Interpretation Guide to Reedy Creek Monitoring Data
2010 Edition

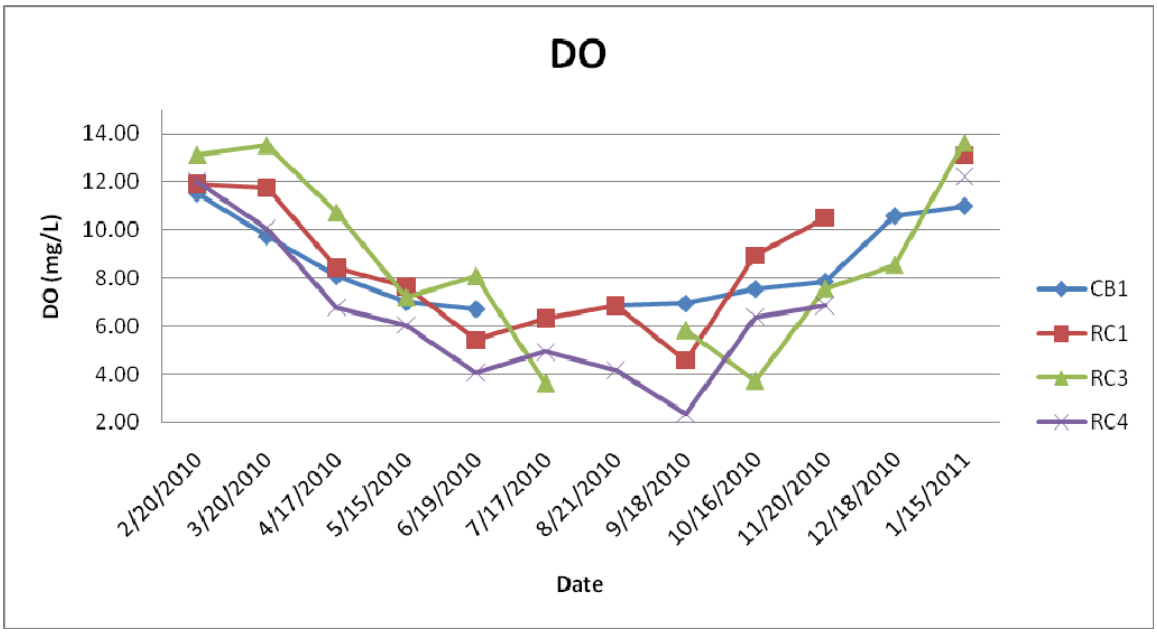
Field Parameters

pH – State water quality standards define an acceptable pH range as 6.0 – 9.0. However, this is a **very broad** standard that applies to most state waters regardless of local geology which can have a dramatic influence on stream pH. In general, Piedmont streams like Reedy Creek have a pH between 6.5 and 7.0 under most conditions. One exception is that the pH will go down following a rain event. In part, this is due to the fact that rain is naturally a little bit acidic plus it often carries air pollution from the burning of fossil fuels creating "acid rain".

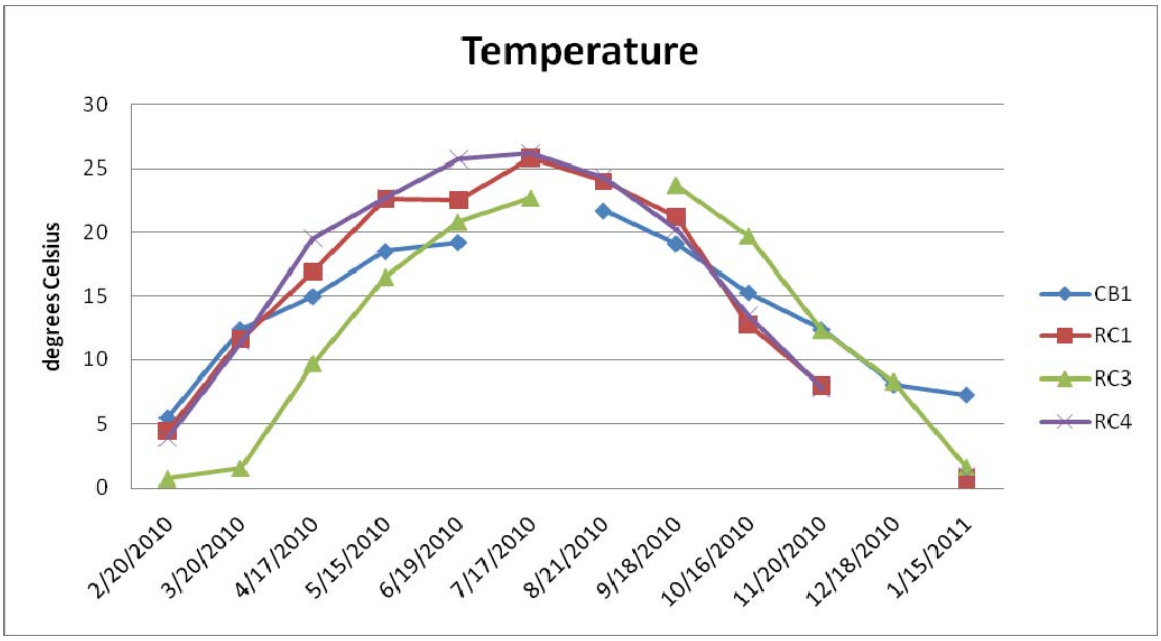
Dissolved Oxygen – The state water quality standard for dissolved oxygen for most state waters is 4.0 milligrams/liter. A dissolved oxygen reading of less than 4.0 mg/L is a violation. In general, DO is not a problem in the colder months because:

