Memo

Water & Earth Technologies, Inc.
Water Resources and Environmental Consulting

Date: November 5, 2008

To: Kevin Stewart and Chad Kudym

From: Markus Ritsch

Subject: **October 2008 ALERT Data Analysis**

I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's Nova Star 4.0 base station (ALERT 2) were analyzed for the period October 1 through October 31, 2008.

II. General System Analysis Summary

A total of 332,841 data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 64 percent, water level sensors 7 percent, and rain sensors 3 percent of the total monthly records.

More than ninety-nine percent (99.70%) of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 944 reports were flagged as "bad". Of these "bad" reports, 313 originated from Blue Mountain (ID 139 & 137) and 56 originated from Squaw Mountain (ID 2191).

The system-wide radio traffic loading was 10,737 reports per day with an average hourly loading of 447 reports. The peak hourly traffic loading was 892 reports, which occurred on October 5, between 8:00 PM and 9:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 604 reports were received from the Hayman rain sensors this month. These reports make up less than 0.2% of the total reports for the month.

III. Rain Sensor Timer Reporting Summary

The following analysis assumes that each rain sensor has a 12-hour timer-reporting interval. System-wide, the ALERT 2 base station received approximately 78 percent of the non-incrementing timer reports. The worst performing rain sensors for the month are summarized (Table 1).

Table 1. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2190	1660	1350	1710	1600	1600	1600	4130	1540	840		
140	2190	110	540	540	110	1660	4560	1700	920		
4150	140	2190	1600	1710	950	4140	4240	740	310		
4060	4170	1370	1350	4080	1710	1350	4570	1360	110		
4470	4150	620	710	4060	540	1710	1710	1660	820		
4530	4530	840	4330	4150	4530	4530	4080	1480	2850		

Sensors identified as having poor timer performance in multiple months are shaded with unique colors. A developing trend can thus be identified from the color shading as the year progresses.

Many stations are winterized in October, which skews the timer reporting percentage for that month.

Sensor ID 1460 has a 24-hour timer reporting interval and is not included in the timer reporting analysis.

Sensor ID 1810 has an 18-hour timer reporting interval and this site has shown poor timer performance in August of only 51% and in September of only 70%.

IV. Rain Sensor Event Reporting Summary

A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors (excluding Hayman sensors) were analyzed to quantify the District-wide statistical total monthly tip summary (Table 2).

Table 2. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	19.59	Only the 1-mm rain sensors were included in the analysis
Median	19	Only the 1-mm rain sensors were included in the analysis
Standard deviation	9.89	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	49.25	Only the 1-mm rain sensors were included in the analysis
Minimum total count	3	Elbert (ID 1440)
Maximum total count	69	Expo Park (ID 420)

The highest reporting rain sensor this month was Expo Park (ID 420) with 69 tips. Irrigation sprinklers influence this sensor. No other sensors reported more than the mean plus three standard deviations.

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 3).

Table 3. Monthly Summary of District-Wide Mean Total 1-mm Tip/Count

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
2006	4.62	5.92	18.39	20.47	19.44	13.75	74.03	46.89	24.17	41.13	5.04	16.45	24.19
2007	11.56	5.40	29.75	65.03	68.30	15.87	36.20	46.38	22.13	29.50	6.54	11.29	29.00
2008	4.05	7.38	12.26	20.57	54.82	26.06	16.43	90.20	37.54	19.59			

C. Sensors with a Jump of Six or More in the Sequential Count

Several sensors had a jump in sequential count of more than six (Table 4). These large jumps are investigated below.

Table 4. Sensors with a Jump of More than 6 in Sequential Count

Sensor Description	Sensor ID	Comment
Fire Station 12	840	A large gap of 30 tips occurred on October 5 between 10:49 AM and 10:50 PM. This sensor is transmitting only 12-hour timer reports, no incrementing reports.
Sand Cr at Colfax	860	A large gap of 21 tips occurred on October 5 between 12:42 PM and 6:42 PM. This sensor is transmitting only 6-hour timer reports, no incrementing reports.
Toll Gate at 6th	700	A large gap of 9 tips occurred on October 5 between 7:04 PM and 8:58 PM.

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 89 percent. A total of 2,451 incrementing reports were received and a total of 2,762 were expected. The total loss of incrementing reports for the month was approximately 11 percent. Those sensors with the worst rain event transmission performance characteristics are summarized (Table 5).

Table 5. Monthly Summary of Sensors with the Most Missed Tips

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1640	4520	2930	1710	1600	1600	1660	1600	870	840		
2190	4820	540	1600	2320	2750	4820	1100	1350	860		
750	4530	2730	540	4150	2710	4080	1660	4090	700		
4570	4470	2210	700	1710	310	2340	870	1050	970		
2990	4810	110	110	4710	4090	2330	1710	2370	2190		
--	700	1350	840	1350	4170	4060	410	120	2820		

Sensors identified as having poor event performance in multiple months are shaded with unique colors. A developing trend can thus be identified from the color shading as the year progresses.

