Regional Water Quality NEWSLETTER

DATE: Report for January 2013
A Tempe, Glendale, Peoria, Chandler, Phoenix, ADEQ, CAP, SRP, Epcor
ASU Regional Water Quality Partnership

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

SUMMARY: EVALUATION AND RECOMMENDATIONS

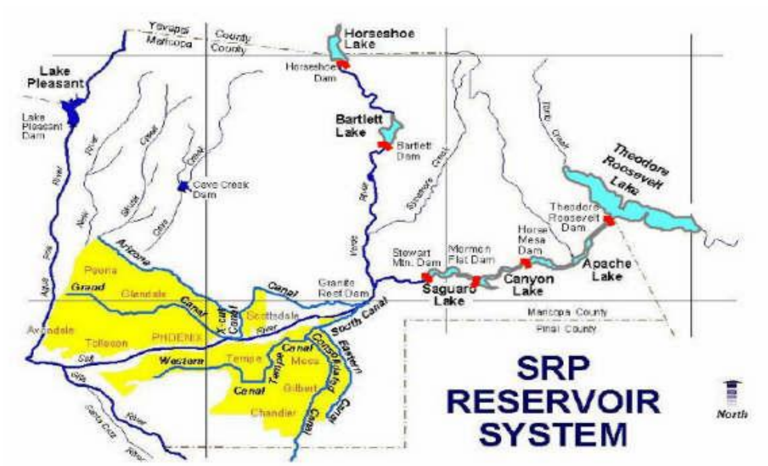
1. Data for January and February 2013 are included in this Newsletter.
2. MIB and geosmin are low everywhere – EXCEPT for the past month in Chandler WTP influent. This is surprising given the cold water temperatures, which usually discourage T&O production. **Why are there high levels of Geosmin only at Chandler WTP?** Wells pumping on the Consolidated Canal above Chandler WTP contain significantly different water quality than SRP surface waters. In the past we have seen this to lead to Geosmin producing algae in the Consolidated Canal. This seems to be the case again now. The wells below are pumping into the Consolidated canal, some of which contain elevated nitrate levels which spur on growth of some cyanobacteria that produce Geosmin.
3. We have observed a major storm event with runoff in the Salt River which impacts dissolved organic carbon levels in Roosevelt Lake. Both dissolved and particulates were delivered into the lake in the Runoff.
4. Snowpack in the Upper Colorado River basin is ~ 82% average, slightly higher snowpack levels exist in parts of Arizona. This means we will have runoff this spring which loads organics into the reservoirs.
5. Quarterly sampling of the Salt River reservoirs continue, and data is presented. We have started measuring trace metals in an effort to better track sources of this water.

Quick Update of Water Supplies for February 2013
(during day of sampling – February 4th)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 54% full	181 cfs	103 cfs into **Arizona Canal** 226 cfs into **South Canal** **(57% Salt River Water)**	4.1 mg/L
Verde River	Reservoirs At 32% full	100 cfs		2.3 mg/L
Colorado River	Lake Pleasant is 69% full (Lake Powell is 50% full)	Lake Pleasant filling; direct Colorado River water is in the CAP canal	33 cfs of **CAP water** into South Canal	2.8 mg/L
Groundwater	Generally increasing due to recharge	140 cfs pumping by SRP	140 cfs **Groundwater Pumping** into SRP Canals	0.5 to 1 mg/L

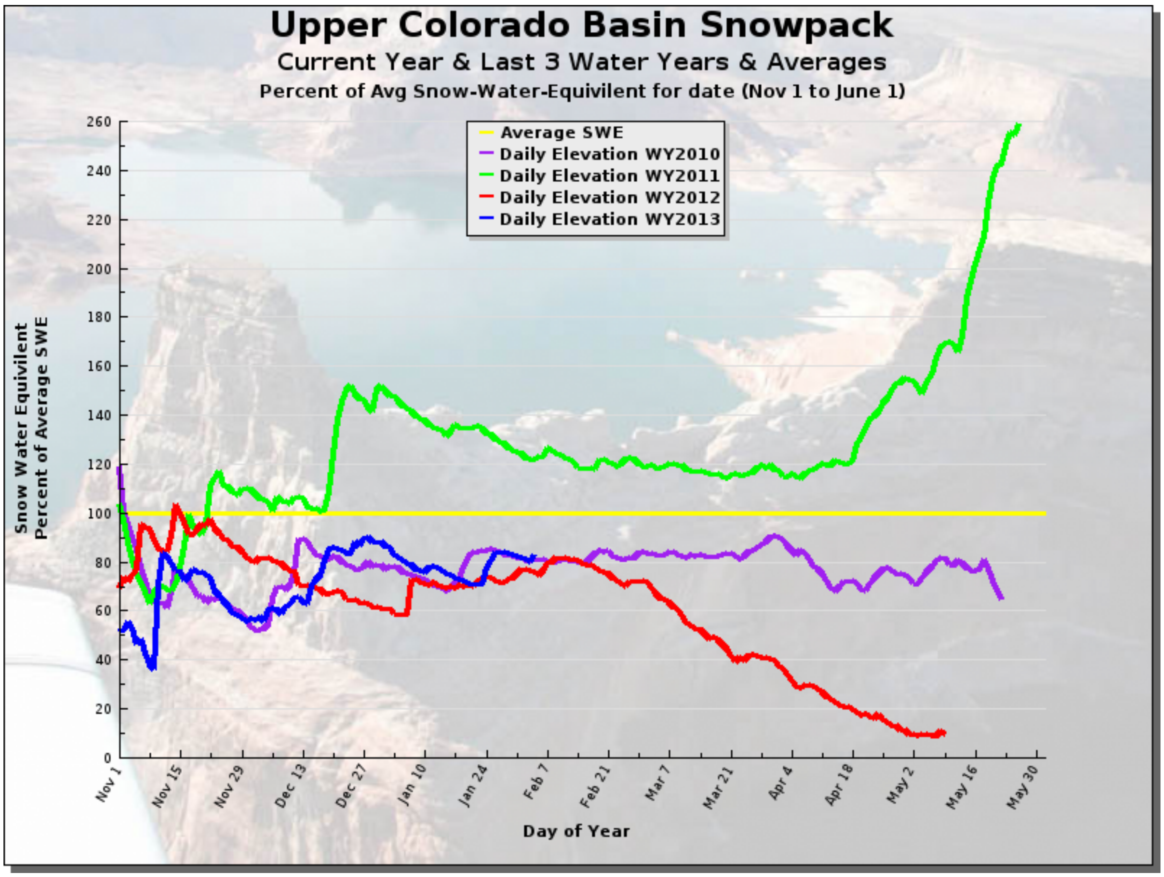
*Concentration of these taste and odor compounds in the upper [lower] levels of the terminal reservoir (Saguaro Lake on the Salt River; Bartlett Lake on the Verde River; Lake Pleasant on the CAP system
**Concentration of DOC in the terminal reservoir
*** On paper cities are receiving CAP water in the SRP canals, but as a method of "paying back" from the last drought for excess CAP deliveries – SRP is delivering wet water only from the Salt and Verde Rivers
Data from the following websites:

- http://www.srpwater.com/dwr/
- http://www.cap-az.com/Operations/LakePleasantOps.aspx
- http://lakepowell.water-data.com/



How is our Snowpack this year? This is a valuable water supply for us during the summer/fall.

