

Memo

Date: July 2, 2013
To: Kevin Stewart
From: Markus Ritsch
Subject: June 2013 ALERT Data Analysis

I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's NovaStar 5.0 base station were analyzed for the period June 1 through June 30, 2013.

II. General System Analysis Summary

In 2013 the District will upgrade the telemetry backbone from legacy ALERT (A1) to the new A2 protocol. As the season progresses, the A1 feed from outlying repeaters to the District base station at Diamond Hill will terminate and all data will be received as A2. The following table quantifies the data reception throughout the conversion of the telemetry system as the season progresses. As of January 29, 2013, the West Creek repeater in Douglas County processes both incoming data on A1 and A2 but passes on only A2 format messages to Diamond Hill.

Table 1. Reception of A1/A2 Data at Diamond Hill

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Legacy	321,136	218,368	264,984	243,044	318,423	342,585						
Concentrator	304,067	319,089	379,891	381,523	571,616	686,278						
ALERT2	--	--	16,450	47,415	88,786	113,822						
TOTAL	625,203	537,457	661,325	671,982	978,825	1,142,685	0	0	0	0	0	0
Conc+A2	--	--	396,341	428,938	660,402	800,100						

In 2013, WET will analyze only the concentrator and A2 data each month going forward since only the concentrator and A2 data received at Diamond Hill represents a complete dataset.

The District base is still receiving many duplicate and triplicate reports which accounts for the large number of total reports. For example

```
07/02/2013 14:20:08 Device: 1640 Data: 51 Line: 1 (legacy ALERT)
07/02/2013 14:20:08 Device: 1640 Data: 51 Line: 2 (data concentrator)
07/02/2013 14:20:08 Device: 1640 Data: 51 Line: 2 (data concentrator)
```

A. Performance of New A2 Sites

Currently there are only a handful of remote sites operating on the new A2 protocol. The "event" performance of these sites will be tracked throughout the 2013 flood season.

Table 2. Event Performance of New A2 Sites

Description	ID	Install Date	Apr	May	Jun	Jul	Aug	Sep	Oct	
Heritage Regional Park	3090	03/14/2013	100%	93%	100%					
ETG @ Hampden	100110	05/01/2013	--	100%	100%					
Blackstone	100100	05/03/2013	--	100%	100%					
Newlin Gulch	3070	05/24/2013	--	--	51%					
Carr Street	100	05/31/2013	--	--	36%					
Maple Grove	1000	05/20/2013	--	--	67%					

B. Specific Issues Identified this Month

Performance of the following sensors (Table 3) was questionable this month.

Table 3. Sensors with Poor Performance Characteristics

Sensor ID	Description	Timer	Event	Comments
2790	W. Cherry Creek Wx	725%	82%	High frequency timer reporting was fixed on June 6
100	Carr Street – A2	93%	36%	TBR format...data packet is incorrect!
1000	Maple Grove Res – A2	585%	67%	TBR format...data packet is incorrect!
3070	Newlin Gulch – A2	85%	51%	GSR format.....double check packet
4470	Little Narrows	87%	46%	Poor event performance end of June
1481, 1482, 1486, 1487	Over 4,000 reports were received from these undefined sensors. Possibly coming from DIA at Third Creek.			
730	No Name at Quincy – under reporting rain relative to neighboring stations for the third month in a row.			

A number of A2 self-reporting sites had poor timer and event performance. A problem exists with the A2 data packets emanating from Carr Street (100) and Maple Grove Reservoir (1000). Both of these sites are using a Tipping Bucket Report (TBR) format but the tip reports within the data packet are not in the correct order. Analysis of a packet follows:

```

It looks like the Campbell transmitter is unsuccessfully trying to use the TBR format. The received message was:
N,2013,06,24,07,58,11.9117,0,0,0,0,0,0,0,0,0,0,15,10012,74,70,0C,02,0A,00,12,00,0A,0D,64,1E,0B,5D,47
The ALERT2 decode follows:
MANT time tag=06/24/2013 07:58:11 UTC
MANT Version=0 ProtocolID=0 TimeStampRequest=0 AddPathRequest=0 DAinHdr=0 Service/Port=0 ReservedBits=0 ACKbit=0
AddedHdr=0 HopLimit=0
MANT Payload Length=15
MANT Source Address=10012
MANT PDU Payload=74,70,0C,02,0A,00,12,00,0A,0D,64,1E,0B,5D,47
PDU Self reporting protocol control=74 version=0 timestampflag=1 testflag=0 APDUID=7 timestampoffset=28684
timestamp=06/24/2013 01:58:04
PDU TBRGR Tipping Bucket Rain Gage Report type=2 length=10
PDU TBRGR id=0 fl=12 accum=10
PDU TBRGR id=0 data=5 toffset=13 timestamp=06/24/2013 01:57:51
PDU TBRGR id=0 data=6 toffset=100 timestamp=06/24/2013 01:56:24
PDU TBRGR id=0 data=7 toffset=30 timestamp=06/24/2013 01:57:34
PDU TBRGR id=0 data=8 toffset=11 timestamp=06/24/2013 01:57:53
PDU TBRGR id=0 data=9 toffset=93 timestamp=06/24/2013 01:56:31
PDU TBRGR id=0 data=10 toffset=71 timestamp=06/24/2013 01:56:53
The TBR format use is clearly defined by the 02 highlighted above in red.

