SUMMARY: EVALUATION AND RECOMMENDATIONS

1. SRP is releasing nearly 75% Salt River water and 25% Verde River water now into the SRP canals.
2. Saguaro Lake Reservoir very high levels of geosmin, which could impact WTPs next month.
3. Some WTPs are already adding powder activated carbon – not for T&O control, but for controlling DBP formation.
4. THM formation is almost a perfect linear relationship with chlorine consumed, across all three water sources. Therefore, keeping track of CHLORINE CONSUMPTION (Dose minus residual) is an EXCELLENT indicator for TTHM formation. This tests clearly indicate that Salt River water has the highest DBP formation potential, even after alum coagulation.
5. Iodide occurrence may be important for utilities considering conversion from free chlorine to chloramines. A discussion is provided.
6. A turbidity spike may be coming down the CAP canal.
7. The April 2007 newsletter from the Arizona Water Institute is attached.
8. Happy tax-time.
Table 1 Summary of WTP Operations

<table>
<thead>
<tr>
<th>Location</th>
<th>Union Hills</th>
<th>24th Street WTP</th>
<th>N.Tempe J.G. Martinez</th>
<th>Deer Valley</th>
<th>Greenway WTP</th>
<th>Val Vida</th>
<th>South Tempe</th>
<th>Chandler WTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAP</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Norit 14 ppm</td>
<td>None</td>
<td>Norit 20B</td>
<td>8 ppm</td>
</tr>
<tr>
<td>PAC Type and Dose</td>
<td>None</td>
<td>None</td>
<td>Norit</td>
<td>None</td>
<td>None</td>
<td>Ozone = 1.1 mg/L</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Copper Sulfate</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>0.25 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PreOxidation</td>
<td>None</td>
<td>None</td>
<td>Ozone</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alum Dose</td>
<td>7.78 †</td>
<td>44.6</td>
<td>13</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkalinity</td>
<td>132/113</td>
<td>147/109</td>
<td>136</td>
<td>170</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.2</td>
<td>6.9</td>
<td>7.5</td>
<td>7.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished water DOC</td>
<td>2.0 mg/L</td>
<td>2.1 mg/L</td>
<td>2.0 mg/L</td>
<td>2.2 mg/L</td>
<td>0.6 mg/L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOC removal †</td>
<td>16%</td>
<td>34%</td>
<td>30%</td>
<td>34%-39%</td>
<td>16%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WTP plant comments</td>
<td>Plant is OFF line</td>
<td>Plant is OFF line</td>
<td></td>
<td>Reports 39.5% TOC removal (TOC=4.25 and DOC = 4.28)</td>
<td>TTHM at plant are 28 ug/L</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† 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 – April 9, 2007

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>MIB (ng/L)</th>
<th>Geosmin (ng/L)</th>
<th>Cyclocitral (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24th Street WTP Inlet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24th Street WTP Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Deer Valley Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Deer Valley WTP Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Val Vista Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Val Vista WTP Treated –East</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Val Vista WTP Treated -West</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Union Hills Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Union Hills Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Tempe North Inlet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tempe North Plant Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Tempe South WTP</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Tempe South Plant Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Tempe South Plant Treated (Lab)</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Chandler WTP Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Chandler WTP Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Greenway WTP Inlet</td>
<td>&lt;2.0</td>
<td>2.5</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Greenway WTP Treated</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>System</td>
<td>Sample Description</td>
<td>MIB (ng/L)</td>
<td>Geosmin (ng/L)</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------</td>
<td>------------</td>
<td>----------------</td>
</tr>
<tr>
<td>CAP</td>
<td>Waddell Canal</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>Union Hills Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>CAP Canal at Cross-connect</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>AZ Canal</td>
<td>Salt River @ Blue Pt Bridge</td>
<td>&lt;2.0</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>Verde River @ Beeline</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal above CAP Cross-connect</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal below CAP Cross-connect</td>
<td>&lt;2.0</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at Highway 87</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at Pima Rd.</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at 56th St.</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Inlet to 24th Street WTP</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Central Avenue</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Inlet to Deer Valley WTP</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Inlet to Greenway WTP</td>
<td>&lt;2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>South and Tempe Canals</td>
<td>South Canal below CAP Cross-connect</td>
<td>&lt;2.0</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>South Canal at Val Vista WTP</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>Head of the Tempe Canal</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>Tempe Canal - Inlet to Tempe's South Plant</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td></td>
<td>Chandler WTP – Inlet</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
</tbody>
</table>
Table 4 - Reservoir Samples – April 9, 2007