The upper Colorado river snowpack is 82% of average as of February 11, 2013. Arizona data is tabulated below, but running slightly under the long-term average too.



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, February 12, 2013□□

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Basin Site Name	Elev (ft)	Snow Water Equivalent Current (in)	Today's Median (in)	Median Peak (in)	Median Peak Date	Percent of Today's Median	Median Peak
VERDE RIVER BASIN							
BAKER BUTTE	7300	3.0	5.0	5.3	Mar 04	60	57
BAKER BUTTE SMT	7700	9.2	N/A	N/A	N/A	*	*
BAR M	6393	1.8	N/A	N/A	N/A	*	*
CHALENDER	7100	2.5	N/A	N/A	N/A	*	*
FORT VALLEY	7350	0.6	N/A	N/A	N/A	*	*
FRY	7200	4.1	6.0	7.0	Mar 01	68	59
HAPPY JACK	7630	6.8	4.5	6.6	Mar 08	151	103
MORMON MOUNTAIN	7500	5.0	4.4	4.9	Feb 24	114	102
MORMON MTN SUMMIT	8500	7.8	N/A	N/A	N/A	*	*
WHITE HORSE LAKE	7180	2.4	4.6	4.8	Feb 23	52	50
Basin-wide percent						**87**	**74**
SAN FRANCISCO PEAKS							
SNOWSLIDE CANYON	9730	14.1	11.6	18.8	Mar 22	122	75
Basin-wide percent						**122**	**75**
CENTRAL MOGOLLON RIM							
BAKER BUTTE	7300	3.0	5.0	5.3	Mar 04	60	57
BAKER BUTTE SMT	7700	9.2	N/A	N/A	N/A	*	*
HEBER	7640	3.7	5.5	5.5	Feb 12	67	67
PROMONTORY	7930	10.6	9.3	11.8	Mar 10	114	90
Basin-wide percent						**87**	**77**
LITTLE COLORADO - SOUTHERN HEADWATERS							
BAKER BUTTE	7300	3.0	5.0	5.3	Mar 04	60	57
BAKER BUTTE SMT	7700	9.2	N/A	N/A	N/A	*	*
BALDY	9125	6.3	7.2	8.3	Mar 06	88	76
HEBER	7640	3.7	5.5	5.5	Feb 12	67	67

MAVERICK FORK	9200	6.5	7.8	9.2	Mar 17	83	71
PROMONTORY	7930	10.6	9.3	11.8	Mar 10	114	90
Basin-wide percent						**86**	**75**
UPPER SALT RIVER BASIN / WHITE MOUNTAINS							
BALDY	9125	6.3	7.2	8.3	Mar 06	88	76
BEAVER HEAD	7990	0.6	3.5	5.9	Mar 07	17	10
CORONADO TRAIL	8400	0.5	2.9	3.3	Jan 31	17	15
HANNAGAN MEADOWS	9020	8.3	9.4	11.3	Mar 19	88	73
MAVERICK FORK	9200	6.5	7.8	9.2	Mar 17	83	71
NUTRIOSO	8500	0.2	N/A	N/A	N/A	*	*
WILDCAT	7850	3.3	3.3	3.6	Feb 21	100	92
WORKMAN CREEK	6900	6.5	5.8	5.8	Feb 15	112	112
Basin-wide percent						**80**	**68**
SAN FRANCISCO / UPPER GILA RIVER BASIN							
BEAVER HEAD	7990	0.6	3.5	5.9	Mar 07	17	10
CORONADO TRAIL	8400	0.5	2.9	3.3	Jan 31	17	15
FRISCO DIVIDE	8000	1.1	2.9	2.9	Feb 14	38	38
HANNAGAN MEADOWS	9020	8.3	9.4	11.3	Mar 19	88	73
LOOKOUT MOUNTAIN	8500	0.6	2.6	2.6	Feb 13	23	23
NUTRIOSO	8500	0.2	N/A	N/A	N/A	*	*
SIGNAL PEAK	8360	1.7	4.2	4.4	Feb 28	40	39
SILVER CREEK DIVIDE	9000	4.4	6.9	8.6	Mar 12	64	51
Basin-wide percent						**53**	**44**
CHUSKA MOUNTAINS							
BEAVER SPRING	9200	9.7	N/A	N/A	N/A	*	*
NAVAJO WHISKEY CK	9050	-M	N/A	N/A	N/A	*	*
Basin-wide percent						*	*

-M = Missing data. * = Analysis may not provide a valid measure of conditions. N/A = Not

Dissolved Organic Carbon In Reservoirs and Treatment Plants

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)

Reservoir Samples

Table 4 - Reservoir Samples – February 5, 2012
Reservoir sampling conducted monthly. CAP is sampling Lake Pleasant and Havasu, and USGS is sampling Verde River at Tangle and Salt River above Roosevelt on slightly different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Havasu (January)		3.1	0.040	1.3	0.4
Lake Pleasant (January)	Epilimnion	3.2	0.039	1.2	0.4
	Hypolimnion	3.4	0.039	1.1	0.4
Verde River	@ Tangle	4.4	0.151	3.4	0.5
Verde River	@ Beeline Hwy	1.8	0.055	3.1	0.5
Bartlett Reservoir	Epilimnion	2.7	0.071	2.6	0.5
	Hypolimnion	2.1	0.050	2.4	0.4
Salt River above Roosevelt	above Roosevelt	9.6	0.475	4.9	1.4
Saguaro Lake	Epilimnion	4.2	0.068	1.6	0.4
	Epi - Duplicate	4.7	0.069	1.5	0.5
	Hypolimnion	3.9	0.066	1.7	0.4
Salt River	@ Blue Point Bridge	3.7	0.064	1.7	1.7

Organic Matter in Canal

Table 3 - Rivers and Canals – January 7, 2013 (CAP 01/08)

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	4.3	0.041	0.9	0.4
Anthem WTP Inlet	3.8	0.037	1.0	0.5
Union Hills Inlet	3.1	0.042	1.4	0.4
CAP Salt-Gila Pump Station	3.1	0.038	1.2	0.3
CAP Mesa Turnout	3.1	0.038	1.2	0.4
CAP Canal at Cross-connect	No flow			
Salt River @ Blue Pt Bridge	4.4	0.064	1.5	0.3
Verde River @ Beeline	2.1	0.031	1.5	0.3
AZ Canal above CAP Cross-connect	Offline			
AZ Canal below CAP Cross-connect	Offline			
AZ Canal at Highway 87	Offline			
AZ Canal at Pima Rd.	Offline			
AZ Canal at 56th St.	Offline			
AZ Canal - Central Avenue	Offline			
AZ Canal - Inlet to Glendale WTP	3.4	0.1	1.6	2.8
AZ Canal at Inlet to GreenwayWTP	Offline			
South Canal below CAP Cross-connect	2.8	0.041	1.5	0.3
Head of the Tempe Canal	1.7	0.019	1.1	1.2
Tempe Canal - Inlet to Tempe's South Plant	1.8	0.028	1.6	1.6
Head of the Consolidated Canal	0.1	0.020	18.2	1.2
Middle of the Consolidated Canal	1.5	0.020	1.3	4.2
Chandler WTP – Inlet	1.6	0.021	1.3	4.2