```

Newlin Gulch is using the General Sensor Report (GSR) format but is not able to package multiple GSR reports into a single data packet. It seems the transmitter is sending only one GSR rain report per frame causing missed tips for multiple tips within the same frame.

C. Continuous Operation of Base Receiver/Decoder

The data feeds to the NS5 base station were in continuous operation for the entire month.

III. Rain Sensor Timer Reporting Summary

The following analysis assumes that each rain sensor has a 12-hour timer-reporting interval. The worst performing rain sensors for the month are summarized (Table 4).

Table 4. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470	4470	2790	1200	3070	2710						
3070	4550	4550	840	2800	840						
1660	4870	2710	800	840	4350						
2790	2790	4870	4330	1700	2790						
4870	4490	4270	2360	2790	5940						
2320	4510	4190	620	100100	1660						

*- Only sensors that operate year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

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 5). For the months of January, February, March, October, November and December only the stations that operate year-round are included in the rain event analysis. These stations include all weather stations and the stations in Boulder County.

Table 5. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	16.39	Only the 1-mm rain sensors were included in the analysis
Median	14	Only the 1-mm rain sensors were included in the analysis
Standard deviation	11.54	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	51.00	Only the 1-mm rain sensors were included in the analysis
Minimum total count	2	No Name @ Quincy (730) – third month in a row that this sensor is the lowest reporting
Maximum total count	76	Utah Park (430) – irrigation influence

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 6).

Table 6. 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	30.24	11.00	5.60	30.89
2010	5.97	11.90	32.54	70.57	39.63	56.04	50.23	31.01	4.18	18.31	8.30	3.31	27.67
2011	6.78	7.45	7.54	33.94	92.68	39.42	90.87	18.25	37.67	25.73	10.41	13.59	32.03
2012	4.89	13.57	2.35	30.17	38.97	19.35	73.03	11.31	48.81	22.32	2.98	4.18	22.66
2013	2.96	14.31	21.86	35.96	45.87	16.39							

*- Only sensors that operate year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

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 7).

Table 7. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
W. Cherry Creek - Wx	2790	Several large jumps occurred during field work
EPC at Hwy 105	3010	One jump exceeding 6 occurred during the month

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 95 percent. A total of 2,889 incrementing reports were received and a total of 3,054 reports were expected. The total loss of incrementing reports for the month was approximately 5 percent. Those sensors with the worst event transmission performance are summarized (Table 8).

Table 8. Monthly Summary of Sensors with the Most Missed Tips

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470	4510	4270	1200	4470	100						
2330	2930	4490	840	5900	4470						
2980	4470	4790	4330	2980	1000						
1660	2980	4510	4100	2790	500						
--	2730	4320	4270	840	1660						
--	4790	4870	2980	4060	3070						

*-Only sensors that are operational year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

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 1,000 messages per hour are analyzed independently in an attempt to quantify data loss rates from rain sensors using their sequential tip count series.

A. The Heaviest Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month are shown (Table 9). Each hour exceeding 1,000 reports was analyzed to quantify the number of missing rain reports for that hour.

Table 9. Periods of Heavy Radio Traffic

Day	Hour	Expected	Received	Total Load	Loss
23	21	69	68	2,786	0.01%
23	18	113	104	2,494	0.09%
23	20	12	12	2,458	0.00%
23	8	4	4	2,414	0.00%
23	22	17	17	2,402	0.00%

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 10).

Table 10. Summary of Unknown IDs

Description	Quantity
Total number of unknown IDs (IDs without a device definition)	971
Total reports from unknown IDs	6,973
Unknown IDs with only a single received report (potential noise)	585
Total reports from all IDs – RecData Log entire month	1,142,685
Unknown reports as a fraction of total reports	0.61%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 11) are the total reports received from unknown sensor IDs for each month of the year.

Table 11. Monthly Summary of Total Reports from Unknown IDs

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	1,220	1,474	1,276	1,174	721	5,707	610	1,738	442	533	2,857	6,396
2011	1,231	2,165	3,065	1,254	2,051	439	489	456	191	683	747	861
2012	692	750	1,575	977	5,469	11,016	453	683	774	2,657	3,854	5,466
2013	4,265	994	1,100	2,589	3,623	6,973						

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 12).