The incrementing data series for those sensors with an event performance value of less than 70 % are manually inspected.

a. Fire Station 12 (ID 840)

This sensor transmitted only 12-hour timer reports during the month. Incrementing reports were not received from this station.

b. Sand Creek at Colfax (ID 860)

This sensor transmitted only 6-hour timer reports during the month. Incrementing reports were not received from this station.

c. Toll Gate at 6th (ID 700)

A large gap between a count of 181 and 190 occurred on October 5 between 7:04 PM and 8:58 PM.

d. Pump Station 3 (ID 970)

A large number of tip reports were missing on October 5 between 5:14 PM and 10:02 PM.

e. Squaw Mountain (ID 2190)

This station is missing single tip reports throughout the month.

f. Haskins Gulch Confluence (ID 2820)

This station is missing single tip reports throughout the month.

V. Heavy Radio Traffic Analysis

Periods exceeding 700 messages per hour are analyzed independently in an attempt to identify rain tip sequences where 3 or more, sequential messages are lost.

A. The Heaviest Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month include:

Peak Traffic Periods	Reports/hour	Hour Beginning
Peak Hourly Traffic	892	10/5/08 8:00 PM
2nd Max	826	10/5/08 7:00 PM
3rd Max	722	10/5/08 6:00 PM
4th Max	707	10/5/08 5:00 PM
5th Max	682	10/5/08 9:00 PM

B. October 5, 2008

The heaviest traffic period occurred on October 5th between 4:00 PM and 11:00 PM. Incrementing rain records from the 1-mm gages for the heavy radio traffic period were examined to characterize the loss of sequential incrementing tip transmissions (Table 6). During the heavy traffic period, a total of 625 reports were expected and only 528 were received yielding a loss of approximately **15.52%** of the incrementing transmissions.

Table 6. Peak Traffic Analysis - Loss of Incrementing Tip Reports

	Occurrences of lost sequential tip reports during period			
Heavy Traffic Period (October 5)	**Loss of 3 sequential tips**	**Loss of 4 sequential tips**	**Loss of 5 sequential tips**	**Loss of 6 or more sequential tips**
4:00 PM to 11:00 PM	2	1	0	0

VI. Unknown Device Analysis – Received Data Log

The ALERT IDs present in the audio signal received by the decoder are compared against a list of "active" device IDs that are defined within NovaStar. Those IDs received by the decoder that are not defined within NovaStar are considered to be "unknown" and may be the result of radio noise or problems with the telemetry system. The reception of "unknown" device reports for the month is summarized (Table 7).

Table 7. Summary of Unknown IDs

Description	Quantity
Total number of unknown IDs (IDs without a device definition)	141
Total reports from unknown IDs	990
Unknown IDs with only a single received report (potential noise)	104
Total reports from all IDs – RecData Log entire month	275,385
Unknown reports as a fraction of total reports	0.36%

The total number of reports from unknown sensors is very small relative to the total reports received for the month.

A number of "unknown" sensors had multiple reports which may indicate the existence of a transmitter that is sending information on an ID that is not currently defined within NovaStar. The unknown IDs with multiple reports including the number of reports received by each are shown (Table 8).

Table 8. Reports Received by Unknown IDs

Unknown ID	Reports
8102	279
8101	241
8100	237
2725	24
2726	19
2736	8
4768	7
4636	4
4760	3
688	3
4656	3
4862	3
4775	3
4087	3
4062	3
1657	3
1311	3
4469	2
915	2
4739	2
2251	2
4748	2
4756	2
4299	2
4766	2
4449	2
4776	2
4831	2
4091	2
4083	2
4848	2
4093	2
4838	2
4013	2
741	2
4796	2
743	2

The “unknown” device reports are analyzed temporally to understand when they are received during the day (Table 9). The goal of this analysis is to determine a pattern of occurrence that may correspond to a source of noise in the system, such as the use of a wireless microphone nearby.

Table 9. Temporal Distribution of Unknown Reports

Hour (AM)	Reports	Hour (PM)	Reports
0:00-00:59	79	12:00-12:59	83
1:00-1:59	8	1:00-1:59	12
2:00-2:59	25	2:00-2:59	35
3:00-3:59	76	3:00-3:59	82
4:00-4:59	13	4:00-4:59	8
5:00-5:59	22	5:00-5:59	25
6:00-6:59	78	6:00-6:59	82
7:00-7:59	9	7:00-7:59	16
8:00-8:59	55	8:00-8:59	25
9:00-9:59	95	9:00-9:59	80
10:00-10:59	14	10:00-10:59	5
11:00-11:59	32	11:00-11:59	31

A large number of timer reports were received on a three-hour interval from sensors 8100, 8101, and 8102. These reporting interval is 1:00, 4:00, 7:00 and 10:00.