Table 3 - Rivers and Canals – February 4, 2013

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	2.9	0.045	1.6	0.6
Anthem WTP Inlet	3.9	0.046	1.2	0.6
Union Hills Inlet	2.8	0.033	1.2	0.6
CAP Salt-Gila Pump Station (January)	3.1	0.038	1.2	0.4
CAP Mesa Turnout (January)	1.5	0.020	1.3	4.2
CAP Canal at Cross-connect	2.8	0.046	1.6	0.5
Salt River @ Blue Pt Bridge	3.7	0.1	1.7	0.4
Verde River @ Beeline	1.8	0.055	3.1	0.5
AZ Canal above CAP Cross-connect	not accessible			
AZ Canal below CAP Cross-connect	not accessible			
AZ Canal at Highway 87	3.1	0.063	2.0	0.5
AZ Canal at Pima Rd.	2.5	0.063	2.5	0.6
AZ Canal at 56th St.	4.5	0.133	3.0	3.3
AZ Canal - Central Avenue	5.2	0.152	2.9	0.8
AZ Canal - Inlet to Glendale WTP	5.0	0.085	1.7	2.0
AZ Canal - Inlet to GreenwayWTP	Offline			
South Canal below CAP Cross-connect	not accessible			
Head of the Tempe Canal	1.1	0.023	2.1	1.9
Tempe Canal - Inlet to Tempe's South Plant	1.6	0.014	0.9	0.9
Head of the Consolidated Canal	1.1	0.018	1.6	1.8
Middle of the Consolidated Canal	1.0	0.022	2.2	1.6
Chandler WTP – Inlet	0.9	0.022	2.4	4.3

Organics at the Water Treatment Plants

Table 2 - Water Treatment Plants – January 7, 2013

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
Union Hills Inlet	3.1	0.042	1.4	0.4	
Union Hills Treated	2.7	0.021	0.8	0.4	13
Tempe North Inlet	Offline				
Tempe North Plant Treated					Offline
Tempe South Inlet	1.8	0.028	1.6	2.6	
Tempe South Plant Treated	1.2	0.006	0.5	2.7	33
Greenway WTP Inlet	Offline				
Greenway WTP Treated					Offline
Glendale WTP Inlet	3.4				
Glendale WTP Treated					3
Anthem WTP Inlet	3.8	0.037	1.0	0.5	
Anthem WTP Treated	3.0	0.038	1.3	0.4	22
Chandler WTP Inlet	1.6	0.021	1.3	4.2	
Chandler WTP Treated	1.7	0.018	1.0	2.4	-

Table 2 - Water Treatment Plants – February 4, 2013

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
Union Hills Inlet	2.8	0.033	1.2	0.6	
Union Hills Treated	2.3	0.026	1.1	0.5	18
Tempe North Inlet	Offline				
Tempe North Plant Treated					
Tempe South Inlet	1.6	0.014	0.9	2.8	
Tempe South Plant Treated	1.0	0.011	1.1	2.7	38
Greenway WTP Inlet	Offline				
Greenway WTP Treated					
Glendale WTP Inlet	5.0	0.085	1.7	2.0	
Glendale WTP Treated	Offline				
Anthem WTP Inlet	3.9	0.046	1.2	0.6	
Anthem WTP Treated	2.6	0.044	1.7	0.5	33
Chandler WTP Inlet	0.9	0.022	2.4	4.3	
Chandler WTP Treated	1.1	0.015	1.4	3.9	-22

Taste and Odor

MIB, Geosmin and Cyclocitral are compounds naturally produced by algae in our reservoirs and canals, usually when the water is warmer and algae are growing/decaying more rapidly. They are non toxic, but detectable to consumers of water because of their earthy-musty-moldy odor. The human nose can detect these in drinking water because the compounds are semi-volatile. Since compounds are more volatile from warmer water, these tend to be more noticable in the summer and fall. The human nose can detect roughly 10 ng/L of these compounds. Our team collects samples from the water sources and raw/treated WTP samples. We usually present all the data when concentrations start to exceed 5 ng/L.

- Data for this month on the next page

- As usual for December, the elevated MIB & geosmin season has ended. In the canals and treatment plants the levels are < 10 ng/L. This is down from the high teens in early November 2012.

- Lake Pleasant is filling with Colorado River water and actually has the highest levels of year.

- Saguaro Lake had peak MIB levels of 75 ng/L in July 2012 and ~20 to 30 ng/L through November.
- Bartlett Lake had peak MIB levels of 100 ng/L in July and ~20 to 30 ng/L through November.

WTP Data for January and February 2013

Table 2 - Water Treatment Plants – January 7, 2013

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	<2.0	<2.0
Union Hills Treated	<2.0	<2.0	<2.0
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	<2.0	<2.0	<2.0
Tempe South Plant Treated	<2.0	<2.0	<2.0
Anthem Inlet	<2.0	<2.0	<2.0
Anthem Treated	<2.0	<2.0	<2.0
Chandler Inlet	<2.0	31.4	<2.0
Chandler Treated	<2.0	30.8	<2.0
Greenway WTP Inlet			
Greenway WTP Treated			
Glendale WTP Inlet	<2.0	2.0	<2.0
Glendale WTP Treated			

Table 2 - Water Treatment Plants – February 4, 2013

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	<2.0	<2.0
Union Hills Treated	<2.0	<2.0	<2.0
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	<2.0	<2.0	<2.0
Tempe South Plant Treated	<2.0	<2.0	<2.0
Anthem Inlet	<2.0	<2.0	<2.0
Anthem Treated	<2.0	<2.0	<2.0
Chandler Inlet	<2.0	22.0	<2.0
Chandler Treated	<2.0	15.2	<2.0
Greenway WTP Inlet			
Greenway WTP Treated			
Glendale WTP Inlet	<2.0	5.6	<2.0
Glendale WTP Treated			

Why are there high levels of Geosmin only at Chandler WTP?

Wells pumping on the Consolidated Canal above Chandler WTP contain significantly different water quality than SRP surface waters. In the past we have seen this to lead to Geosmin producing algae in the Consolidated Canal. This seems to be the case again now. The wells below are pumping into the Consolidated canal, some of which contain elevated nitrate levels which spur on growth of some cyanobacteria that produce Geosmin.

