Water Quality Monitoring Report
Lower Boise River and Snake River Tributaries
April 24 through October 9, 2008

Prepared by
Kirk Campbell
ISDA

ISDA Technical Report Summary W-29

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Introduction

The Idaho State Department of Agriculture (ISDA) surface water program working in conjunction with the Idaho Department of Environmental Quality (IDEQ) conducted a water quality monitoring project for the legislated five year Total Maximum Daily Load (TMDL) review process for the Lower Boise River. The four tributaries monitored by ISDA for the Lower Boise TMDL included Conway Gulch (CG-1), Mason Creek (MC-1), Fifteen Mile Creek (15-1), and Willow Creek (WC-1). A fifth tributary Sand Hollow (SH-1) that resides within the same assessment unit (AU), but discharges into the Snake River, was also monitored by ISDA (Figures 1 and 2).

In 1998, ISDA had conducted TMDL monitoring on three of the tributaries monitored during the 2008 study. The data collected for sediment and phosphorus in 1998 on SH-1, MC-1, and 15-1 will be compared to the 2008 data within the proper sections of this report.

Bi-weekly monitoring began on April 24, 2008 and concluded on October 9, 2008 (n=13). All sample locations were established as close to their confluence with the Boise and Snake River as access and safety allowed (Table 1).

Table 1. Site distances from tributary to confluence with the Snake and Boise River.

Site	Distance to Confluence	River
Sand Hollow	0.55 miles	Snake
Conway Gulch	0.22 miles	Boise
Mason Creek	1.06 miles	Boise
Fifteen Mile	1.2 miles	Boise
Willow Creek	0.20 miles	Boise

On-site measurements collected by ISDA included discharge (CFS), dissolved oxygen, temperature, pH, conductivity and total dissolved solids. Analytical parameters collected were suspended sediment concentration

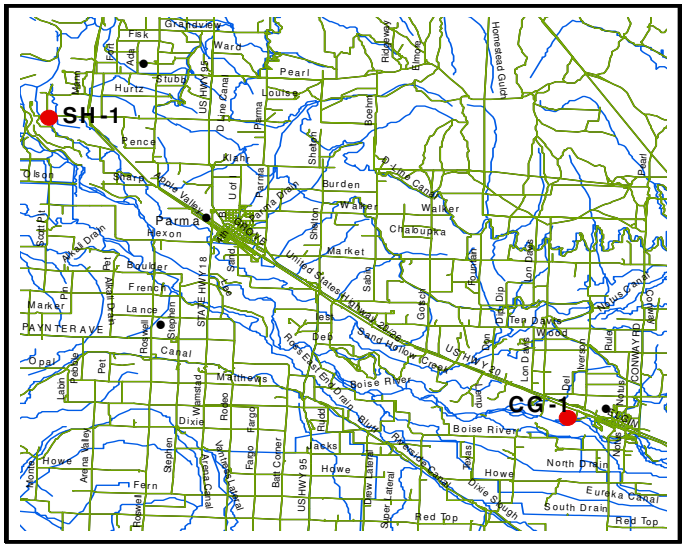

Figure 1. Sand Hollow (SH-1) and Conway Gulch (CG-1 sample locations.

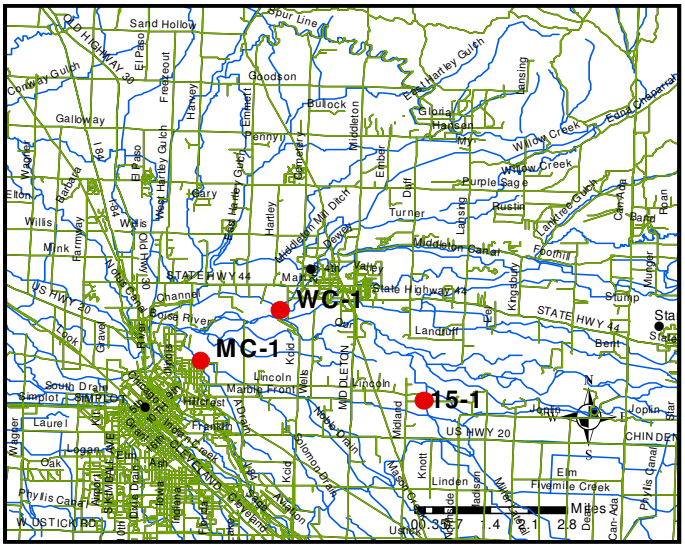

Figure 2. Mason Creek (MC-1), Willow Creek (WC-1), and Fifteen Mile (15-1) sample locations.

