

Memo



Date: November 2, 2007
To: Kevin Stewart and Chad Kudym
From: Markus Ritsch
Subject: **October 2007 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, 2007.

II. General System Analysis Summary

A total of 265,178 individual data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 62 percent, water level sensors 10 percent, and rain sensors 4 percent of the total monthly transmissions.

Ninety-nine point eight percent of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 658 reports were flagged as "bad". Of these "bad" reports, 36 originated from Elbert (ID 1439), 35 originated from Salisbury Park (ID 2724), 32 originated from Highlands Ranch WTP (ID 2704), 31 originated from SSV at Berry Ridge (ID 4463), and 30 from Leyden Reservoir (ID 203).

The system-wide radio traffic loading this month was 8,554 reports per day with an average hourly loading of 356 reports. The peak hourly traffic loading was 637 reports, which occurred on October 21 between 2:00 PM and 3:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 777 reports were received from the Hayman gages this month.

The sensors reporting most frequently this month include:

1. Salisbury Park (ID 2727 – ALERT wind) with 3,589 reports,
2. Castle Rock (ID 2747 - ALERT wind) with 3,925 reports,
3. Blue Mountain (IDs 137, 138, 139, 141, 142) with 2,900 reports each, and
4. Elbert (IDs 1437, 1438, 1439, 1441, 1442) with 2,850 reports each.

The reports from the above sensors are distributed evenly throughout the month.

The sensors reporting infrequently this month include:

1. Sulphur Gulch (IDs 2840, 2843, 2845) with 1 report each,
2. Kinney Peak (ID 2276) with 1 report,
3. Squaw Mountain (ID 2194) with 1 report,
4. Quincy Reservoir (ID 753) with 1 report,
5. Lena @ U.S. Hwy 6 (ID 1043) with 2 reports,
6. Harvard Gulch Park (ID 603) with 2 reports,
7. Van Bibber @ Hwy 93 (ID 333) with 2 reports,
8. El Rancho (ID 2340) with 3 reports, and
9. Stapleton (ID 1463) with 3 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 77 percent of the non-incrementing timer reports. The 5 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
750	1330	2310	1810	1810	1810	1810	1600	1330	2340		
4470	1460	1710	540	310	1710	4560	410	1340	2250		
4560	2330	2350	310	540	4470	2350	1350	1360	2230		
4240	4170	2240	850	850	1500	2250	2190	1370	2240		
4510	4470	2250	1710	1710	4290	4200	4820	2310	2310		
				900	540	4240	4830	1030	2360		

* - Many District stations are taken out-of-service for the winter beginning in October which influences timer performance.

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.

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 is not included in the timer reporting analysis after the month of July.

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) that reported for the entire month 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	29.50	Only the 1-mm rain sensors were included in the analysis
Median	30	Only the 1-mm rain sensors were included in the analysis
Standard deviation	7.19	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	51.07	Only the 1-mm rain sensors were included in the analysis
Minimum total count	5	Elbert (ID 1440)
Maximum total count	54	Powers Park (ID 1500)

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			

The average precipitation experienced district-wide in October was increased slightly from the previous month of September. The District-wide precipitation experienced in October of 2007 was decreased from that experienced in the same month in 2006.

The rain sensor with the lowest tip count total for the month was Elbert (ID 1440).

The rain sensor with the highest tip count total for the month was Powers Park (ID 1500). This sensor was also the only sensor reporting more than the system-wide mean plus 3 standard deviations. This sensor does have a history of sprinkler irrigation influence.

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

Two rain sensors experienced a jump in the sequential tip count of more than six. The tip count series for each sensor was manually inspected and summarized below.

Table 4. Shop Creek (ID1710) - Large Jump in Count

Date/Time	Sensor ID	Count
10/21/2007 2:13:54 AM	1710	29
10/21/2007 2:39:24 AM	1710	30
10/21/2007 4:31:35 AM	1710	30
10/21/2007 5:36:24 AM	1710	31
10/22/2007 4:31:26 AM	1710	41
10/22/2007 4:31:28 PM	1710	41
10/23/2007 4:31:38 AM	1710	41

Table 5. Sand Creek at Colfax (ID 860) - Large Jump in Count

Date/Time	Sensor ID	Count
10/21/2007 2:25:11 AM	860	354
10/21/2007 5:39:59 AM	860	354
10/21/2007 5:46:41 AM	860	355
10/21/2007 6:15:28 AM	860	356
10/21/2007 5:40:01 PM	860	364
10/21/2007 11:40:03 PM	860	364
10/22/2007 5:39:51 AM	860	364

The reason for these large data gaps is not known. It is interesting that they both occurred on about the same day.

C. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm, tip reports for the month was approximately 94 percent. A total of 3,711 incrementing reports were received and a total of 3,923 were expected. The total loss of incrementing reports for the month was approximately 6 percent. Those sensors with the worst rain event transmission performance characteristics 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
2320	1330	540	1350	860	1710	2370	1350	1810	1710		
2190	4080	310	310	4710	1350	150	2310	520	860		
4710	1640	4470	1100	1810	310	1700	540	1360	540		
4090	4050	850	860	1350	1700	1350	1300	1700	850		
4820	4180	4570	540	400	210	850	1920	1710	900		
				4570	110	2340	840	1350	1100		

* Note that the outage of the Blue Mountain repeater caused a large data gap in the sequential count series for many sensors and thus the incrementing tip report performance statistics are skewed 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.

The incrementing data series for each sensor is inspected to identify periods of missing data.

a. Parker/Mississippi (ID 540)

The base station missed 6 transmissions out of 30 for this sensor for an event performance success rate of 80 percent. This sensor experienced a jump of 6 counts on October 22, 2007

b. Flying J (ID 850)

This sensor experienced a jump of 5 counts on October 21, 2007.

c. Aurora Reservoir (ID 900)

This sensor experienced small jumps in the count series throughout the month.

d. Louisville Rec Center (ID 1100)

This sensor experienced small jumps in the count series throughout the month.

V. Heavy Radio Traffic Analysis

Periods exceeding 600 messages per hour are analyzed independently in an attempt to identify rain gage sequences where 3 or more, sequential messages were lost.

A. October 21, 2007

The heaviest radio traffic for the month occurred in the afternoon of October 21, between 12:00 PM and 4:00 PM.

The distribution of hourly reports for the period is as follows:

- 10/21/2007 from 12:00 pm to 1:00 pm (561 reports)
- 10/21/2007 from 1:00 pm to 2:00 pm (631 reports)
- 10/21/2007 from 2:00 pm to 3:00 pm (637 reports)
- 10/21/2007 from 3:00 pm to 4:00 pm (584 reports)

The ALERT data for this period was examined more closely to characterize the distribution of sensor traffic (Table 7). During this time the radio traffic was dominated by water level and rain reports.

Table 7. Peak Traffic Period Sensor Report Distribution

Sensor Group	Reports	Percent
Water Level PT-HSE	639	23%
Precipitation	424	15%
None-ALERT-ID	314	11%
Wind Gust	272	10%
Wind Speed Average & Azimuth	247	9%
Relative Humidity	240	9%
Temperature	204	7%
Wind Direction	120	4%
Wind Speed Average	96	3%
Battery Voltage HSE	45	2%
Battery Voltage Digital	41	1%
Water Level Float	36	1%
Water Level PT	29	1%
Precipitation - Mean	23	1%
Barometric Pressure	21	1%
Solar Radiation	20	1%

Battery Voltage Analog	5	0%
Fuel Moisture	5	0%
Fuel Temperature	5	0%
Handar 585 ALARM Status	5	0%
Repeater Pass List	5	0%
Repeater Status Report	5	0%
Battery	2	0%
12Hr Status Report	1	0%
Hayman Precipitation	1	0%
Precipitation - Test	1	0%
Soil Moisture	1	0%
Total	2,807	100%

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 8). Overall, approximately 7.26% of the incrementing tip reports were lost for this period.

Table 8. Peak Traffic Analysis - Loss of Incrementing Tip Reports

Heavy Traffic Period (Oct 21, 2007)	Occurrences of loss of sequential tip reports during period			
	Loss of 2 tips	Loss of 3 tips	Loss of 4 tips	Loss of 5 tips
12:00 pm to 5:00 pm	1	0	0	0

The majority of lost reports are single tip reports. The loss of 3 or more sequential tip reports was not observed during this heavy traffic period.

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 9).

Table 9. Summary of Unknown IDs

Description	Quantity
Total number of unknown IDs (IDs without a device definition)	170
Total reports from unknown IDs	435
Unknown IDs with only a single received report (potential noise)	127
Total reports from all IDs – RecData Log entire month	222,045
Unknown reports as a fraction of total reports	0.20%

The total number of reports from unknown sensor IDs is 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 quantified (Table 10).

Table 10. Reports Received by Unknown IDs

Unknown Sensor ID	Number of Reports
4013	62
4467	31
4466	29
4468	29
4461	28
4462	26

Unknown Sensor ID	Number of Reports
2239	7
4094	5
4031	5
4768	5
862	4
4748	4
2224	4

The “unknown” device reports were analyzed temporally to understand when they were received during the day (Table 11). 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 11. Temporal Distribution of Unknown Reports

Hour (AM)	Reports	Hour (PM)	Reports
0:00-00:59	6	12:00-12:59	21
1:00-1:59	6	1:00-1:59	17
2:00-2:59	5	2:00-2:59	8
3:00-3:59	8	3:00-3:59	4
4:00-4:59	6	4:00-4:59	7
5:00-5:59	6	5:00-5:59	6
6:00-6:59	113	6:00-6:59	14
7:00-7:59	6	7:00-7:59	12
8:00-8:59	2	8:00-8:59	12
9:00-9:59	14	9:00-9:59	13
10:00-10:59	39	10:00-10:59	20
11:00-11:59	69	11:00-11:59	21

Unknown reports were received during each hour and their distribution throughout the day is shown (Figure 1).