Well Location	Current Status	Current Flow (GPM)
28.3E-04.2N	ON	3585
28.8E-05.0N	ON	2855
29.5E-03.4N	ON	3245
29.5E-05.7N	ON	3700
30.3E-02.6S	ON	1920
30.8E-01.9N	ON	4000
30.8E-06.5N	ON	
30.9E-01.6S	ON	2300
31.0E-06.7N	ON	3590
31.1E-00.3N	ON	2975
31.1E-02.1S	ON	1010
31.2E-01.0N	ON	2610
31.5E-06.4N	ON	3455
32.3E-07.0N	ON	4120
28.5E-04.0N	OFF	0
28.9E-05.5S	OFF	0
29.0E-03.8N	OFF	0
29.3E-04.0S	OFF	0
29.6E-03.5S	OFF	0
30.0E-02.8N	OFF	0
30.0E-04.3N	OFF	0
30.0E-05.9N	OFF	0
30.1E-03.0S	OFF	0
30.5E-06.0N	OFF	0
30.8E-02.0S	OFF	0

30.8E-06.2N	OFF	0
31.0E-01.5S	OFF	0
31.1E-01.0S	OFF	0
31.1E-01.1S	OFF	0
31.3E-00.5S	OFF	0
31.6E-03.0S	OFF	0
31.8E-06.5N	OFF	0
32.5E-00.0N	OFF	0
32.8E-07.2N	OFF	0
33.1E-07.3N	OFF	0
33.3E-07.5N	OFF	0

Table 3 - Canal Sampling

		7-Jan	7-Jan	7-Jan	4-Feb	4-Feb	4-Feb
System	**Sample Description**	**MIB (ng/L)**	**Geosmin (ng/L)**	**Cyclocitral (ng/L)**	**MIB (ng/L)**	**Geosmin**	**Cyclocitral (ng/L)**
CAP	Waddell Canal	<2.0	2.3	<2.0	2.1	2.5	<2.0
	Union Hills Inlet	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	CAP Canal at Cross-connect				<2.0	2.2	<2.0
AZ Canal	Salt River @ Blue Pt Bridge	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Verde River @ Beeline	<2.0	2.2	<2.0	<2.0	<2.0	<2.0
	AZ Canal above CAP Cross-connect						
	AZ Canal below CAP Cross-connect						
	AZ Canal at Highway 87				2.4	<2.0	<2.0
	AZ Canal at Pima Rd.	<2.0	<2.0	<2.0	2.5	<2.0	<2.0
	AZ Canal at 56th St.				2.3	<2.0	<2.0
	AZ Canal - Central Avenue				2.0	3.8	<2.0
	AZ Canal - Inlet to Glendale WTP	<2.0	2.0	<2.0	<2.0	5.6	<2.0
	Head of the Consolidated Canal	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Middle of the Consolidated Canal	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
South Tempe Canals	South Canal below CAP Cross-connect	2.0	2.1	<2.0			
	Head of the Tempe Canal	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Tempe Canal - Inlet to Tempe's South	<2.0	<2.0	<2.0			
	Mesa Turnout	<2.0	2.2	<2.0			
	Salt-Gila Pump	<2.0	2.4	<2.0			

Table 4 - Reservoir Samples

		8-Jan	8-Jan	8-Jan	5-Feb	5-Feb	5-Feb
Sample Description	**Location**	**MIB (ng/L)**	**Geosmin (ng/L)**	**Cyclocitral (ng/L)**	**MIB (ng/L)**	**Geosmin (ng/L)**	**Cyclocitral (ng/L)**
Lake Pleasant (Jan)	Eplimnion	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Lake Pleasant (Jan)	Hypolimnion	**<2.0**	**2.1**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Verde River @ Beeline		**<2.0**	**2.2**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Epilimnion	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Epi-near dock	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Hypolimnion	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Salt River @ BluePt Bridge		**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Saguaro Lake	Epilimnion	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**6.2**	**<2.0**
Saguaro Lake	Epi - Duplicate	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**5.4**	**<2.0**
Lake Havasu (Jan)		**<2.0**	**2.0**	**<2.0**	**<2.0**	**2.0**	**<2.0**
Verde River at Tangle Creek (Dec)		**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
Roosevelt at Salt River Inlet		**2.0**	**3.6**	**<2.0**			

Data from Quarterly Sampling

1. Dissolved organic carbon (DOC) levels are at the lowest point in a few years – mostly because of low runoff (few monsoons) on the Verde River. Higher levels of DOC over the past few years have been working their way through the series of Salt River reservoirs. Our quarterly sampling now show a large winter runoff event, possibly associated with runoff from the Wallow Fire, into Roosevelt Lake. DOC concentrations have increased in Roosevelt Lake by > 1 mg/L over the last few months. UV-VIS spectroscopy and fluorescence analysis of organic matter in these lakes show very little difference, which further suggests there are no hidden "pulses" of organics due to the Wallow Fire anywhere in the series of Salt River reservoirs.
2. MIB levels are higher in up-stream Salt River reservoirs (compared with Saguaro Lake). Of all the Salt River reservoirs, this quarter, Saguaro lake has the lowest levels of dissolved nitrogen or total phosphorous. Higher levels in upstream reservoirs could be associated with Wallow Fire and may suggest next year could have higher levels of MIB in Saguaro Lake and algae related DOC, because these nutrients spur on growth of algae.

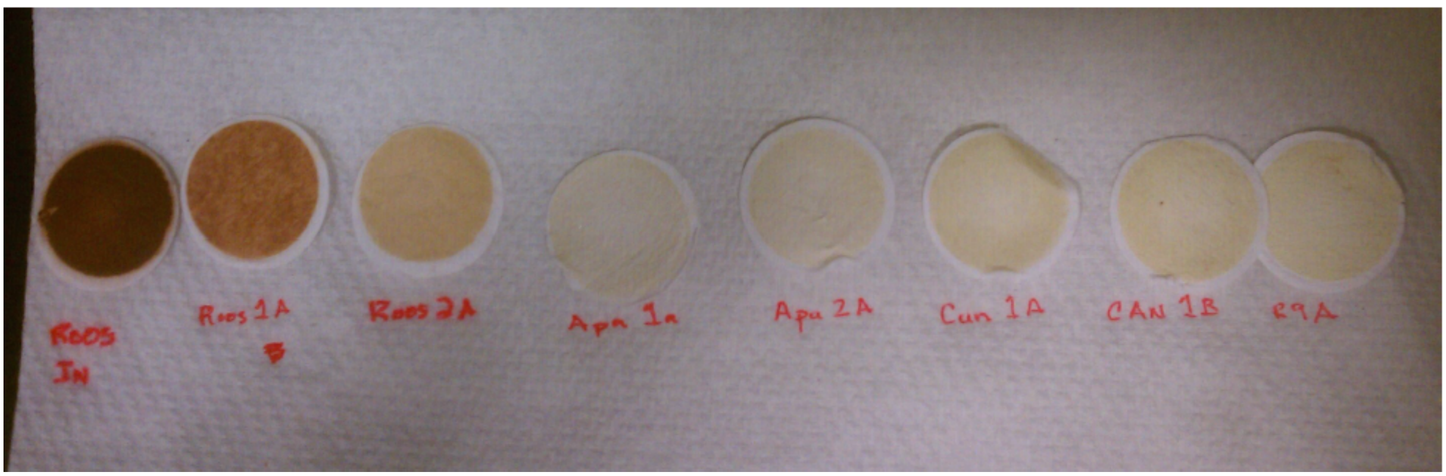
Quarterly Lake Sampling - February 6, 2012

