

Memo



Date: March 1, 2017
To: Kevin Stewart
From: Markus Ritsch
Subject: February 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 February 1 through February 28, 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	212,539											234,074
Concentrator	361,187	367,684											361,187
ALERT2	327,977	422,710											327,977
TOTAL	923,238	1,002,933	0	0	0	0	0	0	0	0	0	0	923,238
Conc/Leg	1.54	1.73	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	637,926											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	212,539											234,074
Concentrator	361,187	367,684											361,187
ALERT2	327,977	422,710											327,977
NS5B (Greenhouse)													
Legacy	234,037	211,806											234,037
Concentrator	360,898	364,788											360,898
ALERT2	327,807	419,042											327,807
Diff (NS5a-NS5b)													
Legacy (Digi One)	37	733	0	0	0	0	0	0	0	0	0	0	37
Concentrator (B2010)	289	2,896	0	0	0	0	0	0	0	0	0	0	289
ALERT2 (B2010)	170	3,668	0	0	0	0	0	0	0	0	0	0	170
Comments		GH Network outage on Feb 8											

The reception rates between Diamond Hill and Greenhouse are consistent. 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). A network outage was identified at Greenhouse on February 8, 2017 which caused the Greenhouse server to miss additional reports this month.

The daily ratio of concentrator to legacy reports is shown.

