REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for January 2011
Sampling conducted January 3-4, 2011
A Tempe, Glendale, Peoria, CAP, SRP– ASU Regional Water Quality Partnership

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

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.
2. Dissolved organic carbon (DOC) concentrations in the reservoir systems are roughly as follows, following thermal destratification in October:
   - Saguaro Lake: 4.8 mg/L
   - Bartlett Lake: 3.5 mg/L
   - CAP supply: 3.2 mg/L
3. Information on predicted weather and precipitation patterns for 2011 are presented, along with an article on if the book Cadillac Desert is coming true.
4. We have obtained samples of an ultrafine powder activated carbon that reportedly has faster kinetics and higher capacity for TOC and MIB removal – we hope to test this material in January 2011.

Table 1 - SRP/CAP OPERATIONS - Values in cfs, for January 3, 2011

System	SRP Diversions	CAP
Arizona Canal	235	25
South Canal	95	0
Pumping	0	0
Total	330	25

- **SRP is releasing water from both Verde and Salt River Systems**. Salt River release from Saguaro Lake: 8 cfs; Verde River release from Bartlett Lake: 359 cfs.
- **SRP reservoirs are 86% full.**

CAP Operations of Lake Pleasant – January 2011

Flow from Colorado River: 3015 cfs (Mark Wilmer pump station at Havasu inlet)
Lake Pleasant Operations/Waddell Canal: 1381 cfs INTO Lake Pleasant (filling)
Lake Pleasant Capacity 82% full

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 below 10 ng/L in the canals.

Table 2 - Water Treatment Plants – January 3, 2011

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet			
Union Hills Treated	<2.0	2.1	<2.0
Tempe South WTP	<2.0	2.3	<2.0
Tempe South Plant Treated	<2.0	<2.0	<2.0
Greenway WTP Inlet	<2.0	<2.0	<2.0
Greenway WTP Treated	<2.0	3.3	3.0
Glendale WTP Inlet	<2.0	4.3	5.1
Glendale WTP Treated			

Table 3 - Canal Sampling – January 3, 2011

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	2.7	<2.0
	Union Hills Inlet			
	CAP Canal at Cross-connect			
	Salt River @ Blue Pt Bridge			
	Verde River @ Beeline	<2.0	2.0	4.2
AZ	AZ Canal above CAP Cross-connect	<2.0	2.6	3.0
Canal	AZ Canal below CAP Cross-connect	<2.0	2.3	2.9
	AZ Canal at Highway 87	<2.0	2.9	4.5
	AZ Canal at Pima Rd.	<2.0	4.7	14.1
	AZ Canal at 56th St.	<2.0	3.7	7.0
	AZ Canal - Central Avenue	<2.0	4.0	6.8
	AZ Canal - Inlet to Glendale WTP	<2.0	4.3	5.1
South	South Canal below CAP Cross-connect	<2.0	2.5	3.1
Tempe	Head of the Tempe Canal	<2.0	2.7	5.2
Canals	Tempe Canal - Inlet to Tempe's South Plant	<2.0	2.3	<2.0

Table 4 - Reservoir Samples – January 4, 2011

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (Dec10)	Eplimnion	**<2.0**	**<2.0**	**<2.0**
Lake Pleasant (Dec10)	Hypolimnion	**<2.0**	**<2.0**	**3.9**
Verde River @ Beeline		**<2.0**	**2.0**	**4.2**
Bartlett Reservoir	Epilimnion	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Epi-near dock	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Hypolimnion	**<2.0**	**<2.0**	**<2.0**
Saguaro Lake	Epilimnion	**2.3**	**2.4**	**<2.0**
Saguaro Lake	Epi - Duplicate	**2.1**	**2.4**	**<2.0**
Saguaro Lake	Epi-near dock	**2.1**	**2.4**	**2.2**
Saguaro Lake	Hypolimnion	**<2.0**	**<2.0**	**7.1**
Lake Havasu (Dec10)		**2.6**	**2.6**	**<2.0**
Verde River at Tangle Creek (Nov10)		**2.1**	**3.1**	**<2.0**