1) Cold water holds more oxygen than warm water
2) Colder temperatures slow down biological processes such as decomposition which use up oxygen
3) Stream flows are higher which helps put oxygen back in the water

The most likely time to see a DO violation is during the summer months when water is warm and stream flow is sluggish. And the most likely time of day to find a violation is at dawn. During the day, algae are pumping oxygen into the water as a result of photosynthesis. But at night, photosynthesis stops and all organisms are using up oxygen (even the algae). So here is additional motivation to stick with early morning sampling! It doesn't just "beat the heat", it increases the chance of detecting DO issues.



Temperature – The state water quality standard for temperature is 32º C. Readings higher than 32º C are a violation of state water quality standards. Given the time that we sample, it is unlikely that we would detect violations. However, given the extent of unshaded concrete channels which absorb a lot of heat, it is certainly possible that segments of Reedy Creek exceed the temperature standard during summer afternoons. It would be interesting to check this out.



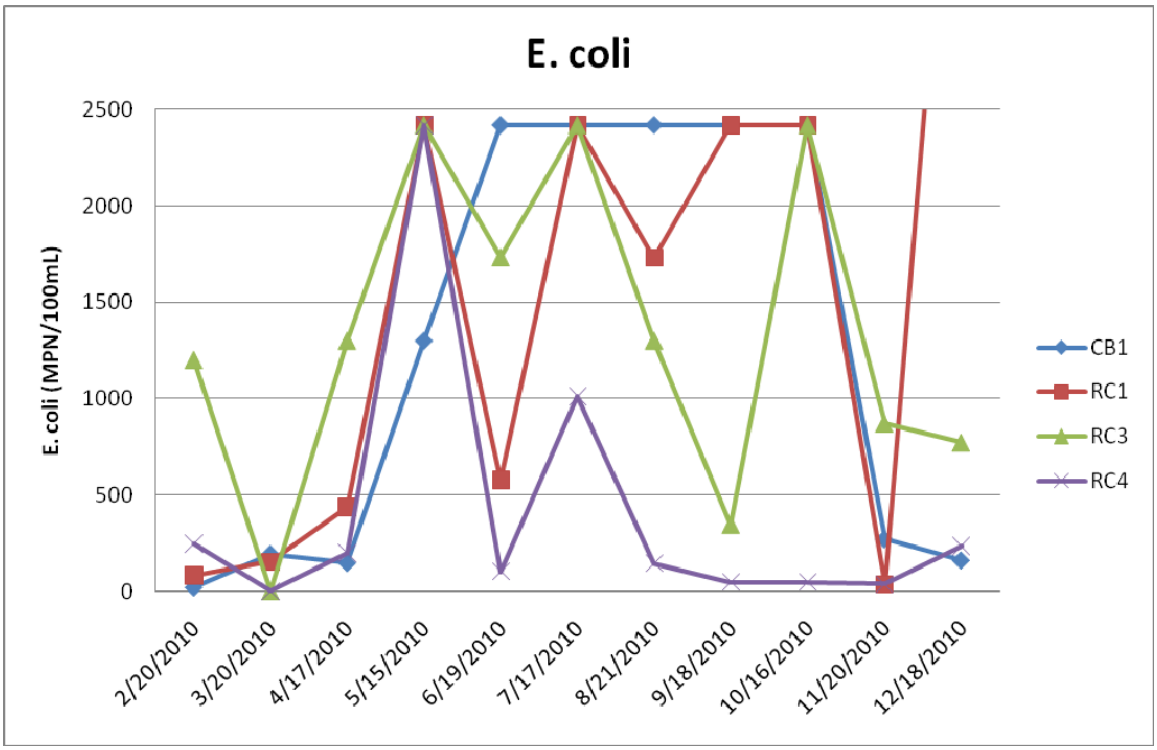
Turbidity - Turbidity is the measure of the relative clarity of water; the greater the turbidity, the murkier the water. Material that becomes mixed and suspended in water will reduce water clarity. During periods of heavy rain, run-off from land can carry large amounts of silt into streams. Silt is often related to nutrient enrichment of a river because nutrients such as phosphorus cling to soil particles. In addition, unprotected shoreline will erode and contribute to suspended particles to the water.