VII. Issues Identified this Month

Sensors with a large number of invalid reports:

Sensor ID	Invalid Reports	Description	Group
139	157	Blue Mountain	Wind Gust
137	156	Blue Mountain	Wind Speed Average
2191	56	Squaw Mountain	Relative Humidity
4774	48	Cal-Wood Ranch	Barometric Pressure
755	47	Quincy Reservoir	Battery Voltage Analog
2744	38	Castle Rock	Wind Gust
2724	33	Salisbury Park	Wind Gust
903	30	Aurora Reservoir	Barometric Pressure
2187	27	Squaw Mountain	Wind Speed Average
2704	22	Highlands Ranch WTP	Wind Gust
2732	17	Salisbury Park	Temperature
4744	16	Louisville Lake	Wind Gust
4764	15	Cal-Wood Ranch	Wind Gust
1914	13	Brighton	Wind Gust
4724	13	Sugarloaf	Wind Gust
5770	12	Hayman	Hayman Precipitation
971	12	Pump Sta 3	Relative Humidity
906	10	Aurora Reservoir	Wind Direction
4704	10	Ward C-1	Wind Gust

Sensors reporting frequently (over reporting):

Sensor ID	Reports	Description	Group
749	5576	Quincy Reservoir	Wind Gust
2747	3178	Castle Rock	Wind Speed Average & Azimuth
2752	3089	Castle Rock	Temperature
2188	2963	Squaw Mountain	Wind Direction
908	2955	Aurora Reservoir	Solar Radiation
2751	2955	Castle Rock	Relative Humidity
2192	2953	Squaw Mountain	Temperature
2744	2948	Castle Rock	Wind Gust
2187	2948	Squaw Mountain	Wind Speed Average
141	2942	Blue Mountain	Relative Humidity
143	2936	Blue Mountain	Fuel Moisture
1467	2933	Stapleton	Wind Gust
751	2930	Quincy Reservoir	Relative Humidity
1465	2929	Stapleton	Wind Speed Average
144	2928	Blue Mountain	Fuel Temperature
1464	2927	Stapleton	Solar Radiation
1462	2926	Stapleton	Temperature

Sensors reporting infrequently (under reporting):

Sensor ID	Reports	Description	Group
760	1	Mission Viejo Park	Precipitation
865	1	Sand Cr at Colfax	Battery Voltage Digital
2310	2	Genesee Village	Precipitation
2315	2	Genesee Village	Battery Voltage HSE
2345	3	El Rancho	Battery Voltage HSE
4433	3	Rowena	Water Level PT HSE
2340	3	El Rancho	Precipitation
2355	4	Idledale	Battery Voltage HSE
2265	5	Brook Forest	Battery Voltage HSE
2280	5	Kinney Peak	Precipitation
2285	5	Kinney Peak	Battery Voltage HSE
2245	5	Cold Sprg Glch conf	Battery Voltage HSE
2375	6	Red Rocks Park	Battery Voltage HSE
2260	6	Brook Forest	Precipitation
2250	6	Rosedale	Precipitation
2270	6	Cub Cr below Blue	Precipitation
2350	7	Idledale	Precipitation
2235	7	Bear Cr below Cub	Battery Voltage HSE
2370	7	Red Rocks Park	Precipitation
2360	7	Indian Hills	Precipitation
2230	7	Bear Cr below Cub	Precipitation
4463	7	SSV at Berry Ridge	Water Level PT HSE
2243	8	Cold Sprg Glch conf	Water Level PT
2273	9	Cub Cr below Blue	Water Level PT
2240	9	Cold Sprg Glch conf	Precipitation
2253	9	Rosedale	Water Level PT
2373	9	Red Rocks Park	Water Level PT
2255	9	Rosedale	Battery Voltage HSE

Poor timer reporting:

The following sensors reported for the entire month and showed poor timer performance.

Sensor ID	Description	Performance
1810	Sand Creek at Mouth	60%
920	Aurora Town Hall WX	73%
310	Guy Hill Ranch	76%
110	Ralston Reservoir	79%
4820	Doudy Draw	81%
4470	Little Narrows	81%

Poor event reporting:

The following sensors reported for the entire month and showed poor event performance.

Sensor	Performance
840	14%
860	18%
700	44%
970	60%
2190	69%
2820	71%
1350	77%
1370	77%
4530	78%
1460	79%

Low rain total:

Rain Sensor ID	Tips
1440	3
1900	7
1300	8
1310	10
320	10

High rain total:

Rain Sensor	Tips
420	69
630	45
840	44
860	44
970	42
850	42
830	41
920	36

Large Jump in Sequential Count (bit flip errors/contention loss/transmitter problems):

Sensor Description	Sensor ID	Comment
Fire Station 12	840	A large gap of 30 tips occurred on October 5 between 10:49 AM and 10:50 PM. This sensor is transmitting only 12-hour timer reports, no incrementing reports.
Sand Cr at Colfax	860	A large gap of 21 tips occurred on October 5 between 12:42 PM and 6:42 PM. This sensor is transmitting only 6-hour timer reports, no incrementing reports.
Toll Gate at 6th	700	A large gap of 9 tips occurred on October 5 between 7:04 PM and 8:58 PM.

