

Memo



Date: February 6, 2016
To: Kevin Stewart
From: Markus Ritsch
Subject: January 2016 ALERT Data Analysis

I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's NovaStar 5 base station were analyzed for the period January 1 through January 31, 2016.

II. General System Analysis Summary

The District receives data through both the legacy ALERT channel and through the ALERT2 (concentrator plus A2 self-reports) channel. The following (Table 1) quantifies the data reports received by each channel.

Table 1. Reception of Data at Diamond Hill (Legacy, ALERT2 and Concentrator Reports from Recdatalog)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Legacy	118,519												118,519
Concentrator	194,948												194,948
ALERT2	136,144												136,144
TOTAL	449,611	0	0	0	0	0	0	0	0	0	0	0	449,611
Conc/Leg	1.64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.64
DataChron	645,913												645,913

The District operates two redundant NovaStar5 base stations: the primary (ns5a) at Diamond Hill and a redundant base (ns5b) at Greenhouse Data. Additional analyses are conducted on the data received by these two base stations (Table 2). The data received by both base stations for the month are shown below.

Table 2. Comparison of Data Reception by ns5a and ns5b

NS5A (Diamond Hill)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Legacy	118,519												118,519
Concentrator	194,948												194,948
ALERT2	136,144												136,144
NS5B (Greenhouse)													
Legacy	118,610												118,610
Concentrator	194,968												194,968
ALERT2	136,330												136,330
Diff (NS5a-NS5b)													
Legacy (Digi One)	-91	0	0	0	0	0	0	0	0	0	0	0	- 91
Concentrator (B2010)	-20	0	0	0	0	0	0	0	0	0	0	0	- 20
ALERT2 (B2010)	-186	0	0	0	0	0	0	0	0	0	0	0	- 186
Comments	Recdatalog format changed...missing several days												

The reception rates between Diamond Hill and Greenhouse are very similar.

The daily ratio of total concentrator reports received versus total legacy ALERT reports received is shown (Figure 1).