Unknown sensor 4013 reports on a 12 hour timed interval at approximately 11:00 AM/PM. The clock on the transmitter drifts a little.

Unknown sensor IDs 4461, 4462, 4466, 4467, and 4468 were received between 6:00 AM and 7:00 AM on October 22, 2007. This explains the large peak in unknown IDs on hour 7 below (Figure 1).

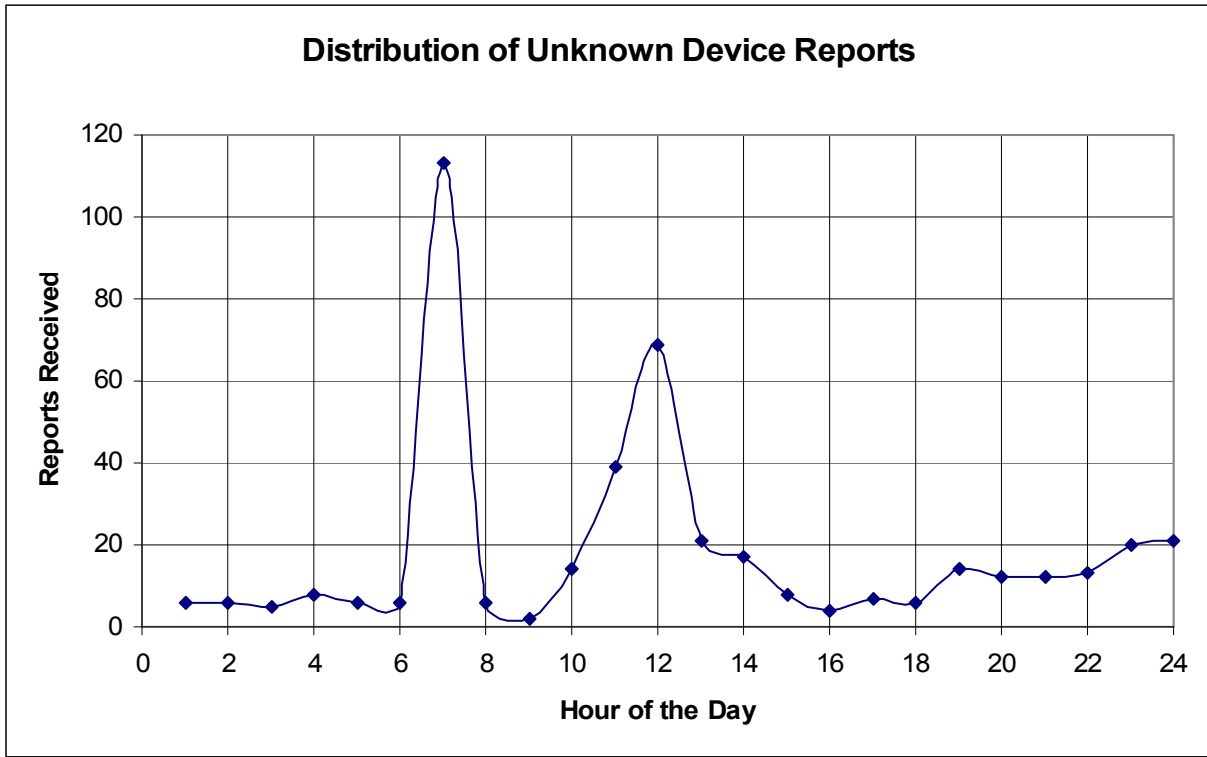


Figure 1. Daily Distribution of Unknown Device Reports

VII. Issues Continued from Previous Month

The following issues were identified last month.

1. **Sand Cr at Mouth (ID 1810), Parker/Mississippi (ID 540), Shop Creek (ID 1710) and Little Narrows (ID 4470):** These sensors all had poor timer performance for the past several months.
2. **Shop Creek (1710), Chatfield COE (1350), Guy Hill Ranch (310), Cherry Creek at Champa (1700), Leyden Confluence (210), Ralston Reservoir (110):** These sensors all exhibited poor event performance for the past several months.
3. **Shop Creek (ID 1710)** - On September 5, the sensor count jumped from 276 to 2047. The reason for this large jump in count is not known and may be due to field maintenance.

VIII. Issues Identified this Month

Sensors with a large number of invalid reports (other than Wind Gust sensors):

1. SSV at Berry Ridge (ID 4463 – Water level PT) with 31 reports,
2. Leyden Reservoir (ID 203 – Water level PT) with 30 reports,
3. Squaw Mountain (ID 2192 – Temperature) with 21 reports.

Sensors reporting frequently:

4. Salisbury Park (ID 2727 – ALERT wind) with 3,589 reports,
5. Castle Rock (ID 2747 - ALERT wind) with 3,925 reports,
6. Blue Mountain (IDs 137, 138, 139, 141, 142) with 2,900 reports each, and
7. Elbert (IDs 1437, 1438, 1439, 1441, 1442) with 2,850 reports each.

