

Memo



Date: February 6, 2017
To: Kevin Stewart
From: Markus Ritsch
Subject: January 2017 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, 2017.

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	234,074												234,074
Concentrator	361,187												361,187
ALERT2	327,977												327,977
TOTAL	923,238	0	0	0	0	0	0	0	0	0	0	0	923,238
Conc/Leg	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54
DataChron	668,091												668,091

The District operates two 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	234,074												234,074
Concentrator	361,187												361,187
ALERT2	327,977												327,977
NS5B (Greenhouse)													
Legacy	234,037												234,037
Concentrator	360,898												360,898
ALERT2	327,807												327,807
Diff (NS5a-NS5b)													
Legacy (Digi One)	37	0	0	0	0	0	0	0	0	0	0	0	37
Concentrator (B2010)	289	0	0	0	0	0	0	0	0	0	0	0	289
ALERT2 (B2010)	170	0	0	0	0	0	0	0	0	0	0	0	170
Comments													

The reception rates between Diamond Hill and Greenhouse are consistent. The differences are likely due to the IP network feed between the ALERT2 decoder and the Diamond Hill base (which resides in Denver) and the Greenhouse base (which resides in Wyoming).

The daily ratio of concentrator to legacy reports is shown.

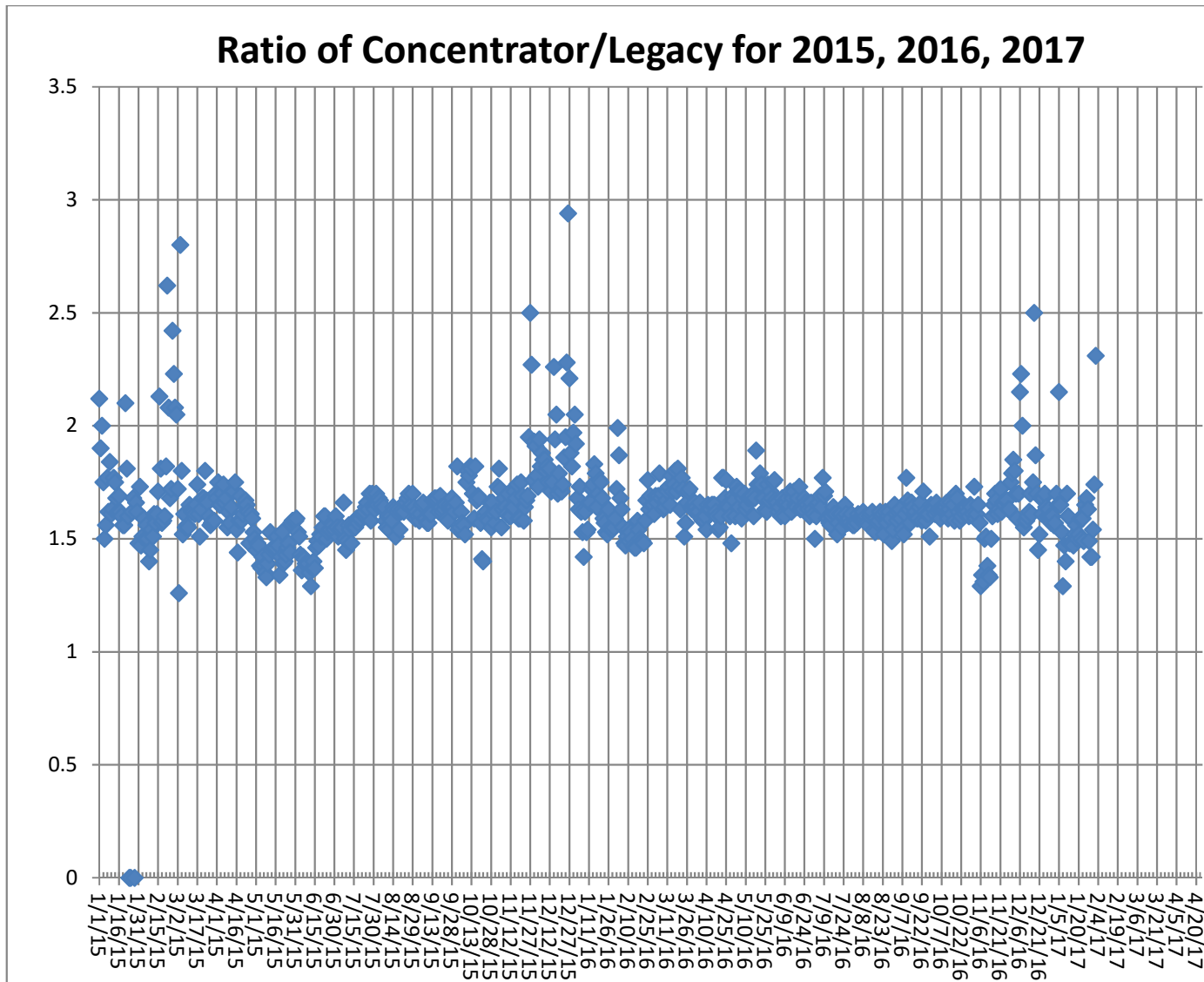


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

The ratio becomes more volatile in the cold months as the Blue Mountain repeater has problems with legacy ALERT reporting when the temperature drops below zero. The ratio stays very consistent all the way through October in 2016 which may be due to the fact the air temperatures were relatively warm throughout the fall.

A. Continuous Operation of Base Receiver/Decoder