Reports from "Unknown Sensors":

The following table shows the "unknown" sensor IDs and the number of reports received for the month.

Unknown ID	Reports
8102	279
8101	241
8100	237
2725	24
2726	19
2736	8
4768	7
4636	4
4760	3
688	3
4656	3
4862	3
4775	3
4087	3
4062	3
1657	3
1311	3
4469	2
915	2
4739	2
2251	2
4748	2
4756	2
4299	2
4766	2
4449	2
4776	2
4831	2
4091	2
4083	2

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2008_Oct\Novastar_extract_2008Oct.mdb

First Date in Database	10/1/08 12:00 AM	**Total Days**	31.0
Last Date in Database	10/31/08 11:59 PM	**Total Hours**	744.0

Total Records Analyzed 332841

Records by Group

None-ALERT-ID	58110	17%
Wind Gust	44222	13%
Temperature	43814	13%
Relative Humidity	42548	13%
Wind Direction	20840	6%
Barometric Pressure	19232	6%
Wind Speed Average	17014	5%
Water Level PT-HSE	16245	5%
Wind Speed Average & Azimuth	14954	4%
Precipitation	10071	3%
Solar Radiation	9316	3%
Battery Voltage HSE	6636	2%
Water Level Float	3946	1%
Fuel Moisture	3680	1%
Fuel Temperature	3673	1%
Battery Voltage Digital	3622	1%
Battery Voltage Analog	3412	1%
Soil Moisture	2926	1%
Water Level PT	1437	0%
Precipitation - Mean	940	0%
Repeater Pass List	609	0%
Hayman Precipitation	604	0%
Repeater Status Report	486	0%
12Hr Status Report	350	0%
Wing Gust	306	0%
Precipitation - Test	247	0%
Battery	192	0%
Battery Voltage	123	0%
Longmont Flow Gage	115	0%
Handar 585 ALARM Status	62	0%
Longmont Water Level PT	57	0%
Total	329789	

Records by Major Group

Meteorologic Sensors	211940	64%
Water Level Sensors	21800	7%
Sensor Status Transmissions	15177	5%
Soil and Fuel Sensors	10279	3%
Rain Sensors	10071	3%
Total	269267	

Records by Validation Type

Good	0	331897	100%
Questionable	1	944	0%
	Total	332841	

Sensors With Most Invalid Data

Description	**Sensor**	**Reports**
Blue Mountain	139	157
Blue Mountain	137	156
Squaw Mountain	2191	56
Cal-Wood Ranch	4774	48
Quincy Reservoir	755	47

Traffic Loading Summary

Alert Reports	332841	
Average Daily Traffic	10737	
Average Hourly Traffic	447	
Median Hourly Traffic	444	hour beginning
Peak Hourly Traffic	892	10/5/08 8:00 PM
2nd Max	826	10/5/08 7:00 PM
3rd Max	722	10/5/08 6:00 PM
4th Max	707	10/5/08 5:00 PM
5th Max	682	10/5/08 9:00 PM