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Location</th>
<th>MIB (ng/L)</th>
<th>Geosmin (ng/L)</th>
<th>Cyclocitral (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Pleasant (April 3, 2007)</td>
<td>Eplimnion</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Lake Pleasant</td>
<td>Hypolimnion</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Verde River @ Beeline</td>
<td></td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Epilimnion</td>
<td>8.6</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Epi-near dock</td>
<td>9.6</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Hypolimnion</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Salt River @ BluePt Bridge</td>
<td>Eplimnion</td>
<td>&lt;2.0</td>
<td>5.4</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Epi-Duplicate</td>
<td>&lt;2.0</td>
<td>366.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Epi-near doc</td>
<td>&lt;2.0</td>
<td>312.0</td>
<td>5.4</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Hypolimnion</td>
<td>&lt;2.0</td>
<td>11.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Verde River at Tangle (March 28, 2007)</td>
<td></td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Havasu (March 28, 2007)</td>
<td></td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
<td>&lt;2.0</td>
</tr>
</tbody>
</table>

Geosmin concentrations in Saguaro Lake in the upper 10 meters of the water column (Eplimnion) and deeper parts of the water column (hypolimnion). Water from the hypolimnion is released downstream to the Salt River, SRP Canals, and then to the water treatment plants.

Geosmin levels have increased dramatically over the past month. One reason for this may be that SRP is releasing water from Canyon Lake for repairs on the dam this year. As a result, this water may be moving through Saguaro Lake with minimal mixing.
Table 5 - SRP/CAP OPERATIONS
Values in cfs, for April 9, 2007

<table>
<thead>
<tr>
<th>System</th>
<th>SRP Diversions</th>
<th>CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona Canal</td>
<td>441</td>
<td>194</td>
</tr>
<tr>
<td>South Canal</td>
<td>376</td>
<td>0</td>
</tr>
<tr>
<td>Pumping</td>
<td>609</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1426</td>
<td>194</td>
</tr>
</tbody>
</table>

SRP is releasing water from both Verde and Salt River Systems. Salt River release from Saguaro Lake: 492 cfs; Verde River release from Bartlett Lake: 108 cfs.

New Feature Section: For Salt Sakes

This section will periodically give updates on salinity related issues in the valley. If you have something to add, please send it along.

There was a question regarding the iodide concentration in the source water, because iodide can affect disinfection byproduct formation (see later in this Newsletter). Even low concentrations of iodide can be important. To our knowledge there is NOT good iodide concentration data in the SRP or CAP system. There are 2 basic approaches to measuring. The first and most accurate is ICP/MS/MS for total iodine (Reference: Germanium dioxide as internal standard for simplified trace determination of bromate, bromide, iodate and iodide by on-line coupling ion chromatography-inductively coupled plasma mass spectrometry, JOURNAL OF CHROMATOGRAPHY A 1050 (1): 103-109 SEP 24 2004). Some iodine may be tied up in organic matrices though, but this give a good overall number. We used this on a recent AwwaRF project for wastewaters. The second is a high sensitivity Ion Chromatography method where Iodide and iodate can be determined by two new methods using anion-exchange chromatography with postcolumn reaction and UV/visible detection. Iodide is determined as IBr2 - at 249 nm. The detection limits for iodide and iodate are 0.1 ìg/L (reference: Determination of Iodide and Iodate by Ion Chromatography with Postcolumn Reaction and UV/Visible Detection, Yves Bichsel and Urs von Gunten, Anal. Chem. 1999, 71, 34-38)