Table 12. Monthly Percent of Unknown Sensor Reports

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	0.42%	0.56%	0.38%	0.32%	0.20%	1.61%	0.17%	0.49%	0.13%	0.16%	0.93%	1.88%
2011	0.39%	0.73%	0.90%	0.37%	0.58%	0.12%	0.12%	0.05%	0.12%	0.18%	0.22%	0.26%
2012	0.30%	0.25%	0.43%	0.26%	1.37%	2.74%	0.11%	0.18%	0.20%	0.72%	1.15%	1.62%
2013	1.40%	0.31%	0.29%	0.60%	0.37%	0.61%						

Any month shaded in yellow has an excessive number of reports from unknown sensors.

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 13).

Table 13. Reports Received by Unknown IDs

Unknown ID	Reports	Comment
1481	1,380	Unknown ID – DIA at Third Creek?
1482	1,329	Unknown ID – DIA at Third Creek?
1486	1,064	Unknown ID – DIA at Third Creek?
1487	1,018	Unknown ID – DIA at Third Creek?
5104	64	
2925	34	

VII. Sensors with Invalid Reports

The following sensors had a large number of invalid reports (bit flip/contention errors/random decode):

Sensor ID	Description	Bad Reports	Comments
1484	Third Cr at DIA	290	
1483	Third Cr at DIA	52	
953	Piney at Liverpool	95	
3050	East/West Trailhead	8	
2210	Wx-Hiwan G.C.	7	
1613	Holly Dam	68	

VIII. Rainfall Alarms and Intensity Analysis

The following rainfall rate alarms from the Urban Drainage and Flood Control District NovaStar 5.0 Web Server were identified this month.

Urban Drainage and Flood Control District
ALERT Web Server

4140	Logan Mill Precipitation-BO	FMC-BA 0.25" in 1 Hour Rainfall	06/28/2013 22:06:25
1200	Broomfield Basin 3207 Precipitation-BO	Boulder County 10 minute rainfall	06/28/2013 21:44:31
4140	Logan Mill Precipitation-BO	FMC-BA 0.25" in 1 Hour Rainfall	06/17/2013 14:19:52
4080	Twin Sisters Precipitation-BO	FMC-BA 0.25" in 1 Hour Rainfall	06/16/2013 18:43:43

General System Analysis

Database Name

P:\A207-UDFCD-Data-Analysis\2013\06-2013\Novastar_extract_2013June.mdb

First Date in Database

6/1/13 12:00 AM

Total Days

30.0

Last Date in Database

6/30/13 11:59 PM

Total Hours

720.0

Total Records Analyzed

800,100

Records by Group

Wind Data	262,389	33%
Temperature	124,735	16%
Relative Humidity	112,933	14%
Water Level	67,885	8%
Barometric Pressure	51,351	6%
Battery Voltage	50,801	6%
Precipitation	28,410	4%
Solar Radiation	24,400	3%
Peak Wind	11,958	1%
Dew Point Temperature	11,957	1%
Wind Chill	11,957	1%
Fuel Moisture	11,615	1%
Fuel Temperature	11,543	1%
Unknown	6,973	1%
Soil Moisture	6,662	1%
Repeater Status Report	2,325	0%
12Hr Status Report	1,032	0%
Hayman Battery	462	0%
Flasher Status	427	0%
Handar 585 ALARM Status	148	0%
Repeater Pass List	70	0%
Dewpoint Temperature	61	0%
ALERT/A2 Testing	4	0%
Longmont Flow Gage	1	0%
Solar Power	1	0%
Total	800,100	

Records by Major Group

Meteorologic Sensors	313,419	39%
Water Level Sensors	67,886	8%
Soil and Fuel Sensors	29,820	4%
Rain Sensors	28,410	4%
Sensor Status Transmissions	3,576	0%
Total	443,111	

Traffic Loading Summary

Alert Reports	800,100	
Average Daily Traffic	26,670	
Average Hourly Traffic	1,111	
Median Hourly Traffic	960	hour beginning
Peak Hourly Traffic	2,786	Jun 23, 9:00 PM
2nd Max	2,494	Jun 23, 6:00 PM
3rd Max	2,458	Jun 23, 8:00 PM
4th Max	2,414	Jun 23, 8:00 AM
5th Max	2,402	Jun 23, 10:00 PM