(SSC), total phosphorus (TP), dissolved phosphorus (DP), and Escherichia coli (*E-coli*).

All on-site measurements and analytical results are listed in Attachment A. This report will address the primary issues (sediment, nutrients, and bacteria) facing both the Lower Boise River TMDL (LBR TMDL) and the Snake River-Hells Canyon TMDL (SR-HC TMDL).

Results

Suspended Sediment Concentrations (SSC)

The LBR TMDL (DEQ, 2000) and the SR-HC TMDL (DEQ, 2003) have somewhat different sediment concentration requirements within their individual TMDLs. The LBR TMDL sediment levels should not exceed 50 mg/L over 60 days and 80 mg/L over 14 days. The SR-HC TMDL requires a sediment level target of ≤ 80 mg/L for no more than 14 days for acute events and ≤ 50 mg/L as a monthly average.

The sediment levels for SH-1, a tributary to the Snake River, exceeds the SR-HC TMDL criteria for both the 80 mg/L and 50 mg/L concentrations (Figure 3). Both CG-1 and MC-1 exceeds the LBR sediment concentrations for both the 60 day and 14 day criteria (Figure 3). Site 15-1 exceeds the 80 mg/L over 14 days in July while WC-1 does not exceed either of the sediment criteria for the Lower Boise River (Figure 3).

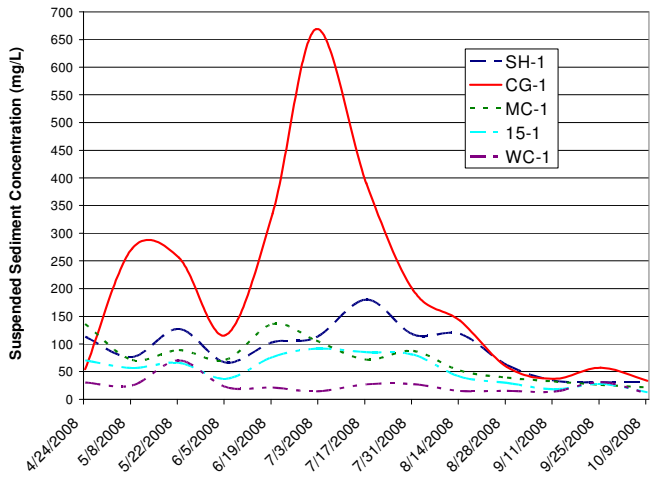

Figure 3. SSC levels for the Snake River tributary and the Lower Boise tributaries.

ISDA collected water column data on three sites (SH-1, MC-1, and 15-1) in 1998 as part of an effort to provide data for the Lower Boise River TMDL process. Unfortunately, the analytical techniques used in 1998 for total suspended solids (TSS) and for suspended sediment concentration (SSC) in 2008 are difficult to compare (USGS, 2000). Table 2 indicates that the SSC concentrations where on average 20% lower in 2008 than in 1998. This could be the result of the differing analytical techniques or could be indicative of other various factors within each watershed.

Table 2. Mean sediment concentrations for 1998 and 2008.

Year	SH-1	MC-1	15-1	Analysis
1998	131 mg/L	88 mg/L	68 mg/L	TSS
2008	90 mg/L	72 mg/L	53 mg/L	SSC
% difference	21%	18%	22%	avg. 20%

Phosphorus (TP)

The goal of the SR-HC TMDL is to lower the phosphorus concentration within the Snake River and Hells Canyon reservoir to ≤0.07 mg/L. At this level, scientists feel that the large algae blooms and anoxic conditions within the reservoir may be alleviated. Therefore, the goal had been to reduce the phosphorus levels in the tributaries that feed the Snake River, such as the Boise River, in order to meet the goal within Hells Canyon. The four tributaries to the Boise River and the one tributary to the Snake River fail to reach the phosphorus goal of 0.07 mg/L (Figure 4).