Total iodine concentrations in water resources are usually in the range of 0.5-20 mg/L but can exceed 50 mg/L in certain groundwaters. Here is an ongoing project sponsored by AwwaRF:

**Project Snapshot**: Iodinated Acids and Iodide in Drinking Water Supplies: Method Development for Nanogram-per-Liter Levels of Detection Relevant for Application in Occurrence Surveys #3175

**Project Summary**: Will develop robust analytical methods for iodide at sub microgram-per-liter levels and iodinated acids at nanogram-per-liter levels that can be used to determine occurrence levels in the U.S. drinking water supply.

**Contractor**: University of North Carolina at Chapel Hill

**Project Manager**: Dianette Khiari

**Funded**: 2005  **Completion Date**: 12/1/2009  **Funding Amount**: $208,000.00
Table 6 - Water Treatment Plants – March 9, 2007

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>DOC (mg/L)</th>
<th>UV254 (1/cm)</th>
<th>SUVA</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>24th Street WTP Inlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24th Street WTP Treated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deer Valley Inlet</td>
<td>3.17</td>
<td>0.062</td>
<td>2.0</td>
<td>1.016</td>
</tr>
<tr>
<td>Deer Valley WTP Treated</td>
<td>2.08</td>
<td>0.029</td>
<td>1.4</td>
<td>0.881</td>
</tr>
<tr>
<td>Val Vista Inlet</td>
<td>3.54</td>
<td>0.0805</td>
<td>2.28</td>
<td>0.309</td>
</tr>
<tr>
<td>Val Vista WTP Treated –East</td>
<td>2.33</td>
<td>0.0462</td>
<td>1.99</td>
<td>0.264</td>
</tr>
<tr>
<td>Val Vista WTP Treated -West</td>
<td>2.17</td>
<td>0.0341</td>
<td>1.57</td>
<td>0.241</td>
</tr>
<tr>
<td>Union Hills Inlet</td>
<td>2.41</td>
<td>0.037</td>
<td>1.53</td>
<td>0.600</td>
</tr>
<tr>
<td>Union Hills Treated</td>
<td>2.01</td>
<td>0.019</td>
<td>0.94</td>
<td>0.579</td>
</tr>
<tr>
<td>Tempe North Inlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tempe North Plant Treated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tempe South WTP</td>
<td>0.72</td>
<td>0.0141</td>
<td>1.97</td>
<td>2.818</td>
</tr>
<tr>
<td>Tempe South Plant Treated</td>
<td>0.60</td>
<td>0.0094</td>
<td>1.57</td>
<td>2.561</td>
</tr>
<tr>
<td>Chandler WTP Inlet</td>
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<tr>
<td>Chandler WTP Treated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greenway WTP Inlet</td>
<td>2.78</td>
<td>0.058</td>
<td>2.1</td>
<td>1.822</td>
</tr>
<tr>
<td>Greenway WTP Treated</td>
<td>1.96</td>
<td>0.021</td>
<td>1.1</td>
<td>1.266</td>
</tr>
</tbody>
</table>

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)

Tempe south plant has high TDN and low DOC/UVA, I did notice quite a bit of algal growth in the sedimentation basins. The ammonia concentrations are low (<0.02 NH3-N), and this TDN is mostly nitrate from the groundwater wells. The MCL for nitrate is 10 mg-NO3-N/L. Groundwater contains low DOC, and is unlikely to form substantial levels of DBPs.
Table 7 - Canal Sampling – March 9, 2007