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
2710	Wx-Highlands Ranch WTP	23	11:59	60	38%
840	Fire Station 12	29	23:32	60	48%
4350	Conifer Hill	36	11:10	60	60%
2790	Wx-W. Cherry Creek	37	14:48	60	62%
5940	Log Jumper	44	12:54	60	73%
1660	SPR at Henderson	47	14:47	60	78%
4850	Porphory Mtn	47	12:51	60	78%
5720	Four Mile Creek	48	13:38	60	80%
3010	EPC at Hwy 105	49	13:12	60	82%
3090	A2-Highland Heritage Park	50	11:28	60	83%
4330	Hansen Rain	50	13:17	60	83%
4870	SBC @ SB Road	51	14:00	60	85%
4470	Little Narrows	52	12:42	60	87%
2360	Indian Hills	53	12:29	60	88%
4270	Cannon Mountain	53	13:31	60	88%
4490	Apple Valley	53	13:09	60	88%
620	Quincy/Highline	54	13:09	60	90%
1360	Denver Zoo	54	13:13	60	90%
1440	Wx-Elbert	54	12:15	60	90%
2900	Russelville Gulch-Douglas	54	13:01	60	90%
5810	Stump Bump	54	13:13	60	90%
700	Toll Gate @ 6th	55	12:41	60	92%
1030	NREL/S. Table Mtn.	55	12:26	60	92%
1710	Shop Creek	55	12:43	60	92%
1720	Cherry Cr @ Steele	55	12:41	60	92%
2280	Kinney Peak	55	12:42	60	92%
2820	Haskins Gulch Conf	55	12:28	60	92%
2890	Spruce Mt - Douglas	55	12:56	60	92%
2910	East Cherry Cr-Douglas	55	12:58	60	92%
2960	Indian Creek	55	12:27	60	92%
4060	Lakeshore	55	12:41	60	92%
4180	Gold Lake	55	12:44	60	92%
4220	Fling's	55	12:59	60	92%
4790	Wx-Button Rock	55	12:44	60	92%
100	A2-Carr Street	56	12:14	60	93%
110	Ralston Reservoir	56	12:25	60	93%
310	Guy Hill Ranch	56	12:12	60	93%
330	Van Bibber @ Hwy 93	56	12:13	60	93%
1700	Cherry Cr @ Champa	56	12:41	60	93%
2950	DC Public Works	56	12:43	60	93%
2980	Dakan Rd	56	12:42	60	93%
3030	WX-Bingham Lake Park	56	11:46	60	93%
3040	CC @ Prairie Canyon Ranch	56	12:45	60	93%
4510	Pinewood Springs	56	12:38	60	93%
4570	St. Antons	56	12:28	60	93%
5740	Trail Creek	56	12:27	60	93%
5860	Cedar Mountain	56	12:29	60	93%
150	Nott Creek	57	12:11	60	95%
430	Utah Park	57	11:57	60	95%
520	Jewell Detention	57	12:27	60	95%
610	Harvard @ Jackson	57	12:10	60	95%
630	Temple Pond at DTC	57	12:17	60	95%
650	Iloff Pond	57	12:26	60	95%
810	Granby Ditch @ 6th	57	12:11	60	95%

820	ETG @ Buckley	57	12:25	60	95%
1100	Louisville Rec Ctr	57	12:26	60	95%
1370	West Metro FS13	57	12:25	60	95%
1530	Bear Creek @ Lowell	57	12:24	60	95%
1570	Wx-Brighton Ditch	57	12:13	60	95%
1620	Slaughterhouse Glch	57	12:11	60	95%
2230	Bear Cr below Cub	57	12:41	60	95%
2240	Cold Sprg Glch conf	57	12:26	60	95%
2250	Rosedale	57	11:57	60	95%
2320	Choke Cherry Resvr	57	12:14	60	95%
2340	El Rancho	57	12:26	60	95%
2370	Red Rocks Park	57	12:12	60	95%
2800	Columbine Open Space	57	12:00	60	95%
2850	Cherry Cr bl Bayou Glch	57	12:13	60	95%
2870	Cottonwood (Apache)	57	12:15	60	95%
3020	Wx-West Creek WX	57	12:14	60	95%
3050	East/West Trailhead	57	12:27	60	95%
4010	Crescent	57	12:11	60	95%
4080	Twin Sisters	57	12:26	60	95%
4230	Golden Age	57	12:11	60	95%
4340	Riverside	57	12:26	60	95%
4810	Shanahan Ridge	57	12:25	60	95%
4830	SBC @ San Souci	57	11:58	60	95%
4860	Fairview Peak	57	12:14	60	95%
410	Kelly Dam	58	11:57	60	97%
420	Expo Park	58	11:58	60	97%
440	Fire Station #7	58	12:11	60	97%
540	Parker/Mississippi	58	12:11	60	97%
720	Confluence Pond	58	12:11	60	97%
730	No Name @ Quincy	58	11:57	60	97%
760	Mission Viejo Park	58	11:57	60	97%
800	Sable Ditch @ 18th	58	12:11	60	97%
870	Murphy Creek GC	58	12:13	60	97%
950	Piney at Liverpool	58	11:57	60	97%
1040	Lena @ U.S. Hwy 6	58	12:13	60	97%
1060	Heritage Square	58	12:12	60	97%
1200	Broomfield 3207	58	12:11	60	97%
1320	SPR at 3rd Ave	58	12:11	60	97%
1340	Sanderson at Xavier	58	11:59	60	97%
1420	Wx-Diamond Hill	58	12:00	60	97%
1520	Wx-Marston Lake North	58	12:13	60	97%
1550	Lakewood CC	58	12:11	60	97%
1810	Sand Creek at mouth	58	12:11	60	97%
2270	Cub Cr below Blue	58	12:12	60	97%
2330	Morrison	58	11:58	60	97%
2840	Sulphur Gulch	58	12:13	60	97%
2860	CC at Stroh Rd	58	12:11	60	97%
3060	Fire Sta 47	58	12:00	60	97%
4050	Walker Ranch	58	12:11	60	97%
4110	Betasso	58	12:11	60	97%
4150	Gold Hill	58	12:12	60	97%
4170	Pine Brook	58	12:13	60	97%
4250	Geer Canyon	58	12:11	60	97%
4260	Taylor Mountain	58	12:12	60	97%
4300	Big Elk Park	58	12:11	60	97%
4530	Winiger Ridge	58	11:58	60	97%
4710	Wx-Ward C-1	58	12:14	60	97%
4880	Whispering Pines	58	11:57	60	97%
5730	West Creek	58	12:00	60	97%