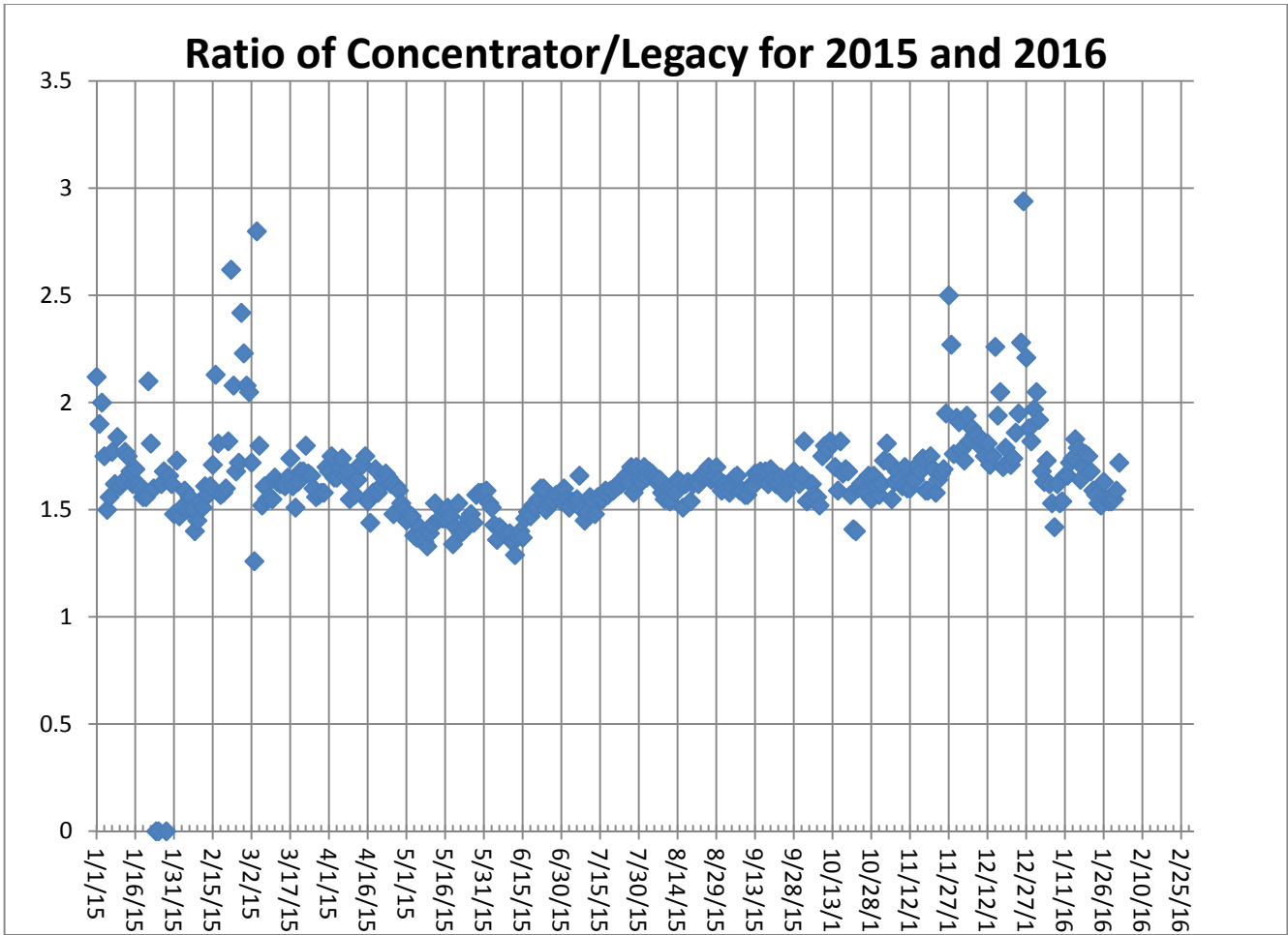


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

The ratio becomes more volatile in the cold months as the Blue Mountain repeater has problems with legacy ALERT reporting when the temperature drops.

A. Continuous Operation of Base Receiver/Decoder

The base station was in continuous operation for the entire month. A total of 744 hours of data were present in the NovaStar5 database (DataChron). Outages of less than one hour are not identified.

B. Specific Issues Identified

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

Table 3. Sensors with Poor Performance Characteristics

Sensor ID	Description	Comments
10027	West Creek Hayman	This station stopped reporting in November...WET to investigate
10026	Trumbull Hayman	Poor timer and event reporting
4550	Boulder Jail	Poor timer performance and poor event performance
4030	Red Garden	Large number of invalid reports.....very noisy
4371, 4372, 4374, 4377, 4378	Unknown IDs	Possible coming from Gross Reservoir (4370)
10022	Arvada Blunn	Notice ALERT2 transmissions on Jan 1, 2, 3 and 4 with report time of 1970

C. Performance of New A2 Sites

This section of the report will look at specific reporting characteristics of the new A2 sites by analyzing their APDUID (Application PDU Identifier). The APDUID is a cyclical, incrementing counter from 0 to 6. Tracking skipped values and restarts of the application control byte counter provides useful insight into site performance and general network health. The performance of the cyclical counter is quantified for each A2 self-reporting site and repeater path (Table 4).

Note the format of the recdatalog changed in January and this the APDUID was not available. This problem was fixed in late January and we will continue to monitor the APDUID beginning in February.

Table 4. APDUID Performance of A2 Sites by Source Address

Description	ID	W. Creek (6001)	Smoky Hill (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)
Carr Street (10012)	100					
Murphy Creek (10019)	870					
Maple Grove (10013)	1000					
Lena @ Nolte Pond (10025)	1020					
Diamond Hill (10028)	1420					
Newlin Gulch	3070					
Heritage Regional Park	3090					
Lower Left Hand (10018)	4453			--		
Magnolia	6602					
Blackstone**	100100					
ETG @ Hampden**	100110					
Upper Sellers	100140					
Haystack Road	100150					
Sand Cr at Colfax	100160					
James Creek	100177			--		
S. St. Vrain at Berry Ridge	100210		--	--		
Arvada/Blunn Reservoir	100227					
Havana Pond	100230					
Westerly Creek Dam	100247					
Trumbull (Hayman)	100260		--	--	--	--
West Creek (Hayman)	100270		--	--	--	--
Plum Creek at Sedalia	100290		--	--	--	--
Coal Creek at McCaslin	100300		--	--	--	--
Broadway	100310					
Weir Gulch	100320					