The base station was in continuous operation for the entire month. Data was collected on a continuous basis for every hour of every day for a total of 744 hours of operation. 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
6502	Smoky Mt Repeater	Significant reduction in ALERT2 throughput relative to the other repeaters
2790	Wx-W. Cherry Creek	Poor timer and event performance
6503	Blue Mt Repeater	Significant reduction in ALERT2 throughput relative to the other repeaters
5720	Four Mile Creek	Poor timer performance
4870	SBC @ SB Road	Poor event performance
1920	Wx-Brighton	Poor event performance
3010	Wx-EPC at Hwy 105	Poor event performance
4230	Golden Age	Reporting many invalid ids (4232, 4234, 4233, 4231)
1920	Brighton	Reporting many invalid ids (1923, 1924)

C. ALERT2 Repeater Loading

The District's 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 4). 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 4. 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 5). This helps to quantify repeater loading for the ALERT2 backbone.

Table 5. 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
Feb-16	11,732	93,120	99,206	96,284	99,188	399,530
Mar-16	12,533	126,123	134,329	140,226	139,536	552,747
Apr-16	13,262	128,473	130,223	135,499	133,197	540,654
May-16	27,002	125,098	124,280	138,033	130,513	544,926
Jun-16	30,405	117,877	111,309	133,036	122,798	515,425
Jul-16	37,492	108,334	102,335	115,028	110,577	473,766
Aug-16	48,323	130,666	123,827	136,746	131,957	571,519
Sep-16	49,555	122,625	115,898	129,454	127,606	545,138
Oct-16	51,170	111,105	110,038	116,087	116,489	504,889
Nov-2016	47,039	72,761	92,941	100,083	99,508	412,332
Dec-2016	48,946	102,329	97,321	79,274	102,097	429,967
Jan-2017	47,286	50,748**	27,307**	97,947	104,689	327,977