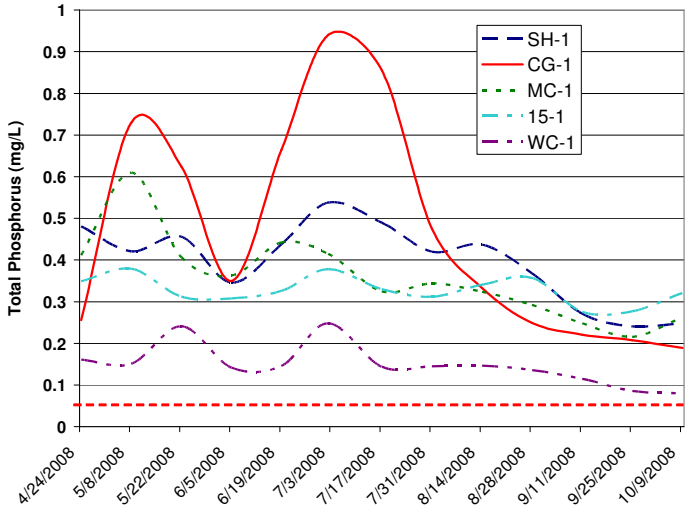

Figure 4. Phosphorus levels within the five tributaries. The red dotted line is approximately the 0.07 mg/l TP level goal.

Comparison of TP concentrations collected by ISDA in 1998 and 2008 showed very little change over the 11 year period (Table 3).

Table 3. 1998 and 2008 average TP comparison.

Year	SH-1	MC-1	15-1
1998	0.38 mg/L	0.34 mg/L	0.33 mg/L
2008	0.40 mg/L	0.36 mg/L	0.33 mg/L
% difference	5%	5%	0%

Another method to look at phosphorus reductions for the various tributaries is to look at total loading (lbs/day) of phosphorus by comparing real data to the desired TMDL goal (0.070 mg/L). Loads (Figure 5) are based on the discharge (CFS), the concentration (mg/L), and a constant (5.368).

The phosphorus load reductions (Figure 5) range from a high of 85% for Conway Gulch to a low of 53% for Willow Creek. The four subwatersheds needing major TP reductions (SH-1, CG-1, MC-1, and 15-1) still have a large percentage of agricultural lands mixed with urban development and sprawl. A large percentage of the agricultural land is still under erodible irrigation techniques such as furrow or flood surface irrigation.

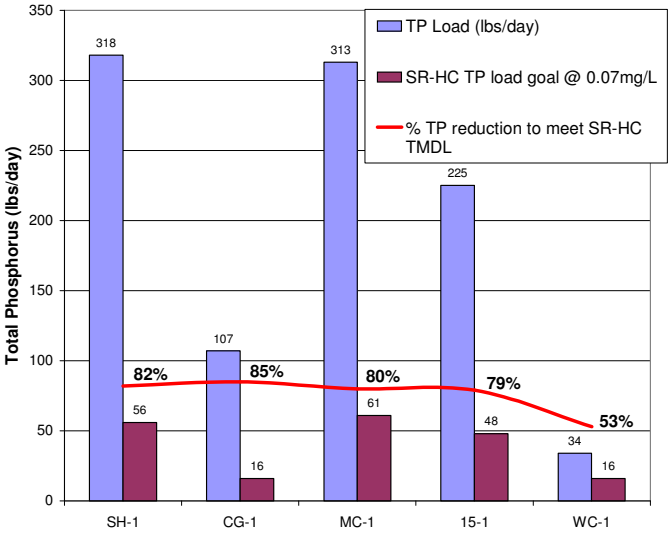

Figure 5. TP load reductions required to meet the SR-HC TMDL goal of 0.07 mg/L of TP.

Although Conway Gulch has a lower discharge rate than most of the sites (Figure 6) it still delivers a sizeable load due to the high concentrations of SSC and TP (Figures 3 and 4).

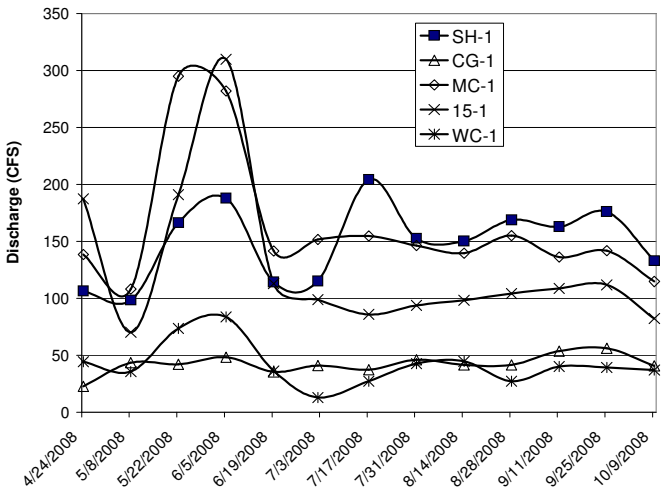

Figure 6. Study period discharge rates.

