

# Memo



**Date:** October 2, 2009  
**To:** Kevin Stewart  
**From:** Markus Ritsch  
**Subject:** September 2009 ALERT Data Analysis

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## 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 September 1 through September 30, 2009.

## II. General System Analysis Summary

A total of 318,522 ALERT data reports were analyzed from the ALERT 2 base station. Meteorological sensors account for 77 percent, water level sensors 7 percent, and rain sensors 5 percent of the total monthly records.

The system-wide radio traffic loading was 10,617 reports per day with an average hourly loading of 442 reports. The peak hourly traffic loading was 750 reports, which occurred on September 21, between 10:00 AM and 11:00 AM. A plot of monthly average and peak hourly traffic loading is provided.

### A. Specific Issues Identified this Month

The performance of the following sensors, highlighted in yellow in the table below, was unacceptable this month.

**Table 1. Rain Sensors with Unacceptable Performance Characteristics**

Rain ID	Description	Timer	Event	Comments
100	Carr Street	0.85	0.67	Poor event performance
850	Flying J	1.00	0.93	Large number of invalid reports
920	Aurora Town Hall Wx	0.20	0.92	Poor timer performance
1350	Chatfield COE	0.71	0.92	This sensor is much improved over previous months.
1440	Elbert	0.77	0.27	Poor event performance, large jump in count series
1460	Urban Farm	0.76	0.21	Poor event performance, large jump in count series
1480	Third Creek at DIA	0.63	0.95	Poor timer performance
1520	Marston Lake North	0.82	0.30	Poor event performance
1530	Bear Creek @ Lowell	0.68	1.00	This sensor is much improved over previous months.
1570	Brighton Ditch Wx	0.88	0.23	Poor event performance, several large jumps in count series
1700	Cherry Creek at Champa	0.30	0.10	Poor event and timer performance
2210	Hiwan G.C.	0.98	0.97	Large number of invalid reports
2230	Bear Cr below Cub	0.82	0.94	Large number of invalid reports
2320	Choke Cherry Resvr	0.90	0.96	Large number of invalid reports
2900	Russelville Gulch	0.55	0.12	Install amplifier during winter "off-season"
2970	Rampart Range Rd	0.35	0.12	Marginal path to West Creek
4030	Red Garden	0.92	1.00	Large number of invalid reports
4070	Bear Peak	0.91	1.00	Large number of invalid reports
4330	Indian Ruins	0.60	0.64	Large number of invalid reports

### 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 90 percent of the non-incrementing timer reports. The worst performing rain sensors for the month are summarized (Table 1).

**Table 2. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)**

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2850	4030	2840	1360	1350	2900	2270	1350	920			
1650	4200	1020	1640	2850	2270	2370	920	1700			
1810	4490	1040	2270	2270	2850	2850	2360	2970			
4250	4520	1720	1600	410	410	1350	2350	2900			
4790	4790	1030	2850	540	540	1530	2900	4330			
4300	4020	1550	1350	2320	1350	110	1460	1480			

\*-Timer statistics are skewed in these months because system start-up occurs and the Blue Mountain repeater was down. The network is operational by April 1.

Sensor ID 1460 and 700 have a 24-hour timer-reporting interval and Sensor ID 1810 and 1640 have an 18-hour timer-reporting interval.

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.

### IV. Rain Sensor Event Reporting Summary

#### A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors were analyzed to quantify the District-wide statistical total monthly tip summary (Table 3).

**Table 3. District-Wide Total Tip/Count Statistical Summary**

Statistical Parameter	Value	Comments
Mean	27.29	Only the 1-mm rain sensors were included in the analysis
Median	24	Only the 1-mm rain sensors were included in the analysis
Standard deviation	13.68	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	68.34	Only the 1-mm rain sensors were included in the analysis
Minimum total count	3	Carr Street (ID 100)
Maximum total count	94	Utah Park (ID 430) – Influenced by irrigation

#### B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 4).

**Table 4. 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	2.82	9.24	25.08
2009	6.33	3.11	11.37	59.26	63.45	68.00	65.00	20.00	27.29				

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

Several sensors experienced a large jump in the sequential tip count (Table 5).

**Table 5. Sensors with a Jump of More than 6 in Sequential Count**

Sensor Description	Sensor ID	Comment
Russelville Gulch	2900	Multiple jumps in tip count were observed throughout the month
Brighton Ditch Wx	1570	Two occurrences of a jump in count of more than 6
Urban Farm	1460	Two occurrences of a jump in count of more than 6
Elbert	1440	One occurrence of a jump in count of more than 6

### D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 90.0 percent. A total of 4,055 incrementing reports were received and a total of 4,503 were expected. The total loss of incrementing reports for the month was approximately 9.95 percent. Those sensors with the worst event transmission performance are summarized (Table 6).