<table>
<thead>
<tr>
<th>System</th>
<th>Sample Description</th>
<th>DOC (mg/L)</th>
<th>UV254 (1/cm)</th>
<th>SUVA</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAP</td>
<td>Waddell Canal</td>
<td>2.53</td>
<td>0.0381</td>
<td>1.51</td>
<td>0.070</td>
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<tr>
<td></td>
<td>Union Hills Inlet</td>
<td>2.41</td>
<td>0.0367</td>
<td>1.53</td>
<td>0.600</td>
</tr>
<tr>
<td></td>
<td>CAP Canal at Cross-connect</td>
<td>2.41</td>
<td>0.0373</td>
<td>1.55</td>
<td>0.611</td>
</tr>
<tr>
<td>AZ</td>
<td>Salt River @ Blue Pt Bridge</td>
<td>4.21</td>
<td>0.1008</td>
<td>2.39</td>
<td>0.303</td>
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<tr>
<td>Canal</td>
<td>Verde River @ Beeline</td>
<td>1.54</td>
<td>0.0466</td>
<td>3.04</td>
<td>0.314</td>
</tr>
<tr>
<td></td>
<td>AZ Canal above CAP Cross-connect</td>
<td>3.83</td>
<td>0.0883</td>
<td>2.31</td>
<td>0.273</td>
</tr>
<tr>
<td></td>
<td>AZ Canal below CAP Cross-connect</td>
<td>3.14</td>
<td>0.0625</td>
<td>1.99</td>
<td>0.451</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at Highway 87</td>
<td>3.38</td>
<td>0.0661</td>
<td>1.96</td>
<td>0.421</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at Pima Rd.</td>
<td>3.40</td>
<td>0.0669</td>
<td>1.97</td>
<td>0.426</td>
</tr>
<tr>
<td></td>
<td>AZ Canal at 56th St.</td>
<td>3.30</td>
<td>0.0668</td>
<td>2.03</td>
<td>0.475</td>
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<tr>
<td></td>
<td>AZ Canal - Inlet to 24th Street WTP</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Central Avenue</td>
<td>3.23</td>
<td>0.0666</td>
<td>2.06</td>
<td>0.580</td>
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<td></td>
<td>AZ Canal - Inlet to Deer Valley WTP</td>
<td>3.17</td>
<td>0.0620</td>
<td>1.96</td>
<td>1.016</td>
</tr>
<tr>
<td></td>
<td>AZ Canal - Inlet to Greenway WTP</td>
<td>2.78</td>
<td>0.0583</td>
<td>2.10</td>
<td>1.822</td>
</tr>
<tr>
<td>South</td>
<td>South Canal below CAP Cross-connect</td>
<td>3.71</td>
<td>0.0897</td>
<td>2.41</td>
<td>0.290</td>
</tr>
<tr>
<td>and</td>
<td>South Canal at Val Vista WTP</td>
<td>3.54</td>
<td>0.0805</td>
<td>2.28</td>
<td>0.309</td>
</tr>
<tr>
<td>Tempe</td>
<td>Head of the Tempe Canal</td>
<td>1.47</td>
<td>0.0285</td>
<td>1.94</td>
<td>1.283</td>
</tr>
<tr>
<td>Canals</td>
<td>Tempe Canal - Inlet to Tempe's South Plant</td>
<td>0.72</td>
<td>0.0141</td>
<td>1.97</td>
<td>2.818</td>
</tr>
<tr>
<td></td>
<td>Chandler WTP – Inlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8 - Reservoir Samples – March 9, 2007