** - The number of reports coming through these repeaters declined significantly

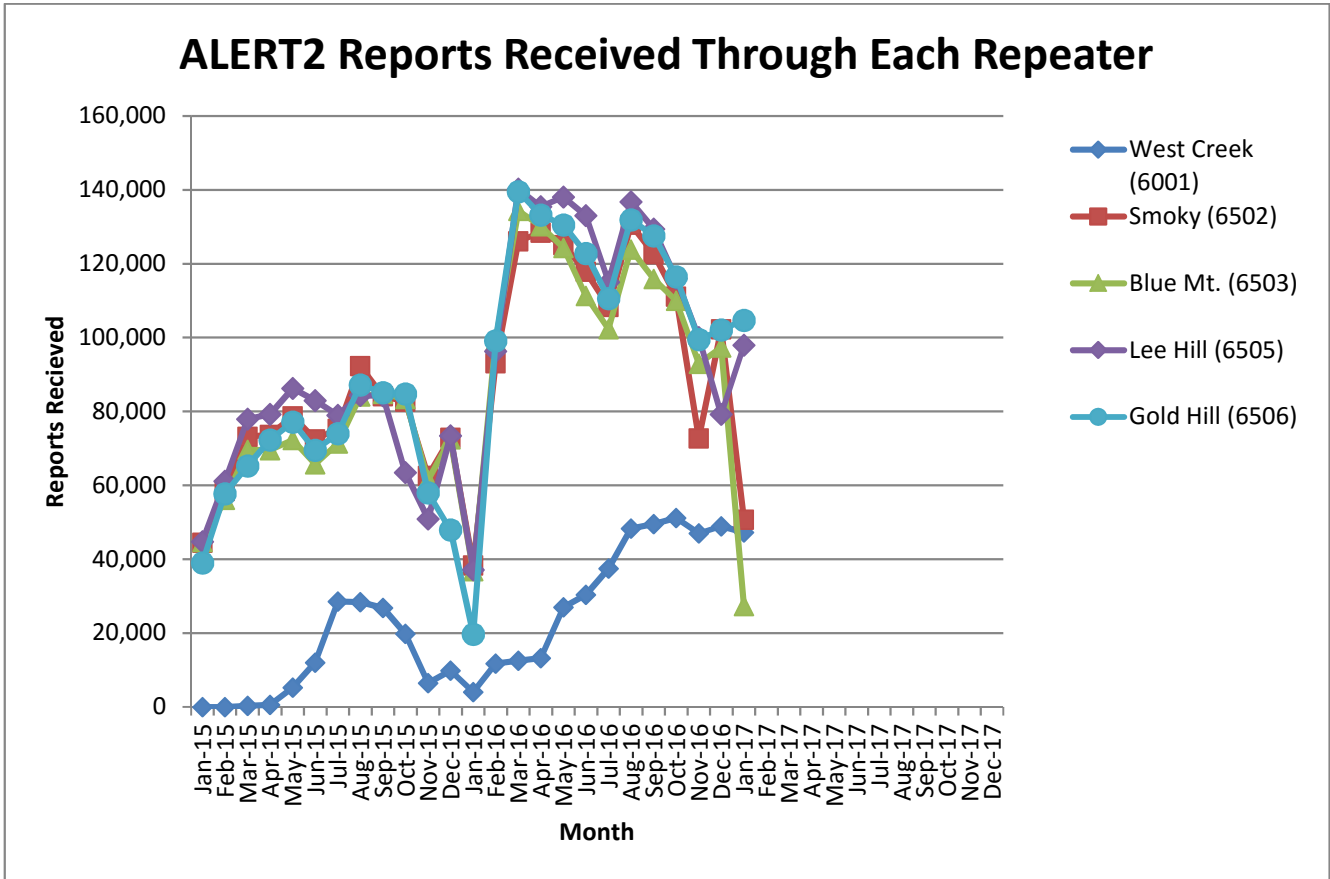


Figure 2. Reports received through each repeater (ALERT2 Only)

A convenient mechanism to track repeater performance throughout the year is to monitor total ALERT2 reports passed by each repeater. In general, each of the primary repeaters in the District process an equivalent number of ALERT2 reports because pass/block filtering is not being used. Several months are evident where the throughput of one repeater is not consistent with the other three.

In January of 2017 the ALERT2 reports received through Blue Mountain and through Smoky Hill showed a significant decrease. There may be a problem at these repeaters or it is possible that pass/block lists have been implemented.

The following tables summarize the system-wide latency of ALERT2 self-reports (Table 6 and Table 7).