Sensors reporting infrequently (under reporting):

8. Sulphur Gulch (IDs 2840, 2843, 2845) with 1 report each,
9. Kinney Peak (ID 2276) with 1 report,
10. Squaw Mountain (ID 2194) with 1 report,
11. Quincy Reservoir (ID 753) with 1 report,
12. Lena @ U.S. Hwy 6 (ID 1043) with 2 reports,
13. Harvard Gulch Park (ID 603) with 2 reports,
14. Van Bibber @ Hwy 93 (ID 333) with 2 reports,
15. El Rancho (ID 2340) with 3 reports, and
16. Stapleton (ID 1463) with 3 reports.

Poor timer reporting:

It is difficult to evaluate the timer performance of sensors in October because many stations are winterized during this month which impacts the analysis.

Low rain total:

17. **Elbert (ID 1440)** – This sensor recorded only 5 tips for the month. Nothing suspicious in the data series. Surrounding stations also had low monthly totals.

High rain total:

18. **Powers Park (ID 1500)** – This sensor recorded a total of 54 tips. This sensor transmitted 10 more tips than the next highest reporting rain sensor. Possible influence by nearby irrigation sprinklers.

Large Jump in Sequential Count Value:

- 19. **Shop Creek (ID 1710)** - On October 21, the sensor count jumped from 31 to 41. The reason for this large jump in count is not known and should be inspected.
- 20. **Sand Creek at Colfax (ID 860)** - On October 21, the sensor count jumped from 356 to 364. The reason for this large jump in count is not known and should be inspected.

Reports from “Unknown Sensors”

- 21. **SSV at Berry Ridge** – This station reported a large number of ALERT IDs that are not defined in the system. The transmissions all occurred on October 22. The transmissions do not occur after October 22 so the issue seems to be resolved.
- 22. **Crescent (ID 4010)** – This station is reporting one ID that is not defined in the system. The transmitter at this location should be re-programmed so that ID 4013 is not transmitted. This ID was transmitted all month long.
- 23. The following table shows the “unknown” sensor IDs and the total number of reports received during the month for these IDs. These reports indicate the existence of a transmitter that is sending information on an ID that is not currently defined within NovaStar.

Unknown Sensor ID	Number of Reports
4013	62
4467	31
4466	29
4468	29
4461	28
4462	26
2239	7
4094	5
4031	5
4768	5
862	4
4748	4
2224	4

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2007_Oct\Novastar_extract_2007Oct.mdb

First Date in Database	10/1/07 12:00 AM	Total Days	31.0
Last Date in Database	10/31/07 11:59 PM	Total Hours	744.0

Total Records Analyzed 265178

Records by Group

None-ALERT-ID	45651	17%
Wind Gust	36291	14%
Relative Humidity	34336	13%
Temperature	34243	13%
Wind Speed Average & Azimuth	21823	8%
Water Level PT-HSE	21499	8%
Wind Direction	18648	7%
Wind Speed Average	13795	5%
Precipitation	11785	4%
Battery Voltage HSE	6083	2%
Battery Voltage Digital	4085	2%
Water Level PT	3333	1%
Solar Radiation	2830	1%
Barometric Pressure	2299	1%
Water Level Float	1682	1%
Precipitation - Mean	954	0%
Hayman Precipitation	777	0%
Fuel Moisture	677	0%
Fuel Temperature	669	0%
Repeater Pass List	627	0%
Battery Voltage Analog	527	0%
Repeater Status Report	490	0%
Handar 585 ALARM Status	454	0%
Precipitation - Test	253	0%
12Hr Status Report	233	0%
Battery	122	0%
Longmont Flow Gage	109	0%
Soil Moisture	64	0%
Longmont Water Level PT	51	0%
Precipitation-Old	5	0%
Total	264395	

Records by Major Group

Meteorologic Sensors	164265	62%
Water Level Sensors	26674	10%
Sensor Status Transmissions	12499	5%
Rain Sensors	11785	4%
Soil and Fuel Sensors	1410	1%
Total	216633	

Records by Validation Type

Good	0	264520	99.8%
Questionable	1	658	0%
Total		265178	

Sensors With Most Invalid Data

Description	Sensor	Reports
Elbert	1439	36
Salisbury Park	2724	35
Highlands Ranch WTP	2704	32
SSV at Berry Ridge	4463	31
Leyden Reservoir	203	30

Traffic Loading Summary

Alert Reports	265178	
Average Daily Traffic	8554	
Average Hourly Traffic	356	
Median Hourly Traffic	356	hour beginning
Peak Hourly Traffic	637	10/21/07 2:00 PM
2nd Max	631	10/21/07 1:00 PM
3rd Max	584	10/21/07 3:00 PM
4th Max	561	10/21/07 12:00 PM
5th Max	526	10/22/07 11:00 AM