**--the APDUID is disabled for these sites....these are original HSE A2 transmitters and may not support the APDUID

D. ALERT2 Repeater Loading

The ALERT2 architecture utilizes 5 repeaters with a single transmit frequency (170.300 MHz) to Diamond Hill. The repeaters utilize a 20 second frame where each repeater is allocated a slot of specific size and an offset within the frame. The slot allocated to each repeater is sized appropriately to accommodate the total number of existing and future remote sites routed through that repeater. Each repeater is shown along with its designated slot (Table 5). Currently there is no pass-listing for the ALERT2 repeaters. Any remote ALERT2 site can be received by all repeaters and re-broadcast to the base except for West Creek which has an input frequency unique to Douglas County.

Table 5. ALERT2 Repeater Architecture

Repeater	Slot Size (sec)	Slot Offset (sec)	Source Address	ALERT2 Input Frequency (MHz)	ALERT2 Output Frequency (MHz) – received at Diamond Hill
West Creek	2	0	6001	169.425	170.300
Smoky	3	2	6502	169.525	170.300
Blue Mt.	4	5	6503	169.525	170.300
Lee Hill	3	9	6505	169.525	170.300
Gold Hill	3	12	6506	169.525	170.300
Magnolia	5	15	6507		170.300
Frame Size	20				

The following tables summarize the total number of reports received through each repeater (Table 6). This helps to quantify repeater loading for the ALERT2 backbone.

Table 6. ALERT2 Reports Received through Each Repeater (Only A2 Self Reports)

Month-Yr	West Creek (6001)	Smoky (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)	TOTAL
Jan-15	0	44,501	44,636	44,783	39,007	172,927
Feb-15	0	58,543	56,150	61,160	57,764	233,617
Mar-15	346	73,198	69,604	77,968	65,323	286,439
Apr-15	595	73,711	69,568	79,215	72,310	295,399
May-15	5,259	78,694	72,340	86,297	77,174	319,764
June-15	11,987	72,449	65,742	82,998	69,570	302,746
July-15	28,595	75,379	71,394	79,026	74,041	328,435
Aug-15	28,409	92,299	84,057	84,363	87,211	376,339
Sep-15	26,809	84,143	84,776	84,289	85,123	365,140
Oct-15	19,775	82,683	83,390	63,475**	84,825	334,148
Nov-15	6,438	62,615	61,477	50,888	58,004	239,422
Dec-15	9,835	72,886	72,465	73,431	47,996	276,613
Jan-16	4,034	38,348	36,826	37,168	19,768	138,160