Rain Timer Performance

Analyze Rain Sensors

			systemwide average (days) 0.5257		78%
Rain Sensors	**Description**	**Rcv**	**Timer Ave**	**Exp**	**Performance**
100	Carr Street	52	14:02	62.00	84%
110	Ralston Reservoir	49	14:39	62.00	79%
120	West Woods	56	12:43	62.00	90%
130	Simms Street	58	12:48	62.00	94%
140	Blue Mountain	59	12:14	62.00	95%
200	Leyden Reservoir	58	12:25	62.00	94%
220	Upper Leyden	59	12:00	62.00	95%
300	Van Bibber Park	58	12:26	62.00	94%
310	Guy Hill Ranch	47	13:51	62.00	76%
320	Sports Complex	55	12:42	62.00	89%
330	Van Bibber @ Hwy 93	55	12:57	62.00	89%
410	Kelly Dam	56	12:27	62.00	90%
420	Expo Park	52	12:15	62.00	84%
440	Fire Station #7	53	12:13	62.00	85%
500	Havana Park	50	12:32	62.00	81%
520	Jewell Detention	53	12:12	62.00	85%
530	Fire Station #19	60	12:10	62.00	97%
540	Parker/Mississippi	56	12:43	62.00	90%
600	Harvard Gulch Park	37	12:21	62.00	60%
610	Harvard @ Jackson	60	12:10	62.00	97%
620	Quincy/Highline	60	12:11	62.00	97%
630	Temple Pond at DTC	60	12:13	62.00	97%
640	Goldsmith at Eastman	56	12:59	62.00	90%
650	Iliff Pond	55	13:11	62.00	89%
700	Toll Gate @ 6th	55	12:15	62.00	89%
710	Horseshoe Park Drop	53	11:57	62.00	85%
720	Confluence Pond	32	11:57	62.00	52%
730	No Name @ Quincy	60	12:11	62.00	97%
750	Quincy Reservoir	60	11:57	62.00	97%
800	Sable Ditch @ 18th	51	12:14	62.00	82%
810	Granby Ditch @ 6th	52	11:57	62.00	84%
820	ETG @ Buckley	49	12:31	62.00	79%
830	Side Creek Park	52	11:57	62.00	84%
840	Fire Station 12	44	12:36	62.00	71%
850	Flying J	53	11:54	62.00	85%
860	Sand Cr at Colfax	97	6:03	62.00	156%
870	Murphy Creek GC	53	13:31	62.00	85%
900	Aurora Reservoir	59	12:28	62.00	95%
920	Aurora Town Hall Wx	45	16:35	62.00	73%
940	Sampson Gulch	59	12:25	62.00	95%
950	Piney at Liverpool	59	11:58	62.00	95%
970	Pump Sta 3	56	12:14	62.00	90%
1000	Maple Grove Resv.	59	12:39	62.00	95%
1010	Denver West	56	12:41	62.00	90%
1020	Lena @ Nolte Pond	57	12:51	62.00	92%
1030	NREL/S. Table Mtn.	56	12:12	62.00	90%
1040	Lena @ U.S. Hwy 6	55	12:42	62.00	89%
1050	Jeffco Fairgrounds	56	13:12	62.00	90%
1060	Heritage Square	58	12:27	62.00	94%
1100	Louisville Rec Ctr	8	13:59	62.00	13%
1110	Gunbarrel	53	13:44	62.00	85%
1300	Hidden Lake	56	13:08	62.00	90%
1310	LDC at 64th	53	13:27	62.00	85%
1320	SPR at 3rd Ave	56	13:09	62.00	90%
1330	Roslyn	51	12:16	62.00	82%
1340	Sanderson at Xavier	55	13:02	62.00	89%
1350	Chatfield COE	54	12:46	62.00	87%

1370	West Metro FS13	55	12:14	62.00	89%
1420	Diamond Hill	58	12:28	62.00	94%
1440	Elbert	55	13:24	62.00	89%
1460	Stapleton	28	23:59	62.00	45%
1500	Powers Park	57	12:41	62.00	92%
1520	Marston Lake North	58	12:43	62.00	94%
1530	Bear Creek @ Lowell	59	12:24	62.00	95%
1550	Lakewood CC	58	12:11	62.00	94%
1570	Brighton Ditch Wx	59	12:00	62.00	95%
1600	Englewood Dam	55	12:41	62.00	89%
1610	Holly Dam	59	12:22	62.00	95%
1620	Slaughterhouse Glch	59	12:11	62.00	95%
1630	SPR at Dartmouth	59	12:22	62.00	95%
1660	SPR at Henderson	56	13:11	62.00	90%
1710	Shop Creek	55	12:58	62.00	89%
1720	Cherry Cr @ Steele	58	11:57	62.00	94%
1810	Sand Creek at mouth	37	19:41	62.00	60%
1900	Niver Detention	57	12:38	62.00	92%
1920	Brighton	60	12:13	62.00	97%
2190	Squaw Mountain	54	12:30	62.00	87%
2210	Hiwan G.C.	63	11:22	62.00	102%
2220	Evergreen Lake	57	12:50	62.00	92%
2230	Bear Cr below Cub	4	11:57	62.00	6%
2240	Cold Sprg Glch conf	4	11:57	62.00	6%
2250	Rosedale	4	11:57	62.00	6%
2260	Brook Forest	3	23:53	62.00	5%
2270	Cub Cr below Blue	4	11:57	62.00	6%
2280	Kinney Peak	4	11:58	62.00	6%
2330	Morrison	60	11:58	62.00	97%
2340	El Rancho	2	11:57	62.00	3%
2350	Idledale	3	11:57	62.00	5%
2360	Indian Hills	4	11:57	62.00	6%
2370	Red Rocks Park	5	11:57	62.00	8%
2710	Highlands Ranch WTP	64	11:22	62.00	103%
2730	Salisbury Park	60	12:00	62.00	97%
2750	Castle Rock	62	11:47	62.00	100%
2810	Pine Cliff Road	12	15:35	62.00	19%
2820	Haskins Gulch Conf	58	12:26	62.00	94%
2840	Sulphur Gulch	15	12:59	62.00	24%
2850	Cherry Cr bl Bayou Glch	50	14:17	62.00	81%
2920	West Cherry Head-Douglas Cnty	28	12:00	62.00	45%
2930	Spring Valley Rd - DougCnty	27	12:28	62.00	44%
2940	Willow Creek - DougCnty	27	12:28	62.00	44%
2990	Tomah Rd-Douglas Cnty	61	11:33	62.00	98%
4010	Cresent	52	13:33	62.00	84%
4020	Rio Grande	57	13:11	62.00	92%
4030	Red Garden	56	12:42	62.00	90%
4040	Martin Gulch	57	12:42	62.00	92%
4050	Walker Ranch	60	12:25	62.00	97%
4060	Lakeshore	50	14:07	62.00	81%
4070	Bear Peak	58	12:27	62.00	94%
4080	Twin Sisters	57	12:56	62.00	92%
4090	Magnolia	54	12:42	62.00	87%
4100	Filter Plant	57	12:42	62.00	92%
4110	Betasso	57	12:58	62.00	92%
4130	Swiss Peaks	54	12:44	62.00	87%
4140	Logan Mill	53	13:35	62.00	85%
4150	Gold Hill	52	13:32	62.00	84%
4160	Sunshine	57	12:42	62.00	92%
4170	Pine Brook	56	13:29	62.00	90%
4180	Gold Lake	52	13:39	62.00	84%
4190	Slaughterhouse	60	12:11	62.00	97%