**Table 6. Monthly Summary of Sensors with the Most Missed Tips**

Jan	Feb*	Mar*	Apr**	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
140	4030	860	860	110	2900	2900	2900	2900			
4490	4470	840	840	1350	540	2320	2810	1460			
1420	4490	700	1640	2320	2320	2820	2320	1570			
4040	4110	2840	2850	2850	110	110	2820	1440			
4160	4510	1340	700	540	1350	1350	1350	1520			
4470	4790	920	1350	1810	2350	2370	1640	4330			

\* - Event statistics are poor in February and March due to system start-up.

\*\* - Poor event performance is evident at every station because the ALERT2 base station was unable to receive data for part of this month.

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.

## V. Heavy Radio Traffic Analysis

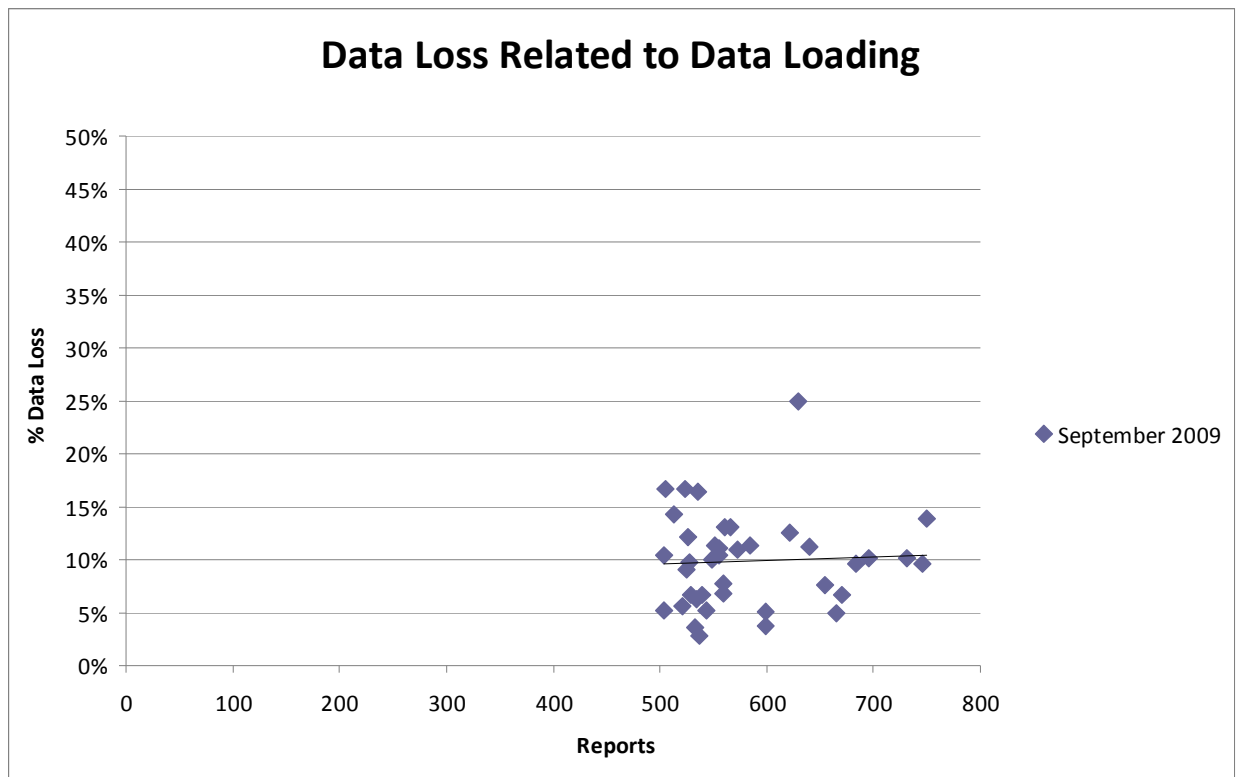
Periods exceeding 500 messages per hour were analyzed independently in an attempt to quantify data loss rates from rain sensors using the sequential tip count series.

### A. The Heaviest Hourly Traffic Periods This Month

The hours of highest radio traffic this month include:

Peak Traffic Periods	Reports/hour	Hour Beginning
Peak Hourly Traffic	750	9/21/2009 10:00 AM
2nd Max	746	9/21/2009 9:00 AM
3rd Max	731	9/25/2009 2:00 AM
4th Max	696	9/12/2009 6:00 PM
5th Max	683	9/12/2009 5:00 PM

Each hour exceeding 500 reports was analyzed to quantify the number of missing rain reports for that hour. The following plot shows the data loss as a function of data loading.