** - The number of reports coming through Lee Hill declined in October

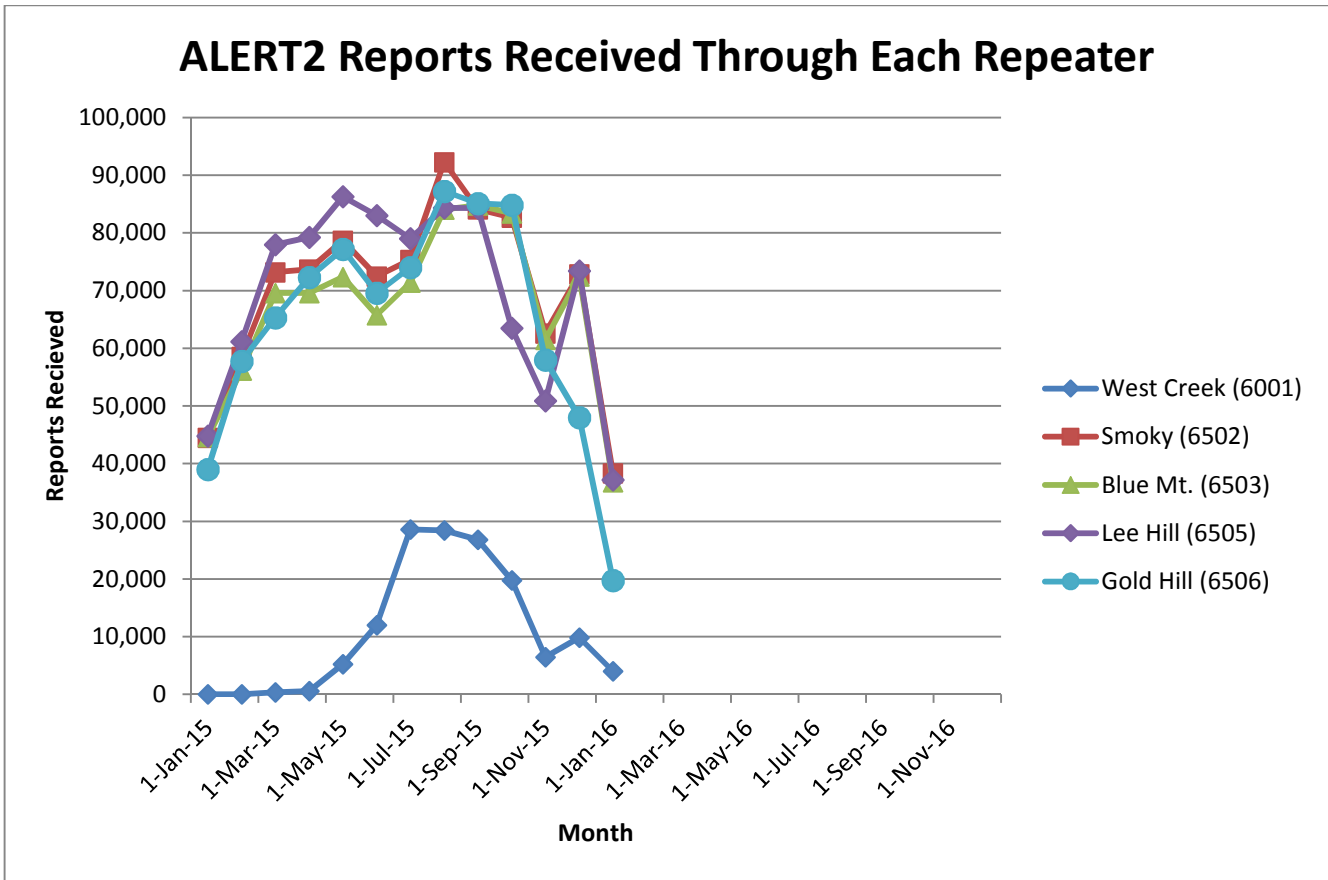


Figure 2. Reports received through each repeater (ALERT2 Only)

In general each of the primary repeaters in the District process an equivalent number of ALERT2 reports. Several months are evident where the throughput of one repeater is not consistent with the other three. The reduction of ALERT2 reports through Lee Hill in October is evident (Figure 2) as is the reduction of ALERT2 reports through Gold Hill in December.

The following tables summarize the system-wide latency of ALERT2 self-reports (Table 7 and Table 8).

Table 7. System-Wide Latency of ALERT2 Self-Reports (seconds)

Statistical Parameter	Value (sec)	Comments
Mean	66.17	The average time it took a report from the field to reach the base
Minimum	3	The minimum time it took for a report to go from the field to the base
Maximum	300	The maximum time it took for a report to go from the field to the base
Crazy	1444305780	Noticed several ALERT2 transmissions from SA 10022 with report time of 1970

Table 8. Summary of ALERT2 System-Wide Latency (seconds)

Statistical Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	66.17											
Minimum	3											
Maximum	300											
Station with Max Latency	Magnolia WX (6602)											

E. Rain Sensor Timer Reporting Summary

The following analysis assumes that each legacy rain sensor has a 12-hour timer-reporting interval and each A2 rain sensor has a 1-hour timer-reporting interval. The worst performing rain sensors for the month are summarized (Table 9).

Table 9. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
10026											
4550											
2330											
4270											
1660											
4330											

*- 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.