Organic Matter in Water Treatment Plants

Table 2 - Water Treatment Plants – January 03, 2011

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN		DOC removal (%)	
Union Hills Inlet	2.57	0.043	1.66	0.57			Data from Waddell Canal
Union Hills Treated	2.33	0.026	1.12	0.46		9	
Tempe North Inlet							
Tempe North Plant Treated							offline
Tempe South WTP	2.34	0.061	2.61	0.36			
Tempe South Plant Treated	1.56	0.025	1.60	0.29		33	
Greenway WTP Inlet	1.54	0.038	2.47	5.10			
Greenway WTP Treated	1.38	0.020	1.43	4.76		10	
Glendale WTP Inlet	2.79	0.080	2.86	0.85			
Glendale WTP Treated							offline

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)

Organics in Canals

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	2.57	0.043	1.66	0.57
Salt River @ Blue Pt Bridge				
Verde River @ Beeline	2.62	0.066	2.52	0.25
AZ Canal above CAP Cross-connect	2.55	0.065	2.53	0.31
AZ Canal below CAP Cross-connect	2.57	0.063	2.45	0.32
AZ Canal at Highway 87	2.62	0.056	2.13	0.31
AZ Canal at Pima Rd.	2.59	0.064	2.47	0.26
AZ Canal at 56th St.	2.45	0.061	2.50	0.32
AZ Canal - Central Avenue	2.20	0.057	2.61	0.37
AZ Canal - Inlet to Glendale WTP	2.79	0.080	2.86	0.85
AZ Canal - Inlet to Greenway WTP	1.54	0.038	2.47	5.10
South Canal below CAP Cross-connect	2.53	0.064	2.52	0.35
South Canal at Val Vista WTP				
Head of the Tempe Canal	2.41	0.060	2.50	0.26
Tempe Canal - Inlet to Tempe's South Plant	2.34	0.061	2.61	0.36
Chandler WTP – Inlet				

Organics in Lakes

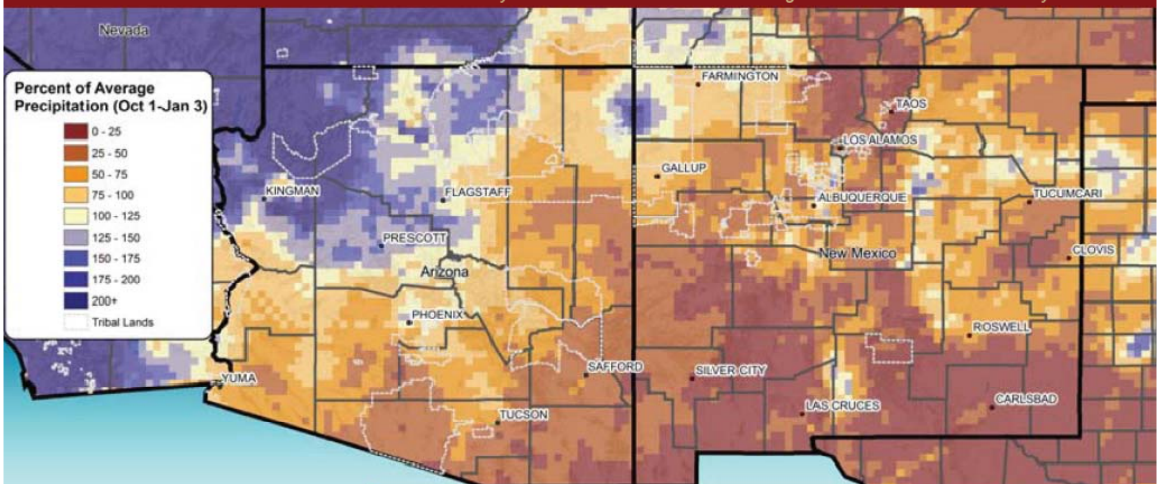
Table 4 - Reservoir Samples – January 03, 2011