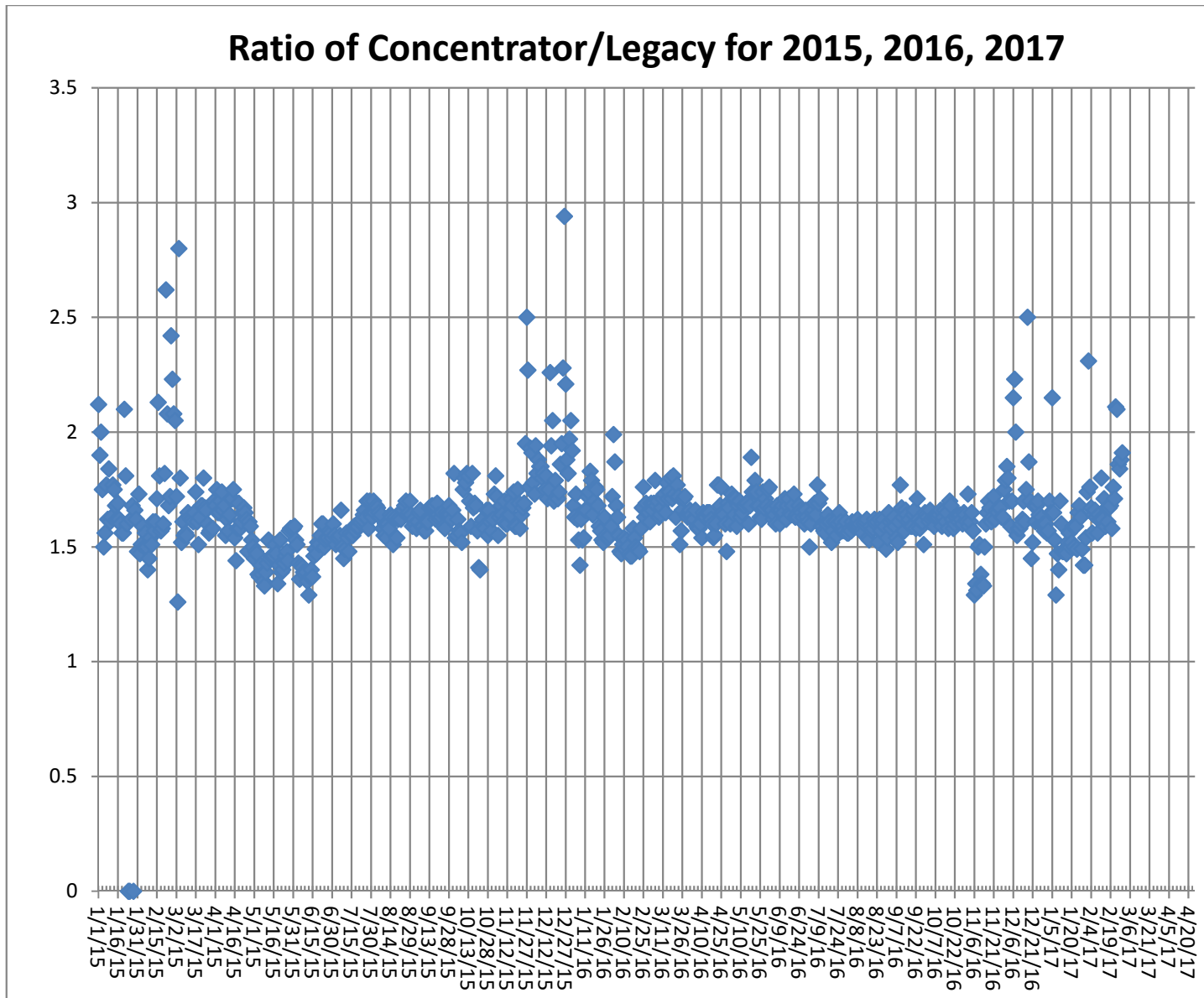


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

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. The ratio seems a bit volatile in February of 2017.

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 672 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
2790	W. Cherry Creek - WX	Poor timer and poor event performance
4100	Filter Plant	Poor timer performance
4330	Hansen Rain	Poor timer and poor event performance
4490	Apple Valley	Poor event performance, high rain total for the month
3050	E/W Trailhead	The rain ID is being stepped on by another transmitter
3040	Russellville Gulch	The rain ID is being stepped on by another transmitter
2810	Pine Cliff Road	This site has many invalid reports, check radio path

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
Feb-2017	45,366	96,629	94,065	88,239	98,411	422,710