III. 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 10). 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 10. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	4.68	Only the 1-mm rain sensors were included in the analysis
Median	4	Only the 1-mm rain sensors were included in the analysis
Standard deviation	3.66	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	15.65	Only the 1-mm rain sensors were included in the analysis
Mean minus two standard deviations	---	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	Many stations
Maximum total count	27	Boulder Jail (4550)
Sensors showing NO rain for the month		--
Sensors greater than 3 SD (over reporting)		Boulder Jail (4550) – looks like field maintenance work on Jan 22

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 11).

Table 11. 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	52.33	50.63	229.74	29.64	5.86	4.00	42.46
2014	6.88	11.86	25.91	29.30	77.30	29.16	99.73	43.59	50.96	29.26	13.36	8.11	35.45
2015	9.88	24.42	20.78	69.75	143.07	86.93	54.59	29.95	7.16	53.28	22.08	10.80	44.39
2016	4.68												

*- 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 12).

Table 12. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
Wx-West Creek	3020	Random bad decodes.....noisy channel
Sunset	4240	Random bad decodes

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 96 percent. A total of 356 incrementing reports were received and a total of 370 reports were expected. The total loss of incrementing reports for the month was approximately 4 percent. Those sensors with the worst event transmission performance are summarized (Table 13).

Table 13. Monthly Summary of Sensors with the Worst Performance

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
1530											
4550											
1640											
4180											
1660											
4840											

*-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.

IV. 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 14).

Table 14. Summary of Unknown IDs

Description	Concentrator	Legacy	A2
Total number of unknown IDs (IDs without a device definition)	135	198	0
Total reports from unknown IDs	323	442	0
Unknown IDs with only a single received report (potential noise)	92	142	0
Total reports from all IDs – RecData Log entire month	194,948	118,519	136,144
Unknown reports as a fraction of total reports	0.105%	0.301%	0%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 15) are the total reports received from unknown sensor IDs for each month of the year.

Table 15. Monthly Summary of Total Reports from Unknown IDs (Concentrator)

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	5,230	1,070	4,429	781	13,459	1,213
2014	870	4,284	2,399	2,104	25,746	1,832	3,983	268	369	448	470	1,099
2015	542	9,137	1,524	1,007	946	699	1,179	1,860	1,153	1,063	600	619
2016	323											

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 16).

Table 16. Monthly Percent of Unknown Sensor Reports (Concentrator)

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%	0.82%	0.21%	0.96%	0.31%	5.37%	0.23%
2014	0.14%	0.94%	0.40%	0.34%	3.95%	0.34%	0.66%	0.03%	0.03%	0.07%	0.11%	0.26%
2015	0.15%	2.25%	0.34%	0.22%	0.19%	0.14%	0.26%	0.42%	0.29%	0.24%	0.15%	0.15%
2016	0.10%											

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 17).

Table 17. Reports Received by Unknown IDs

Concentrator		Legacy ALERT		Comment
Unknown ID	Reports	Unknown ID	Reports	
1382	63	1382	60	This is actually a sensor.water temp at Ferril Lake (1382)
--	--	2	32	Possible noise on the legacy channel at Diamond Hill as it was noticed the Kantronics decoder was receiving full squelch
4371	11	4371	11	Possibly coming from Gross Reservoir (ID 4370)
4374	9	4374	9	Possibly coming from Gross Reservoir (ID 4370)
4378	8	4378	9	Possibly coming from Gross Reservoir (ID 4370)
1470	8	1470	8	

V. Sensors with Invalid Reports

The sensors below (Table 18 and Table 19) have the largest number of invalid decodes as determined by the validation process defined at the District NovaStar5 base station. These invalid reports may indicate poor radio paths (bit flip/contention errors/random decode) or validation criteria that do not match the physical installation at the site.

Table 18. Rain Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1530-Bear Cr. At Lowell	8											
2750-Wx-Castle Rock	10											
3020-Wx-West Creek	9											
3070-Newlin Gulch	10											
4030-Red Garden	23											

VI. 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.

There were no rainfall alarms this month.