Sample Description	Location	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Roosevelt	Site 1	Eplimnion	<2.0	<2.0	<2.0
Lake Roosevelt	Site 1	Hypolimn	2.1	<2.0	<2.0
Lake Roosevelt	Site 2	Eplimnion	<2.0	<2.0	<2.0
Lake Roosevelt	Site 2	Hypolimn	<2.0	<2.0	<2.0
Lake Apache	Site 1	Eplimnion	<2.0	<2.0	<2.0
Lake Apache	Site 1	Hypolimn	<2.0	<2.0	<2.0
Lake Apache	Site 2	Eplimnion	<2.0	<2.0	<2.0
Lake Apache	Site 2	Hypolimn	<2.0	<2.0	<2.0
Lake Canyon	Site 1	Eplimnion	2.0	<2.0	<2.0
Lake Canyon	Site 1	Hypolimn	<2.0	<2.0	<2.0
Lake Canyon	Site 2	Eplimnion	2.1	<2.0	<2.0
Lake Canyon	Site 2	Hypolimn	<2.0	<2.0	<2.0

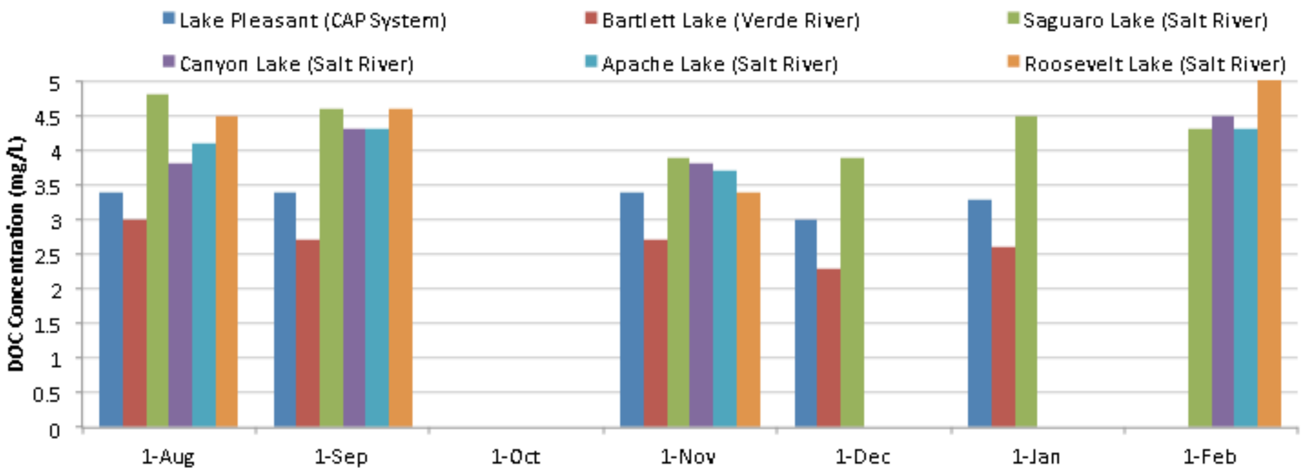
Table 5 - Upper Reservoir Quarterly Samples – February 6, 2013
Samples are listed in upstream to downstream order

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Roosevelt	Epilimnion	5.3	0.150	2.9	0.6
	Hypolimnion	5.3	0.147	2.8	0.6
	Epilimnion	5.9	0.164	2.8	0.7
	Hypolimnion	3.5	0.064	1.8	0.4
Apache	Epilimnion	4.4	0.072	1.6	0.4
	Hypolimnion	4.2	0.062	1.5	0.4
	Epilimnion	3.5	0.060	1.7	0.4
	Hypolimnion	4.3	0.058	1.4	0.4
Canyon	Epilimnion	5.2	0.102	2.0	0.4
	Hypolimnion	3.9	0.066	1.7	0.5
	Epilimnion	4.8	0.102	2.1	0.4
	Hypolimnion	3.8	0.066	1.7	0.5
Saguaro Lake	Epilimnion	4.2	0.068	1.6	0.1
	Epi - Duplicate	4.7	0.069	1.5	0.1
	Hypolimnion	3.9	0.066	1.7	0.1

Particulates LOOK visually very different in the Reservoirs this month

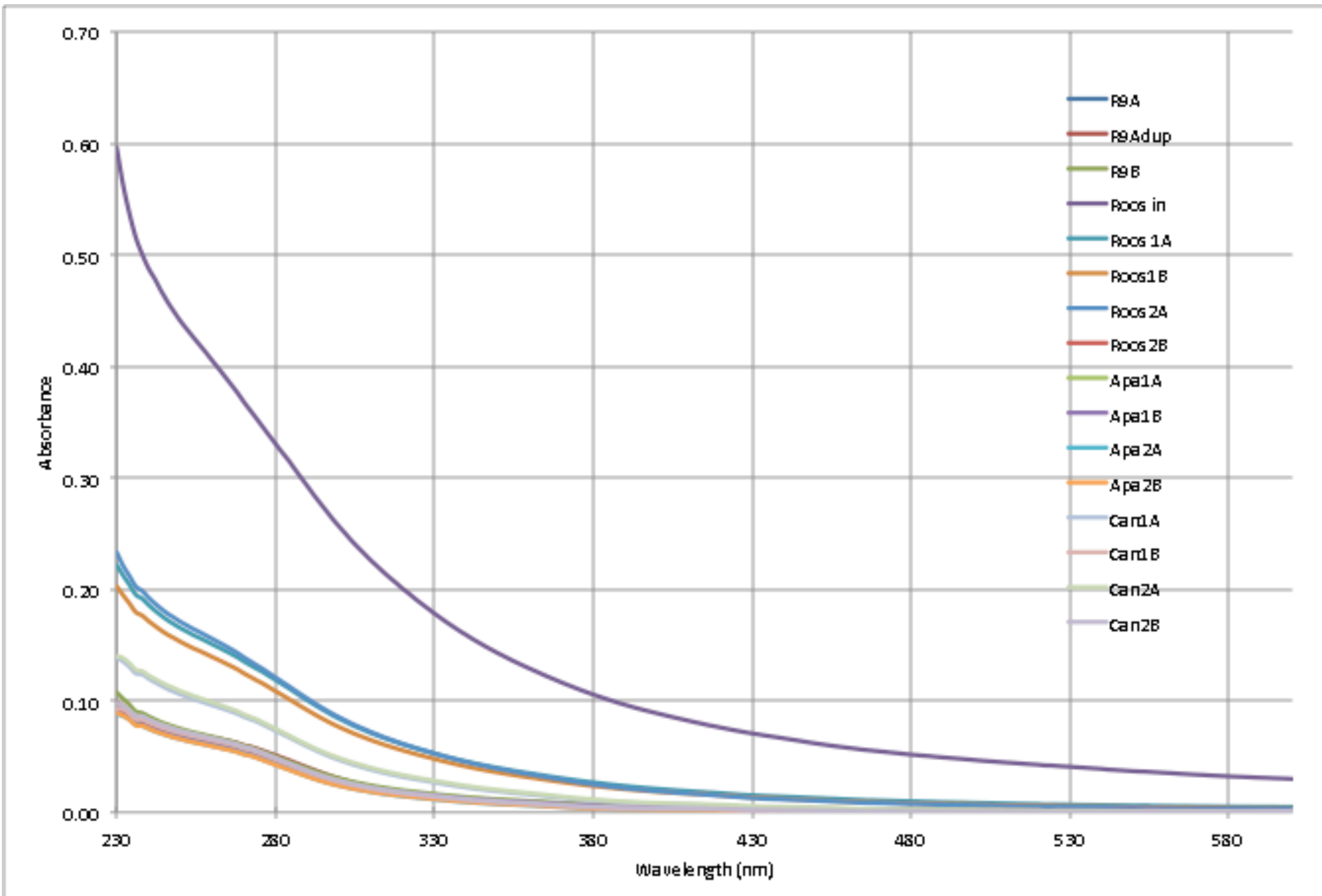


ROOS In is the Salt River *entering* **Roosevelt lake and had high turbidity during the runoff**. Roosevelt lake itself (ROOS 1A and ROOS 2A) had redish color. In contrast to Roosevelt Lake, downstream lakes had yellowish-brown color which is typical of some algae activity.

