
| Tempe South WTP | **3.45** | **0.083** | **2.41** | **0.43** | |
| Tempe South Plant Treated | **2.94** | **0.061** | **2.07** | **0.50** | **15** |
| Greenway WTP Inlet | | | | | |
| Greenway WTP Treated | | | | | |
| Glendale WTP Inlet | **3.24** | **0.079** | **2.42** | **0.64** | |
| Glendale 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)**

## Organic Matter Status In the Canals

| Sample Description | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN |
|---|---|---|---|---|
| Waddell Canal | 2.66 | 0.039 | 1.46 | 0.58 |
| Union Hills Inlet | 2.69 | 0.041 | 1.53 | 0.58 |
| CAP Canal at Cross-connect | | | | |
| Salt River @ Blue Pt Bridge | | | | |
| Verde River @ Beeline | 2.30 | 0.068 | 2.95 | 0.62 |
| AZ Canal above CAP Cross-connect | 3.28 | 0.084 | 2.56 | 0.54 |
| AZ Canal below CAP Cross-connect | 3.30 | 0.085 | 2.57 | 0.55 |
| AZ Canal at Highway 87 | 3.01 | 0.070 | 2.31 | 0.49 |
| AZ Canal at Pima Rd. | 3.08 | 0.071 | 2.31 | 0.64 |
| AZ Canal at 56th St. | 2.99 | 0.068 | 2.29 | 0.63 |
| AZ Canal - Inlet to 24$^{th}$ Street WTP | 3.08 | 0.069 | 2.25 | 0.66 |
| AZ Canal - Central Avenue | 3.39 | 0.077 | 2.26 | 0.80 |
| AZ Canal - Inlet to Deer Valley WTP | 3.33 | 0.078 | 2.33 | 0.64 |
| AZ Canal - Inlet to Glendale WTP | 3.24 | 0.079 | 2.42 | 0.64 |
| AZ Canal - Inlet to Greenway WTP | | | | |
| South Canal below CAP Cross-connect | | | | |
| South Canal at Val Vista WTP | 3.02 | 0.076 | 2.52 | 0.54 |
| Head of the Tempe Canal | 3.35 | 0.081 | 2.40 | 0.46 |
| Tempe Canal - Inlet to Tempe's South Plant | 3.45 | 0.083 | 2.41 | 0.43 |
| Chandler WTP – Inlet | | | | |

## Organic Matter Status In the Watershed

| Sample Description | Location | DOC (mg/L) | UV254 (1/cm) | SUVA (L/mg-m) | TDN |
|---|---|---|---|---|---|
| Lake Pleasant (Dec 2008) | Eplimnion | **3.13** | **0.048** | **1.53** | **0.43** |
| Lake Pleasant (Dec 2008) | Hypolimnio | **3.15** | **0.048** | **1.52** | **0.41** |
| Verde River @ Beeline | | **2.30** | **0.068** | **2.95** | **0.62** |
| Bartlett Reservoir | Epilimnion | **3.05** | **0.083** | **2.72** | **0.44** |
| Bartlett Reservoir | Epi-near dock | | | | |
| Bartlett Reservoir | Hypolimnio | **3.35** | **0.083** | **2.49** | **0.52** |
| Salt River @ BluePt Bridge | | | | | |
| Saguaro Lake | Epilimnion | **4.94** | **0.114** | **2.30** | **0.71** |
| Saguaro Lake | Epi - Duplicate | **4.80** | **0.112** | **2.34** | **0.65** |
| Saguaro Lake | Epi-near doc | | | | |
| Saguaro Lake | Hypolimnio | **4.75** | **0.112** | **2.35** | **0.58** |
| Verde River at Tangle | Nov-09 | **1.00** | **0.020** | **2.00** | **0.09** |
| Havasu | Nov-09 | **2.87** | **0.040** | **1.40** | **0.64** |

Nitrogen levels and organic carbon levels remain higher in the Salt River system compared with the Verde River system. Over the next month we will be sampling all of the Salt River reservoirs for organic matter analysis.