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Location</th>
<th>DOC (mg/L)</th>
<th>UV254 (1/cm)</th>
<th>SUVA</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Pleasant</td>
<td>Epilimnion</td>
<td>2.90</td>
<td>0.0442</td>
<td>1.53</td>
<td>0.372</td>
</tr>
<tr>
<td>Lake Pleasant</td>
<td>Hypolimnio</td>
<td>2.87</td>
<td>0.0444</td>
<td>1.55</td>
<td>0.388</td>
</tr>
<tr>
<td>Verde River @ Beeline</td>
<td></td>
<td>1.54</td>
<td>0.0466</td>
<td>3.03</td>
<td>0.314</td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Epilimnion</td>
<td>1.74</td>
<td>0.0384</td>
<td>2.20</td>
<td>0.191</td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Epi-near dock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bartlett Reservoir</td>
<td>Hypolimnio</td>
<td>1.80</td>
<td>0.0439</td>
<td>2.44</td>
<td>0.201</td>
</tr>
<tr>
<td>Salt River @ BluePt Bridge</td>
<td></td>
<td>4.21</td>
<td>0.1008</td>
<td>2.39</td>
<td>0.303</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Epilimnion</td>
<td>5.13</td>
<td>0.1035</td>
<td>2.01</td>
<td>0.372</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Epi-Duplicate</td>
<td>4.99</td>
<td>0.1010</td>
<td>2.02</td>
<td>0.333</td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Epi-near doc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saguaro Lake</td>
<td>Hypolimnio</td>
<td>5.01</td>
<td>0.1054</td>
<td>2.10</td>
<td>0.487</td>
</tr>
<tr>
<td>Verde River at Tangle</td>
<td></td>
<td>1.06</td>
<td>0.0296</td>
<td>2.78</td>
<td>0.137</td>
</tr>
<tr>
<td>Havasu</td>
<td></td>
<td>2.46</td>
<td>0.0385</td>
<td>1.57</td>
<td>0.645</td>
</tr>
</tbody>
</table>

Data from Central Arizona Project

Data for Lake Havasu indicate a turbidity spike that will affect water quality in the CAP Canal.
Disinfection By-Products

1. Iodinated DBPs

Iodide can form iodinated disinfection byproducts which have odor (e.g., iodoform, CHI3) or pose potential toxic response to human cells. During chlorination iodide is rapidly oxidized to iodine (HOI/OI-) and then to iodate (IO3-). However, during chloramination, monochloramine (NH2Cl) forms iodine, but not iodate. So iodine, like chlorine or bromine, can react with natural organic matter present in water to form iodinated-DBPs.

2. DBP formation in jar tests – part of ongoing SRP project to develop models that predict the “treatability” of water in its reservoirs. Data presented here is from the March 2007 sampling

Increasing alum dosages remove DOC. Separate studies also used some H2SO4 acid addition prior to alum addition (not shown).
THM formation is almost a perfect linear relationship with chlorine consumed, across all three water sources. Therefore, keeping track of CHLORINE CONSUMPTION (Dose minus residual) is an EXCELLENT indicator for TTHM formation.

![Graph of Total THM vs. Consumed Chlorine](image1)

Chlorine consumption is a better indicator of TTHM formation than just DOC concentration alone:

![Graph of Total THM vs. DOC](image2)

This tests clearly indicate that Salt River water has the highest DBP formation potential, even after alum coagulation.
The bromide ion concentration are similar for the three reservoirs:

<table>
<thead>
<tr>
<th>Source</th>
<th>Bromide Conc (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett</td>
<td>76</td>
</tr>
<tr>
<td>Pleasant</td>
<td>105</td>
</tr>
<tr>
<td>Saguaro</td>
<td>100</td>
</tr>
</tbody>
</table>

These bromide concentrations affect the Bromide Incorporation Factor (BIF) of THMs. BIF of 1 means all the THMs are bromoform and a value of zero indicates the are all chloroform. This is a simple way to assess how much of the THMs include bromide. The BIF increases as a function of alum dose. Why? Because the Br/DOC ratio increases with alum addition. Alum addition removes DOC but not bromide, causing the Br/DOC ratio to increase.