Reservoir sampling will be conducted only monthly. CAP is sampling Lake Pleasant on slightly different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant - Dec 2010	Eplimnion	3.19	0.06	1.77	0.43
Lake Pleasant	Hypolimnion	3.22	0.06	1.73	0.43
Verde River @ Beeline		2.62	0.066	2.52	0.25
Bartlett Reservoir	Epilimnion	3.44	0.083	2.42	0.43
Bartlett Reservoir	Hypolimnion	3.52	0.084	2.37	0.46
Saguaro Lake	Epilimnion	4.66	0.099	2.13	0.42
Saguaro Lake	Epi - Duplicate	4.82	0.098	2.03	0.44
Saguaro Lake	Hypolimnion	5.49	0.103	1.87	0.75
Verde River at Tangle	Nov-11	0.87	0.023	2.64	0.07
Havasu	Dec-10	2.68	0.04	1.53	0.69

La Niña DROUGHT T·R·A·C·K·E·R

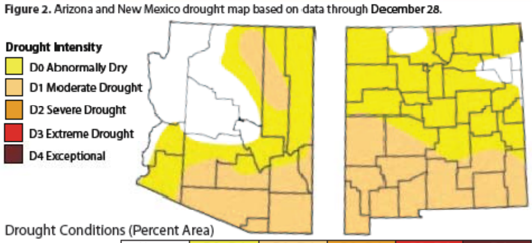
January 2011 / Vol. 1 / Issue 2 / Drought Tracker / A Publication by CLMAS



Source: National Weather Service Advanced Hydrologic Prediction Service

D·R·O·U·G·H·T CONDITIONS

Figure 2. Arizona and New Mexico drought map based on data through December 28.



Drought Conditions (Percent Area)

		None	D0–D4	D1–D4	D2–D4	D3–D4	D4
Current	AZ	31.4	68.6	32.5	0.0	0.0	0.0
	NM	6.2	93.8	40.4	0.0	0.0	0.0
One Month Ago	AZ	50.5	49.5	6.8	0.0	0.0	0.0
	NM	68.7	31.3	0.6	0.0	0.0	0.0
Oct. 1 start of water year	AZ	40.0	60.0	18.6	3.2	0.0	0.0
	NM	76.7	23.3	0.0	0.0	0.0	0.0

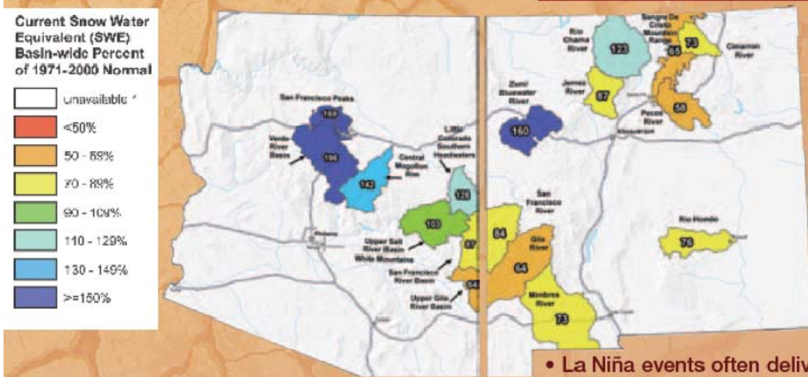
Source: U.S. Drought Monitor

Strong winter storms at the end of December delivered widespread and heavy rain and snow to Arizona and New Mexico and helped end nearly two months of zero precipitation, particularly in southern regions. The storms are a good reminder that even during La Niña events when probabilities increase for drier-than-average weather, storms will drench portions of the Southwest. However, even with the recent rain and snow only northwest Arizona has experienced above-average precipitation since the water year began on October 1 (Top Figure). Southeast Arizona and southern New Mexico have been the driest, with deficits measuring between two and four inches below average. The La Niña precipitation pattern, which historically has the strongest signal in the southern tier of both states, is holding up in spite of recent weather. The wet conditions, however, will likely improve short-term drought conditions depicted in the most recent U.S. Drought Monitor (Figure 2). As of December 28, about 69 percent of Arizona was classified as "abnormally dry" or worse—an expansion of about 19 percent from one month ago—and about 32 percent as "moderate drought". Conditions in New Mexico are drier; about 94 percent of the state is abnormally dry or worse and about 40 percent is classified with moderate drought, an increase of about 34 and 21 percent from one month ago, respectively.