Turbidity affects fish and aquatic life by interfering with the penetration of sunlight. If suspended particles "block out" light, photosynthesis, which produces oxygen for fish and aquatic life, will be reduced. Suspended sediment may also affect aquatic life by clogging gills and reducing visibility needed to find food.

There is no state standard for turbidity.

Laboratory Analytes

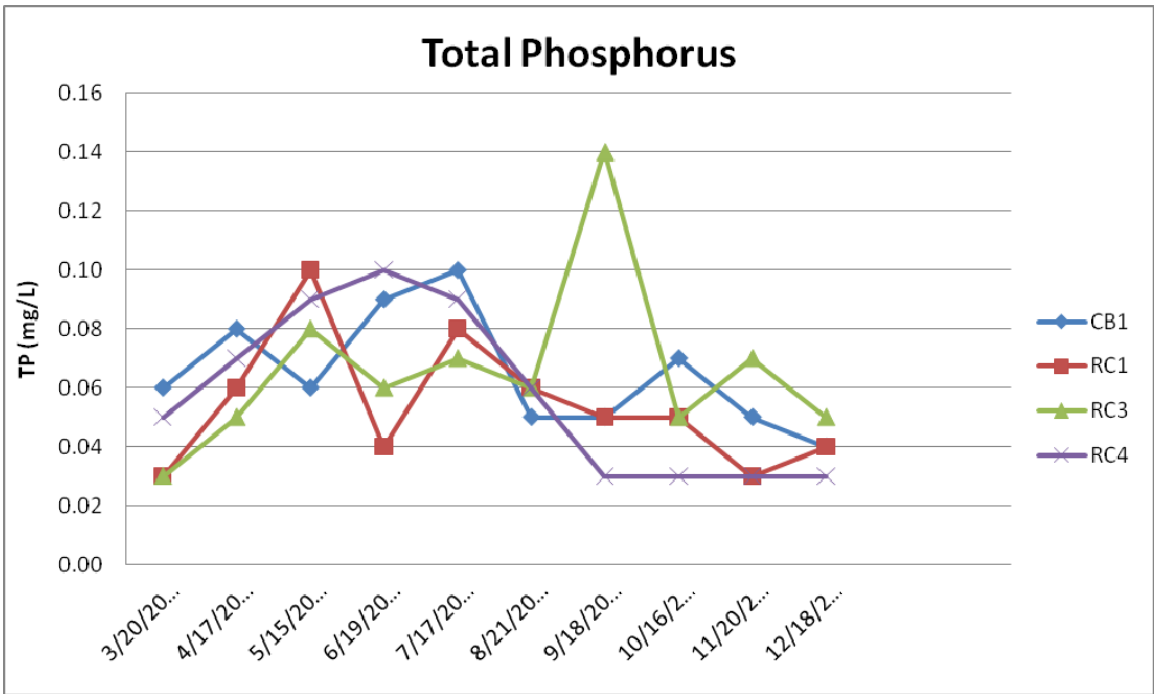
***Escherichia coli* –** The standard for *E. coli* is 235 colony-forming units/100 milliliters of sample water. (A colony-forming unit is simply one bacterial cell and 100 ml is about 3 fluid ounces or less than ½ cup.) As you look at the data, you will see that most of our stations exceed this critical value most of the time, especially in warmer months.



***Nutrients* –** Some General Comments first. Virginia does not currently have any relevant numerical standards for nutrients in surface waters. There is a drinking water standard for nitrate (10 mg/L) to protect human health; but this value is far too high to protect aquatic resources. (It is one thing to drink some water; but it much different to actually live in it.) There is also a very complicated set of standards for ammonia in surface water to guard against direct toxicity from ammonia. But it is not really meant to protect against indirect effects of ammonia as a nutrient.