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

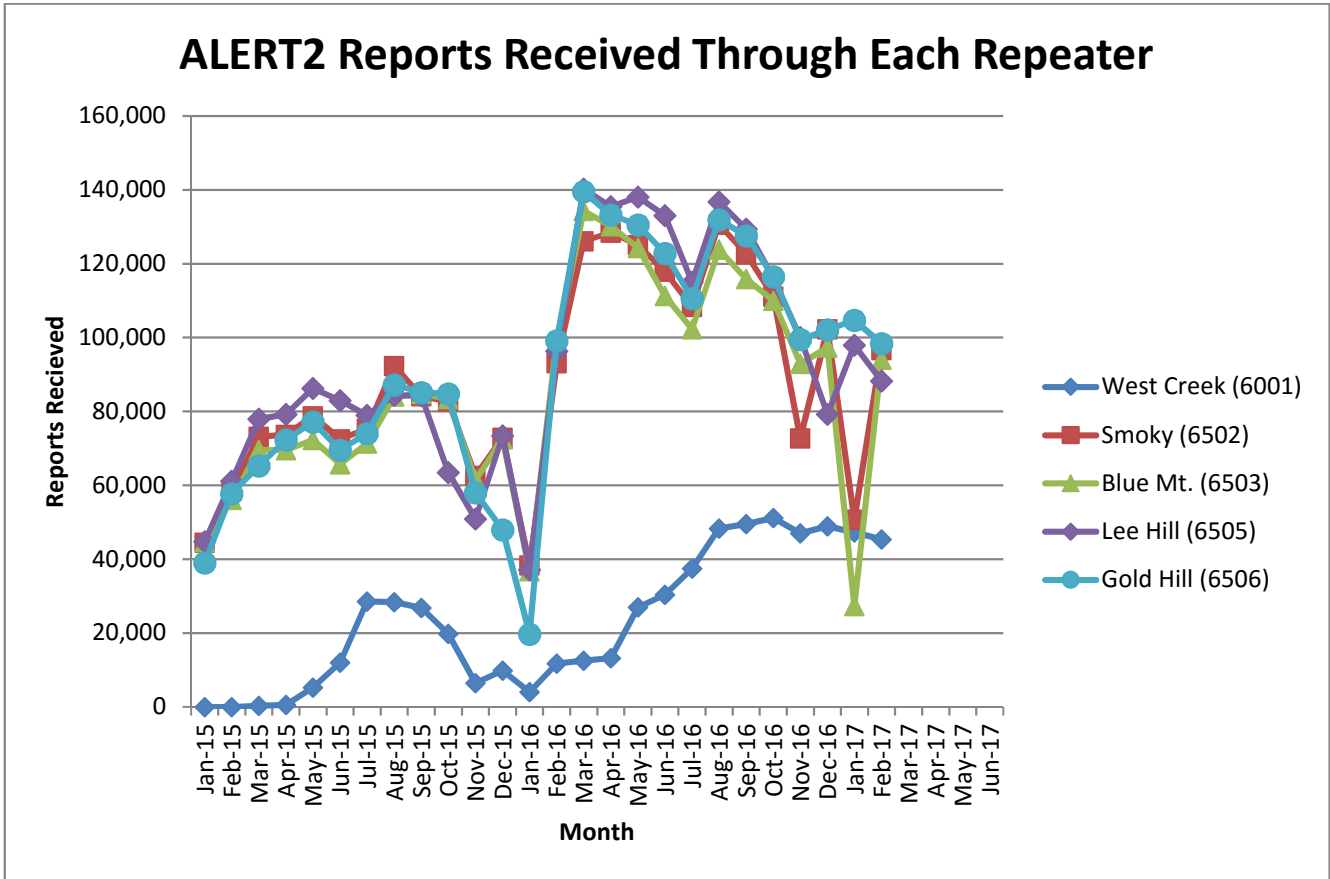


Figure 2. Reports received through each repeater (ALERT2 Only)

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. In February of 2017 all repeaters appear again to be passing an equivalent number of reports.

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	51.39	The average time it took a report from the field to reach the base
Minimum	-23	The minimum time it took for a report to go from the field to the base
Maximum	12,946	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	51.39										
Minimum	-29	-23										
Maximum	286	12,946										
Station with Max Latency												

The negative latencies are observed only from the station West Creek WX (3019). This is a HydroLynx transmitter. It is likely that the clock on this transmitter is drifting badly. WET will service the transmitter in April when access to the site is open.

The large positive latency observed in February of 3 hours and 35 minutes occurred on February 1st at 12:41:00 PM. Several stations had an excessively large latency on February 1st between 9:00 AM and 12:40 PM. This appears to be a system problem at the base station and not a problem at a remote station or a repeater. The NovaStar5 database had a monthly data partition issue on February 1st that was resolved by WET and TriLynx.

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	2790										
5720	4100										
4510	4330										
100260	4040										
4870	4270										
5940	4510										

*- 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	5.84	Only the 1-mm rain sensors were included in the analysis
Median	5	Only the 1-mm rain sensors were included in the analysis
Standard deviation	4.42	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	19.1	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	Several Stations
Maximum total count	28	Apple Valley (4490)
Sensors showing NO rain for the month		
Sensors greater than 3 SD (over reporting)		Apple Valley (4490)

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	5.84											
Ave	6.83	10.09	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
Castle Rock - WX	2750	Maintenance related jump in rain count on February 20, 2017

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 93 percent. A total of 375 incrementing reports were received and a total of 403 reports were expected. The total loss of incrementing reports for the month was approximately 7 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	4330										
4870	750										
1920	2790										
3010	100260										
4510	4270										
4330	4490										

*-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)	330	305	0
Total reports from unknown IDs	844	853	0
Unknown IDs with only a single received report (potential noise)	186	186	0
Total reports from all IDs – RecData Log entire month	367,684	212,539	422,710
Unknown reports as a fraction of total reports	0.23%	0.40%	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	844										

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%	0.23%										

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	
--	--	0, 1, 2	118, 53, 53	
3071	45	1446	11	
3044	42	1443	13	
3047	24	1954	12	
1470	22	1470	22	
1534	16	1534	18	