The La Niña event remained moderate to strong during the last month and there is a greater than 80 percent chance that the event will persist into spring. Since all previous La Niña events have delivered dry winter conditions to the Southwest as a whole, and the strongest La Niña signal is in the January—April period, drought conditions are expected to expand (Supplemental Figure 1).

S·N·O·W PACK

Source: National Resources Conservation Service

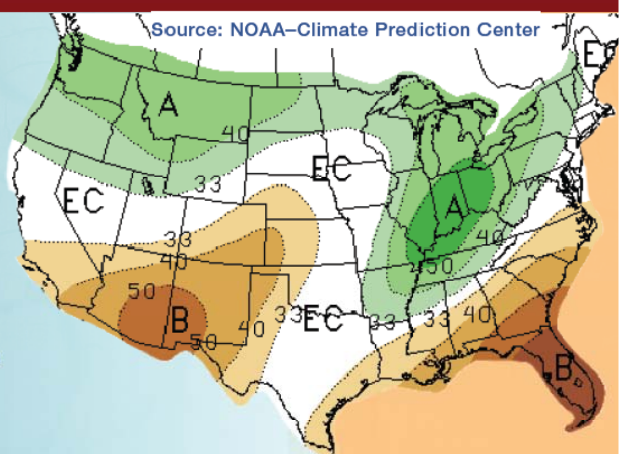


- Late December storms covered many mountains in snow. Most snow water content (SWC) in Arizona is near or above average; in New Mexico, however, snowpack is mostly below average (Left Figures).
- Most SNOTEL stations in the Colorado River Basin in Colorado and Utah (not shown) measure above-average SWC; the upper Rio Grande basin has slightly above-average SWC.
- La Niña events often deliver above-average snow to northern Colorado between December and April, which bodes well for spring Colorado River flows (Suppl. Figures 2–4).

A L·O·O·K AHEAD

- The Climate Prediction Center outlook suggests a high likelihood of drier-than-average conditions for January–March, particularly in southern areas where the La Niña influence is strongest (Right Figure).
- Dry conditions are also forecasted for the February–April period, with the highest chances for dry conditions projected for the southern half of Arizona.
- Temperatures are also expected to be warmer than average during rest of the winter season, but this forecast is mostly based on recent warming trends and is less influenced by La Niña, which does not have a strong influence on temperature in the Southwest.

Source: NOAA–Climate Prediction Center



F·I·N·A·L WORD

- The La Niña event is currently classified as moderate to strong; it has maintained its strength over the past month and is one of the strongest events in the last 60 years.
- Total winter precipitation in the Southwest during all past La Niña events has been near to or drier than average; the strongest La Niña precipitation signal in the Southwest occurs from January to April (Supplemental Figures 5–7).
- Widespread precipitation in late December punctuated a very dry two-month period during which many regions received no rain or snow (Supplemental Figures 8–12).
- Areas in southern Arizona and New Mexico are drier than average despite recent storms.
- Recent storms demonstrate that during La Niña events, precipitation can vary both in time and space, with greater variability in northern regions.
- Early winter snowpack in Colorado and Utah, from which a large portion of Colorado River and Rio Grande runoff originates, is above average.
- Precipitation forecasts call for dry conditions in the Southwest for the rest of the winter.

Arizona Cooperative Extension

CLIMAS Climate Assessment for the Southwest

Institute of the Environment

The University of Arizona.

• www.climas.arizona.edu •

http://asunews.asu.edu/20101213_cadillac_desert

'Cadillac desert' withstands test of time, technology

December 15, 2010

In 1986, Marc Reisner published "Cadillac Desert: The American West and its disappearing water," a foundational work about the long-term environmental costs of U.S. western states' water projects and land development. It sounded an alarm about the direction of the American West and how it was using its most precious resource. Now it all appears to becoming true.

Researchers applying modern scientific tools and mapping technologies, unavailable during Reisner's time, find his conclusions for the most part to be accurate and scientifically correct. As a result, current water practices are not sustainable and many dramatic initiatives will be needed to correct the current unsustainable path the West is on.

In a paper published in the Dec. 14 Online Early Edition of the *Proceedings of the National Academy of Sciences*, a research team led by John Sabo, an Arizona State University associate professor in the School of Life Sciences, confirms Reisner's assertions of the illusion of sustainability and ongoing water scarcity in the modern day American West.