5880	Hackett Mountain	58	12:13	60	97%
120	West Woods	59	11:58	60	98%
140	Wx-Blue Mountain	59	12:00	60	98%
200	Leyden Reservoir	59	11:57	60	98%
210	Leyden Confluence	59	11:58	60	98%
300	Van Bibber Park	59	11:58	60	98%
320	Sports Complex	59	11:58	60	98%
400	Montview Park	59	11:58	60	98%
510	Virginia Court	59	11:57	60	98%
530	Fire Station #19	59	11:57	60	98%
600	Harvard Gulch Park	59	11:58	60	98%
640	Goldsmith @ Eastman	59	11:43	60	98%
710	Horseshoe Park Drop	59	11:58	60	98%
830	Side Creek Park	59	11:58	60	98%
850	Flying J	59	12:00	60	98%
860	Sand Cr at Colfax	59	12:00	60	98%
1010	Denver West	59	11:57	60	98%
1050	Jeffco Fairgrounds	59	11:57	60	98%
1110	Gunbarrel	59	11:58	60	98%
1350	Chatfield COE	59	11:59	60	98%
1460	Wx-Urban Farm	59	12:00	60	98%
1480	Third Creek at DIA	59	11:57	60	98%
1500	Powers Park	59	11:57	60	98%
1600	Englewood Dam	59	11:57	60	98%
1640	SPR at Union Ave.	59	11:57	60	98%
1800	Sand Creek Park	59	11:58	60	98%
1900	Niver Detention	59	11:57	60	98%
1920	Wx-Brighton	59	12:00	60	98%
2260	Brook Forest	59	11:58	60	98%
2310	Genesee Village	59	11:58	60	98%
2350	Idledale	59	11:57	60	98%
2730	Wx-Salisbury Park	59	11:46	60	98%
2940	Willow Creek - DougCnty	59	12:00	60	98%
4020	Rio Grande	59	11:58	60	98%
4040	Martin Gulch	59	11:57	60	98%
4090	Magnolia	59	11:58	60	98%
4100	Filter Plant	59	11:59	60	98%
4130	Swiss Peaks	59	11:59	60	98%
4140	Logan Mill	59	11:58	60	98%
4160	Sunshine	59	11:58	60	98%
4200	Lazy Acres	59	11:59	60	98%
4240	Sunset	59	11:58	60	98%
4290	Red Hill	59	11:58	60	98%
4310	Johnny Park	59	11:58	60	98%
4320	Lee Hill Rain 2012	59	11:58	60	98%
4360	Justice Center	59	11:58	60	98%
4520	Eagle Ridge	59	12:00	60	98%
4550	Boulder Jail	59	11:57	60	98%
4730	Wx-Sugarloaf	59	12:00	60	98%
4750	Wx-Louisville Lake	59	12:00	60	98%
4770	Wx-Cal-Wood Ranch	59	12:00	60	98%
4820	Doudy Draw	59	11:57	60	98%
4840	SBC@S Boulder Ditch	59	11:58	60	98%
100100	A2-Blackstone Precip	59	12:00	60	98%
100110	A2-ETG @ Hampden Precip	59	12:00	60	98%
220	Upper Leyden	60	11:53	60	100%
500	Havana Park	60	11:45	60	100%
920	Wx-Aurora Town Hall	60	11:45	60	100%
970	Pump Sta 3	60	11:46	60	100%