Table 6. System-Wide Latency of ALERT2 Self-Reports (seconds)

Statistical Parameter	Value (sec)	Comments
Mean	53.1	The average time it took a report from the field to reach the base
Minimum	-29	The minimum time it took for a report to go from the field to the base
Maximum	286	The maximum time it took for a report to go from the field to the base

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

Statistical Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	53.1											
Minimum	-29											
Maximum	286											
Station with Max Latency												

The minimum latency of -29 seconds occurred on January 12, 2017. It was observed through the West Creek repeater from the station West Creek WX (3019). This is a HydroLynx transmitter. This issue will be raised with Dave Leader in early February to understand why we see future times.

```
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037 Time: 01/12/2017 05:31:40 MANT Received:
N,2017,01,12,12,31,40.0894,0,0,0,1,0,0,0,0,0,0,8,10037,1,6001,04,07,89,03,03,10,00,93
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037 Time: 01/12/2017 05:31:40 MANT TS=01/12/2017 12:31:40.0894 UTC VN=0 PROTOCOL=0 TSR=0 APR=1
DAR=0 PORT=0 RB=0 AB=0 AHR=0 HL=0 Length=8 SA=10037 SN=1 SA[0]=6001
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037 Time: 01/12/2017 05:31:40 MANT PDU Payload=04,07,89,03,03,10,00,93
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037,6001 Time: 01/12/2017 05:31:40 PDU Self Report CB=04 VN=0 TSF=1 TST=0 APDUID=0 EX=0 TO=1929
TS=01/12/2017 05:32:09
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037,6001 Time: 01/12/2017 05:31:40 PDU MSR Multi-Sensor Report type=3 length=3 dataflags=10
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037,6001 Time: 01/12/2017 05:31:40 PDU MSR Wind Direction scaledData=147 deg rawData=147
reportTime=01/12/2017 05:32:09
Jan 12 05:31:40 udfcd-ns5a nsrecdata[4179]: Line: 4 SA: 10037,6001 Time: 01/12/2017 05:32:09 ID: 3019 Data: 147 Scaled: 108 Action: insert
```

D. 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 8).

Table 8. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
2790											
5720											
4510											
100260											
4870											
5940											

*- 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 9). 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 9. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	13.3	Only the 1-mm rain sensors were included in the analysis
Median	12.5	Only the 1-mm rain sensors were included in the analysis
Standard deviation	7.4	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	35.5	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	Winiger Ridge (4530)
Maximum total count	31	Johnny Park (4310)
Sensors showing NO rain for the month		
Sensors greater than 3 SD (over reporting)		none

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 10).

Table 10. 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	9.91	32.30	52.10	49.40	40.50	24.20	31.00	8.86	7.51	8.56	8.74	23.23
2017	13.3												
Ave	6.83	10.48	19.55	44.28	62.99	37.41	57.88	38.11	45.32	27.86	8.81	8.66	30.64

*- 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 11).

Table 11. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
None this 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 1085 incrementing reports were received and a total of 1144 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 12).

Table 12. Monthly Summary of Sensors with the Worst Performance

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
2790											
4870											
1920											
3010											
4510											
4330											

*-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 13).

Table 13. Summary of Unknown IDs

Description	Concentrator	Legacy	A2
Total number of unknown IDs (IDs without a device definition)	241	296	0
Total reports from unknown IDs	11,875	11,958	0
Unknown IDs with only a single received report (potential noise)	122	189	0
Total reports from all IDs – RecData Log entire month	361,187	234,074	327,977
Unknown reports as a fraction of total reports	3.29%	5.11%	0%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 14) are the total reports received from unknown sensor IDs for each month of the year.

Table 14. 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	1,241	3,085	3,586	1,268	945	1,408	2,029	1,413	753	617	879
2017	11,875											

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 15).

Table 15. 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%	0.30%	0.69%	0.82%	0.28%	0.22%	0.33%	0.50%	0.36%	0.18%	0.17%	0.22%
2017	3.29%											

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 16).