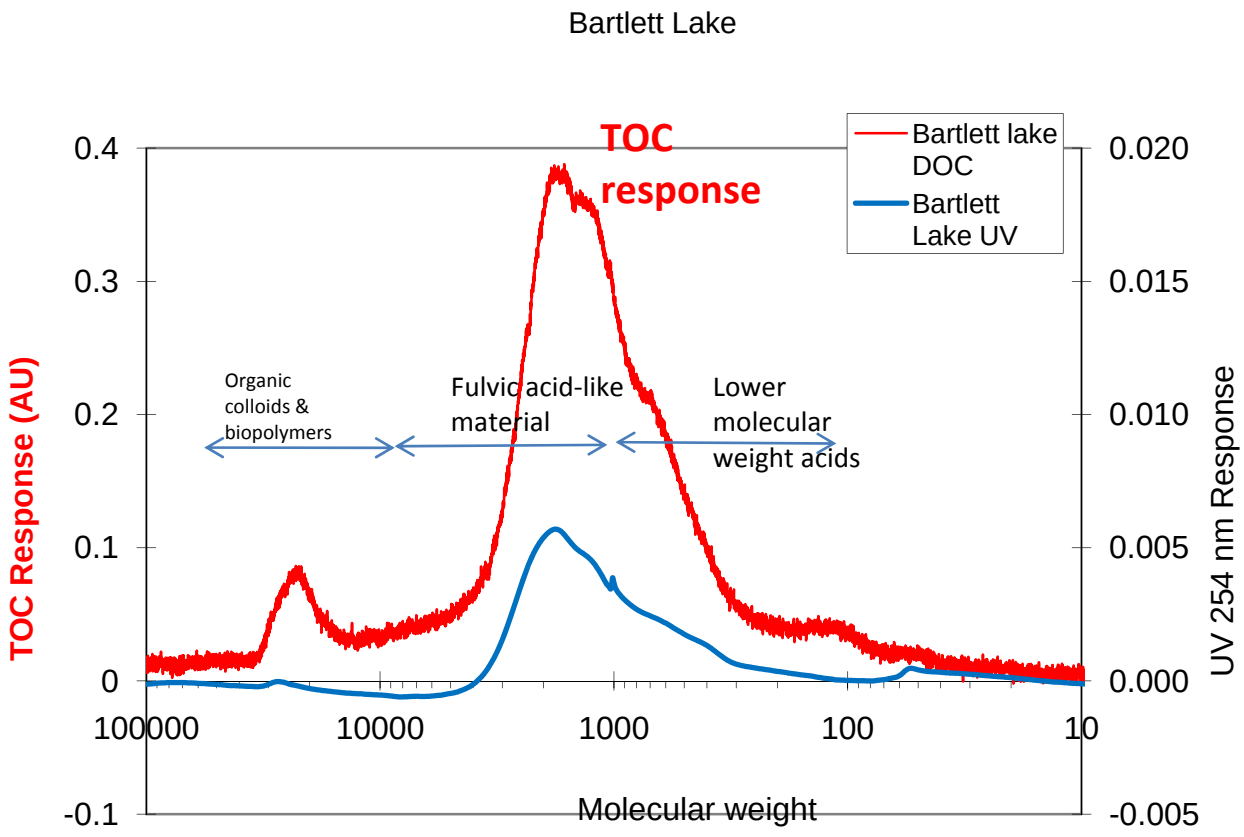
### Research Focus for 2009

1. Continue baseline regional monitoring of watershed, canals and treatment facilities for T&O compounds, organics, nutrients and conductance (and other water quality).
2. Continue analysis of pharmaceuticals in source waters and potential to remove them during activated carbon treatment.
3. Disinfection byproduct research
    a. Investigate easy & rapid measurement assays for THMs
    b. Assess impact of Las Vegas wastewater discharge options on DBP precursors in the CAP system
    c. Assess colorimetric assays to identify DBP-reactive portions of organic matter and assess their removal during water treatment and within the watershed
    d. Collaborate with an Arizona Water Institute project on riverbank filtration for central Arizona water supplies.
    e. Removal of DBP precursors by GAC treatment
4. Other ideas that are important to your utility should be brought to our attention