1300	Hidden Lake	60	11:55	60	100%
1310	LDC at 64th	60	11:58	60	100%
1400	Upper Sloan Det.	60	11:58	60	100%
2210	Wx-Hiwan G.C.	60	11:46	60	100%
2750	Wx-Castle Rock	60	11:54	60	100%
2810	Pine Cliff Road	60	11:56	60	100%
2920	West Cherry Head-Douglas Cr	60	11:37	60	100%
2990	Wx-Tomah Rd-DougCnty	60	11:47	60	100%
3080	Tallman Gulch	60	12:00	60	100%
4030	Red Garden	60	11:59	60	100%
4070	Bear Peak	60	11:58	60	100%
4190	Slaughterhouse	60	11:44	60	100%
750	Wx-Quincy Reservoir	61	11:48	60	102%
900	Wx-Aurora Reservoir	61	11:36	60	102%
2880	Happy Canyon at N Surrey D	61	11:34	60	102%
2930	Wx-Spring Valley Rd-DougCn	61	11:44	60	102%
940	Sampson Gulch	66	10:41	60	110%
3070	Newlin Gulch	102	6:22	120	85%
1000	A2-Maple Grove Resv.	351		60	585%
2970	Rampart Range Rd-Satellite	140		60	233%
5900	Horse Creek-Satellite	1386		60	2310%