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2016\01-2016\Novastar_extract_2016Jan.mdb

First Date in Database	12/31/15 11:59 PM	Total Days	31.0
Last Date in Database	1/31/16 11:59 PM	Total Hours	744.0

Summarize

Total Records Analyzed 194,948

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	81,483	41.8%	44,862	37.9%	69,664	51.2%
Temperature	34,524	17.7%	18,133	15.3%	21,025	15.4%
Relative Humidity	29,955	15.4%	17,843	15.1%	20,797	15.3%
Barometric Pressure	16,344	8.4%	10,101	8.5%	127	0.1%
Battery Voltage	9,041	4.6%	5,006	4.2%	9,449	6.9%
Solar Radiation	5,610	2.9%	5,411	4.6%	0	0.0%
Water Level	4,049	2.1%	4,974	4.2%	5,153	3.8%
Fuel Temperature	2,993	1.5%	2,884	2.4%	0	0.0%
Fuel Moisture	2,982	1.5%	2,850	2.4%	0	0.0%
Precipitation	2,467	1.3%	2,352	2.0%	3,319	2.4%
Wind Direction	1,912	1.0%	0	0.0%	1,228	0.9%
Soil Moisture	1,479	0.8%	1,415	1.2%	0	0.0%
Repeater Status Report	1,092	0.6%	1,387	1.2%	0	0.0%
ET-Hourly	377	0.2%	376	0.3%	0	0.0%
Unknown	323	0.2%	442	0.4%	0	0.0%
Hayman Battery	147	0.1%	0	0.0%	0	0.0%
12Hr Status Report	67	0.0%	60	0.1%	0	0.0%
GPS Lock	32	0.0%	66	0.1%	1,427	1.0%
Not Used	25	0.0%	22	0.0%	0	0.0%
Repeater Pass List	22	0.0%	284	0.2%	0	0.0%
ET-Daily	16	0.0%	16	0.0%	0	0.0%
Solar Power	6	0.0%	6	0.0%	0	0.0%
Flasher Status	1	0.0%	1	0.0%	0	0.0%
Handar 585 ALARM Status	1	0.0%	2	0.0%	0	0.0%
stle Rock Repeater ALERT M:	0	0.0%	26	0.0%	0	0.0%
Dew Point Temperature	0	0.0%	0	0.0%	3,955	2.9%
Total	194,948	100.0%	118,519	100.0%	136,144	100.0%

Traffic Loading Summary	Concentrator	Legacy	ALERT2
Alert Reports	194,948	118,519	136,144
Average Daily Traffic	6,092	3,823	4,376
Average Hourly Traffic	254	159	182
Median Hourly Traffic	91	171	284
Peak Hourly Traffic	794	467	450
2nd Max	790	459	442
3rd Max	783	452	439
4th Max	749	450	438
5th Max	740	447	437