3. AWI Newsletter The following pages describe projects sponsored by the Arizona Water Institute – a collaboration of state agencies and the three state universities. It is the April 2007 newsletter.
NEWS UPDATE

Climate/Water Issues on the Front Page
In the past few months, a series of reports have focused national and international attention on issues of climate change, drought and water supply:

- On February 2, Working Group I of the International Panel on Climate Change (IPCC), the Physical Science Basis Report for Policymakers was released. This is a consensus-based summary of climate change research developed by 600 authors from 40 countries. See report specifics at: http://www.ipcc.ch/about/about.htm
- On February 28, the US Bureau of Reclamation (Reclamation) released its draft EIS on shortage sharing and coordinated operations of Lakes Mead and Powell on February 28. See report specifics at: http://www.usbr.gov/lc/region/programs/strategies/draftEIS/index.html
- Last week (April 13), the draft Summary for Policymakers of the IPCC Working Group II: Impacts, Adaptation and Vulnerability was distributed. See report specifics at: http://www.ipcc.ch/about/about.htm

All of these items made front page news across the west, where the implications of climate change for water management are a key take home story.

Key findings of the IPCC reports include: 1) the model outputs related to precipitation are now more consistent than they were in the previous IPCC reports, and the Southwest and other subtropical regions are now shown as areas likely to have declining precipitation; 2) runoff is projected to decline by up to 30% in the Colorado basin; 3) more intense rainfall events have been observed and are expected worldwide in the future, meaning that even in the context of long-term drought projections, we need to be prepared for major flooding episodes; 4) other observations noted in the IPCC reports include rising sea levels, reductions in snow pack, glaciers and ice sheets, impacts on agriculture, forestry, coastal zones, human health and numerous impacts on natural systems, including increase in the rate of species extinction.

The combined implications of increased temperatures and the potential for decreased precipitation do not paint a pretty picture for the interior west and southwest of the US or for other arid regions in subtropical areas worldwide.

The NRC report comes to a similar conclusion, focusing on tree-ring based reconstructions of the Colorado River’s flow over hundreds of years, finding that average annual flows varied more than previously assumed and that future droughts may be longer and more severe because of the warming trend. The report also states that a preponderance of evidence suggests that rising temperatures will reduce the river’s flow and water supplies.

AWI Participation in Climate/Water Issues

AWI is currently engaged in a project funded by Reclamation, the U of A Sustainability Program and the UA Water Resources Research Center (WRRC) that is focused on improving the use of climate information at various time scales for managing the Colorado River. This interdisciplinary project, now in its third year, is called “Enhancing Water Supply Reliability through Enhanced Use of Climate Predictions.”

The questions that are posed by the research in this project were derived from interviewing Central Arizona Project stakeholders who are impacted by Colorado River water availability. Key research questions include: 1) developing increased water supply forecasting skill over a one- to three-year time horizon; 2) providing increased temporal and spatial resolution of streamflow records in the Upper and Lower Basins through tree-ring reconstructions; and 3) evaluation of economic and management strategies to enhance dry-year water supply reliability.

AWI Sponsors Decadal Prediction Workshop

On March 23 AWI co-sponsored a workshop on decadal climate prediction in cooperation with the US Climate Variability and Predictability (CLIVAR) program, working towards developing a research agenda for using our improving understanding of longer time scale ocean-atmosphere interactions (such as the Pacific Decadal Oscillation) to project likely future climate conditions in the one-to-three year time frame. Although this information will not yield actual predictions of specific climate conditions at specific time frames in the future, if we understand the underlying drivers of the changes in “phase” of these oscillations, we will have a better idea whether the climate conditions are likely to switch from one phase to another, which could be important when facing declining reservoirs and the potential to hit key trigger elevations in the system.

Given that inflow projections on the Colorado for this year are in the vicinity of 50% of normal the first shortage condition could be experienced as early as 2009, much
earlier than previously assumed. For more on this topic, please check the website of this project at http://ag.arizona.edu/AZWATER/EWSR/ The latest news from the project team will be available within the next week or two, if you would like to receive this newsletter please contact Dustin Garrick at dustygarrick@gmail.com.

News from the Arizona Department of Commerce

Bennett Curry, the AWI Associate Director at the Department of Commerce, has developed a strategic plan for his activities related to commercializing water-related university innovations that will create jobs and economic development opportunities in Arizona. He has also identified several sources of funding for university researchers who are interested in technology transfer.