Rain Event Performance		Reports Received	2,889	Analyze Rain Sensors											
	Systemwide Avg	Total Tips	3,054												
	94.60%	Data Loss	5.40%												
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket	
A2-Carr Street	100	36%	2	2	1	2	1	0	0	8	22	14	0	0.0393701	
Little Narrows	4470	46%	2	2	1	1	0	0	0	6	13	7	0	0.0393701	
A2-Maple Grove Resv.	1000	67%	7	4	1	0	0	0	0	12	18	6	0	0.0393701	
Havana Park	500	67%	3	0	1	0	0	0	0	4	6	2	0	0.0393701	
SPR at Henderson	1660	78%	5	2	0	0	0	0	0	7	9	2	0	0.0393701	
Cherry Cr bl Bayou Glch	2850	79%	12	2	1	0	0	0	0	15	19	4	0	0.0393701	
Dakan Rd	2980	80%	9	3	0	0	0	0	0	12	15	3	0	0.0393701	
Rampart Range Rd-Satellite	2970	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701	
Gold Lake	4180	81%	17	3	1	0	0	0	0	21	26	5	0	0.0393701	
Wx-W. Cherry Creek	2790	82%	35	5	2	0	0	0	0	42	51	9	0	0.0393701	
Conifer Hill	4350	85%	10	0	1	0	0	0	0	11	13	2	0	0.0393701	
Guy Hill Ranch	310	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701	
Lakeshore	4060	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701	
Doudy Draw	4820	87%	11	2	0	0	0	0	0	13	15	2	0	0.0393701	
Columbine Open Space	2800	88%	13	0	1	0	0	0	0	14	16	2	0	0.0393701	
Shanahan Ridge	4810	88%	12	2	0	0	0	0	0	14	16	2	0	0.0393701	
Wx-Louisville Lake	4750	88%	6	1	0	0	0	0	0	7	8	1	0	0.0393701	
Wx-Spring Valley Rd-DougCnty	2930	88%	13	2	0	0	0	0	0	15	17	2	0	0.0393701	
Cold Sprg Glch conf	2240	89%	21	3	0	0	0	0	0	24	27	3	0	0.0393701	
Cottonwood (Apache)	2870	89%	30	4	0	0	0	0	0	34	38	4	0	0.0393701	
St. Antons	4570	89%	15	2	0	0	0	0	0	17	19	2	0	0.0393701	
Choke Cherry Resvr	2320	90%	16	2	0	0	0	0	0	18	20	2	0	0.0393701	
Red Hill	4290	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701	
CC at Stroh Rd	2860	91%	36	4	0	0	0	0	0	40	44	4	0	0.0393701	
Ralston Reservoir	110	91%	9	1	0	0	0	0	0	10	11	1	0	0.0393701	
ETG @ Buckley	820	91%	9	1	0	0	0	0	0	10	11	1	0	0.0393701	
Bear Cr below Cub	2230	92%	20	2	0	0	0	0	0	22	24	2	0	0.0393701	
Happy Canyon at N Surrey Dr	2880	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701	
Eagle Ridge	4520	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701	
Wx-Button Rock	4790	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
SBC @ SB Road	4870	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
Slaughterhouse	4190	93%	12	1	0	0	0	0	0	13	14	1	0	0.0393701	
Cannon Mountain	4270	93%	12	1	0	0	0	0	0	13	14	1	0	0.0393701	
CC @ Prairie Canyon Ranch	3040	93%	37	3	0	0	0	0	0	40	43	3	0	0.0393701	
Iliff Pond	650	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701	
Wx-Salisbury Park	2730	93%	40	3	0	0	0	0	0	43	46	3	0	0.0393701	
Wx-Marston Lake North	1520	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
Sampson Gulch	940	94%	15	1	0	0	0	0	0	16	17	1	1	0.0393699	
SBC @ San Souci	4830	94%	15	1	0	0	0	0	0	16	17	1	0	0.0393701	
Cherry Cr @ Champa	1700	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701	
Red Rocks Park	2370	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701	
Temple Pond at DTC	630	95%	68	4	0	0	0	0	0	72	76	4	0	0.0393701	
Indian Hills	2360	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701	
Broomfield 3207	1200	95%	18	1	0	0	0	0	0	19	20	1	0	0.0393701	
Wx-Diamond Hill	1420	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701	
Sulphur Gulch	2840	96%	43	2	0	0	0	0	0	45	47	2	0	0.0393701	
Upper Sloan Det.	1400	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701	
WX-Bingham Lake Park	3030	96%	23	1	0	0	0	0	0	24	25	1	0	0.0393701	
Slaughterhouse Glch	1620	96%	24	1	0	0	0	0	0	25	26	1	0	0.0393701	
Wx-Aurora Town Hall	920	96%	26	1	0	0	0	0	0	27	28	1	0	0.0393701	
Fling's	4220	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701	
Fire Sta 47	3060	97%	37	1	0	0	0	0	0	38	39	1	0	0.0393701	
Tallman Gulch	3080	98%	39	1	0	0	0	0	0	40	41	1	0	0.0393701	
Powers Park	1500	98%	57	1	0	0	0	0	0	58	59	1	0	0.0393701	
Utah Park	430	100%	76	0	0	0	0	0	0	76	76	0	0	0.0393701	
Virginia Court	510	100%	49	0	0	0	0	0	0	49	49	0	0	0.0393701	
Expo Park	420	100%	48	0	0	0	0	0	0	48	48	0	0	0.0393701	
Wx-Ward C-1	4710	100%	30	0	0	0	0	0	0	30	30	0	0	0.0393701	
Pump Sta 3	970	100%	28	0	0	0	0	0	0	28	28	0	0	0.0393701	
Lakewood CC	1550	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701	
Wx-Aurora Reservoir	900	100%	25	0	0	0	0	0	0	25	25	0	0	0.0393699	
Hidden Lake	1300	100%	25	0	0	0	0	0	0	25	25	0	0	0.0393701	
Logan Mill	4140	100%	24	0	0	0	0	0	0	24	24	0	0	0.0393701	
A2-Blackstone Precip	100100	100%	24	0	0	0	0	0	0	24	24	0	0	0.0393701	
Piney at Liverpool	950	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701	
Wx-Sugarloaf	4730	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701	
Murphy Creek GC	870	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
LDC at 64th	1310	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
Wx-Hiwan G.C.	2210	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
Cub Cr below Blue	2270	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
East Cherry Cr-Douglas	2910	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
Gold Hill	4150	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701	
Denver Zoo	1360	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701	
Genesee Village	2310	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701	
Russelville Gulch-Douglas	2900	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701	
Swiss Peaks	4130	100%	19	0	0	0	0	0	0	19	19	0	0	0.0393701	