Rain Timer Performance

Analyze Rain Sensors

systemwide average (days)
0.5172

Systemwide Average
77%

Rain Sensors	Description	Received	Average Timer Interval	Expected	Performance
2340	El Rancho	2	12:40	62.00	3%
920	Aurora Town Hall	4	11:59	62.00	6%
2250	Rosedale	4	12:00	62.00	6%
2230	Bear Cr below Cub	5	8:00	62.00	8%
2240	Cold Sprg Glch conf	6	12:00	62.00	10%
2310	Genesee Village	6	7:14	62.00	10%
2360	Indian Hills	7	12:00	62.00	11%
2260	Brook Forest	8	12:00	62.00	13%
2270	Cub Cr below Blue	8	10:17	62.00	13%
2350	Idledale	9	12:00	62.00	15%
2370	Red Rocks Park	9	12:00	62.00	15%
1570	Denver Zoo	14	10:05	62.00	23%
150	Nott Creek	15	12:51	62.00	24%
110	Ralston Reservoir	17	11:02	62.00	27%
310	Guy Hill Ranch	18	10:44	62.00	29%
520	Jewell Detention	18	12:39	62.00	29%
630	Temple Pond at DTC	18	11:57	62.00	29%
1060	Heritage Square	18	11:12	62.00	29%
1460	Stapleton	31	23:22	62.00	50%
540	Parker/Mississippi	34	15:47	62.00	55%
1810	Sand Creek at mouth	39	18:00	62.00	63%
830	Side Creek Park	40	12:18	62.00	65%
420	Expo Park	41	13:06	62.00	66%
810	Granby Ditch @ 6th	41	12:40	62.00	66%
850	Flying J	41	13:03	62.00	66%
1710	Shop Creek	41	16:35	62.00	66%
1010	Denver West	42	11:57	62.00	68%
500	Havana Park	43	13:04	62.00	69%
840	Fire Station 12	43	12:20	62.00	69%
1800	Sand Creek Park	43	12:38	62.00	69%
300	Van Bibber Park	44	11:57	62.00	71%
510	Virginia Court	44	13:04	62.00	71%
530	Fire Station #19	44	12:17	62.00	71%
710	Horseshoe Park Drop	44	11:57	62.00	71%
800	Sable Ditch @ 18th	44	11:57	62.00	71%
820	ETG @ Buckley	44	11:57	62.00	71%
1330	Roslyn	44	12:00	62.00	71%
1350	Chatfield COE	44	15:34	62.00	71%
440	Fire Station #7	45	12:35	62.00	73%
1050	Jeffco Fairgrounds	45	11:57	62.00	73%
1900	Niver Detention	46	14:21	62.00	74%
400	Montview Park	47	12:14	62.00	76%
2330	Morrison	48	13:09	62.00	77%
2810	Pine Cliff Road	49	11:57	62.00	79%
4130	Swiss Peaks	49	13:45	62.00	79%
4470	Little Narrows	49	14:17	62.00	79%
4820	Doudy Draw	49	14:13	62.00	79%
4060	Lakeshore	50	14:48	62.00	81%
4080	Twin Sisters	50	13:54	62.00	81%
760	Mission Viejo Park	51	12:34	62.00	82%
870	Murphy Creek GC	51	13:25	62.00	82%
1200	Broomfield 3207	51	14:20	62.00	82%
4240	Sunset	51	13:47	62.00	82%
1100	Louisville Rec Ctr	52	13:15	62.00	84%
1340	Sanderson at Xavier	52	12:30	62.00	84%
4150	Gold Hill	52	13:01	62.00	84%
4170	Pine Brook	52	12:46	62.00	84%
4560	Lyons Diversion NSV	52	13:38	62.00	84%
650	Iliff Pond	54	12:58	62.00	87%
720	Confluence Pond	54	12:12	62.00	87%
1660	SPR at Henderson	54	13:47	62.00	87%
4570	St. Antons	54	12:13	62.00	87%
4750	Louisville Lake	54	13:47	62.00	87%
4840	SBC@S Boulder Ditch	54	12:58	62.00	87%
1300	Hidden Lake	55	11:58	62.00	89%
1600	Englewood Dam	55	12:28	62.00	89%
1620	Slaughterhouse Glch	55	13:11	62.00	89%
2730	Salisbury Park	55	12:16	62.00	89%
4530	Winiger Ridge	55	13:14	62.00	89%
1310	LDC at 64th	56	11:57	62.00	90%
1360	Denver Zoo	56	12:30	62.00	90%
4050	Walker Ranch	56	12:41	62.00	90%
4180	Gold Lake	56	13:00	62.00	90%
4260	Taylor Mountain	56	13:15	62.00	90%