The Small Business Innovation Research Program (SBIR) and the Small Business Technology Transfer Program (STTR) award competitive grants to explore the validity of a concept. The US Small Business Administration (SBA) website has complete information. http://www.sba.gov/sbir/index/sbir-sttr.html

In addition, three workshops may be of interest:

1. SBIR/STTR Phase 1 – ASU Technopolis will hold a workshop on May 11 to help write more competitive SBIR/STTR Phase 1 proposals. This link has details: https://www.aztechnopolis.org/programs_details.cfm?program_id=43

2. Arizona Center for Innovation – A Tech transfer luncheon on April 19 will be held at the Student Union Memorial Center. Technical assistance providers will present. Contact Anita Bell (520) 382-3260 or anitabell@azinnovation.com

3. Commercialization Workshop in Tucson – April 27. Half day at the Pima Community College Small Business Development Center. (520) 206-6404 or sbdc@pima.edu

If you have other ideas to share, please contact Bennett at bennettc@azcommerce.gov.

AWI Fundraising News

AWI is expected to generate significant portions of its funding from external sources, including private donors, corporations, federal grants, contracts for services and foundation support. AWI has received several major donations and pledges of support from cities, counties, utilities and individuals, but we have a significant challenge ahead in meeting our needs for funding. In our next newsletter we will highlight some components of our fundraising activities to date.

UPDATE ON AWI FUNDED PROJECTS

In our November & December newsletters, we described 17 proposals that were selected for funding through the collaborative Request for Proposals across the three universities. We will be providing updates on these projects in our newsletters; progress on two of the projects follows:


For many high-tech manufacturers, improving water treatment and boosting water conservation are vital goals. In this project, UA and ASU are collaborating with Intel Corporation to study electrochemical processes occurring in a treatment technology called electrocoagulation. This treatment technology is being tested on experimental equipment provided by Intel at one of their facilities to remove contaminants from cooling tower blowdown water and increase the number of reuse cycles of the water. The results of this research will likely have broad relevance to municipal, commercial, and industrial applications. Intel has provided funding and hired two student interns for the summer (one each from UA and ASU) to perform the research under the direction of the principal investigators. These students will have the opportunity to work on-site at an Intel facility.

“Comparison of Estrogenic Compound Removal Efficiency from POTWs Across Arizona”

Investigators: Catherine Proppe (NAU Biological Sciences), Timothy Vail (NAU Chemistry and Biochemistry), Jani Ingram (NAU Chemistry and Biochemistry), Eduardo Sáez (UA Chemical and Environmental Engineering), Paul Westerhoff (ASU Civil & Environmental Engineering), Martin Karpiscak (UA Arid Lands Studies), Patricia Adler (Arizona Department of Health Sciences).

Treated wastewater discharged from sewage treatment plants contains traces of chemicals that impact endocrine (hormonal) activity in organisms living or coming into contact with the wastewater. These chemicals include excreted and discarded pharmaceuticals, personal care products, and industrial and agricultural compounds. Although aquatic organisms may be particularly susceptible to exposure to these compounds, the human health effects remain undefined. Because of the potential for biological impact from exposure to these compounds, it is important to determine which wastewater treatment processes produce the best chemical removal efficiency. To accomplish the goal of this study, influent, effluent, and biosolids (sewage sludge) from six Arizonaeldon’s, high-performance, tertiary sewage treatment plants of varying system design will be evaluated to determine overall removal efficiencies of two common wastewater compounds. The study will also evaluate the removal efficiency of the overall endocrine activity in terms of estrogen-like effects from the tested facilities. Results from this study will help determine the treatment processes most effective at removal of some compounds associated with estrogen-like hormonal activity. Sampling will occur in April and May. This project also includes the development and refinement of better test methods for some of these chemicals. Because much of the wastewater in the Southwest is designated for potential reuse, it is critical to find water treatment procedures that lead to limiting water contaminant output.