## 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)	343
Total reports from unknown IDs	583
Unknown IDs with only a single received report (potential noise)	250
Total reports from all IDs – RecData Log entire month	318,522
Unknown reports as a fraction of total reports	0.18%

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. Reports Received by Unknown IDs**

Unknown Sensor ID	Number of Reports
109	21
1299	20
419	18
1499	17
1423	7
1453	6
1470	6
1631	6
608	5
1501	5
1607	5
1934	5
2224	5
2736	5
4091	5
1446	4
1457	4
1486	4
1506	4
1814	4

1933	4
1946	4
1966	4
4026	4
4029	4
4031	4
4759	4
4858	4
206	3
1415	3
1443	3
1478	3
1529	3
1661	3
1960	3
2215	3
2239	3
4023	3
4046	3
4061	3
4093	3
4856	3
5711	3

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	31	12:00-12:59	50
1:00-1:59	18	1:00-1:59	57
2:00-2:59	6	2:00-2:59	13
3:00-3:59	7	3:00-3:59	18
4:00-4:59	14	4:00-4:59	16
5:00-5:59	9	5:00-5:59	30
6:00-6:59	4	6:00-6:59	40
7:00-7:59	7	7:00-7:59	23
8:00-8:59	15	8:00-8:59	19
9:00-9:59	24	9:00-9:59	25
10:00-10:59	42	10:00-10:59	28
11:00-11:59	53	11:00-11:59	34

## VII. Sensors with Invalid Reports

Precipitation sensors with a large number of invalid reports (bit flip/contention errors/random decode):

Sensor ID	Description	July Reports	August Reports	Sept Reports
310	Guy Hill Ranch	0	0	3
330	Van Bibber @ Hwy 93	4	0	0
630	Temple Pond at DTC	0	0	3
850	Flying J	0	9	3
920	Aurora Town Hall Wx	3	0	1
1350	Chatfield COE	1	4	0
1530	Bear Creek at Lowell	2	5	0
2210	Hiwan G.C.	12	6	2
2230	Bear Cr below Cub	6	3	3
2240	Cold Sprg Glch conf	4	0	0
2270	Cub Cr below Blue	3	0	0
2320	Choke Cherry Resvr	8	3	3
2370	Red Rocks Park	0	5	0
2810	Pine Cliff Road	6	0	0
2820	Haskins Gulch Conf	5	4	0
2860	CC at Stroh Rd	3	7	1
4030	Red Garden	2	4	3
4070	Bear Peak	0	0	3
4260	Taylor Mountain	4	0	0
4330	Indian Ruins	0	0	7
4770	Cal-Wood Ranch	3	0	0
4790	Button Rock	0	0	3



The following rainfall intensity summary is presented to corroborate the rainfall rate alarms.

<b>10 Minute Peak Intensities</b>				
<b>Station</b>	<b>Date</b>	<b>Tips</b>	<b>Inches</b>	<b>in/hr</b>
870	9/5/09 5:05 PM	11	0.433	2.598
1460	9/25/09 11:31 PM	9	0.354	2.126
4010	9/13/09 4:55 PM	9	0.354	2.126
4180	9/8/09 9:32 PM	9	0.354	2.126
4060	9/13/09 4:49 PM	8	0.315	1.890
4130	9/8/09 10:12 PM	8	0.315	1.890
1570	9/25/09 11:56 AM	7	0.276	1.654
2990	9/8/09 6:32 PM	7	0.276	1.654
4020	9/13/09 4:53 PM	7	0.276	1.654
5760	9/12/09 1:10 PM	7	0.276	1.654
140	9/13/09 5:16 PM	6	0.236	1.417
150	9/13/09 4:51 PM	6	0.236	1.417
220	9/21/09 12:35 PM	6	0.236	1.417
1400	9/9/09 2:25 PM	6	0.236	1.417
1440	9/12/09 5:42 PM	6	0.236	1.417
1440	9/21/09 5:43 PM	6	0.236	1.417
1520	9/12/09 8:16 PM	6	0.236	1.417
4020	9/5/09 6:28 PM	6	0.236	1.417
4300	9/8/09 9:10 PM	6	0.236	1.417
4530	9/5/09 6:26 PM	6	0.236	1.417
5760	9/26/09 1:10 AM	6	0.236	1.417
1440	9/25/09 5:43 AM	5	0.197	1.181
1570	9/13/09 11:56 PM	5	0.197	1.181
1640	9/28/09 1:23 PM	5	0.197	1.181
2260	9/13/09 7:21 PM	5	0.197	1.181
2280	9/8/09 12:01 PM	5	0.197	1.181
2730	9/12/09 7:09 PM	5	0.197	1.181
2840	9/12/09 7:08 PM	5	0.197	1.181
4730	9/8/09 10:17 PM	5	0.197	1.181
5730	9/8/09 5:41 PM	5	0.197	1.181
5800	9/7/09 7:31 PM	5	0.197	1.181
430	9/2/09 2:58 PM	4	0.157	0.945
500	9/25/09 5:00 AM	4	0.157	0.945