4270	Cannon Mountain	56	12:56	62.00	90%
4330	Indian Ruins	56	12:28	62.00	90%
4510	Pinewood Springs	56	12:56	62.00	90%
4520	Eagle Ridge	56	13:13	62.00	90%
410	Kelly Dam	57	12:41	62.00	92%
700	Toll Gate @ 6th	57	12:00	62.00	92%
1040	Lena @ U.S. Hwy 6	57	12:40	62.00	92%
1370	West Metro FS13	57	12:00	62.00	92%
1400	Upper Sloan Det.	57	12:54	62.00	92%
2190	Squaw Mountain	57	12:54	62.00	92%
2220	Evergreen Lake	57	12:39	62.00	92%
4010	Crescent	57	12:28	62.00	92%
4070	Bear Peak	57	12:56	62.00	92%
4090	Magnolia	57	12:42	62.00	92%
4100	Filter Plant	57	12:42	62.00	92%
4110	Betasso	57	12:28	62.00	92%
4290	Red Hill	57	12:58	62.00	92%
4350	Conifer Hill	57	12:59	62.00	92%
4360	Justice Center	57	12:41	62.00	92%
4810	Shanahan Ridge	57	12:40	62.00	92%
4830	SBC @ San Souci	57	12:42	62.00	92%
600	Harvard Gulch Park	58	12:39	62.00	94%
620	Quincy/Highline	58	12:25	62.00	94%
750	Quincy Reservoir	58	12:11	62.00	94%
1320	SPR at 3rd Ave	58	11:57	62.00	94%
1480	Third Creek at DIA	58	12:14	62.00	94%
1500	Powers Park	58	12:31	62.00	94%
2930	Spring Valley Rd - DougCt	58	12:40	62.00	94%
4140	Logan Mill	58	12:12	62.00	94%
4220	Fling's	58	12:41	62.00	94%
4730	Sugarloaf	58	12:00	62.00	94%
100	Carr Street	59	12:11	62.00	95%
220	Upper Leyden	59	12:00	62.00	95%
610	Harvard @ Jackson	59	11:57	62.00	95%
640	Goldsmith @ Eastman	59	11:57	62.00	95%
730	No Name @ Quincy	59	11:57	62.00	95%
900	Aurora Reservoir	59	12:05	62.00	95%
1020	Lena @ Nolte Pond	59	12:12	62.00	95%
1030	NREL/S. Table Mtn.	59	12:40	62.00	95%
1110	Gunbarrel	59	12:26	62.00	95%
1440	Elbert	59	12:26	62.00	95%
1720	Cherry Cr @ Steele	59	12:14	62.00	95%
1920	Brighton	59	12:27	62.00	95%
2940	Willow Creek - DougCnt	59	12:13	62.00	95%
4030	Red Garden	59	12:11	62.00	95%
4300	Big Elk Park	59	12:14	62.00	95%
4490	Apple Valley	59	12:37	62.00	95%
4770	Cal-Wood Ranch	59	12:00	62.00	95%
4790	Button Rock	59	12:27	62.00	95%
120	West Woods	60	11:57	62.00	97%
140	Blue Mountain	60	12:00	62.00	97%
210	Leyden Confluence	60	11:57	62.00	97%
320	Sports Complex	60	12:01	62.00	97%
1520	Marston Lake North	60	12:13	62.00	97%
1530	Bear Creek @ Lowell	60	11:57	62.00	97%
1610	Holly Dam	60	12:10	62.00	97%
1640	SPR at Union Ave.	60	12:13	62.00	97%
1700	Cherry Cr @ Champa	60	12:00	62.00	97%
4020	Rio Grande	60	12:12	62.00	97%
4040	Martin Gulch	60	12:12	62.00	97%
4190	Slaughterhouse	60	12:25	62.00	97%
4200	Lazy Acres	60	12:25	62.00	97%
4230	Golden Age	60	12:11	62.00	97%
4340	Riverside	60	12:27	62.00	97%
330	Van Bibber @ Hwy 93	61	12:00	62.00	98%
1420	Diamond Hill	61	12:00	62.00	98%
1540	Sanderson at Xavier	61	11:57	62.00	98%
2750	Castle Rock	61	12:00	62.00	98%
2820	Haskins Gulch Conf	61	11:57	62.00	98%
4160	Sunshine	61	12:11	62.00	98%
4250	Geer Canyon	61	11:58	62.00	98%
4310	Johnny Park	61	11:51	62.00	98%
740	Smoky Hill	62	11:58	62.00	100%
2210	Hiwan G.C.	62	11:33	62.00	100%
2710	Highlands Ranch WTP	62	12:00	62.00	100%
4710	Ward C-1	62	11:31	62.00	100%
200	Leyden Reservoir	63	11:21	62.00	102%
1000	Maple Grove Resv.	64	11:02	62.00	103%
860	Sand Cr at Colfax	78	6:43	62.00	126%