Table 16. Reports Received by Unknown IDs

Concentrator		Legacy ALERT		Comment
Unknown ID	Reports	Unknown ID	Reports	
4231, 4232, 4233, 4234	2537, 2443, 2425, 2423	4231, 4232, 4233, 4234	2486, 2380, 2373, 2222	Looks like Golden Age legacy transmitter has all IDs activated
1923, 1924	1172, 174	1923, 1924	164, 1467	Brighton legacy transmitter has all IDs activated
3044, 3047	23, 44	0, 1, 2	164, 128, 59	
3052, 3053, 3055	39, 12, 11	1470	24	

V. Sensors with Invalid Reports

The sensors below (Table 17 and Table 18) 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 17. 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	9											
2810-Pine Cliff Rd.	41											
3010-Wx-EPC @ 105	6											
3050-E/W Trailhead	23											

Table 18. Level Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1523-Marston Lake North	10											
1649-SPR at 19 th Street	152											
2813-Pine Cliff Road	16											
3013-EPC@Hwy 105	3											
4383-Eldorado Springs	16											

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\2017\01-2017\MDB.mdb

First Date in Database	1/1/17 12:00 AM	Total Days	31.0
Last Date in Database	1/31/17 11:59 PM	Total Hours	744.0

Summarize

Total Records Analyzed 361,187

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	147,927	41.0%	85,189	36.4%	125,582	38.3%
Temperature	59,499	16.5%	33,620	14.4%	59,573	18.2%
Relative Humidity	52,808	14.6%	33,191	14.2%	57,671	17.6%
Barometric Pressure	30,437	8.4%	20,370	8.7%	1,299	0.4%
Battery Voltage	17,481	4.8%	8,811	3.8%	29,059	8.9%
Unknown	11,875	3.3%	11,958	5.1%	0	0.0%
Water Level	8,869	2.5%	8,102	3.5%	14,281	4.4%
Solar Radiation	8,092	2.2%	10,405	4.4%	0	0.0%
Precipitation	6,199	1.7%	4,843	2.1%	13,515	4.1%
Fuel Moisture	4,956	1.4%	5,469	2.3%	0	0.0%
Fuel Temperature	4,934	1.4%	5,487	2.3%	0	0.0%
Hayman Battery	2,513	0.7%	0	0.0%	0	0.0%
Repeater Status Report	1,682	0.5%	2,422	1.0%	0	0.0%
Soil Moisture	1,651	0.5%	2,586	1.1%	0	0.0%
Wind Direction	915	0.3%	0	0.0%	12,904	3.9%
ET-Hourly	729	0.2%	733	0.3%	0	0.0%
GPS Lock	213	0.1%	2	0.0%	14,093	4.3%
Water Temp	120	0.0%	102	0.0%	0	0.0%
12Hr Status Report	111	0.0%	119	0.1%	0	0.0%
Repeater Pass List	65	0.0%	557	0.2%	0	0.0%
Not Used	59	0.0%	50	0.0%	0	0.0%
ET-Daily	31	0.0%	30	0.0%	0	0.0%
Solar Power	17	0.0%	27	0.0%	0	0.0%
ALERT/A2 Testing	2	0.0%	0	0.0%	0	0.0%
Handar 585 ALARM Status	1	0.0%	0	0.0%	0	0.0%
Longmont Flow Gage	1	0.0%	1	0.0%	0	0.0%
Total	361,187	100.0%	234,074	100.0%	327,977	100.0%

Traffic Loading Summary	Concentrator		Legacy		ALERT2	
Alert Reports	361,187		234,074		327,977	
Average Daily Traffic	11,651		7,551		10,249	
Average Hourly Traffic	485		315		427	
Median Hourly Traffic	469	hour beginning	308	hour beginning	398	hour beginning
Peak Hourly Traffic	1,015	Jan 9, 11:00 AM	658	Jan 9, 11:00 AM	652	Jan 14, 10:00 AM
2nd Max	972	Jan 9, 10:00 AM	643	Jan 9, 11:00 PM	652	Jan 14, 10:00 AM
3rd Max	968		639		651	Jan 20, 9:00 PM
4th Max	966	Jan 9, 12:00 PM	628	Jan 9, 9:00 AM	649	Jan 20, 5:00 PM
5th Max	948	Jan 9, 2:00 PM	623	Jan 9, 10:00 PM	648	Jan 21, 8:00 AM