Dissolved phosphorus (DP) is the most readily available form of phosphorus for aquatic plant uptake. Large concentrations of DP may lead to excessive aquatic plant growth which could effect the water quality of a river or lake system.

The percentage of DP, for all sites, ranged from a low of 32% at CG-1 to a high of 70% at 15-1 (Figure 7). Installing Best Management Practices (BMPs) that decrease sediment loads along with particulate phosphorus would most likely, at most sites, not be sufficient to lower the overall phosphorus levels required by the SR-HC TMDL. Conway Gulch would be the likely location for BMPs addressing particulate phosphorus due to the low levels of DP. Additional BMPS that address dissolved phosphorus would need to be implemented at most sites if the Lower Boise River is ever going to meet the necessary phosphorus reduction from non-point sources.

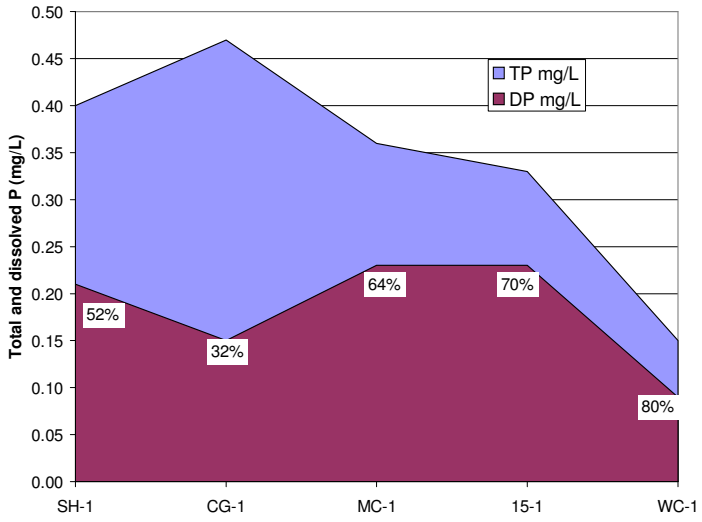

Figure 7. Percentage of DP compared to TP.

Bacteria Escherichia Coli (*E-Coli*)

State of Idaho water quality standards for *E-coli* are specific for primary and secondary contact waters (IDAPA 58.1.02). Primary contact waters have a limit not to exceed 406 *E-coli* organisms per colony forming units (CFUs). The state standards for *E*-coli levels in secondary contact waters should not exceed 576 CFUs. A single exceedance of primary or secondary levels does not constitute a violation. They do indicate the need for a geomean evaluation which entails collecting 5 samples within a 30 day period. The geomean is then calculated to determine if the data exceeds the geomean criteria of 126 CFUs. Table 4 (shaded cells indicate an exceedance) would indicate that stations SH-1, MC-1, 15-1, and possibly WC-1 would likely exceed the geomean criteria.

Table 4. *E-coli* results (CFUs).

Date	SH-1	CG-1	MC-1	15-1	WC-1
4/24/2008	>2400	59	140	39	57
5/8/2008	730	390	690	170	170
5/22/2008	1000	1200	730	980	1300
6/5/2008	730	240	820	980	370
6/19/2008	580	340	730	1400	650
7/2/2008	1100	310	520	1400	1100
7/17/2008	1000	240	690	580	290
7/31/2008	1000	370	310	290	770
8/14/2008	730	180	240	490	180
8/28/2008	870	120	170	370	330
9/11/2008	250	260	410	240	160
9/25/2008	190	72	180	180	86
10/9/2008	410	110	170	610	79

Conclusions

The data indicates that the four tributaries to the Boise River are still significant contributors of nutrients, sediment and bacteria. Sand Hollow which confluences with the Snake River continues to be a major source of pollutants.

When establishing priorities for BMP implementation, within the Boise River watershed, Conway Gulch should be the first priority followed by Mason Creek. Although Conway Gulch has a lower overall load (lbs/day) of phosphorus and sediment the overall concentrations of SSC (201 mg/L) and TP (0.47 mg/L) exceeds all other tributaries. The lower average discharge (42 CFS) of Conway Gulch would make it more manageable for BMP treatment than Mason Creek with its higher average discharge (162 CFS). In addition, BMPs that address sediment along with particulate phosphorus would be more effective in the Conway Gulch sub watershed due to the lower percentage of DP when compared to TP.