4200	Lazy Acres	56	12:59	62.00	90%
4220	Fling's	61	12:11	62.00	98%
4230	Golden Age	57	12:40	62.00	92%
4240	Sunset	52	13:30	62.00	84%
4250	Geer Canyon	57	12:16	62.00	92%
4260	Taylor Mountain	55	12:56	62.00	89%
4270	Cannon Mountain	59	12:26	62.00	95%
4290	Red Hill	57	12:29	62.00	92%
4300	Big Elk Park	57	12:42	62.00	92%
4310	Johnny Park	56	12:45	62.00	90%
4340	Riverside	55	12:44	62.00	89%
4350	Conifer Hill	55	12:56	62.00	89%
4360	Justice Center	60	12:25	62.00	97%
4470	Little Narrows	50	13:56	62.00	81%
4490	Apple Valley	55	12:56	62.00	89%
4510	Pinewood Springs	54	13:15	62.00	87%
4520	Eagle Ridge	58	12:26	62.00	94%
4530	Winiger Ridge	55	12:58	62.00	89%
4550	Boulder Jail	59	11:57	62.00	95%
4560	Lyons Diversion NSV	53	13:35	62.00	85%
4570	St. Antons	52	13:56	62.00	84%
4710	Ward C-1	58	12:13	62.00	94%
4730	Sugarloaf	52	13:04	62.00	84%
4750	Louisville Lake	54	13:16	62.00	87%
4770	Cal-Wood Ranch	57	12:41	62.00	92%
4790	Button Rock	55	13:15	62.00	89%
4810	Shanahan Ridge	56	13:12	62.00	90%
4820	Doudy Draw	50	13:39	62.00	81%
4830	SBC @ San Souci	59	12:26	62.00	95%
4840	SBC@S Boulder Ditch	59	12:25	62.00	95%