Rain Timer Performance

Analyze Rain Sensors



Rain Sensors	Description	Rcv	Timer	Exp	Performance
100260	Wx-A2-Trumbull (Hayman) - Precip	334		744	45%
4550	Boulder Jail	31	14:59	64	48%
2330	Morrison	39	17:59	64	61%
4270	Cannon Mountain	45	15:18	64	70%
1660	SPR at Henderson	50	14:24	64	78%
4330	Hansen Rain	50	14:04	64	78%
2790	Wx-W. Cherry Creek	52	13:47	64	81%
4240	Sunset	54	13:08	64	84%
2320	Choke Cherry Resvr	55	12:41	64	86%
3020	Wx-West Creek WX	56	12:15	64	88%
4030	Red Garden	56	13:10	64	88%
5940	Log Jumper	56	13:10	64	88%
1460	Wx-Urban Farm	57	12:27	64	89%
4350	Conifer Hill	57	13:08	64	89%
4490	Apple Valley	57	12:38	64	89%
4510	Pinewood Springs	57	12:38	64	89%
4790	Wx-Button Rock	57	12:40	64	89%
3010	WX-EPC at Hwy 105	58	12:28	64	91%
4050	Walker Ranch	58	12:37	64	91%
4290	Red Hill	58	12:37	64	91%
1520	Wx-Marston Lake North	59	12:26	64	92%
1570	Wx-Brighton Ditch	59	12:12	64	92%
4040	Martin Gulch	59	12:23	64	92%
4070	Bear Peak	59	12:24	64	92%
4100	Filter Plant	59	12:26	64	92%
4200	Lazy Acres	59	12:26	64	92%
110	Ralston Reservoir	60	12:10	64	94%
140	Wx-Blue Mountain	60	12:12	64	94%
700	Toll Gate @ 6th	60	12:13	64	94%
970	Pump Sta 3	60	12:12	64	94%
1440	Wx-Elbert	60	12:12	64	94%
1920	Wx-Brighton	60	12:13	64	94%
2710	Wx-Highlands Ranch WTP	60	12:12	64	94%
2980	Dakan Rd	60	12:12	64	94%
3030	WX-Bingham Lake Park	60	12:00	64	94%
3070	A2-Newlin Gulch Precip	60	12:12	64	94%
3090	A2-Highland Heritage Park	60	12:12	64	94%
4010	Crescent	60	12:10	64	94%
4020	Rio Grande	60	12:10	64	94%
4080	Twin Sisters	60	12:10	64	94%
4190	Slaughterhouse	60	12:09	64	94%
4250	Geer Canyon	60	12:09	64	94%
4260	Taylor Mountain	60	12:10	64	94%
4300	Big Elk Park	60	12:22	64	94%
100140	A2-Upper Sellers Gulch Precip	60	12:12	64	94%
100150	A2-Sellers Gulch at Haystack Precip	60	12:12	64	94%
750	Wx-Quincy Reservoir	61	11:56	64	95%
900	Wx-Aurora Reservoir	61	12:00	64	95%
920	Wx-Aurora Town Hall	61	12:00	64	95%
1420	A2-Wx-Diamond Hill	61	12:00	64	95%
1700	Cherry Cr @ Champa	61	11:59	64	95%
2730	Wx-Salisbury Park	61	12:00	64	95%
2930	Wx-Spring Valley Rd-DougCnty	61	12:00	64	95%
2990	Wx-Tomah Rd-DougCnty	61	12:00	64	95%

4110	Betasso	61	12:10	64	95%
4160	Sunshine	61	11:58	64	95%
4180	Gold Lake	61	11:30	64	95%
4230	Golden Age	61	11:57	64	95%
4310	Johnny Park	61	12:10	64	95%
4340	Riverside	61	11:58	64	95%
4360	Justice Center	61	12:02	64	95%
4520	Eagle Ridge	61	12:00	64	95%
4770	Wx-Cal-Wood Ranch	61	12:00	64	95%
4830	SBC @ San Souci	61	11:31	64	95%
4870	SBC @ SB Road	61	12:13	64	95%
200	Leyden Reservoir	62	11:32	64	97%
1640	SPR at Union Ave.	62	11:45	64	97%
2210	Wx-Hiwan G.C.	62	11:48	64	97%
4140	Logan Mill	62	11:33	64	97%
4320	Lee Hill Rain 2012	62	11:45	64	97%
4570	St. Antons	62	11:59	64	97%
4820	Doudy Draw	62	11:20	64	97%
4850	Porphory Mtn	62	11:36	64	97%
6601	A2-Magnolia WX-Precip	91	8:05	93	98%
100290	Wx-A2-PlumCr at Sedalia - Precip	732		744	98%
4060	Lakeshore	63	11:21	64	98%
4090	Magnolia	63	11:08	64	98%
4150	Gold Hill	63	11:21	64	98%
4170	Pine Brook	63	11:30	64	98%
4220	Fling's	63	11:21	64	98%
4530	Winiger Ridge	63	11:33	64	98%
4750	Wx-Louisville Lake	63	11:12	64	98%
4810	Shanahan Ridge	63	11:36	64	98%
4860	Fairview Peak	63	11:24	64	98%
1000	A2-Maple Grove Resv.	743		744	100%
100300	A2-CoalCreek at McCaslin - Precip	743		744	100%
4130	Swiss Peaks	66	11:02	64	103%
4710	Wx-Ward C-1	66	11:01	64	103%
4880	Whispering Pines	67	10:51	64	105%
4730	Wx-Sugarloaf	68	10:53	64	106%
4840	SBC@S Boulder Ditch	68	10:23	64	106%
2750	Wx-Castle Rock	69	10:32	64	108%