Any reduction of sediment, phosphorus and bacteria on the two major tributaries (Conway and Mason) would greatly improve water quality within the Boise River. Reduction of inputs from Sand Hollow into the Snake River would help reduce loading of SSC, TP and bacteria into Brownlee Reservoir.

Comparing data collected in 1998 and 2008 by ISDA at three sites (Sand Hollow, Mason Creek and 15 mile) showed no significant difference in the concentration of SSC and TP over the 11 year period. The data indicates that very little if any BMP land applications have occurred or resulted in the reduction of these pollutants.

Funding for BMP implementation should be pursued through grants or other sources and dedicated to reducing pollutant loading from Conway Gulch, Mason Creek and Sand Hollow. Initial priority and funding should be earmarked for work within the Conway Gulch subwatershed.

References

Gray,J.R.,Glysson,G.D.,Turcios,L.M.,Schwarz,G.E., 2000, Comparability of Suspended Sediment Concentrations and Total Suspended Solids Data: U.S. Geological Survey Water Resources Investigation Report 00-4191.

Idaho Department of Environmental Quality. 2003. Brownlee Reservoir Subbasin Assessment and TMDL.

Idaho Department of Environmental Quality. 2000. Lower Boise River Subbasin Assessment and TMDL.

Idaho Department of Environmental Quality, IDAPA 58.1.02. Water Quality Standards and Wastewater Treatment Requirements.

Attachment A

Sand Hollow SH-1

Date	DO	Temp	%Sat	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/24/2008	10.25	8.9	88.9	477	234	8.35	106.3	113	0.481	0.268	>2400
5/8/2008	8.63	11.5	79.3	525	257	8.12	98.3	76.3	0.421	0.224	730
5/22/2008	9.38	10.5	84.1	406	199	7.64	166.3	127	0.456	0.2	1000
6/5/2008	8.61	12.5	81.6	438	215	8.12	187.7	66.5	0.346	0.174	730
6/19/2008	7.99	16.5	81.8	494	242	7.61	114.2	103	0.438	0.221	580
7/2/2008	7.31	19.7	80.1	489	240	8.02	115.1	112	0.538	0.273	1100
7/17/2008	7.43	19.1	80.4	427	209	7.84	204.2	180	0.49	0.219	1000
7/31/2008	7.88	17.8	82.8	442	217	8.12	152.5	117	0.42	0.196	1000
8/14/2008	7.42	19	80	470	231	8.22	150.2	118	0.437	0.236	730
8/28/2008	7.93	16.2	80.8	449	220	7.98	168.8	62.1	0.368	0.219	870
9/11/2008	8.85	14.1	86.1	514	252	8.02	162.7	34	0.271	0.183	250
9/25/2008	8.56	14.1	83.3	540	265	7.93	176	30.9	0.241	0.186	190
10/9/2008	10.37	10.1	92.1	546	267	7.94	132.9	30.6	0.248	0.154	410

Conway Gulch CG-1

Date	DO	Temp	%Sat	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/24/2008	10.9	9.8	96.2	608	298	8.32	22.62	54.3	0.256	0.15	59
5/8/2008	9.85	10.7	88.8	475	233	8.28	43.4	272.3	0.73	0.181	390
5/22/2008	10.14	10.3	90.7	473	232	8.21	41.9	256	0.625	0.166	1200
6/5/2008	9.29	12.2	86.8	464	227	8.21	48.2	116	0.35	0.119	240
6/19/2008	8.92	14.4	86.8	573	281	8.15	35.4	336	0.665	0.156	340
7/2/2008	8.63	16.7	89.2	538	264	8.16	40.9	669	0.94	0.187	310
7/17/2008	8.67	16.4	88.7	509	249	8.13	37.3	390	0.855	0.191	240
7/31/2008	8.57	15.5	87	533	261	8.22	46	197	0.476	0.15	370
8/14/2008	8.46	16.4	86.2	558	273	8.27	41.4	142	0.333	0.157	180
8/28/2008	8.96	14.7	88.2	544	267	8.19	41.5	58.4	0.249	0.146	120
9/11/2008	9.11	13.5	87.5	526	258	7.87	53.6	36.9	0.221	0.121	260
9/25/2008	8.8	14.1	85.4	500	245	7.87	56	57	0.208	0.134	72
10/9/2008	9.7	11.1	88.3	566	277	7.98	40.6	33.6	0.189	0.121	110