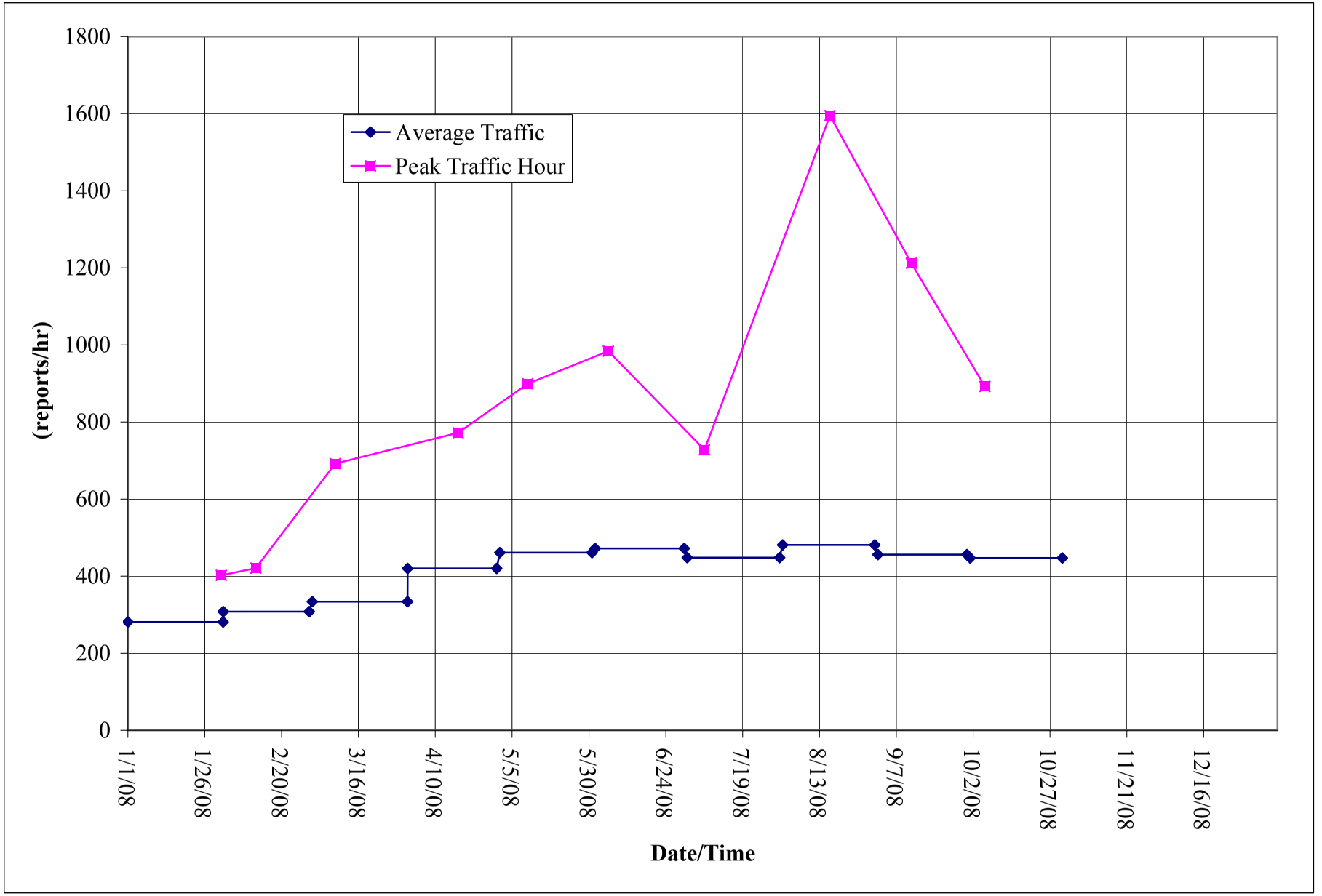
Rain Event Performance

Analyze Rain Sensors

	Reports Received	2451	
Systemwide Avg	Total Tips	2762	
89%	Data Loss	11.26%	

ID	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket
840	14%	0	3	0	2	0	0	1	6	44	9	0	0.0393701
860	18%	2	3	0	1	0	0	2	8	44	6	0	0.0393701
2810	33%	0	0	1	0	0	0	0	1	3	2	0	0.0393701
700	44%	7	2	1	1	0	0	1	12	27	7	0	0.0393701
970	60%	17	3	2	2	1	0	0	25	42	17	0	0.0393701
1100	67%	3	0	1	0	0	0	0	4	6	2	0	0.0393701
2190	69%	6	2	1	0	0	0	0	9	13	4	0	0.0393701
2820	71%	7	5	0	0	0	0	0	12	17	5	0	0.0393701
1300	75%	4	2	0	0	0	0	0	6	8	2	0	0.0393701
2840	75%	2	1	0	0	0	0	0	3	4	1	0	0.0393701
1350	77%	13	3	1	0	0	0	0	17	22	5	0	0.0393701
1370	77%	13	3	1	0	0	0	0	17	22	5	0	0.0393701
4530	78%	14	3	1	0	0	0	0	18	23	5	0	0.0393701
1460	79%	15	3	1	0	0	0	0	19	24	5	0	0.0393701
1310	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701
4180	80%	13	2	1	0	0	0	0	16	20	4	0	0.0393701
4060	81%	13	4	0	0	0	0	0	17	21	4	0	0.0393701
4240	82%	11	3	0	0	0	0	0	14	17	3	0	0.0393701
100	83%	8	2	0	0	0	0	0	10	12	2	0	0.0393701
850	83%	28	7	0	0	0	0	0	35	42	7	0	0.0393701
920	83%	25	4	1	0	0	0	0	30	36	6	0	0.0393701
1810	83%	8	2	0	0	0	0	0	10	12	2	0	0.0393701
4010	83%	12	3	0	0	0	0	0	15	18	3	0	0.0393701
2710	84%	13	3	0	0	0	0	0	16	19	3	0	0.0393701
2730	85%	9	2	0	0	0	0	0	11	13	2	0	0.0393701
4470	85%	15	1	1	0	0	0	0	17	20	3	0	0.0393701
830	85%	30	4	1	0	0	0	0	35	41	6	0	0.0393701
300	86%	10	2	0	0	0	0	0	12	14	2	0	0.0393701
1530	86%	15	3	0	0	0	0	0	18	21	3	0	0.0393701
1900	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701
110	86%	17	1	1	0	0	0	0	19	22	3	0	0.0393701
650	86%	16	3	0	0	0	0	0	19	22	3	0	0.0393701
1000	87%	11	2	0	0	0	0	0	13	15	2	0	0.0393701
1050	87%	11	2	0	0	0	0	0	13	15	2	0	0.0393701
1010	88%	12	2	0	0	0	0	0	14	16	2	0	0.0393701
1550	88%	12	2	0	0	0	0	0	14	16	2	0	0.0393701
4140	88%	18	3	0	0	0	0	0	21	24	3	0	0.0393701
4220	88%	12	2	0	0	0	0	0	14	16	2	0	0.0393701
4090	88%	19	3	0	0	0	0	0	22	25	3	0	0.0393701
1500	88%	20	3	0	0	0	0	0	23	26	3	0	0.0393701
610	89%	15	0	1	0	0	0	0	16	18	2	0	0.0393701
1320	89%	14	2	0	0	0	0	0	16	18	2	0	0.0393701
1420	89%	14	2	0	0	0	0	0	16	18	2	0	0.0393701
540	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701
820	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701
620	89%	15	2	0	0	0	0	0	17	19	2	0	0.0393701
1040	89%	15	2	0	0	0	0	0	17	19	2	0	0.0393701
520	90%	24	1	1	0	0	0	0	26	29	3	0	0.0393701
2330	90%	23	3	0	0	0	0	0	26	29	3	0	0.0393701
320	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701
330	90%	16	2	0	0	0	0	0	18	20	2	0	0.0393701
730	90%	16	2	0	0	0	0	0	18	20	2	0	0.0393701
1600	90%	17	0	1	0	0	0	0	18	20	2	0	0.0393701
2920	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701
870	90%	26	1	1	0	0	0	0	28	31	3	0	0.0393701
4130	90%	17	2	0	0	0	0	0	19	21	2	0	0.0393701
440	91%	27	3	0	0	0	0	0	30	33	3	0	0.0393701
4710	91%	18	2	0	0	0	0	0	20	22	2	0	0.0393701
4730	91%	18	2	0	0	0	0	0	20	22	2	0	0.0393701
420	91%	57	6	0	0	0	0	0	63	69	6	0	0.0393701
4820	91%	19	2	0	0	0	0	0	21	23	2	0	0.0393701
4510	92%	20	2	0	0	0	0	0	22	24	2	0	0.0393701
1710	93%	24	0	1	0	0	0	0	25	27	2	0	0.0393701
640	93%	24	2	0	0	0	0	0	26	28	2	0	0.0393701
800	93%	25	2	0	0	0	0	0	27	29	2	0	0.0393701
630	93%	39	3	0	0	0	0	0	42	45	3	0	0.0393701
1570	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701
4790	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701
900	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393699
4270	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701
1620	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701
4100	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701
4350	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701
940	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393699
1720	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
530	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701
4290	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701
1060	95%	18	1	0	0	0	0	0	19	20	1	0	0.0393701
4340	95%	18	1	0	0	0	0	0	19	20	1	0	0.0393701
410	95%	19	1	0	0	0	0	0	20	21	1	0	0.0393701