# General System Analysis

**Database Name**

P:\A207-UDFCD-Data-Analysis\2009\09-2009\Novastar\_extract\_2009Sep.mdb

**First Date in Database**  
**Last Date in Database**

9/1/09 12:00 AM
9/30/09 11:59 PM

**Total Days**  
**Total Hours**

30.0
720.0

**Total Records Analyzed**

318522

**Records by Group**

Temperature	52991	17%
Relative Humidity	52474	16%
Wind Gust	50479	16%
Barometric Pressure	23465	7%
Wind Direction	19880	6%
Wind Speed Average	19214	6%
Wind Speed Average & Azimuth	18045	6%
Water Level PT-HSE	17300	5%
Precipitation	15500	5%
Solar Radiation	8325	3%
Battery Voltage HSE	8124	3%
Fuel Temperature	5736	2%
Fuel Moisture	5703	2%
Water Level Float	3941	1%
Battery Voltage Digital	3830	1%
Battery Voltage Analog	3621	1%
Battery	2087	1%
Water Level PT	1734	1%
Repeater Status Report	1570	0%
Soil Moisture	915	0%
Wing Gust	710	0%
12Hr Status Report	644	0%
Hayman Battery	621	0%
Repeater Pass List	591	0%
Battery Voltage	271	0%
Water Level	129	0%
Handar 585 ALARM Status	34	0%
Solar Power	3	0%
Hayman Stage	1	0%
Longmont Flow Gage	1	0%
<b>Total</b>	<b>317939</b>	

**Records by Major Group**

Meteorologic Sensors	244873	77%
Water Level Sensors	22976	7%
Sensor Status Transmissions	18417	6%
Rain Sensors	15500	5%
Soil and Fuel Sensors	12354	4%
<b>Total</b>	<b>314120</b>	

**Records by Validation Type**

Good	0	379957	100%
Questionable	1	791	0%
<b>Total</b>		<b>380748</b>	

**Sensors With Most Invalid Data**

Description	Sensor	Reports
Quincy Reservoir	755	85
Hiwan G.C.	2213	51
Castle Rock	2744	28
Squaw Mountain	2189	25
Salisbury Park	2724	25

**Traffic Loading Summary**

Alert Reports	318522	
Average Daily Traffic	10617	
Average Hourly Traffic	442	
Median Hourly Traffic	438	hour beginning
Peak Hourly Traffic	750	9/21/09 10:00 AM
2nd Max	746	9/21/09 9:00 AM
3rd Max	731	9/25/09 2:00 AM
4th Max	696	9/12/09 6:00 PM
5th Max	683	9/12/09 5:00 PM

# Rain Timer Performance

# n Timer Performance

Analyze Rain Sensors

12:30

0.900396825

Rain ID	Description	Rcv	Timer	Ave Exp	Performance
920	Aurora Town Hall Wx	12	10:17	60.00	20%
1700	Cherry Cr @ Champa	18	6:29	60.00	30%
2970	Rampart Range Rd	21	12:36	60.00	35%
2900	Russelville Gulch-Douglas	33	15:43	60.00	55%
4330	Indian Ruins	36	16:21	60.00	60%
2870	Cottonwood (Apache)	37	11:57	60.00	62%
1480	Third Creek at DIA	38	12:20	60.00	63%
1530	Bear Creek @ Lowell	41	12:43	60.00	68%
1350	Chatfield COE	43	12:18	60.00	72%
1810	Sand Creek at mouth	43	12:37	60.00	72%
2370	Red Rocks Park	43	12:40	60.00	72%
4090	Magnolia	43	14:52	60.00	72%
320	Sports Complex	45	15:10	60.00	75%
4850	Porphory Mtn	45	13:27	60.00	75%
1440	Elbert	46	12:00	60.00	77%
1460	Urban Farm	23	1:15	30.00	77%
4150	Gold Hill	48	13:13	60.00	80%
1520	Marston Lake North	49	13:07	60.00	82%
2230	Bear Cr below Cub	49	13:39	60.00	82%
4240	Sunset	49	13:13	60.00	82%
4530	Winiger Ridge	49	14:10	60.00	82%
4820	Doudy Draw	49	14:11	60.00	82%
510	Virginia Court	50	12:53	60.00	83%
4080	Twin Sisters	50	13:40	60.00	83%
4130	Swiss Peaks	50	12:55	60.00	83%
4470	Little Narrows	50	13:05	60.00	83%
4570	St. Antons	50	13:11	60.00	83%
4770	Cal-Wood Ranch	50	13:25	60.00	83%
100	Carr Street	51	13:40	60.00	85%
310	Guy Hill Ranch	51	12:45	60.00	85%
2250	Rosedale	51	13:28	60.00	85%
2350	Idledale	51	13:37	60.00	85%
2860	CC at Stroh Rd	51	12:48	60.00	85%
4010	Crescent	51	13:13	60.00	85%
4860	Fairview Peak	51	13:15	60.00	85%
220	Upper Leyden	52	12:16	60.00	87%
840	Fire Station 12	52	12:47	60.00	87%
2360	Indian Hills	52	13:00	60.00	87%
2810	Pine Cliff Road	52	13:40	60.00	87%
2920	West Cherry Head-Douglas Cnty	52	12:51	60.00	87%
2980	Dakan Rd	52	12:17	60.00	87%
4170	Pine Brook	52	13:16	60.00	87%
4310	Johnny Park	52	12:45	60.00	87%
4750	Louisville Lake	52	13:02	60.00	87%
430	Utah Park	53	12:29	60.00	88%
620	Quincy/Highline	53	12:43	60.00	88%
1000	Maple Grove Resv.	53	13:33	60.00	88%
1010	Denver West	53	13:01	60.00	88%
1050	Jeffco Fairgrounds	53	13:00	60.00	88%
1400	Upper Sloan Det.	53	12:28	60.00	88%
1570	Brighton Ditch Wx	53	10:28	60.00	88%
2240	Cold Sprg Glch conf	53	12:46	60.00	88%
2820	Haskins Gulch Conf	53	12:16	60.00	88%
2950	DC Public Works	53	12:31	60.00	88%