Mason Creek MC-1

Date	DO	Temp	%Sat	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/24/2008	10.8	9.2	93.7	362	178	8.31	138.4	136	0.412	0.241	140
5/8/2008	9.79	11	89.2	462	226	8.14	108	71.2	0.61	0.313	690
5/22/2008	10.2	9.6	89.7	385	189	8.2	295	88.9	0.407	0.239	730
6/5/2008	9.44	12.3	88.1	422	207	8.18	282	71.5	0.363	0.22	820
6/19/2008	8.95	15	88.8	505	248	8.18	141.4	136	0.442	0.269	730
7/2/2008	8.17	17.1	84.8	381	187	8.36	151.6	106	0.415	0.278	520
7/17/2008	8.2	17	84.8	373	183	8.09	154.6	71.6	0.325	0.22	690
7/31/2008	8.55	16.6	87.8	389	190	8.24	146.2	87.4	0.344	0.212	310
8/14/2008	8.09	17.4	84.6	406	199	8.08	139.6	51.6	0.324	0.237	240
8/28/2008	8.46	15.5	84.8	399	196	8.23	155	39.2	0.292	0.23	170
9/11/2008	9.27	14.1	90.3	412	202	7.9	136.2	32.3	0.248	0.192	410
9/25/2008	8.69	14.7	85.5	412	202	7.91	141.6	26.1	0.216	0.193	180
10/9/2008	10.21	11	92.6	522	256	7.88	114.7	21.5	0.262	0.206	170

Fifteen Mile 15-1

Date	DO	Temp	%Sat	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/24/2008	11.37	8.1	96.3	188.9	93	8.24	187.4	70.4	0.349	0.228	39
5/8/2008	12.09	10.5	108.5	268.6	132	8.35	70.1	56.5	0.379	0.279	170
5/22/2008	10.91	9.6	95.8	191.3	94	8.25	191.1	66	0.312	0.18	980
6/5/2008	9.95	11.7	91.8	198	97	8	309.8	37.1	0.308	0.187	980
6/19/2008	9.57	15	94.9	273	134	8.17	112.7	76.4	0.326	0.231	1400
7/2/2008	8.84	16.7	90.9	284	139	7.92	98.7	91.4	0.378	0.229	1400
7/17/2008	9.07	16.4	92.5	252	123	8.05	85.8	85	0.33	0.213	580
7/31/2008	9.74	17	100.9	261	128	8.29	93.7	80.7	0.312	0.218	290
8/14/2008	9.41	17.6	98.5	278	136	8.15	98.3	40.8	0.341	0.263	490
8/28/2008	9.7	15.3	97	282	138	8.23	104.2	29.7	0.357	0.286	370
9/11/2008	10.44	14.2	101.7	261	128	7.96	108.6	18.2	0.276	0.224	240
9/25/2008	9.23	14.7	91	255	125	7.93	111.8	27.8	0.277	0.219	180
10/9/2008	11.36	10.9	102.9	385	189	8.06	82.1	12.8	0.321	0.261	610

Willow Creek WC-1

Date	DO	Temp	%Sat	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/24/2008	10.72	10	95.2	131.9	65	8.07	44.2	30.4	0.161	0.075	57
5/8/2008	10.26	12.1	95.2	158.1	77	8.07	35.7	25	0.151	0.089	170
5/22/2008	10.15	11.1	92.4	127.7	63	8.23	73.6	70.3	0.241	0.083	1300
6/5/2008	9.58	13.7	92.3	128.7	63	8	83.5	22.2	0.142	0.074	370
6/19/2008	8.94	17.4	93.4	148	73	8.11	36.2	21.3	0.146	0.104	650
7/2/2008	7.96	20.4	88.3	211	103	7.8	12.9	14.4	0.248	0.204	1100
7/17/2008	8.47	19.8	92.8	130	64	7.8	27.2	27.1	0.144	0.091	290
7/31/2008	8.64	19	93.2	136.3	67	8.15	42.5	27.4	0.145	0.098	770
8/14/2008	7.91	20	87.4	139	68	8.04	44.6	15	0.147	0.109	180
8/28/2008	9.31	16.9	96.2	128	62	8.05	27.1	15.3	0.136	0.096	330
9/11/2008	9.44	15.7	95	135.9	67	7.8	40	13.9	0.115	0.07	160
9/25/2008	9.36	15.1	92.9	112	55	7.82	39.2	30.9	0.086	0.046	86
10/9/2008	10.61	10.9	96	132	65	7.93	36.8	10.6	0.08	0.042	79