UA Finalizes Two AWI Faculty Incentive Awards

The University of Arizona (UA) has awarded faculty
research grants to two projects. These awards are for researchers to use in preparation of larger grant applications to federal or other agencies such as NSF. These two projects address major issues facing Arizona and the border region. This background work will provide the focused arguments for researchers to seek further investments to investigate alternative sources of water and the interface of energy and water – two critical areas of water management. 2007 Faculty Incentive recipients are:

Stephanie Buechler (Bureau of Applied Research in Anthropology – BARA), Terry Sprague (WRRC), Diane Austin (BARA), and Jim Riley (Soil, Water & Environmental Sciences) – Creating a Successful Rainwater Harvesting and Greywater Reuse Program: Combining Community Participation, Technology and Design to Enhance Urban Water Sustainability. This research will focus on how to increase the use of rainwater harvesting and greywater systems in a broad range of socio-economic groups in Tucson. Problems related to stormwater management as well as drought can be ameliorated with the use of these two systems; if properly incorporated into urban planning and policymaking, such strategies can be an important part of current and future water management in the Southwest, particularly in light of climate projections that indicate we will experience more extreme climate events, both floods and droughts. With the projected increase in costs of infrastructure and water use fees, the incentive for residential water savings via these and other measures will increase. The proposed project will include collaborations with local NGOs and government agencies.

Christopher Scott and Robert Varady (Udall Center) – Coupled Water and Energy Demand in the Arizona-Sonora Border Region. The goal of this effort is to inform and support domestic (state and federal) and bi-national policies that couple the anticipated needs for both water and energy. This research addresses the AWI priority areas of international applications and research and aquifer management and sustainability, in addition to the energy-water nexus. The water management implications of energy generation are considerable, and the energy implications of water delivery have historically not received much scrutiny. For example, few are aware that 30% of the total energy use in the State of California is for pumping water. This work will develop background data and conduct a needs assessment to focus future work on the US-Mexico border region, where such issues are of increasing concern. The research will include UA and Sonoran colleagues as well as agency representatives.

**Upcoming Events**


The day will include panels on the History of the Environmental Quality Act and ADEQ, the Water Quality Assurance Revolving Fund (WQARF), Emerging and Emerging Contaminants, Emerging Policy Challenges, and the Future of ADEQ. Director Steve Owens will deliver the State of ADEQ address at the luncheon. Governor Napolitano has been invited to kick-off the program, and the day will end with a celebratory reception. Please join us!

The agenda can be found, along with registration and hotel information, on our website at [http://azwaterinstitute.org/AZWATER/awg2007/index.html](http://azwaterinstitute.org/AZWATER/awg2007/index.html) Early Bird Registration (before May 1st) is $115. Beginning May 1, registration will be $135. Reduced rates are available for students.

For more information on these and other events that AWI will be engaged with, please see our website at www.azwaterinstitute.org.

- April 18 - Earth Day at Boeing
- April 23 - Investor Owned Water Utilities Association Water Summit, Phoenix
- April 24-27 - Congressional testimony with USG on climate change, Washington DC
- May 2-4 - AZ Water & Pollution Control Association - ’06 Annual AIA/PCA Conference & Exhibition’, Phoenix
- May 10-11 – AZ Municipal Utilities Leadership Institute, Phoenix
- May 16-18 - Western States Water Council & Western Governor’s Association - Climate Change Workshop, Irvine CA
- August 29-September 1 - Southwest Hydrology & Arizona Hydrological Society 2007 Water Symposium – “Sustainable Water, Unlimited Water, Quality of Life - Can We Have It All?”, Tucson
- September 19-21 - Water Education Foundation, Colorado River Project - “6th Biennial Colorado River Symposium”, Santa Fe NM
- September 26-27 - Rice University, James A. Baker III Institute for Public Policy conference “Beyond Science: The Politics and Economics of Responding to Climate Change”, Houston TX

For comments and suggestions or additional information on the Arizona Water Institute, please contact us:

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