Sanderson at Xavier	1340	100%	18	0	0	0	0	0	0	0	18	18	0	0	0.0393701
Rosedale	2250	100%	18	0	0	0	0	0	0	0	18	18	0	0	0.0393701
Willow Creek - DougCnty	2940	100%	18	0	0	0	0	0	0	0	18	18	0	0	0.0393701
Wx-Tomah Rd-DougCnty	2990	100%	18	0	0	0	0	0	0	0	18	18	0	0	0.0393701
Betasso	4110	100%	18	0	0	0	0	0	0	0	18	18	0	0	0.0393701
Taylor Mountain	4260	100%	17	0	0	0	0	0	0	0	17	17	0	0	0.0393701
Goldsmith @ Eastman	640	100%	16	0	0	0	0	0	0	0	16	16	0	0	0.0393701
Side Creek Park	830	100%	16	0	0	0	0	0	0	0	16	16	0	0	0.0393701
Wx-Elbert	1440	100%	16	0	0	0	0	0	0	0	16	16	0	0	0.0393701
Bear Creek @ Lowell	1530	100%	16	0	0	0	0	0	0	0	16	16	0	0	0.0393701
Morrison	2330	100%	16	0	0	0	0	0	0	0	16	16	0	0	0.0393701
Jewell Detention	520	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Confluence Pond	720	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
SPR at Union Ave.	1640	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Shop Creek	1710	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Sand Creek at mouth	1810	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Brook Forest	2260	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Wx-Castle Rock	2750	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Sunset	4240	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
SBC@S Boulder Ditch	4840	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.0393701
Nott Creek	150	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Upper Leyden	220	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Van Bibber @ Hwy 93	330	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Montview Park	400	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Parker/Mississippi	540	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Wx-Quincy Reservoir	750	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Wx-Highlands Ranch WTP	2710	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
DC Public Works	2950	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Magnolia	4090	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Sunshine	4160	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.0393701
Flying J	850	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Wx-Brighton Ditch	1570	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Kinney Peak	2280	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Lee Hill Rain 2012	4320	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Riverside	4340	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Boulder Jail	4550	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Wx-Cal-Wood Ranch	4770	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.0393701
Fire Station #19	530	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Harvard Gulch Park	600	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Harvard @ Jackson	610	100%	12	0	0	0	0	0	0	0	12	12	0	1	0.0393701
Heritage Square	1060	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Englewood Dam	1600	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Winiger Ridge	4530	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Whispering Pines	4880	100%	12	0	0	0	0	0	0	0	12	12	0	0	0.0393701
Sports Complex	320	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Fire Station #7	440	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Horseshoe Park Drop	710	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
SPR at 3rd Ave	1320	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Wx-Urban Farm	1460	100%	11	0	0	0	0	0	0	0	11	11	0	1	0.0393701
Wx-Brighton	1920	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Pine Cliff Road	2810	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
West Cherry Head-Douglas Cnty	2920	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
East/West Trailhead	3050	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Highland Heritage Park-A2	3090	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Twin Sisters	4080	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Geer Canyon	4250	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
A2-ETG @ Hampden Precip	100110	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.0393701
Mission Viejo Park	760	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Granby Ditch @ 6th	810	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Lena @ U.S. Hwy 6	1040	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Sand Creek Park	1800	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
El Rancho	2340	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Haskins Gulch Conf	2820	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Crescent	4010	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Pine Brook	4170	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Lazy Acres	4200	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Big Elk Park	4300	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.0393701
Wx-Blue Mountain	140	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Toll Gate @ 6th	700	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Sable Ditch @ 18th	800	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Fire Station 12	840	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Sand Cr at Colfax	860	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Gunbarrel	1110	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Spruce Mt - Douglas	2890	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Hansen Rain	4330	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
Justice Center	4360	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.0393701
West Woods	120	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.0393701
Quincy/Highline	620	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.0393701
Denver West	1010	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.0393701
Jeffco Fairgrounds	1050	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.0393701
Niver Detention	1900	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.0393701

Idledale	2350	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Wx-West Creek WX	3020	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Johnny Park	4310	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Apple Valley	4490	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Leyden Confluence	210	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Van Bibber Park	300	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Kelly Dam	410	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
NREL/S. Table Mtn.	1030	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
West Metro FS13	1370	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Cherry Cr @ Steele	1720	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Indian Creek	2960	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Filter Plant	4100	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Pinewood Springs	4510	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Leyden Reservoir	200	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Louisville Rec Ctr	1100	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Chatfield COE	1350	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Rio Grande	4020	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Martin Gulch	4040	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Bear Peak	4070	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Golden Age	4230	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Third Creek at DIA	1480	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
Red Garden	4030	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
Walker Ranch	4050	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
No Name @ Quincy	730	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
		Total	2752	116	16	3	2	0	0	2889	3054	165	3	
Newlin Gulch-A2	3070	51%	11	27	6	0	1	0	0	45	88	43	0	0.019
EPC at Hwy 105	3010	75%	65	15	5	1	0	0	1	86	114	28	0	0.01
Porphyry Mtn	4850	78%	26	5	0	0	1	0	0	32	41	9	0	0.01
Fairview Peak	4860	97%	30	1	0	0	0	0	0	31	32	1	0	0.01
Four Mile Creek	5720	89%	7	1	0	0	0	0	0	8	9	1	0	0.0393701
West Creek	5730	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Trail Creek	5740	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Stump Bump	5810	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701
Cedar Mountain	5860	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701
Hackett Mountain	5880	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
Horse Creek-Satellite	5900	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Log Jumper	5940	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701

2013 Monthly ALERT Radio Traffic Summary