4110	Betasso	53	13:19	60.00	88%
4140	Logan Mill	53	13:30	60.00	88%
4160	Sunshine	53	12:31	60.00	88%
4200	Lazy Acres	53	13:02	60.00	88%
4510	Pinewood Springs	53	13:04	60.00	88%
4790	Button Rock	53	12:31	60.00	88%
4810	Shanahan Ridge	53	12:29	60.00	88%
210	Leyden Confluence	54	12:43	60.00	90%
300	Van Bibber Park	54	12:57	60.00	90%
330	Van Bibber @ Hwy 93	54	12:26	60.00	90%
750	Quincy Reservoir	54	12:59	60.00	90%
1040	Lena @ U.S. Hwy 6	54	12:58	60.00	90%
2310	Genesee Village	54	12:40	60.00	90%
2990	Tomah Rd-Douglas Cnty	54	12:48	60.00	90%
4020	Rio Grande	54	12:49	60.00	90%
4040	Martin Gulch	54	12:45	60.00	90%
4060	Lakeshore	54	12:30	60.00	90%
4220	Fling's	54	12:49	60.00	90%
4840	SBC@S Boulder Ditch	54	12:28	60.00	90%
140	Blue Mountain	55	12:00	60.00	92%
150	Nott Creek	55	12:47	60.00	92%
440	Fire Station #7	55	12:13	60.00	92%
600	Harvard Gulch Park	55	12:43	60.00	92%
610	Harvard @ Jackson	55	12:29	60.00	92%
760	Mission Viejo Park	55	12:53	60.00	92%
870	Murphy Creek GC	55	12:32	60.00	92%
2270	Cub Cr below Blue	55	12:46	60.00	92%
2330	Morrison	55	12:06	60.00	92%
2840	Sulphur Gulch	55	12:44	60.00	92%
2960	Indian Creek	55	12:45	60.00	92%
3020	West Creek WX	55	12:36	60.00	92%
4030	Red Garden	55	12:31	60.00	92%
4070	Bear Peak	55	13:01	60.00	92%
4180	Gold Lake	55	12:45	60.00	92%
4260	Taylor Mountain	55	12:28	60.00	92%
4270	Cannon Mountain	55	12:48	60.00	92%
400	Montview Park	56	12:41	60.00	93%
500	Havana Park	56	11:57	60.00	93%
540	Parker/Mississippi	56	12:40	60.00	93%
640	Goldsmith @ Eastman	56	12:12	60.00	93%
700	Toll Gate @ 6th	28	1:05	30.00	93%
720	Confluence Pond	56	12:13	60.00	93%
800	Sable Ditch @ 18th	56	12:26	60.00	93%
810	Granby Ditch @ 6th	56	12:26	60.00	93%
1320	SPR at 3rd Ave	56	12:40	60.00	93%
1550	Lakewood CC	56	12:26	60.00	93%
1710	Shop Creek	56	12:15	60.00	93%
1720	Cherry Cr @ Steele	56	12:43	60.00	93%
2190	Squaw Mountain	56	12:32	60.00	93%
2850	Cherry Cr bl Bayou Glch	56	12:45	60.00	93%
2930	Spring Valley Rd - DougCnty	56	12:46	60.00	93%
4300	Big Elk Park	56	12:47	60.00	93%
4350	Conifer Hill	56	12:27	60.00	93%
4830	SBC @ San Souci	56	12:41	60.00	93%
120	West Woods	57	12:28	60.00	95%
410	Kelly Dam	57	12:12	60.00	95%
520	Jewell Detention	57	11:57	60.00	95%
530	Fire Station #19	57	12:11	60.00	95%
650	Iliff Pond	57	12:12	60.00	95%