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	11										
2810-Pine Cliff Rd.	41	32										
3010-Wx-EPC @ 105	6	7										
3050-E/W Trailhead	23	18										
4030-Red Garden	--	10										
4240-Sunset	--	9										

Table 18. Level Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
723-WTG above Conf Pond	--	8										
1483-Third Creek at DIA	--	8										
1523-Marston Lake North	10	8										
1649-SPR at 19th Street	152	--										
2813-Pine Cliff Road	16	12										
3013-EPC@Hwy 105	3	--										
4383-Eldorado Springs	16	2										

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\02-2017\ALL_DATA.mdb

Summarize

First Date in Database	2/1/17 12:00 AM	Total Days	28.0
Last Date in Database	2/28/17 11:59 PM	Total Hours	672.0

Total Records Analyzed 367,684

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	162,053	44.1%	85,266	40.1%	159,718	37.8%
Temperature	58,910	16.0%	31,265	14.7%	76,865	18.2%
Relative Humidity	53,692	14.6%	31,773	14.9%	74,925	17.7%
Barometric Pressure	29,937	8.1%	19,033	9.0%	1,231	0.3%
Battery Voltage	19,414	5.3%	8,415	4.0%	38,921	9.2%
Solar Radiation	9,992	2.7%	9,389	4.4%	0	0.0%
Water Level	7,348	2.0%	6,522	3.1%	23,305	5.5%
Precipitation	5,997	1.6%	4,402	2.1%	19,292	4.6%
Fuel Moisture	5,365	1.5%	4,961	2.3%	0	0.0%
Fuel Temperature	5,365	1.5%	4,949	2.3%	0	0.0%
Soil Moisture	2,668	0.7%	2,292	1.1%	0	0.0%
Hayman Battery	2,174	0.6%	0	0.0%	0	0.0%
Repeater Status Report	1,760	0.5%	1,954	0.9%	0	0.0%
Wind Direction	887	0.2%	1	0.0%	12,232	2.9%
Unknown	844	0.2%	853	0.4%	0	0.0%
ET-Hourly	655	0.2%	658	0.3%	0	0.0%
GPS Lock	219	0.1%	0	0.0%	16,221	3.8%
12Hr Status Report	126	0.0%	111	0.1%	0	0.0%
Water Temp	114	0.0%	92	0.0%	0	0.0%
Repeater Pass List	61	0.0%	501	0.2%	0	0.0%
Not Used	49	0.0%	46	0.0%	0	0.0%
ET-Daily	27	0.0%	28	0.0%	0	0.0%
Solar Power	21	0.0%	21	0.0%	0	0.0%
Handar 585 ALARM Status	4	0.0%	5	0.0%	0	0.0%
ALERT/A2 Testing	2	0.0%	2	0.0%	0	0.0%
Total	367,684	100.0%	212,539	100.0%	422,710	100.0%

Traffic Loading Summary	Concentrator		Legacy		ALERT2	
Alert Reports	367,684		212,539		422,710	
Average Daily Traffic	13,132		7,591		14,576	
Average Hourly Traffic	547		316		607	
Median Hourly Traffic	551	hour beginning	330	hour beginning	635	hour beginning
Peak Hourly Traffic	728	Feb 8, 12:00 PM	436	Feb 6, 11:00 PM	727	Feb 24, 10:00 AM
2nd Max	721	Feb 8, 1:00 PM	429	Feb 8, 11:00 AM	725	Feb 25, 10:00 AM
3rd Max	717	Feb 10, 12:00 PM	424	Feb 10, 12:00 PM	720	Feb 28, 1:00 PM
4th Max	715	Feb 27, 12:00 PM	424	Feb 7, 12:00 AM	715	Feb 24, 1:00 PM
5th Max	715	Feb 27, 1:00 PM	424	Feb 10, 12:00 PM	714	Feb 21, 3:00 AM