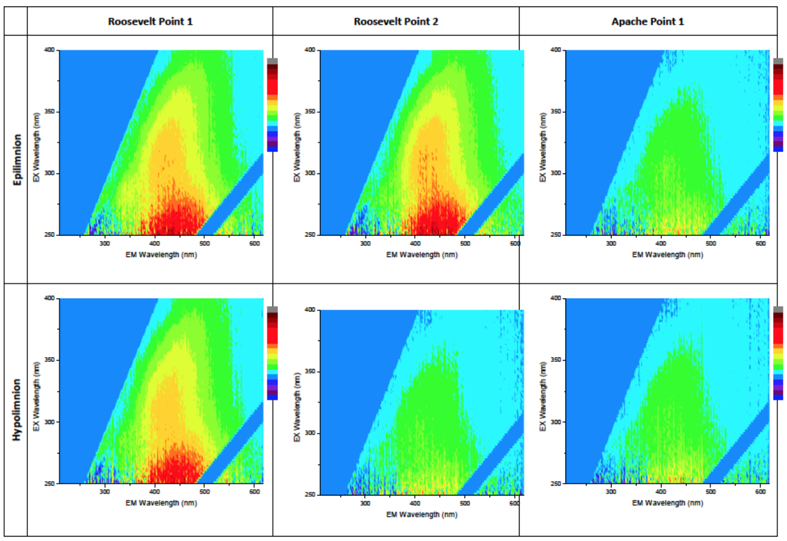

Lake Pleasant (CAP System)
Bartlett Lake (Verde River)
Saguaro Lake (Salt River)
Canyon Lake (Salt River)
Apache Lake (Salt River)
Roosevelt Lake (Salt River)
DOC Concentration (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb

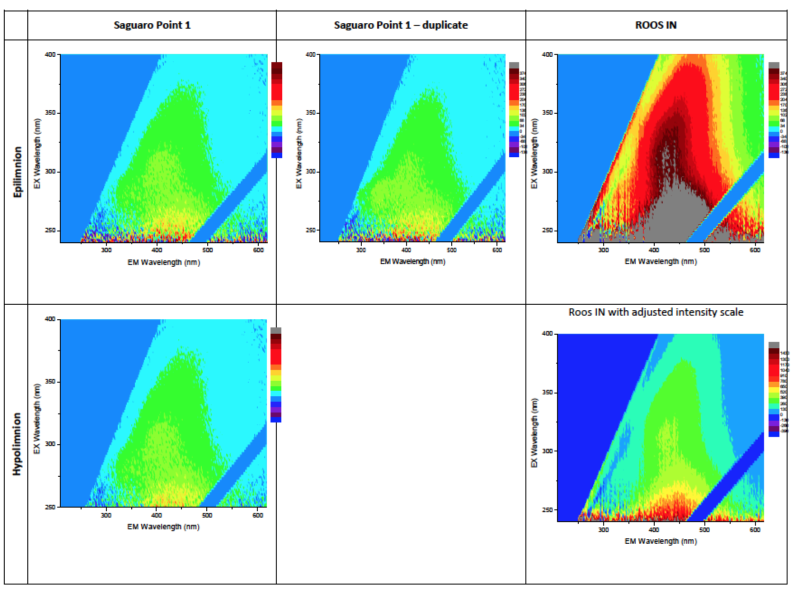
Below are UV-Vis spectra for the series of Salt River lakes. Roos = Roosevelt Lake, Apa = Apache Lake; Can = Canyon Lake; R9 = Saguaro Lake. A = upper 10 m of the water column & B = sample from deeper in the water column. The data show the highest curve (largest absorbance) is for the Influent Roosevelt Sample (ROOS_in) which is the Salt River as it enters Roosevelt Lake. This is DISSOLVED organic molecules in the runoff, and is typical of events that mobilize decaying vegetation into water.

Similarity continues for **fluorescence spectra** (next page). Compounds fluorescence (give off light energy) when excited based upon the structure of their bonds. Where energy is fluoresced has been shown to relate to the "origin" of organic matter – either allochthonous (derived from soil or other terrestrial organic matter) or autochthonous (derived from algae or bacteria). These samples have autochthonous signatures. More details about intepretting these spectra are available – let us know if you want more information?



Fluorescence Excitation-Emission (EEM) Spectra
This type of analysis “fingerprints” dissolved organic matter. Brighter colors indicator higher “response” or more fluorescence. What the data below indicates is a decline in the “red” colored area by the time water leaves the uppermost lake (Roosevelt Lake) and then little change in NOM structure between Apache and Saguaro Lake. Most the high “red” response is in the influent side of Roosevelt Lake and near the surface – which is consistent with being impacted by runoff. The “red” colored area is consistent with humic substances.





New Datasets being collected on Quarterly Samples – Trace Metals

We will be collecting and analyzing a wide suite of trace metals quarterly to build a dataset on potential tracers of different source waters. This is something new that we hope to discuss over time, but raw data is shown here in case people have ideas on what they would like to see.

ICP-OES

	Ag3280	Ag3382	Al3944	Al3961	As1890	As1937	Ba2335	Ba4554	Be2348	Be3130	Bi2230	Ca3933	Ca3968	Cd2144
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ROOS 1A	.0004	.0315	.1080	.0619	.0052	.0067	.1913	.1861	.0001	.0001	.0026	52.79	53.83	.0000
ROOS 1B	.0001	.0306	.2221	.1691	.0055	.0016	.1072	.1040	.0002	.0000	-.0009	51.62	52.13	.0003
ROOS 2A	-.0005	.0311	.0921	.0483	.0067	.0021	.1400	.1352	.0000	.0000	-.0012	51.17	52.07	-.0002
ROOS 2B	-.0006	.0308	.0823	.0375	.0049	.0024	.1445	.1409	.0000	.0000	-.0013	50.90	51.53	-.0003
APA 1A	-.0006	.0299	.0737	.0288	.0023	.0043	.1261	.1233	-.0001	-.0001	-.0022	49.62	50.11	-.0001
APA 1B	.0002	.0306	.0629	.0207	.0057	.0026	.1140	.1107	.0000	-.0001	.0009	49.32	49.98	-.0003
APA 2A	-.0002	.0313	.0614	.0153	.0038	-.0002	.1111	.1076	.0001	-.0001	-.0017	49.76	50.33	-.0002
APA 2B	-.0007	.0310	.0494	.0068	.0019	.0040	.0939	.0915	.0000	.0000	-.0015	49.39	50.28	-.0003
CAN 1A	-.0006	.0309	.0594	.0166	.0069	.0027	.1423	.1402	.0002	.0000	-.0013	50.73	51.33	-.0003
CAN 1B	-.0006	.0302	.0493	.0094	.0040	.0020	.1038	.1020	.0002	-.0001	-.0012	50.12	50.61	-.0003
CAN 2A	.0008	.0300	.0454	.0082	.0010	-.0002	.1110	.1112	.0001	-.0001	.0023	49.32	49.56	-.0003
CAN 2B	-.0004	.0288	.0386	.0059	.0025	.0016	.1059	.1060	.0001	-.0001	-.0014	49.24	49.19	-.0002
R3	-.0007	.0305	.0395	-.0015	.0033	.0013	.1795	.1846	.0001	-.0001	-.0004	63.25	63.52	-.0004
R10	-.0002	.0274	.0311	.0005	.0022	-.0009	.1168	.1193	.0000	-.0001	-.0005	46.48	46.46	-.0004
R25	-.0006	.0260	.0403	.0089	.0203	.0163	.0902	.0919	.0001	-.0001	-.0022	39.65	39.37	-.0004
R2A	-.0010	.0283	.0533	.0144	-.0005	.0040	.1379	.1437	.0004	.0002	-.0022	62.64	62.36	-.0004