Rain Event Performance		Reports Received	3711	Analyze Rain Sensors										
	Systemwide Avg	Total Tips	3923											
	94%	Data Loss	5.40%											
Rain Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcvd	Exp	Miss	Hold	Bucket	
1060	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701	
2260	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701	
2360	50%	0	1	0	0	0	0	0	1	2	1	0	0.0393701	
2350	100%	2	0	0	0	0	0	0	2	2	0	1	0.0393701	
2370	100%	2	0	0	0	0	0	0	2	2	0	1	0.0393701	
2240	67%	1	1	0	0	0	0	0	2	3	1	1	0.0393701	
2230	75%	2	1	0	0	0	0	0	3	4	1	1	0.0393701	
Rain Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcvd	Exp	Miss	Hold	Bucket	
1710	56%	13	2	0	0	0	0	1	15	27	2	0	0.0393701	
860	70%	19	0	0	0	0	0	1	19	27	0	0	0.0393701	
540	80%	22	1	0	0	0	1	0	24	30	6	0	0.0393701	
850	81%	20	1	0	0	1	0	0	22	27	5	0	0.0393701	
900	83%	21	3	1	0	0	0	0	25	30	5	1	0.0393699	
1100	85%	23	5	0	0	0	0	0	28	33	5	0	0.0393701	
4470	85%	23	5	0	0	0	0	0	28	33	5	0	0.0393701	
4010	85%	25	3	1	0	0	0	0	29	34	5	0	0.0393701	
4080	86%	20	4	0	0	0	0	0	24	28	4	0	0.0393701	
4530	86%	20	4	0	0	0	0	0	24	28	4	0	0.0393701	
4730	86%	21	2	1	0	0	0	0	24	28	4	0	0.0393701	
4510	86%	26	5	0	0	0	0	0	31	36	5	0	0.0393701	
410	86%	21	4	0	0	0	0	0	25	29	4	0	0.0393701	
4090	87%	23	2	1	0	0	0	0	26	30	4	0	0.0393701	
4130	87%	22	4	0	0	0	0	0	26	30	4	0	0.0393701	
4140	87%	22	4	0	0	0	0	0	26	30	4	0	0.0393701	
1110	89%	22	1	1	0	0	0	0	24	27	3	0	0.0393701	
1720	89%	28	4	0	0	0	0	0	32	36	4	0	0.0393701	
4790	89%	30	1	0	1	0	0	0	32	36	4	0	0.0393701	
4150	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701	
4490	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701	
4570	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701	
1900	89%	15	2	0	0	0	0	0	17	19	2	0	0.0393701	
870	89%	30	4	0	0	0	0	0	34	38	4	0	0.0393701	
2330	90%	32	4	0	0	0	0	0	36	40	4	0	0.0393701	
1200	90%	25	3	0	0	0	0	0	28	31	3	0	0.0393701	
4710	91%	19	2	0	0	0	0	0	21	23	2	0	0.0393701	
4820	92%	31	1	1	0	0	0	0	33	36	3	0	0.0393701	
720	92%	21	2	0	0	0	0	0	23	25	2	0	0.0393701	
1310	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701	
4220	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701	
4270	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701	
4770	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701	
820	93%	23	2	0	0	0	0	0	25	27	2	0	0.0393701	
1620	93%	23	2	0	0	0	0	0	25	27	2	0	0.0393701	
750	93%	26	0	1	0	0	0	0	27	29	2	1	0.0393701	
840	93%	25	2	0	0	0	0	0	27	29	2	0	0.0393701	
4200	93%	25	2	0	0	0	0	0	27	29	2	0	0.0393701	
4310	93%	38	3	0	0	0	0	0	41	44	3	0	0.0393701	
320	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701	
760	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701	
1350	93%	27	0	1	0	0	0	0	28	30	2	0	0.0393701	
2730	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701	
4060	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701	
640	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701	
810	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701	
4070	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701	
4290	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701	
1480	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
530	94%	28	2	0	0	0	0	0	30	32	2	0	0.0393701	
4330	94%	29	2	0	0	0	0	0	31	33	2	0	0.0393701	
2940	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701	
510	94%	30	2	0	0	0	0	0	32	34	2	0	0.0393701	
1000	94%	31	2	0	0	0	0	0	33	35	2	0	0.0393701	
4840	94%	32	0	1	0	0	0	0	33	35	2	0	0.0393701	
1360	94%	32	2	0	0	0	0	0	34	36	2	0	0.0393701	
740	95%	35	2	0	0	0	0	0	37	39	2	0	0.0393701	
4360	95%	36	2	0	0	0	0	0	38	40	2	0	0.0393701	
710	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701	
1600	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701	
1660	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701	
4240	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701	