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
2790	Wx-W. Cherry Creek	6	18:00	56	11%
2940	Willow Creek - DougCnty	28	12:00	56	50%
4100	Filter Plant	37	17:39	56	66%
4330	Hansen Rain	40	14:32	56	71%
4040	Martin Gulch	45	13:48	56	80%
4270	Cannon Mountain	46	13:54	56	82%
4510	Pinewood Springs	47	12:48	56	84%
4490	Apple Valley	47	13:45	56	84%
100260	Wx-A2-Trumbull (Hayman) - Precip	574		672	85%
3010	WX-EPC at Hwy 105	48	13:31	56	86%
4870	SBC @ SB Road	48	12:48	56	86%
4030	Red Garden	48	12:33	56	86%
4220	Fling's	49	13:33	56	88%
4790	Wx-Button Rock	50	12:48	56	89%
4190	Slaughterhouse	50	12:59	56	89%
4520	Eagle Ridge	51	13:02	56	91%
4350	Conifer Hill	51	12:41	56	91%
4290	Red Hill	51	12:41	56	91%
4060	Lakeshore	51	12:41	56	91%
4530	Winiger Ridge	52	12:27	56	93%
4070	Bear Peak	52	12:12	56	93%
1460	Wx-Urban Farm	53	12:28	56	95%
1440	Wx-Elbert	53	12:14	56	95%
4830	SBC @ San Souci	53	12:26	56	95%
4820	Doudy Draw	53	12:39	56	95%
4340	Riverside	53	12:12	56	95%
4320	Lee Hill Rain 2012	53	12:28	56	95%
4310	Johnny Park	53	12:12	56	95%
4260	Taylor Mountain	53	12:27	56	95%
4240	Sunset	53	12:27	56	95%
4200	Lazy Acres	53	12:31	56	95%
4080	Twin Sisters	53	12:26	56	95%
4710	Wx-Ward C-1	54	12:16	56	96%
1520	Wx-Marston Lake North	54	12:00	56	96%
2710	Wx-Highlands Ranch WTP	54	12:13	56	96%
4770	Wx-Cal-Wood Ranch	54	12:13	56	96%
1570	Wx-Brighton Ditch	54	12:00	56	96%
4880	Whispering Pines	54	12:13	56	96%
4860	Fairview Peak	54	12:00	56	96%
4570	St. Antons	54	11:59	56	96%
4130	Swiss Peaks	54	11:57	56	96%
4110	Betasso	54	12:15	56	96%
4050	Walker Ranch	54	12:10	56	96%
4020	Rio Grande	54	12:11	56	96%
4730	Wx-Sugarloaf	55	12:00	56	98%
2730	Wx-Salisbury Park	55	12:00	56	98%
2210	Wx-Hiwan G.C.	55	12:00	56	98%
2750	Wx-Castle Rock	55	12:00	56	98%
1920	Wx-Brighton	55	12:00	56	98%
140	Wx-Blue Mountain	55	12:00	56	98%
920	Wx-Aurora Town Hall	55	12:00	56	98%
900	Wx-Aurora Reservoir	55	12:00	56	98%
100270	Wx-A2-WestCreek (Hayman) - Precip	660		672	98%
100200	Wx-A2-OneRain Weather - Precipitation	55	12:00	56	98%