730	No Name @ Quincy	57	11:57	60.00	95%
1030	NREL/S. Table Mtn.	57	12:11	60.00	95%
1060	Heritage Square	57	12:11	60.00	95%
1110	Gunbarrel	57	12:26	60.00	95%
1200	Broomfield 3207	57	12:27	60.00	95%
1310	LDC at 64th	57	12:11	60.00	95%
1330	Roslyn	57	12:00	60.00	95%
1420	Diamond Hill	57	12:34	60.00	95%
1620	Slaughterhouse Glch	57	12:26	60.00	95%
1640	SPR at Union Ave.	57	12:02	60.00	95%
1800	Sand Creek Park	57	11:57	60.00	95%
2260	Brook Forest	57	12:30	60.00	95%
2340	El Rancho	57	12:43	60.00	95%
4100	Filter Plant	57	12:13	60.00	95%
4230	Golden Age	57	12:26	60.00	95%
4250	Geer Canyon	57	12:12	60.00	95%
4360	Justice Center	57	12:25	60.00	95%
4490	Apple Valley	57	12:26	60.00	95%
4520	Eagle Ridge	57	12:00	60.00	95%
4710	Ward C-1	57	12:32	60.00	95%
630	Temple Pond at DTC	58	11:58	60.00	97%
820	ETG @ Buckley	58	12:26	60.00	97%
940	Sampson Gulch	58	12:12	60.00	97%
1340	Sanderson at Xavier	58	12:00	60.00	97%
1360	Denver Zoo	58	12:00	60.00	97%
1370	West Metro FS13	58	11:59	60.00	97%
1600	Englewood Dam	58	12:26	60.00	97%
1920	Brighton	58	12:14	60.00	97%
2280	Kinney Peak	58	12:12	60.00	97%
2710	Highlands Ranch WTP	58	12:00	60.00	97%
2730	Salisbury Park	58	12:00	60.00	97%
2750	Castle Rock	58	12:14	60.00	97%
2940	Willow Creek - DougCnty	58	12:14	60.00	97%
4050	Walker Ranch	58	12:12	60.00	97%
4190	Slaughterhouse	58	12:12	60.00	97%
4340	Riverside	58	12:27	60.00	97%
4730	Sugarloaf	58	12:15	60.00	97%
710	Horseshoe Park Drop	59	11:58	60.00	98%
830	Side Creek Park	59	11:57	60.00	98%
1660	SPR at Henderson	59	11:49	60.00	98%
1900	Niver Detention	59	12:11	60.00	98%
2210	Hiwan G.C.	59	12:00	60.00	98%
2910	East Cherry Cr-Douglas	59	12:00	60.00	98%
4290	Red Hill	59	11:58	60.00	98%
110	Ralston Reservoir	60	7:49	60.00	100%
850	Flying J	60	11:02	60.00	100%
970	Pump Sta 3	60	11:45	60.00	100%
1100	Louisville Rec Ctr	60	11:52	60.00	100%
4550	Boulder Jail	60	11:44	60.00	100%
900	Aurora Reservoir	61	11:37	60.00	102%
200	Leyden Reservoir	64	11:20	60.00	107%
1300	Hidden Lake	69	9:19	60.00	115%
1500	Powers Park	71	9:00	60.00	118%
420	Expo Park	75	8:36	60.00	125%
860	Sand Cr at Colfax	112	6:13	60.00	187%
2320	Choke Cherry Resvr	201		60.00	