400	96%	22	1	0	0	0	0	0	0	23	24	1	0	0.0393701
800	96%	22	1	0	0	0	0	0	0	23	24	1	0	0.0393701
4180	96%	22	1	0	0	0	0	0	0	23	24	1	0	0.0393701
1920	96%	24	1	0	0	0	0	0	0	25	26	1	0	0.0393701
2210	96%	24	1	0	0	0	0	0	0	25	26	1	1	0.0393701
1050	96%	25	1	0	0	0	0	0	0	26	27	1	0	0.0393701
4050	96%	25	1	0	0	0	0	0	0	26	27	1	0	0.0393701
1520	97%	27	1	0	0	0	0	0	0	28	29	1	0	0.0393701
420	97%	28	1	0	0	0	0	0	0	29	30	1	0	0.0393701
4170	97%	28	1	0	0	0	0	0	0	29	30	1	0	0.0393701
1400	97%	29	1	0	0	0	0	0	0	30	31	1	0	0.0393701
4830	97%	29	1	0	0	0	0	0	0	30	31	1	0	0.0393701
620	97%	30	1	0	0	0	0	0	0	31	32	1	0	0.0393701
650	97%	30	1	0	0	0	0	0	0	31	32	1	0	0.0393701
1420	97%	30	1	0	0	0	0	0	0	31	32	1	0	0.0393701
2820	97%	30	1	0	0	0	0	0	0	31	32	1	0	0.0393701
4750	97%	30	1	0	0	0	0	0	0	31	32	1	0	0.0393701
120	97%	31	1	0	0	0	0	0	0	32	33	1	0	0.0393701
1040	97%	31	1	0	0	0	0	0	0	32	33	1	0	0.0393701
500	97%	34	1	0	0	0	0	0	0	35	36	1	0	0.0393701
730	97%	34	1	0	0	0	0	0	0	35	36	1	0	0.0393701
100	97%	35	1	0	0	0	0	0	0	36	37	1	0	0.0393701
1370	97%	35	1	0	0	0	0	0	0	36	37	1	0	0.0393701
610	97%	36	1	0	0	0	0	0	0	37	38	1	0	0.0393701
4040	97%	37	1	0	0	0	0	0	0	38	39	1	0	0.0393701
4030	98%	38	1	0	0	0	0	0	0	39	40	1	0	0.0393701
4340	98%	38	1	0	0	0	0	0	0	39	40	1	0	0.0393701
1440	100%	5	0	0	0	0	0	0	0	5	5	0	1	0.0393701
2190	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.0393701
2930	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.0393701
700	100%	9	0	0	0	0	0	0	0	9	9	0	1	0.0393701
1030	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
2750	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
4230	100%	22	0	0	0	0	0	0	0	22	22	0	0	0.0393701
1700	100%	23	0	0	0	0	0	0	0	23	23	0	0	0.0393701
830	100%	25	0	0	0	0	0	0	0	25	25	0	0	0.0393701
1810	100%	25	0	0	0	0	0	0	0	25	25	0	0	0.0393701
1300	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
1330	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
1640	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
1800	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
4100	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
4190	100%	26	0	0	0	0	0	0	0	26	26	0	0	0.0393701
300	100%	27	0	0	0	0	0	0	0	27	27	0	0	0.0393701
2810	100%	27	0	0	0	0	0	0	0	27	27	0	0	0.0393701
1460	100%	28	0	0	0	0	0	0	0	28	28	0	1	0.0393701
210	100%	29	0	0	0	0	0	0	0	29	29	0	0	0.0393701
440	100%	29	0	0	0	0	0	0	0	29	29	0	0	0.0393701
1540	100%	29	0	0	0	0	0	0	0	29	29	0	0	0.0393701
140	100%	30	0	0	0	0	0	0	0	30	30	0	0	0.0393701
4160	100%	30	0	0	0	0	0	0	0	30	30	0	0	0.0393701
600	100%	31	0	0	0	0	0	0	0	31	31	0	0	0.0393701
2710	100%	31	0	0	0	0	0	0	0	31	31	0	0	0.0393701
4250	100%	31	0	0	0	0	0	0	0	31	31	0	0	0.0393701
200	100%	32	0	0	0	0	0	0	0	32	32	0	0	0.0393701
1320	100%	32	0	0	0	0	0	0	0	32	32	0	0	0.0393701
2320	100%	32	0	0	0	0	0	0	0	32	32	0	0	0.0393701
4110	100%	32	0	0	0	0	0	0	0	32	32	0	0	0.0393701
4350	100%	32	0	0	0	0	0	0	0	32	32	0	0	0.0393701
1530	100%	33	0	0	0	0	0	0	0	33	33	0	0	0.0393701
4260	100%	33	0	0	0	0	0	0	0	33	33	0	0	0.0393701
4520	100%	33	0	0	0	0	0	0	0	33	33	0	0	0.0393701
330	100%	34	0	0	0	0	0	0	0	34	34	0	0	0.0393701
1010	100%	34	0	0	0	0	0	0	0	34	34	0	0	0.0393701
1340	100%	34	0	0	0	0	0	0	0	34	34	0	0	0.0393701
630	100%	35	0	0	0	0	0	0	0	35	35	0	0	0.0393701
220	100%	37	0	0	0	0	0	0	0	37	37	0	0	0.0393701
4020	100%	37	0	0	0	0	0	0	0	37	37	0	0	0.0393701
4810	100%	38	0	0	0	0	0	0	0	38	38	0	0	0.0393701
4300	100%	42	0	0	0	0	0	0	0	42	42	0	0	0.0393701
1500	100%	54	0	0	0	0	0	0	0	54	54	0	0	0.0393701
	Total Tips	3535	164	9	1	1	1	2	3711	3923	194	6		