1420	Wx-A2-Diamond Hill	55	12:00	56	98%
4840	SBC@S Boulder Ditch	55	11:57	56	98%
4810	Shanahan Ridge	55	11:57	56	98%
4550	Boulder Jail	55	11:57	56	98%
4360	Justice Center	55	11:57	56	98%
4300	Big Elk Park	55	11:57	56	98%
4250	Geer Canyon	55	11:52	56	98%
4180	Gold Lake	55	11:58	56	98%
4170	Pine Brook	55	11:57	56	98%
4160	Sunshine	55	11:58	56	98%
4150	Gold Hill	55	11:58	56	98%
4140	Logan Mill	55	11:58	56	98%
4090	Magnolia	55	11:58	56	98%
4010	Crescent	55	11:58	56	98%
100290	A2-PlumCr at Sedalia - Precip	663		672	99%
6601	Wx-A2-Magnolia WX-Precip	83	8:00	84	99%
100420	A2-Thorncreek - Precip	668		672	99%
100410	A2-Brantner Gulch - Precip	668		672	99%
100300	A2-CoalCreek at McCaslin - Precip	670		672	100%
4850	Porphory Mtn	670		672	100%
2990	Wx-Tomah Rd-DougCnty	56	11:56	56	100%
750	Wx-Quincy Reservoir	56	11:58	56	100%
4750	Wx-Louisville Lake	56	11:58	56	100%
3030	WX-Bingham Lake Park	56	11:20	56	100%
4230	Golden Age	56	11:58	56	100%
3020	Wx-West Creek WX	690		672	103%
2930	Wx-Spring Valley Rd-DougCnty	58	11:20	56	104%
3060	Fire Sta 47	718		672	107%
430	Utah Park	27	11:58	56	48%
520	Jewell Detention	24	13:40	56	43%
530	Fire Station #19	26	11:57	56	46%
540	Parker/Mississippi	26	11:57	56	46%
630	Temple Pond at DTC	2	11:57	56	4%
640	Goldsmith @ Eastman	7	3:00	56	13%
700	Toll Gate @ 6th	53	12:28	56	95%
720	Confluence Pond	24	12:33	56	43%
730	No Name @ Quincy	24	11:58	56	43%
760	Mission Viejo Park	31	11:57	56	55%
800	Sable Ditch @ 18th	13	11:58	56	23%
830	Side Creek Park	31	12:00	56	55%
840	Fire Station 12	35	11:12	56	63%
870	A2-Murphy Creek GC	300		672	45%
940	Aurora Regional Pond	20	12:42	56	36%
950	Piney at Liverpool	24	11:57	56	43%
970	Pump Sta 3	55	12:00	56	98%
1000	A2-Maple Grove Resv.	668		672	99%
1360	Denver Zoo	10	0:20	56	18%
1480	Third Creek at DIA	17	8:34	56	30%
1640	SPR at Union Ave.	55	11:57	56	98%
1660	SPR at Henderson	41	13:17	56	73%
1700	Cherry Cr @ Champa	54	11:45	56	96%
1710	Shop Creek	26	14:46	56	46%
1720	Cherry Cr @ Steele	26	13:00	56	46%
1800	Sand Creek Park	13	11:58	56	23%
2320	Choke Cherry Resvr	52	12:44	56	93%
2330	Morrison	37	17:59	56	66%
2810	Pine Cliff Road	1		56	
2820	Haskins Gulch Conf	23	12:36	56	41%
2890	Spruce Mt - Douglas	27	12:55	56	48%

2900	Russelville Gulch-Douglas	25	11:58	56	45%
2910	East Cherry Cr-Douglas	31	11:34	56	55%
2920	West Cherry Head-Douglas Cnty	30	12:00	56	54%
2950	DC Public Works	28	12:00	56	50%
2960	Indian Creek	22	12:40	56	39%
2970	Rampart Range Rd-Satellite	83	3:42	56	148%
2980	Dakan Rd	33	18:12	56	59%
3050	East/West Trailhead	4	11:58	56	7%
5720	Four Mile Creek	41	16:12	56	73%
5730	West Creek	54	12:13	56	96%
5740	Trail Creek	53	12:28	56	95%
5810	Stump Bump	53	12:28	56	95%
5860	Cedar Mountain	53	12:29	56	95%
5880	Hackett Mountain	52	12:45	56	93%
5900	Horse Creek-Satellite	78	2:32	56	139%
5940	Log Jumper	42	15:36	56	75%
100100	A2-Blackstone Precip	25	11:27	672	4%
100110	A2-ETG @ Hampden Precip	27	11:00	672	4%
100140	A2-Upper Sellers Gulch Precip	219		672	33%
100160	A2-Sand Creek at Colfax Precip	153		672	23%
100230	A2-Havana Pond Precip	157		672	23%