Rain Event Performance																			
	Reports Received	Reports Received	356		Analyze Rain Sensors					0	<<show stations with zero rain (1=yes, 0=no)								
	Systemwide Avg	Total Tips	370																
	96.22%	Data Loss	3.78%																
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket					
Bear Creek @ Lowell	1530	50%	0	1	0	0	0	0	0	1	2	1	0	0.03937					
Boulder Jail	4550	70%	16	0	2	0	1	0	0	19	27	8	0	0.03937	Mean			4.683544	
SPR at Union Ave.	1640	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	Median			4	
Gold Lake	4180	80%	3	1	0	0	0	0	0	4	5	1	0	0.03937	St. Dev			3.656902	
SPR at Henderson	1660	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937	Mean plus 3 SD			15.65425	
SBC@S Boulder Ditch	4840	87%	11	2	0	0	0	0	0	13	15	2	0	0.03937	Min			1	
Ralston Reservoir	110	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	Max			27	
Wx-Blue Mountain	140	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Leyden Reservoir	200	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Toll Gate @ 6th	700	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Wx-Quincy Reservoir	750	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Wx-Aurora Town Hall	920	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937					
A2-Maple Grove Resv.	1000	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
A2-Wx-Diamond Hill	1420	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Wx-Elbert	1440	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Wx-Urban Farm	1460	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Wx-Marston Lake North	1520	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
Cherry Cr @ Champa	1700	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Wx-Brighton	1920	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Wx-Hiwan G.C.	2210	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937					
Choke Cherry Resvr	2320	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Morrison	2330	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Wx-Highlands Ranch WTP	2710	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Wx-Salisbury Park	2730	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Wx-Castle Rock	2750	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Wx-W. Cherry Creek	2790	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Wx-Spring Valley Rd-DougCnty	2930	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Wx-Tomah Rd-DougCnty	2990	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937					
Wx-West Creek WX	3020	100%	11	0	0	0	0	0	2	11	11	0	0	0.03937					
WX-Bingham Lake Park	3030	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Crescent	4010	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Rio Grande	4020	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Red Garden	4030	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Martin Gulch	4040	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Walker Ranch	4050	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Lakeshore	4060	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Bear Peak	4070	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Twin Sisters	4080	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937					
Magnolia	4090	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Filter Plant	4100	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Betasso	4110	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
Swiss Peaks	4130	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Logan Mill	4140	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Gold Hill	4150	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Sunshine	4160	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Pine Brook	4170	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Slaughterhouse	4190	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Lazy Acres	4200	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Fling's	4220	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Sunset	4240	100%	1	0	0	0	0	0	1	1	1	0	0	0.03937					
Geer Canyon	4250	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					

Taylor Mountain	4260	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Cannon Mountain	4270	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Red Hill	4290	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Johnny Park	4310	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Lee Hill Rain 2012	4320	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Hansen Rain	4330	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
Riverside	4340	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Conifer Hill	4350	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Justice Center	4360	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Apple Valley	4490	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Pinewood Springs	4510	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Eagle Ridge	4520	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Winiger Ridge	4530	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
St. Antons	4570	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Wx-Ward C-1	4710	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Wx-Sugarloaf	4730	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Wx-Louisville Lake	4750	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Wx-Cal-Wood Ranch	4770	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Wx-Button Rock	4790	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Shanahan Ridge	4810	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Doudy Draw	4820	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
SBC @ San Souci	4830	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
SBC @ SB Road	4870	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Whispering Pines	4880	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
Log Jumper	5940	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Wx-A2-Trumbull (Hayman) - Precip	100260	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
A2-CoalCreek at McCaslin - Precip	100300	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Wx-Aurora Reservoir	900	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937
		Total Tips	347	6	2	0	1	0	3	356	370	14	0	
WX-EPC at Hwy 105	3010	96%	24	1	0	0	0	0	0	25	26	1	0	0.01
Porphory Mtn	4850	100%	2	0	0	0	0	0	0	2	2	0	0	0.01
Fairview Peak	4860	100%	3	0	0	0	0	0	0	3	3	0	0	0.01
A2-Magnolia WX-Precip	6601	100%	4	0	0	0	0	0	0	4	4	0	0	0.01

2016 Monthly Peak Hour ALERT Radio Traffic Summary