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	0.508474 Timer	Exp	0.933096 Performar
2790	Wx-W. Cherry Creek	5	8:00	62	8%
5720	Four Mile Creek	42	15:34	62	68%
4510	Pinewood Springs	46	14:09	62	74%
100260	Wx-A2-Trumbull (Hayman) - Precip	559		744	75%
4870	SBC @ SB Road	47	14:38	62	76%
5940	Log Jumper	49	13:20	62	79%
4240	Sunset	49	14:53	62	79%
3010	WX-EPC at Hwy 105	50	14:30	62	81%
4270	Cannon Mountain	51	13:47	62	82%
140	Wx-Blue Mountain	52	14:20	62	84%
4330	Hansen Rain	52	14:17	62	84%
4100	Filter Plant	54	13:34	62	87%
3030	WX-Bingham Lake Park	55	12:42	62	89%
4490	Apple Valley	55	12:54	62	89%
4060	Lakeshore	55	13:10	62	89%
5860	Cedar Mountain	56	12:44	62	90%
4310	Johnny Park	56	12:43	62	90%
4030	Red Garden	56	12:42	62	90%
2730	Wx-Salisbury Park	57	12:53	62	92%
1440	Wx-Elbert	57	12:53	62	92%
4220	Fling's	57	12:42	62	92%
4710	Wx-Ward C-1	58	12:30	62	94%
750	Wx-Quincy Reservoir	58	12:37	62	94%
2750	Wx-Castle Rock	58	12:39	62	94%
4790	Wx-Button Rock	58	12:00	62	94%
5810	Stump Bump	58	12:41	62	94%
4360	Justice Center	58	12:26	62	94%
4040	Martin Gulch	58	12:22	62	94%
4010	Cresent	58	12:50	62	94%
2930	Wx-Spring Valley Rd-DougCnty	59	12:00	62	95%
1920	Wx-Brighton	59	10:04	62	95%
1420	Wx-A2-Diamond Hill	59	12:13	62	95%
4860	Fairview Peak	59	12:13	62	95%
4180	Gold Lake	59	12:12	62	95%
4080	Twin Sisters	59	12:25	62	95%
4050	Walker Ranch	59	12:35	62	95%
1460	Wx-Urban Farm	60	12:12	62	97%
2710	Wx-Highlands Ranch WTP	60	12:00	62	97%
1570	Wx-Brighton Ditch	60	12:12	62	97%
4530	Winiger Ridge	60	12:09	62	97%
5880	Hackett Mountain	60	12:13	62	97%
5740	Trail Creek	60	12:00	62	97%
5730	West Creek	60	12:13	62	97%
4880	Whispering Pines	60	12:11	62	97%
4820	Doudy Draw	60	12:10	62	97%
4810	Shanahan Ridge	60	12:10	62	97%
4340	Riverside	60	12:12	62	97%
4260	Taylor Mountain	60	12:26	62	97%
4190	Slaughterhouse	60	12:10	62	97%
4170	Pine Brook	60	12:10	62	97%
4090	Magnolia	60	12:10	62	97%
2990	Wx-Tomah Rd-DougCnty	61	12:00	62	98%
4730	Wx-Sugarloaf	61	12:00	62	98%
1520	Wx-Marston Lake North	61	12:00	62	98%