Rain Event Performance			Reports Received	4,055	Analyze Rain Sensors									
	Systemwide Avg	Total Tips	4,503											
	90.05%	Data Loss	9.95%											
Rain ID	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket	
2900	12%	1	1	0	0	0	0	4	2	50	44	0	0.0393701	
1460	21%	2	1	1	0	0	0	2	4	28	22	0	0.0393701	
1570	23%	2	1	0	0	1	0	2	4	26	20	0	0.0393701	
1440	27%	5	2	1	1	1	2	1	12	49	36	0	0.0393701	
1520	30%	1	2	0	3	0	1	0	7	23	16	0	0.0393701	
4330	64%	10	3	3	0	0	0	0	16	25	9	0	0.0393701	
100	67%	1	1	0	0	0	0	0	2	3	1	0	0.0393701	
220	76%	15	0	0	0	0	1	0	16	21	5	1	0.0393701	
4240	77%	13	3	1	0	0	0	0	17	22	5	0	0.0393701	
840	79%	11	4	0	0	0	0	0	15	19	4	0	0.0393701	
4750	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701	
4110	83%	8	2	0	0	0	0	0	10	12	2	0	0.0393701	
4820	83%	8	2	0	0	0	0	0	10	12	2	0	0.0393701	
110	83%	13	1	1	0	0	0	0	15	18	3	1	0.0393701	
540	83%	12	3	0	0	0	0	0	15	18	3	0	0.0393701	
1400	83%	13	1	1	0	0	0	0	15	18	3	0	0.0393701	
4470	83%	13	1	1	0	0	0	0	15	18	3	0	0.0393701	
4530	84%	26	4	1	0	0	0	0	31	37	6	0	0.0393701	
4770	84%	18	2	1	0	0	0	0	21	25	4	0	0.0393701	
2270	84%	28	3	0	1	0	0	0	32	38	6	0	0.0393701	
1370	85%	19	4	0	0	0	0	0	23	27	4	0	0.0393701	
4130	85%	25	3	1	0	0	0	0	29	34	5	0	0.0393701	
730	86%	25	5	0	0	0	0	0	30	35	5	0	0.0393701	
2870	86%	31	6	0	0	0	0	0	37	43	6	0	0.0393701	
860	86%	21	4	0	0	0	0	0	25	29	4	0	0.0393701	
1600	86%	21	4	0	0	0	0	0	25	29	4	0	0.0393701	
4090	86%	16	3	0	0	0	0	0	19	22	3	0	0.0393701	
4250	86%	16	3	0	0	0	0	0	19	22	3	0	0.0393701	
2840	87%	38	7	0	0	0	0	0	45	52	7	0	0.0393701	
4710	87%	30	1	2	0	0	0	0	33	38	5	0	0.0393701	
520	87%	17	3	0	0	0	0	0	20	23	3	0	0.0393701	
4150	87%	18	1	1	0	0	0	0	20	23	3	0	0.0393701	
320	88%	12	2	0	0	0	0	0	14	16	2	0	0.0393701	
440	88%	19	3	0	0	0	0	0	22	25	3	0	0.0393701	
700	88%	19	3	0	0	0	0	0	22	25	3	0	0.0393701	
2980	88%	38	6	0	0	0	0	0	44	50	6	0	0.0393701	
1050	88%	13	2	0	0	0	0	0	15	17	2	0	0.0393701	
2910	88%	46	7	0	0	0	0	0	53	60	7	0	0.0393701	
1640	88%	21	1	1	0	0	0	0	23	26	3	0	0.0393701	
2820	89%	35	3	1	0	0	0	0	39	44	5	0	0.0393701	
2950	89%	41	6	0	0	0	0	0	47	53	6	0	0.0393701	
4520	89%	14	2	0	0	0	0	0	16	18	2	0	0.0393701	
4790	89%	15	0	1	0	0	0	0	16	18	2	0	0.0393701	
4140	89%	15	2	0	0	0	0	0	17	19	2	0	0.0393701	
510	90%	24	1	1	0	0	0	0	26	29	3	0	0.0393701	
2250	90%	31	4	0	0	0	0	0	35	39	4	0	0.0393701	
410	90%	16	2	0	0	0	0	0	18	20	2	0	0.0393701	
1320	90%	16	2	0	0	0	0	0	18	20	2	0	0.0393701	
2960	90%	33	4	0	0	0	0	0	37	41	4	0	0.0393701	
120	90%	17	2	0	0	0	0	0	19	21	2	0	0.0393701	
2330	90%	18	0	1	0	0	0	0	19	21	2	1	0.0393701	
2370	90%	17	2	0	0	0	0	0	19	21	2	1	0.0393701	
3020	91%	44	3	1	0	0	0	0	48	53	5	0	0.0393701	
4510	91%	18	2	0	0	0	0	0	20	22	2	0	0.0393701	
310	91%	19	2	0	0	0	0	0	21	23	2	0	0.0393701	
1620	91%	19	2	0	0	0	0	0	21	23	2	0	0.0393701	
2350	91%	20	0	1	0	0	0	0	21	23	2	0	0.0393701	
4570	91%	19	2	0	0	0	0	0	21	23	2	0	0.0393701	
600	92%	20	2	0	0	0	0	0	22	24	2	0	0.0393701	
920	92%	31	3	0	0	0	0	0	34	37	3	0	0.0393701	
640	92%	21	2	0	0	0	0	0	23	25	2	0	0.0393701	
1350	92%	21	2	0	0	0	0	0	23	25	2	0	0.0393701	
4060	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701	
2990	92%	44	4	0	0	0	0	0	48	52	4	0	0.0393701	
970	93%	23	2	0	0	0	0	0	25	27	2	0	0.0393701	
2710	93%	24	2	0	0	0	0	0	26	28	2	0	0.0393701	
2810	93%	36	3	0	0	0	0	0	39	42	3	0	0.0393701	
850	93%	51	2	1	0	0	0	0	54	58	4	0	0.0393701	
500	93%	38	3	0	0	0	0	0	41	44	3	0	0.0393701	
2850	93%	38	3	0	0	0	0	0	41	44	3	0	0.0393701	
200	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701	
1550	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701	
4230	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701	