**Characterization of Organic Matter in our Watershed**

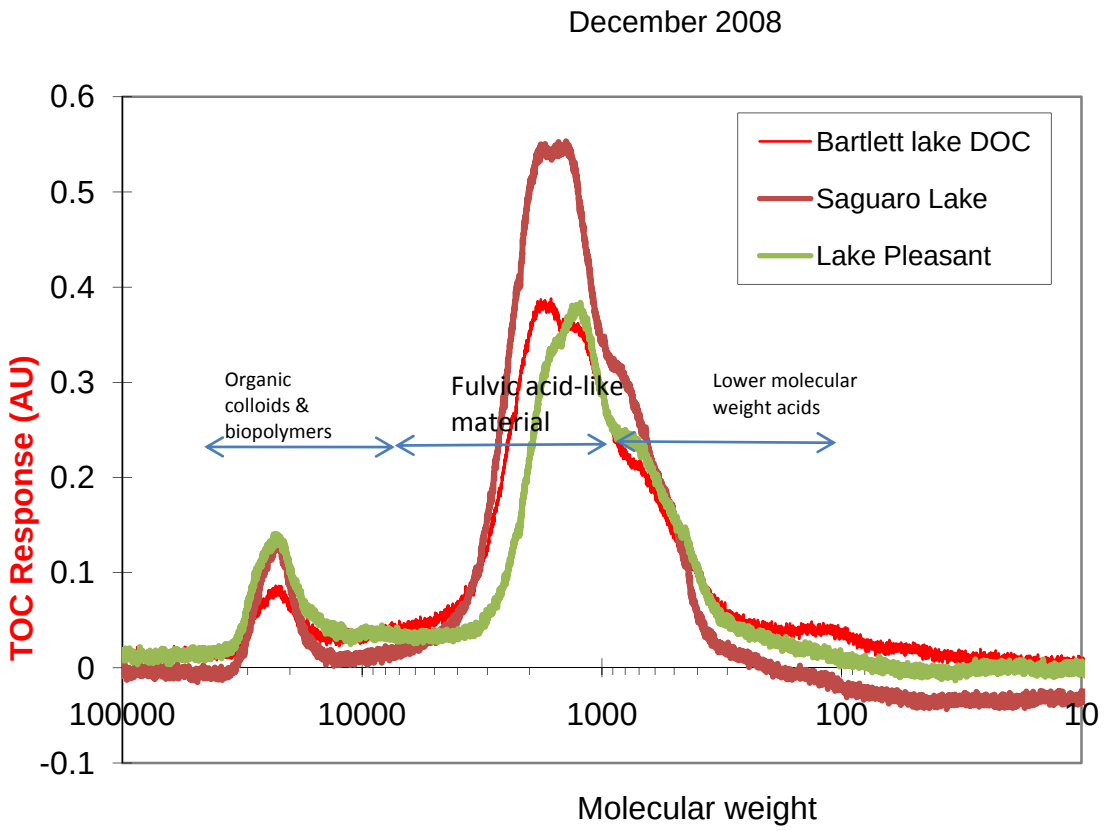
We now have the capability to do size-exclusion chromatography with on-line TOC detection of water samples. This is allowing us to "fingerprint" different molecular sizes of TOC in the watershed and removal during water treatment. This is an important step in understanding how TOC from different watersheds can be treated and affect DBP formation. Examples are given below.

The SEC-TOC and SEC-UV chromatogram below is for Bartlett Lake. In red is the organic carbon response and in blue is the UV absorbance at 254 nm response. From left to right on the x-axis is the molecular weights of the organic matter. High molecular weight organic colloids and biopolymers exhibit a TOC response, but no UV254 response. Fulvic –acid like materials are moderately high molecular weight and exhibit both UV and TOC response (i.e., higher SUVA). Lower molecular weight organics have less UV response (i.e., lower SUVA).



We can also integrate the area under the curve to represent the amount of TOC response for different molecular weight ranges. The table below compares Bartlett Lake against the other major surface water sources; the plots for this data are shown below too. Together the results show that Lake Pleasant (CAP water) has a higher organic colloid content and more lower molecular weight organics than the SRP supplies. Saguaro Lake on the Salt River has the highest TOC response and higher molecular weight materials.

| | Percentage TOC response in each region | | |
|---|---|---|---|
| Molecular weight Range | Bartlett Lake | Lake Pleasant | Saguaro Lake |
| 10,000 to 50,000 | 9% | 14% | 7% |
| 1,000 to 10,000 | 58% | 49% | 66% |
| 300 to 1,000 | 27% | 32% | 27% |
| 100 to 300 | 7% | 4% | 0% |



**WHAT:** AzSCE Water Resources Technical Committee
Monthly Breakfast Meeting / Presentation

**WHEN:** Thursday, January 15, 2009 @ 7:15 AM
* Presentation Begins at 7:30 AM *

**WHERE:** Salt River Project cafeteria
1521 North Project Drive (One block East of Van Buren / Priest)

**WHO:** Al Graves, P.E., Senior Civil Maintenance Engineer, Central Arizona Project

Al graduated from Arizona State University with a BS in Civil Engineering in 1974. He spent the next 31 years working for various U.S. Government agencies, spending most of his career with the U.S. Bureau of Reclamation. His Reclamation activities included designing the water operation and control schemes for the Central Arizona Project (CAP), providing technical assistance to the Egyptian Ministry of Public Works and Water Resources, and managing Reclamation's Dam Safety inspection program. He spent the last ten years of his Reclamation career heading up Reclamation's rope access team, inspecting most of the major dams in Reclamation's inventory.

Al retired from the U.S. Government in September 2005 and returned to the CAP as a Maintenance Engineer. He has provided CAP with the benefit of his varied water resource experiences and was tasked with managing CAP's Quagga Mussel Program when the mussels were discovered in Lake Mead in January 2007.

**TOPIC:** How CAP is Facing the Quagga Mussel Invasion

Al will provide a brief overview of CAP's Quagga Mussel Program and some background on the Quagga Mussel infestation, and then discuss the potential impact of the mussels on CAP's ability to deliver water and its monitoring efforts. Information on current research efforts by Reclamation and others as well as potential biological solutions will also be presented.