4750	Wx-Louisville Lake	61	12:00	62	98%
2210	Wx-Hiwan G.C.	61	12:00	62	98%
920	Wx-Aurora Town Hall	61	12:00	62	98%
900	Wx-Aurora Reservoir	61	12:00	62	98%
100200	Wx-A2-OneRain Weather - Precipitation	61	12:00	62	98%
4840	SBC@S Boulder Ditch	61	11:57	62	98%
4830	SBC @ San Souci	61	11:58	62	98%
4570	St. Antons	61	11:59	62	98%
4550	Boulder Jail	61	11:57	62	98%
4520	Eagle Ridge	61	12:00	62	98%
4350	Conifer Hill	61	12:10	62	98%
4320	Lee Hill Rain 2012	61	11:58	62	98%
4300	Big Elk Park	61	12:11	62	98%
4290	Red Hill	61	11:57	62	98%
4250	Geer Canyon	61	12:11	62	98%
4200	Lazy Acres	61	11:59	62	98%
4160	Sunshine	61	11:58	62	98%
4150	Gold Hill	61	11:58	62	98%
4140	Logan Mill	61	11:58	62	98%
4110	Betasso	61	11:59	62	98%
4020	Rio Grande	61	11:58	62	98%
100420	A2-Thorncreek - Precip	462		468	99%
100270	Wx-A2-WestCreek (Hayman) - Precip	735		744	99%
100410	A2-Brantner Gulch - Precip	465		468	99%
100290	A2-PlumCr at Sedalia - Precip	740		744	99%
100300	A2-CoalCreek at McCaslin - Precip	743		744	100%
4850	Porphory Mtn	743		744	100%
4230	Golden Age	62	11:47	62	100%
4070	Bear Peak	62	11:57	62	100%
4130	Swiss Peaks	63	11:57	62	102%
3020	Wx-West Creek WX	763		744	103%
4770	Wx-Cal-Wood Ranch	64	11:37	62	103%
6601	Wx-A2-Magnolia WX-Precip	92	8:00	62	148%
3060	Fire Sta 47	768		744	103%
2980	Dakan Rd	49	14:59	62	79%
2810	Pine Cliff Road	1		62	
2330	Morrison	44	15:47	62	71%
2320	Choke Cherry Resvr	52	14:15	62	84%
1700	Cherry Cr @ Champa	57	12:57	62	92%
1660	SPR at Henderson	48	15:20	62	77%
1640	SPR at Union Ave.	54	12:57	62	87%
1000	A2-Maple Grove Resv.	743		744	100%
970	Pump Sta 3	60	12:12	62	97%
700	Toll Gate @ 6th	57	12:56	62	92%

Rain Event Performance																		
	Reports Received	Reports Received	1,085		Analyze Rain Sensors						0	<<show stations with zero rain (1=yes, 0=no)						
	Systemwide Avg	Total Tips	1,144															
	94.84%	Data Loss	5.16%															
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket				
Wx-W. Cherry Creek	2790	50%	0	1	0	0	0	0	0	1	2	1	0	0.03937				
SBC @ SB Road	4870	63%	11	4	1	0	1	0	0	17	27	10	0	0.03937	Mean	13.3		
Wx-Brighton	1920	65%	11	2	1	0	1	0	0	15	23	8	1	0.03937	Median	12.5		
WX-EPC at Hwy 105	3010	67%	1	1	0	0	0	0	0	2	3	1	0	0.03937	St. Dev	7.4		
Pinewood Springs	4510	79%	16	1	2	0	0	0	0	19	24	5	0	0.03937	Mean plus 3 SD	35.5		
Hansen Rain	4330	83%	13	1	1	0	0	0	0	15	18	3	0	0.03937	Min	1		
Wx-A2-Trumbull (Hayman) - Precip	100260	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937	Max	31		
Morrison	2330	85%	9	2	0	0	0	0	0	11	13	2	0	0.03937				
Wx-A2-Diamond Hill	1420	86%	15	3	0	0	0	0	0	18	21	3	0	0.03937				
Cannon Mountain	4270	88%	12	2	0	0	0	0	0	14	16	2	0	0.03937				
Lakeshore	4060	88%	14	0	1	0	0	0	0	15	17	2	0	0.03937				
Wx-Button Rock	4790	89%	15	0	1	0	0	0	0	16	18	2	0	0.03937				
Red Garden	4030	90%	17	2	0	0	0	0	0	19	21	2	0	0.03937				
Conifer Hill	4350	91%	19	0	1	0	0	0	0	20	22	2	0	0.03937				
Twin Sisters	4080	92%	10	1	0	0	0	0	0	11	12	1	0	0.03937				
Lee Hill Rain 2012	4320	92%	10	1	0	0	0	0	0	11	12	1	0	0.03937				
Riverside	4340	92%	20	2	0	0	0	0	0	22	24	2	0	0.03937				
Apple Valley	4490	92%	10	1	0	0	0	0	0	11	12	1	0	0.03937				
Martin Gulch	4040	92%	22	2	0	0	0	0	0	24	26	2	0	0.03937				
Fling's	4220	93%	23	2	0	0	0	0	0	25	27	2	0	0.03937				
Eagle Ridge	4520	93%	13	1	0	0	0	0	0	14	15	1	0	0.03937				
Bear Peak	4070	94%	15	1	0	0	0	0	0	16	17	1	0	0.03937				
Gold Lake	4180	94%	16	1	0	0	0	0	0	17	18	1	0	0.03937				
Big Elk Park	4300	95%	20	1	0	0	0	0	0	21	22	1	0	0.03937				
Taylor Mountain	4260	96%	24	1	0	0	0	0	0	25	26	1	0	0.03937				
Johnny Park	4310	97%	29	1	0	0	0	0	0	30	31	1	0	0.03937				
A2-Brantner Gulch - Precip	100410	100%	3	0	0	0	0	0	0	3	3	0	0	0.039371				
A2-Thorncreek - Precip	100420	100%	6	0	0	0	0	0	0	6	6	0	0	0.039371				
Wx-Blue Mountain	140	100%	14	0	0	0	0	0	0	14	14	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%	4	0	0	0	0	0	0	4	4	0	0	0.03937				
A2-Maple Grove Resv.	1000	100%	19	0	0	0	0	0	0	19	19	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%	7	0	0	0	0	0	0	7	7	0	0	0.03937				
Wx-Marston Lake North	1520	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937				
SPR at Union Ave.	1640	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937				
SPR at Henderson	1660	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937				
Cherry Cr @ Champa	1700	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937				
Wx-Hiwan G.C.	2210	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937				
Choke Cherry Resvr	2320	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937				
Wx-Highlands Ranch WTP	2710	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937				
Wx-Salisbury Park	2730	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937				
Wx-Castle Rock	2750	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937				
Wx-Spring Valley Rd-DougCnty	2930	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937				
Wx-Tomah Rd-DougCnty	2990	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937				
Wx-West Creek WX	3020	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937				
WX-Bingham Lake Park	3030	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937				
Fire Sta 47	3060	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937				
Crescent	4010	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937				
Rio Grande	4020	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937				