"Reclaiming freshwater sustainability in the Cadillac Desert," is one of eight papers in a special section of *PNAS*. The special feature explores the challenges presented by the 21st century drought compared with earlier droughts in the Southwest, and analyzes the impact of greenhouse gases on the water supply.

"Cadillac Desert was prescient, published before a comprehensive analysis like this new study was possible," said Stephanie Hampton, deputy director of the National Center for Ecological Analysis & Synthesis at the University of California, Santa Barbara. "Using innovative approaches to scientific synthesis, Sabo and his colleagues provide a rich understanding of the status of Western water, and additional incentive to pursue the vision for sustainability that Cadillac Desert originally inspired in so many of us."

At the core of their analysis, Sabo and his colleagues applied the best available tools to data on water, soil, salt, dams, fish and crop yields. "Our data and analyses confirm with numbers and maps what Reisner deftly described with words," Sabo said.

Some of the primary findings are:

• Currently, the desert Southwest uses 76 percent of its total surface water to support its population. This will rise to 86 percent with a doubling of urban population (expected in 50 to 100 years). Sustainable balance for the region is achieved when 40 percent of total surface water is used.

• Salt, which results from the application of large quantities of water to grow drought intolerant food crops on desert farmlands, has likely caused about $2.5 billion in reductions in crop revenues in the Western United States.

• The water footprints of Los Angeles, Las Vegas and Phoenix are the top three in the United States. The footprint of Los Angeles alone is larger the seven largest eastern U.S. cities (including New York, Chicago and Washington, D.C.)

"California is arguably the most important farmland in North America," Sabo said. "But the water needed to support California agriculture (which is exported as food products to the rest of the country) is at odds with healthy populations of freshwater fish like salmon.

"Can we have salmon and tomatoes on the same table," he asks. "Something will have to give. We may have to embrace increases in the current rock bottom prices for water and high quality produce or policies that discourage rapid urban population growth and expansion unless we are willing to let go of the idea of healthy rivers, coastal waters and a viable salmon fishery in California."

Sabo and his team used advanced technologies to come to their conclusions. Geographical information systems, distributed hydrological models and innovative methods to quantify human water scarcity and water footprints were used by the team to dissect patterns of freshwater unsustainability in the western United States.

"We found that many of the most rapidly growing cities and most important croplands in the United States are precisely in those western arid lands incapable of supporting them with regionally generated stream flow," Sabo said.

To reclaim sustainability in the Cadillac Desert, the team suggests several important and tough measures. One is aimed at lowering the huge amount of surface water required to sustain the region's population.

"We suggest an initially modest target of a 16 percent reduction (to 60 percent total) in the fraction of stream flow withdrawn," the researchers state. This alone would require the seven states that make up the region to do several things they have yet to do, including improving urban water use efficiency, implementing a desalinization system by coastal cities, improvements in land-use practices that minimize erosion and sediment infilling of the region's reservoirs and implementing modified crop portfolios that include only salt tolerant and cash crops.

“The water crisis in the West is a regional one,” Sabo said. “This suggests that local conservation efforts (shorter showers, banning lawns, installing a gray-water recycling systems) are necessary but not sufficient for a solution. Regional and national policy changes are called for,” he added.

“The cards are stacked high against freshwater sustainability in the West,” Sabo added. “Something will have to give, and it likely will be the price of water and high quality produce. If water were priced appropriately (by market forces or policy mandates), we would become much more efficient with water use in cities and on farms, and we would likely do agriculture completely differently than we do it now in the Western U.S.”

In addition to Sabo, the paper’s authors are: Tushar Sinha, North Carolina State University; John Kominoski, University of Georgia; William Graf, University of South Carolina; Laura Bowling and Keith Cherkauer, Purdue University; Gerrit Schoups, Delft University of Technology; Wesley Wallender and Jan Hopmans, University of California, Davis; Michael Campana, Oregon State University; Pam Fuller and Robert Webb, U.S. Geological Survey; Carissa Taylor, Arizona State University; Stanley Trimble, University of California, Los Angeles; and Ellen Wohl, Warner College of Natural Resources, Colorado State University.

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