One of the reasons that Virginia has not yet developed nutrient standards is because it is so difficult. There are a lot of variables (stream shading, flow, geology, aquatic community interactions) which can influence what nutrient level is too high for a particular stream. On the other hand, there is a wealth of data that clearly shows that aquatic communities are negatively impacted as nutrient levels increase. The guidelines below are based primarily on data collected in Virginia streams.

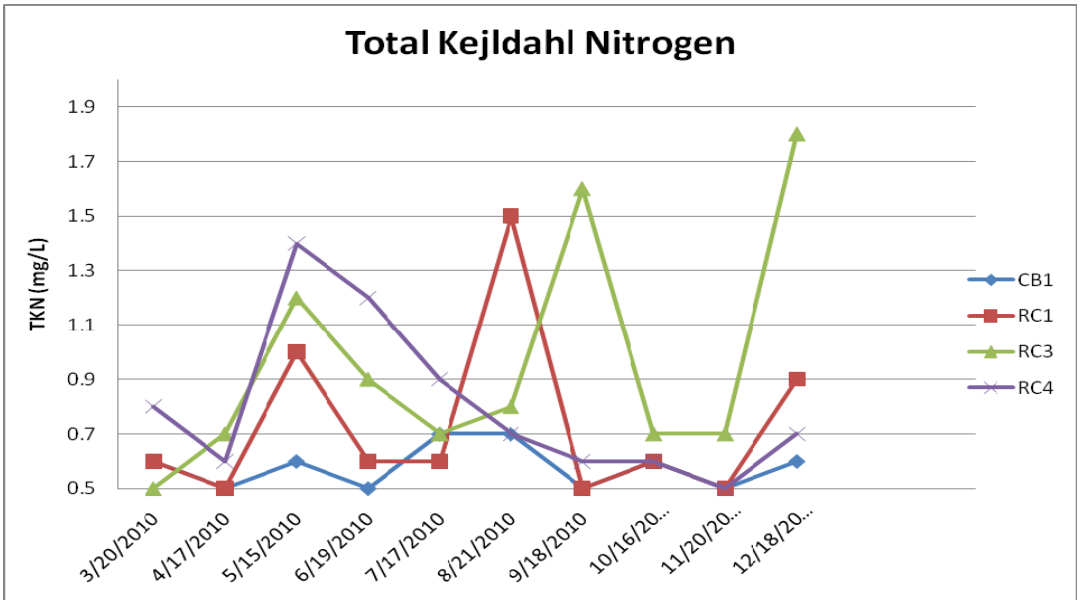
Total Phosphorous – Phosphorous is usually the most important nutrient in fresh waters like Reedy Creek. In general, total phosphorous (TP) levels between 0.05 and 0.10 mg/L are cause for concern. Virginia streams that have not been impacted much by human activities usually have TP concentrations of 0.02 mg/L or less. TP concentrations greater than 0.1 mg/L are cause for serious concern. Streams with TP concentrations above 0.1 mg/L usually show clear signs of impairment to the biological community.



Ammonia – Ammonia levels are usually fairly low in streams because ammonia tends to be converted to nitrate and other forms of nitrogen rather quickly. In a stream such as Reedy Creek, high ammonia levels could result from sewer line leaks/overflows, an illicit discharge, or fertilizer runoff. Healthy streams generally have ammonia levels under 0.1 mg/L. Ammonia concentrations above 0.3 mg/L are higher then desirable and concentrations above 0.5 mg/L are cause for serious concern.

Nitrate – Nitrate is often the most common form of nitrogen in streams. Nitrate concentrations above 1.0 mg/L are cause for concern in Piedmont streams like Reedy Creek.

Total Kejldahl (TKN) – TKN is a measure of organic nitrogen in a stream. TKN values above 0.6 mg/L are cause for concern. Anything above 1.0 mg/L is definitely bad and in Reedy Creek would probably be due to a sanitary sewer issue.



Total Nitrogen (TN) – Total nitrogen can be obtained by summing the values for nitrate and TKN. TN values above 2.0 mg/L are associated with impairment to aquatic life.

Total Suspended Solids (TSS) – TSS is a measure of sediment suspended in the water column. This value is highly variable depending on recent precipitation, stream flow, and other variables. There are no state water quality standards and there is even disagreement among water quality professionals over how useful this parameter is when trying to evaluate sediment issues. However, it is good to be collecting this baseline data for Reedy Creek in case someone figures out a good way to use it!!