	Cd2265	Cd2288	Co2286	Co2388	Cr2677	Cr2835	Cu3247	Cu3273	Fe2382	Fe2395	Fe2599	K_7664-	K_7698-	Li6707	Mg2852
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ROOS 1A	.0001	.0001	.0010	-.0001	.0020	.0004	.0010	.0016	.0742	.0718	.0729	13.82	13.46	.1984	16.93
ROOS 1B	.0004	.0003	.0010	.0001	.0020	.0003	.0023	.0023	.1806	.1757	.1753	14.42	14.21	.2047	20.26
ROOS 2A	.0000	-.0001	.0008	-.0006	.0015	.0000	.0014	.0014	.0461	.0449	.0459	13.47	13.27	.1787	15.04
ROOS 2B	-.0001	-.0004	.0009	-.0007	.0018	.0003	.0008	.0010	.0364	.0355	.0359	13.46	13.19	.1678	16.63
APA 1A	.0001	-.0001	.0005	-.0010	.0019	.0001	.0016	.0021	.0602	.0590	.0592	11.55	10.89	.1362	13.52
APA 1B	-.0002	-.0003	.0006	-.0001	.0018	-.0001	.0006	.0009	.0366	.0360	.0362	11.48	10.73	.1436	15.71
APA 2A	-.0002	-.0003	.0007	-.0009	.0022	.0000	.0007	.0009	.0323	.0317	.0327	11.61	9.855	.1550	8.994
APA 2B	-.0001	-.0004	.0003	-.0013	.0017	.0002	.0004	.0004	.0358	.0347	.0351	11.33	10.23	.1459	13.16
CAN 1A	-.0001	-.0004	.0006	-.0003	.0018	-.0001	.0005	.0011	.0449	.0434	.0444	11.37	10.21	.1621	11.99
CAN 1B	.0000	-.0002	.0008	-.0012	.0013	.0003	.0004	.0009	.0336	.0342	.0339	11.46	10.79	.1416	15.72
CAN 2A	-.0001	-.0003	.0006	-.0012	.0013	.0004	.0005	.0005	.0289	.0291	.0282	10.83	10.16	.1504	18.77
CAN 2B	.0001	-.0003	.0005	-.0006	.0014	.0000	.0008	.0003	.0199	.0207	.0197	10.91	10.48	.1447	17.20
R3	-.0001	-.0004	.0003	.0000	.0015	.0002	.0009	.0006	.0039	.0036	.0040	7.380	6.751	.0428	22.61
R10	.0000	-.0003	.0005	-.0009	.0018	.0004	.0009	.0001	.0026	.0040	.0042	10.86	9.965	.1387	14.23
R25	-.0001	-.0002	.0000	-.0016	.0015	.0001	.0007	-.0002	.0081	.0080	.0086	5.358	5.277	.0346	29.90
R2A	-.0002	-.0003	.0000	.0002	.0022	-.0002	.0009	.0005	.0047	.0056	.0057	7.107	6.991	.0351	22.22

	Mn2576	Mn2593	Mo2020	Mo2816	Na5889	Ni2216	Ni2316	Ni3414	Pb2169	Pb2203	Sb2068	Sb2175	Se1960	Se2039
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ROOS 1A	.0128	.0127	.0032	.0046	229.0	-.5016	.0004	.0006	.0002	.0073	.0014	.0004	.0005	.0120
ROOS 1B	.0279	.0275	.0021	.0036	221.9	-.5160	.0007	.0019	.0031	.0077	.0035	.0013	.0057	.0047
ROOS 2A	.0503	.0493	.0018	.0024	201.0	-.5078	.0007	-.0006	.0004	.0063	.0028	.0011	-.0013	.0106
ROOS 2B	.0352	.0350	.0018	.0018	199.4	-.5017	.0005	-.0006	.0034	.0051	.0022	.0007	.0018	.0075
APA 1A	.0960	.0954	.0016	.0017	163.7	-.5027	.0004	-.0009	.0013	.0058	.0016	.0017	.0030	.0032
APA 1B	.0806	.0801	.0017	.0018	160.6	-.5006	.0005	.0010	.0017	.0055	.0024	.0034	.0005	.0039
APA 2A	.0876	.0867	.0015	.0020	157.0	-.5085	.0009	.0023	.0064	.0070	.0007	.0017	.0003	.0155
APA 2B	.1186	.1179	.0015	.0011	156.2	-.5044	.0004	.0028	.0090	.0050	.0010	-.0001	-.0017	.0025
CAN 1A	.1015	.1008	.0015	.0020	151.9	-.5200	.0003	.0019	.0029	.0053	.0006	.0027	.0007	.0083
CAN 1B	.0956	.0954	.0013	.0013	150.6	-.5141	.0007	.0021	-.0020	.0047	.0023	.0027	-.0021	.0012
CAN 2A	.1147	.1158	.0027	.0035	153.3	-.5160	.0004	.0037	.0077	.0047	.0027	.0015	.0017	.0123
CAN 2B	.0743	.0753	.0018	.0022	153.0	-.5193	.0004	.0025	.0030	.0058	.0029	.0027	-.0049	.0036
R3	.0002	.0001	.0040	.0044	64.32	-.3088	.0009	.0020	.0055	.0022	.0022	.0011	.0029	.0105
R10	.0004	.0005	.0015	.0024	147.6	-.5373	.0007	.0001	.0066	.0060	.0027	.0062	.0063	.0066
R25	.0013	.0013	.0025	.0038	36.09	-.6893	.0008	.0029	.0018	.0072	.0017	.0031	-.0012	.0054
R2A	.0007	.0007	.0041	.0054	66.89	-.3240	.0014	.0015	.0024	.0026	.0025	.0036	.0011	.0043