Rain Event Performance																
	Reports Received	Reports Received	375	Analyze Rain Sensors						0	<<show stations with zero rain (1=yes, 0=no)					
	Systemwide Avg	Total Tips	403													
	93.05%	Data Loss	6.95%													
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket		
Hansen Rain	4330	33%	1	1	0	0	0	1	0	3	9	6	0	0.03937		
Wx-Quincy Reservoir	750	40%	1	0	0	1	0	0	0	2	5	3	0	0.03937	Mean	5.84
Wx-W. Cherry Creek	2790	50%	0	1	0	0	0	0	0	1	2	1	0	0.03937	Median	5
Wx-A2-Trumbull (Hayman) - Precip	100260	50%	0	1	0	0	0	0	0	1	2	1	0	0.03937	St. Dev	4.42
Cannon Mountain	4270	67%	1	1	0	0	0	0	0	2	3	1	0	0.03937	Mean plus 3 SD	19.1
Apple Valley	4490	75%	14	7	0	0	0	0	0	21	28	7	0	0.03937	Min	1
Geer Canyon	4250	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	Max	28
Wx-A2-Diamond Hill	1420	80%	3	1	0	0	0	0	0	4	5	1	0	0.03937		
Wx-Aurora Reservoir	900	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937		
Justice Center	4360	83%	9	0	1	0	0	0	0	10	12	2	0	0.03937		
Swiss Peaks	4130	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937		
Red Garden	4030	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937		
SBC @ SB Road	4870	89%	7	1	0	0	0	0	0	8	9	1	0	0.03937		
Slaughterhouse	4190	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937		
Wx-West Creek WX	3020	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Wx-Ward C-1	4710	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937		
Wx-Urban Farm	1460	100%	3	0	0	0	0	0	0	3	3	0	1	0.03937		
Wx-Tomah Rd-DougCnty	2990	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Wx-Sugarloaf	4730	100%	7	0	0	0	0	0	0	7	7	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-Marston Lake North	1520	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Wx-Louisville Lake	4750	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
Wx-Hiwan G.C.	2210	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Wx-Highlands Ranch WTP	2710	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Wx-Elbert	1440	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Wx-Castle Rock	2750	100%	1	0	0	0	0	0	1	1	1	0	0	0.03937		
Wx-Button Rock	4790	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937		
Wx-Blue Mountain	140	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
WX-Bingham Lake Park	3030	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
Wx-Aurora Town Hall	920	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Wx-A2-WestCreek (Hayman) - Precip	100270	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
Winiger Ridge	4530	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
A2-Thorncreek - Precip	100420	100%	4	0	0	0	0	0	0	4	4	0	0	0.039371		
A2-Brantner Gulch - Precip	100410	100%	2	0	0	0	0	0	0	2	2	0	0	0.039371		
A2-CoalCreek at McCaslin - Precip	100300	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
A2-PlumCr at Sedalia - Precip	100290	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937		
Whispering Pines	4880	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		
SBC@S Boulder Ditch	4840	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
SBC @ San Souci	4830	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		
Shanahan Ridge	4810	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
St. Antons	4570	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Boulder Jail	4550	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Eagle Ridge	4520	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Pinewood Springs	4510	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Conifer Hill	4350	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937		
Riverside	4340	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Lee Hill Rain 2012	4320	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Johnny Park	4310	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Big Elk Park	4300	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Red Hill	4290	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		