Chlorophyll – Chlorophyll is an indirect way to detect nutrient pollution because it measures how much algae is in the water column. In some cases, it can be more valuable than measuring the nutrient levels directly. Imagine there is a steady, relatively high level of nutrients coming into the creek. As the algae grow, they are taking in the nutrients and lowering the concentration of nutrients in the stream. If you measured nutrients under these conditions, the nutrient levels might be fairly low; but the chlorophyll levels might be sky high. So it can be very helpful to measure both chlorophyll and nutrients.

Now, here's the rub. In streams like Reedy Creek, most of the algae is attached to the rocks, sand, wood, etc. and is not floating free in the water column where you sample. This is why most of the chlorophyll levels from your samples were undetectable (less than 5mg/L). However, it is probably worth continuing to sample chlorophyll because one can imagine conditions where the data could be useful. In the meantime, please keep making observations of the algae growing on the rocks – this is very important information to capture!

This guide was compiled by Bill Shananbruch, Reedy Creek Coalition, and Anna Mathis, Alliance for the Chesapeake Bay. Many thanks to our volunteer monitors for field work and sample collection and to City of Richmond Department of Public Utilities for their in-kind lab analysis services.

Reedy Creek 2010 Water Quality Data

Site	Date	Air Temp	Water Temp	DO (mg/L)	pH	water depth (cm)	water clarity (cm)	Ammonia (mg/L)	Chlorophyll A (µg/L)	E. Coli (MPN/100mL)	Nitrate+ Nitrite (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)
CB1	2/20/2010	6.0	5.5	11.50	6.30	36.0	114.8	< 0.1	< 5	20	0.9	< 0.5	< 0.1	
CB1	3/20/2010	15.6	12.4	9.73	6.47	17.0	87.3	< 0.1	< 5	194	1.4	0.6	0.06	
CB1	4/17/2010	15.5	15.0	8.08	6.81	35.0	> 120	0.5	< 5	147	1.9	< 0.5	0.08	3.0
CB1	5/15/2010	21.6	18.5	7.00	6.86	32.0	79.4	0.1	< 5	1300	1.5	0.6	0.06	5
CB1	6/19/2010	27.4	19.2	6.72	6.94	36.5	> 120	< 0.1	< 5	> 2420	2.2	< 0.5	0.09	< 1
CB1	7/17/2010							0.1	no data	> 2420	1.5	0.7	0.1	4
CB1	8/21/2010	22.9	21.7	6.85	6.92		> 120	< 0.1	< 5	> 2420	1.9	0.7	0.05	3
CB1	9/18/2010	16.7	19.1	6.95	7.00	36.2	> 120	0.1	< 5	> 2420	2	< 0.5	0.05	1
CB1	10/16/2010	8.1	15.3	7.55	6.88	22.0	> 120	0.2	< 5	> 2420	1.8	0.6	0.07	5
CB1	11/20/2010	7.7	12.4	7.86	6.90	32.5	> 120	< 0.1	< 5	270	2	< 0.5	0.05	1
CB1	12/18/2010	1.6	8.1	10.57	6.83	29.9	> 120	0.6	< 5	161	1.7	0.6	0.04	1
CB1	1/15/2011	7.7	7.3	10.98	6.98	30.1	> 120	0.2	< 5	228	2.1	< 0.5	< 0.02	0
RC1	2/20/2010	42 (F)	40 (F)	11.90	6.75	5.9	102.3	< 0.1	< 5	82	0.7	< 0.5	< 0.1	
RC1	3/20/2010	14.4	11.6	11.76	7.32	10.6	> 120	< 0.1	< 5	153	0.8	0.6	0.03	
RC1	4/17/2010	16.6	16.9	8.43	7.24			0.1	< 5	435	0.8	< 0.5	0.06	4.0
RC1	5/15/2010		22.6	7.64		11.0	53.0	0.3	< 5	> 2420	< 0.5	1	0.1	9
RC1	6/19/2010		22.5	5.42	6.83	14.0	> 120	< 0.1	< 5	579	0.7	0.6	0.04	1
RC1	7/17/2010		25.8	6.31	6.55	7.0	76.3	< 0.1	no data	> 2420	< 0.5	0.6	0.08	5
RC1	8/21/2010		24.0	6.87	7.33	8.3	> 120	< 0.1	< 5	1730	< 0.5	1.5	0.06	2
RC1	9/18/2010		21.2	4.58	7.23	11.9	> 120	0.1	< 5	> 2420	2	< 0.5	0.05	1
RC1	10/16/2010		12.8	8.94	7.28	0.4	113	0.1	< 5	2420	< 0.5	0.6	0.05	3
RC1	11/20/2010		8	10.5	6.74	8.5	> 120	< 0.1	< 5	35	0.6	< 0.5	0.03	1
RC1	12/18/2010							0.7	< 5	> 4840	0.8	0.9	0.04	3
RC1	1/15/2011		0.7	13.1	7.13	10	49.3	0.2	< 5	185	1	0.5	0.03	10