4080	95%	19	1	0	0	0	0	0	20	21	1	0	0.0393701
4190	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
4150	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
4830	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
750	96%	22	1	0	0	0	0	0	23	24	1	0	0.0393701
4570	96%	22	1	0	0	0	0	0	23	24	1	0	0.0393701
2210	96%	23	1	0	0	0	0	0	24	25	1	1	0.0393701
4110	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
4170	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
4250	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
4360	96%	24	1	0	0	0	0	0	25	26	1	0	0.0393701
4810	96%	26	1	0	0	0	0	0	27	28	1	0	0.0393701
810	97%	28	1	0	0	0	0	0	29	30	1	0	0.0393701
500	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
710	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
720	97%	32	1	0	0	0	0	0	33	34	1	0	0.0393701
120	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
140	100%	28	0	0	0	0	0	0	28	28	0	0	0.0393701
200	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
220	100%	22	0	0	0	0	0	0	22	22	0	0	0.0393701
310	100%	22	0	0	0	0	0	0	22	22	0	0	0.0393701
600	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
950	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701
1030	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
1110	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
1330	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701
1340	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701
1440	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
1520	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701
1660	100%	13	0	0	0	0	0	0	13	13	0	0	0.0393701
1920	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
2230	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
2240	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
2250	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2260	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
2270	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2350	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
2360	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
2370	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2750	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
2850	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
2930	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
2940	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
2990	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4020	100%	18	0	0	0	0	0	0	18	18	0	0	0.0393701
4030	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701
4040	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
4050	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4070	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
4160	100%	24	0	0	0	0	0	0	24	24	0	0	0.0393701
4200	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701
4230	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
4260	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4300	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701
4310	100%	23	0	0	0	0	0	0	23	23	0	0	0.0393701
4490	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
4520	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
4550	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
4750	100%	13	0	0	0	0	0	0	13	13	0	0	0.0393701
4770	100%	18	0	0	0	0	0	0	18	18	0	0	0.0393701
4840	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701
	Total Tips	**2238**	**182**	**20**	**6**	**1**	**0**	**4**	**2451**	**2762**	**244**	**1**	


1800
1600
1400
1200
1000
800
600
400
200
0
(reports/hr)
Average Traffic
Peak Traffic Hour
1/1/08
1/26/08
2/20/08
3/16/08
4/10/08
5/5/08
5/30/08
6/24/08
7/19/08
8/13/08
9/7/08
10/2/08
10/27/08
11/21/08
12/16/08
Date/Time