Taylor Mountain	4260	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937
Sunset	4240	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Golden Age	4230	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Fling's	4220	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Lazy Acres	4200	100%	13	0	0	0	0	0	0	0	13	13	0	0	0.03937
Gold Lake	4180	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Pine Brook	4170	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Sunshine	4160	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Gold Hill	4150	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.03937
Logan Mill	4140	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Betasso	4110	100%	15	0	0	0	0	0	0	0	15	15	0	0	0.03937
Magnolia	4090	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Twin Sisters	4080	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Bear Peak	4070	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.03937
Lakeshore	4060	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Walker Ranch	4050	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937
Martin Gulch	4040	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Rio Grande	4020	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Crescent	4010	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937
		Total Tips	354	18	1	1	0	1	1	375	403	28	1		
Porphory Mtn	4850	93%	13	1	0	0	0	0	0	14	15	1	0	0.01	
Fairview Peak	4860	100%	4	0	0	0	0	0	0	4	4	0	0	0.01	
Wx-A2-Magnolia WX-Precip	6601	100%	26	0	0	0	0	0	0	26	26	0	0	0.01	
Wx-A2-OneRain Weather - Precipitation	100200	92%	11	1	0	0	0	0	0	12	13	1	0	0.01	
A2-Havana Pond Precip	100230	67%	1	1	0	0	0	0	0	2	3	1	0	0.03937	
A2-Sand Creek at Colfax Precip	100160	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
A2-Upper Sellers Gulch Precip	100140	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937	
A2-ETG @ Hampden Precip	100110	67%	1	1	0	0	0	0	0	2	3	1	0	0.03937	
A2-Blackstone Precip	100100	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	
Log Jumper	5940	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937	
Horse Creek-Satellite	5900	33%	0	0	1	0	0	0	0	1	3	2	0	0.03937	
Hackett Mountain	5880	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
Cedar Mountain	5860	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937	
Stump Bump	5810	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
Trail Creek	5740	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937	
West Creek	5730	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937	
Fire Sta 47	3060	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937	
East/West Trailhead	3050	33%	0	0	1	0	0	0	0	1	3	2	0	0.03937	
Dakan Rd	2980	55%	2	3	1	0	0	0	1	6	11	5	0	0.03937	
Rampart Range Rd-Satellite	2970	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
Indian Creek	2960	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937	
DC Public Works	2950	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937	
Willow Creek - DougCnty	2940	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937	
West Cherry Head-Douglas Cnty	2920	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
East Cherry Cr-Douglas	2910	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
Russelville Gulch-Douglas	2900	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937	
Haskins Gulch Conf	2820	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937	
Pine Cliff Road	2810	50%	1	1	1	0	0	0	0	3	6	3	0	0.03937	
Morrison	2330	60%	1	2	0	0	0	0	0	3	5	2	0	0.03937	
Choke Cherry Resvr	2320	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937	
Sand Creek Park	1800	60%	2	0	1	0	0	0	0	3	5	2	0	0.03937	
Cherry Cr @ Steele	1720	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937	
Shop Creek	1710	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937	
Cherry Cr @ Champa	1700	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937	

SPR at Henderson	1660	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
SPR at Union Ave.	1640	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937		
Third Creek at DIA	1480	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
Denver Zoo	1360	75%	2	1	0	0	0	0	0	1	3	4	1	0	0.03937		
A2-Maple Grove Resv.	1000	89%	7	1	0	0	0	0	0	0	8	9	1	0	0.03937		
Pump Sta 3	970	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937		
Piney at Liverpool	950	67%	1	1	0	0	0	0	0	0	2	3	1	0	0.03937		
Aurora Regional Pond	940	67%	3	0	1	0	0	0	0	0	4	6	2	0	0.03937		
A2-Murphy Creek GC	870	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
Fire Station 12	840	58%	5	1	0	0	1	0	0	0	7	12	5	4	0.03937		
Side Creek Park	830	83%	4	1	0	0	0	0	0	0	5	6	1	0	0.03937		
Sable Ditch @ 18th	800	83%	4	1	0	0	0	0	0	0	5	6	1	0	0.03937		
Mission Viejo Park	760	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937		
No Name @ Quincy	730	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937		
Confluence Pond	720	82%	8	0	1	0	0	0	0	0	9	11	2	0	0.03937		
Toll Gate @ 6th	700	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
Goldsmith @ Eastman	640	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937		
Temple Pond at DTC	630	67%	1	1	0	0	0	0	0	0	2	3	1	0	0.03937		
Parker/Mississippi	540	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
Fire Station #19	530	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937		
Jewell Detention	520	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937		
Utah Park	430	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937		

2017 Monthly Peak Hour ALERT Radio Traffic Summary