Note: Data highlighted in red either does not meet state water quality standards or is at a level that causes concern for stream health.

Reedy Creek 2010 Water Quality Data

Site	Date	Air Temp	Water Temp	DO (mg/L)	pH	water depth (cm)	water clarity (cm)	Ammonia (mg/L)	Chlorophyll A (µg/L)	E. Coli (MPN/100mL)	Nitrate+ Nitrite (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)
RC3	2/20/2010	5.0	1.5	13.50	6.50	29.8	109.0	< 0.1	< 5	1200	0.6	0.7	< 0.1	
RC3	3/20/2010	13.6	9.7	10.71	6.99	27.0	> 120	< 0.1	< 5	166	0.8	< 0.5	0.03	
RC3	4/17/2010	15.5	16.5	7.19	6.81	134.0	>120	0.3	< 5	1300	0.9	0.7	0.05	3.0
RC3	5/15/2010	25.4	20.8	8.07	7.14	27.0	62	0.3	< 5	> 2420	0.6	1.2	0.08	8
RC3	6/19/2010	27.5	22.7	3.62	6.78	24.5	> 120	0.3	10	1733	1.2	0.9	0.06	6
RC3	7/17/2010							< 0.1	no data	>2420	< 0.5	0.7	0.07	6
RC3	8/21/2010	23.0	23.7	5.84	7.07		> 120	< 0.1	< 5	1300	< 0.5	0.8	0.06	3
RC3	9/18/2010	20.5	19.7	3.74	6.94	21.0	> 120	0.4	< 5	345	0.8	1.6	0.14	11
RC3	10/16/2010	13.7	12.3	7.56	6.99	21.0	> 120	0.2	< 5	> 2420	< 0.5	0.7	0.05	3
RC3	11/20/2010	8.5	8.3	8.54	6.86	24.0	> 120	0.2	< 5	870	0.8	0.7	0.07	3
RC3	12/18/2010	1.7	1.6	13.6	6.97	22.5	88	0.8	< 5	770	0.8	1.8	0.05	3
RC3	1/15/2011	7.1												
RC4	2/20/2010	47 (F)	39 (F)	12.00	6.25	15.3	75.0	< 0.1	< 5	248	< 0.5	< 0.5	< 0.1	
RC4	3/20/2010	19.8	11.4	10.05	6.85	10.6	59.0	< 0.1	< 5	172	< 0.5	0.8	0.05	
RC4	4/17/2010	19.2	19.5	6.78	6.71	12.0	72.0	0.4	< 5	199	< 0.5	0.6	0.07	5.0
RC4	5/15/2010		22.7	6.04		18.0	48.2	0.8	< 5	> 2420	0.5	1.4	0.09	11
RC4	6/19/2010		25.7	4.07	6.85	18.0	99	0.3	< 5	102	< 0.5	1.2	0.1	5
RC4	7/17/2010		26.2	4.93	6.23	15.0	52.4	< 0.1	no data	1010	< 0.5	0.9	0.09	8
RC4	8/21/2010		24.3	4.17	6.75	16.0	> 120	< 0.1	5	145	< 0.5	0.7	0.06	3
RC4	9/18/2010		20.2	2.36	6.73	1.1		< 0.1	< 5	48	< 0.5	0.6	0.03	3
RC4	10/16/2010		13.5	6.39	6.65	0.9	78.2	< 0.1	< 5	48	< 0.5	0.6	0.03	3
RC4	11/20/2010		7.8	6.86	6.36	6.3	> 120	< 0.1	< 5	36	< 0.5	< 0.5	0.03	4
RC4	12/18/2010							0.2	< 5	236	< 0.5	0.7	0.03	2
RC4	1/15/2011		0.9	12.21	6.42	18	> 120	< 0.1	< 5	285	< 0.5	< 0.5	< .02	2

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