	Sr4077	Sr4215	Th2837	Th3180	Tl1908	Tl2767	U_3670	U_3859	V_2924	V_3093	V_3102	Zn2025	Zn2025	Zn2138
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ROOS 1A	.5642	.5377	.0135	.0479	.0023	.0400	.0026	-.0717	.0035	.0439	.0034	.0353	.0386	.0421
ROOS 1B	.5345	.5315	.0035	.0378	.0017	.0330	.0096	-.0722	.0038	.0434	.0025	.0091	.0111	.0149
ROOS 2A	.5382	.5106	.0017	.0338	.0019	.0181	.0073	-.0647	.0032	.0410	.0020	.0061	.0093	.0127
ROOS 2B	.5501	.5121	-.0006	.0342	.0018	.0216	-.0018	-.0621	.0031	.0408	.0025	.0478	.0507	.0545
APA 1A	.4733	.4560	-.0001	.0345	-.0008	.0365	.0044	-.0549	.0015	.0348	.0002	.0138	.0178	.0207
APA 1B	.4456	.4534	-.0006	.0335	.0023	.0200	-.0001	-.0550	.0014	.0345	.0004	.0018	.0058	.0087
APA 2A	.4900	.4550	.0006	.0351	-.0004	.0122	.0087	-.0559	.0015	.0344	.0005	.0028	.0067	.0096
APA 2B	.4693	.4524	-.0008	.0339	-.0007	.0234	.0019	-.0529	.0010	.0340	.0007	.0006	.0039	.0066
CAN 1A	.4656	.4469	.0014	.0352	.0020	.0381	.0005	-.0536	.0013	.0332	.0002	.0654	.0609	.0642
CAN 1B	.4433	.4407	-.0007	.0308	-.0033	.0079	.0020	-.0536	.0013	.0338	-.0003	.0087	.0094	.0124
CAN 2A	.4215	.4363	.0145	.0445	.0005	.0226	-.0096	-.0626	.0011	.0347	-.0005	.0058	.0073	.0105
CAN 2B	.4341	.4328	.0023	.0318	-.0004	.0135	-.0114	-.0586	.0011	.0354	-.0009	.0037	.0072	.0106
R3	.8374	.8432	.0001	.0424	.0022	.0288	-.0012	-.0243	.0020	.0561	-.0004	.0586	.0620	.0721
R10	.4337	.4284	.0035	.0267	.0033	.0102	.0018	-.0656	.0015	.0361	-.0010	.0090	.0081	.0115
R25	.5850	.6012	.0022	.0190	.0036	.0583	-.0008	-.0172	.0055	.0781	.0020	.0005	.0036	.0099
R2A	.8729	.8643	.0012	.0409	.0024	.0209	-.0063	-.0288	.0025	.0629	-.0010	.0032	.0083	.0144

ICP-MS

	7Li	9Be	27Al	51V	52Cr	55Mn	56Fe	59Co	60Ni	65Cu	66Zn
Quarterly Sam	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
ROOS 1A	147.2	0.398	46.29	7.123	0.871	12.64	74.7	0.466	1.617	1.677	39.9
ROOS 1B	148.2	0.106	99.27	7.35	0.792	27.63	151.3	0.27	1.695	2.442	13.88
ROOS 2A	134.5	0.052	33.55	6.602	0.635	51.17	42.22	0.166	1.307	1.585	12.81
ROOS 2B	133.1	0.02	34.69	6.553	0.678	33.3	39.42	0.13	1.319	1.061	51.26
APA 1A	111.6	0.017	32.22	4.939	0.647	106.8	75.91	0.116	1.403	1.943	19.65
APA 1B	111.1	0.012	27.67	4.75	0.555	92.67	43.61	0.098	1.229	0.859	8.214
APA 2A	109.2	0.008	22.21	4.745	0.583	97.61	40.54	0.096	1.36	1.224	9.145
APA 2B	109.3	0.002	11.89	4.817	0.466	136.8	42.64	0.095	1.29	0.847	6.307
CAN 1A	106.3	0.002	19.56	4.739	0.98	114.5	58.12	0.087	1.259	0.92	60.09
CAN 1B	106	0	13.66	4.652	0.578	109.8	46.14	0.086	1.179	0.809	11.68
CAN 2A	106.1	0.003	12.56	4.646	0.503	136.2	33.19	0.08	1.157	0.761	9.788
CAN 2B	107.1	0.005	10.14	4.625	0.524	88.21	26.26	0.077	1.201	1.043	9.784
R3	35.47	0.003	2.84	2.643	0.431	0.139	4.775	0.089	1.673	1.39	65.54
R10	101.5	-0.008	2.727	4.221	0.473	0.471	4.284	0.067	1.005	1.137	10.35
R25	29.54	-0.003	12.6	4.873	0.618	1.326	8.408	0.112	0.997	1.091	9.191
R2A	35.72	-0.004	10.91	2.634	0.416	0.736	5.073	0.096	1.722	1.126	13.32

	75As	82Se	88Sr	95Mo	107Ag	111Cd	121Sb	138Ba	202Hg	205Tl	208Pb	232Th	235U	238U
Quarterly Sam	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
ROOS 1A	5.391	5.848	609	3.288	0.375	0.445	0.716	208.7	1.34	0.369	0.481	0.443	5.362	1.715
ROOS 1B	4.975	3.048	612.2	1.901	0.047	0.564	0.372	118.1	0.492	0.094	0.37	0.109	4.935	1.468
ROOS 2A	4.734	2.457	580.4	1.635	0.013	0.101	0.284	156.4	0.271	0.03	0.129	0.04	4.656	1.36
ROOS 2B	4.635	2.472	579	1.569	0.013	0.038	0.275	159.6	0.181	-0.002	0.077	0.022	4.63	1.324
APA 1A	5.111	1.826	510.9	1.486	0.004	0.111	0.219	145.8	0.138	0.001	0.126	0.026	4.006	1.128
APA 1B	5.126	1.828	505.8	1.449	0.006	0.034	0.196	123	0.112	-0.007	0.12	0.021	3.757	1.113
APA 2A	5.004	1.663	505.1	1.42	0.008	0.085	0.187	121.7	0.09	-0.006	0.072	0.01	3.815	1.102
APA 2B	4.892	2.237	506.4	1.427	0.009	0.023	0.171	102.2	0.081	-0.008	0.044	0.15	3.858	1.109
CAN 1A	4.62	0.976	500.9	1.362	0.001	0.046	0.164	153.2	0.071	-0.009	0.081	0.025	3.698	1.063
CAN 1B	4.56	1.708	501.4	1.354	-0.005	0.04	0.18	114.8	0.062	-0.009	0.059	0.018	3.823	1.066
CAN 2A	4.5	1.73	500.7	1.4	0.003	0.021	0.16	122.8	0.058	-0.009	0.059	0.013	3.717	1.067
CAN 2B	4.555	2.626	504.4	1.343	-0.002	0.195	0.163	119.3	0.049	-0.009	0.062	0.007	3.763	1.065
R3	2.485	2.836	960.4	3.541	-0.003	0.003	0.359	206.9	0.041	-0.007	0.01	0.003	11.45	3.285
R10	4.512	1.579	508.8	1.503	-0.004	-0.004	0.762	132.1	0.043	-0.008	0.051	0	4.075	1.166
R25	14.99	1.141	695.8	2.476	0	0.01	0.287	102.6	0.035	-0.009	0.018	0.003	6.817	1.948
R2A	3.349	3.151	1009	3.849	-0.001	0.002	0.356	158.9	0.291	-0.007	0.009	0.002	12.46	3.504