Walker Ranch	4050	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
Magnolia	4090	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937
Betasso	4110	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937
Swiss Peaks	4130	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
Logan Mill	4140	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Gold Hill	4150	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
Sunshine	4160	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Pine Brook	4170	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937
Slaughterhouse	4190	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
Lazy Acres	4200	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Golden Age	4230	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Sunset	4240	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937
Geer Canyon	4250	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937
Red Hill	4290	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Justice Center	4360	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937
Winiger Ridge	4530	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937
Boulder Jail	4550	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937
St. Antons	4570	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937
Wx-Ward C-1	4710	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Wx-Sugarloaf	4730	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937
Wx-Louisville Lake	4750	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Shanahan Ridge	4810	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
SBC @ San Souci	4830	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937
SBC@S Boulder Ditch	4840	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937
Whispering Pines	4880	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
Four Mile Creek	5720	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
West Creek	5730	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Trail Creek	5740	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
Stump Bump	5810	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Cedar Mountain	5860	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Hackett Mountain	5880	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Log Jumper	5940	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Wx-A2-WestCreek (Hayman) - Precip	100270	100%	13	0	0	0	0	0	0	13	13	0	1	0.03937
A2-PlumCr at Sedalia - Precip	100290	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
A2-CoalCreek at McCaslin - Precip	100300	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937
Wx-Aurora Reservoir	900	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
		Total Tips	1040	35	8	0	2	0	0	1085	1144	59	2	
Porphory Mtn	4850	94%	29	2	0	0	0	0	0	31	33	2	1	0.01
Fairview Peak	4860	97%	27	1	0	0	0	0	0	28	29	1	0	0.01
Wx-A2-Magnolia WX-Precip	6601	100%	40	0	0	0	0	0	0	40	40	0	0	0.01
Wx-A2-OneRain Weather - Precipitation	100200	90%	62	8	0	0	0	0	0	70	78	8	0	0.01

2017 Monthly Peak Hour ALERT Radio Traffic Summary