4490	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701
4180	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701
870	93%	39	3	0	0	0	0	0	42	45	3	0	0.0393701
1010	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701
4050	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701
2230	94%	28	2	0	0	0	0	0	30	32	2	0	0.0393701
2750	94%	28	2	0	0	0	0	0	30	32	2	0	0.0393701
2730	94%	42	3	0	0	0	0	0	45	48	3	0	0.0393701
2860	94%	42	3	0	0	0	0	0	45	48	3	0	0.0393701
1300	94%	15	1	0	0	0	0	0	16	17	1	1	0.0393701
1310	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701
1710	94%	30	2	0	0	0	0	0	32	34	2	0	0.0393701
2920	94%	45	3	0	0	0	0	0	48	51	3	0	0.0393701
1360	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
1920	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
4080	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
4290	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
330	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701
4160	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701
2930	95%	35	2	0	0	0	0	0	37	39	2	0	0.0393701
4010	95%	35	2	0	0	0	0	0	37	39	2	0	0.0393701
4190	95%	18	1	0	0	0	0	0	19	20	1	0	0.0393701
2940	95%	36	2	0	0	0	0	0	38	40	2	0	0.0393701
900	95%	37	2	0	0	0	0	0	39	41	2	0	0.0393699
1480	95%	19	1	0	0	0	0	0	20	21	1	0	0.0393701
400	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
1040	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
1420	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
4260	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
2310	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
4730	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
430	96%	86	4	0	0	0	0	0	90	94	4	1	0.0393701
<b>4270</b>	96%	22	1	0	0	0	0	0	23	24	1	0	0.0393701
150	96%	44	2	0	0	0	0	0	46	48	2	0	0.0393701
620	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
650	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
2320	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
2340	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
4340	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701
420	96%	46	2	0	0	0	0	0	48	50	2	0	0.0393701
810	96%	24	1	0	0	0	0	0	25	26	1	0	0.0393701
630	96%	73	1	1	0	0	0	0	75	78	3	0	0.0393701
820	96%	25	1	0	0	0	0	0	26	27	1	0	0.0393701
4300	96%	25	1	0	0	0	0	0	26	27	1	0	0.0393701
140	96%	26	1	0	0	0	0	0	27	28	1	0	0.0393701
710	97%	27	1	0	0	0	0	0	28	29	1	0	0.0393701
750	97%	27	1	0	0	0	0	0	28	29	1	0	0.0393701
720	97%	28	1	0	0	0	0	0	29	30	1	0	0.0393701
2210	97%	29	1	0	0	0	0	0	30	31	1	0	0.0393701
1500	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
2280	97%	31	1	0	0	0	0	0	32	33	1	0	0.0393701
760	98%	38	1	0	0	0	0	0	39	40	1	0	0.0393701
2260	98%	53	1	0	0	0	0	0	54	55	1	0	0.0393701
940	98%	64	1	0	0	0	0	0	65	66	1	0	0.0393699
4170	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4550	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4100	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
1110	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
4360	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
1100	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
4840	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
4200	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701
4830	100%	13	0	0	0	0	0	0	13	13	0	1	0.0393701
1810	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
1900	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
300	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
1000	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
4810	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
210	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
1030	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
1330	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
1660	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
1200	100%	18	0	0	0	0	0	0	18	18	0	0	0.0393701
4310	100%	18	0	0	0	0	0	0	18	18	0	0	0.0393701
4070	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701
1060	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701
1340	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701

1800	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701
530	100%	22	0	0	0	0	0	0	22	22	0	0	0.0393701
610	100%	22	0	0	0	0	0	0	22	22	0	0	0.0393701
800	100%	23	0	0	0	0	0	0	23	23	0	0	0.0393701
1530	100%	23	0	0	0	0	0	0	23	23	0	0	0.0393701
2190	100%	23	0	0	0	0	0	0	23	23	0	0	0.0393701
4350	100%	24	0	0	0	0	0	0	24	24	0	0	0.0393701
830	100%	25	0	0	0	0	0	0	25	25	0	0	0.0393701
4030	100%	26	0	0	0	0	0	0	26	26	0	0	0.0393701
1720	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701
2240	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701
2360	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701
4040	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701
4220	100%	35	0	0	0	0	0	0	35	35	0	0	0.0393701
4020	100%	39	0	0	0	0	0	0	39	39	0	0	0.0393701
	<b>Total Tips</b>	<b>3,764</b>	<b>256</b>	<b>24</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>9</b>	<b>4,055</b>	<b>4,503</b>	<b>439</b>	<b>7</b>	

# Monthly Traffic Loading

