Memo

Date: March 19, 2015
To: Kevin Stewart
From: Markus Ritsch
Subject: **February 2015 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, 2015.

II. General System Analysis Summary

In 2015 data will be received at the District 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 through each telemetry channel.

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

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Legacy	216,461	241,285										
Concentrator	366,229	405,210										
ALERT2	172,927	233,617										
TOTAL	**755,617**	**880,112**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Conc+A2	539,156	638,827										
Conc/Leg	1.69	1.68										
DataChron	529,216	564,798										

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
Legacy	216,461	241,285								
Concentrator	366,229	405,210								
ALERT2	172,927	233,617								
NS5B (Greenhouse)										
Legacy	244,232	241,143								
Concentrator	409,951	405,875								
ALERT2	191,784	234,150								
Diff (NS5a-NS5b)										
Legacy (Digi One)	-27,771	142								
Concentrator (B2010)	-43,722	-665								
ALERT2 (B2010)	-18,857	-533								
Comments	Failed hard drive on ns5a									

In February the number of total legacy, concentrator and ALERT2 reports received by ns5a and ns5b is fairly consistent. The daily ratio of total concentrator reports received versus total legacy ALERT reports received is shown (Figure 1).

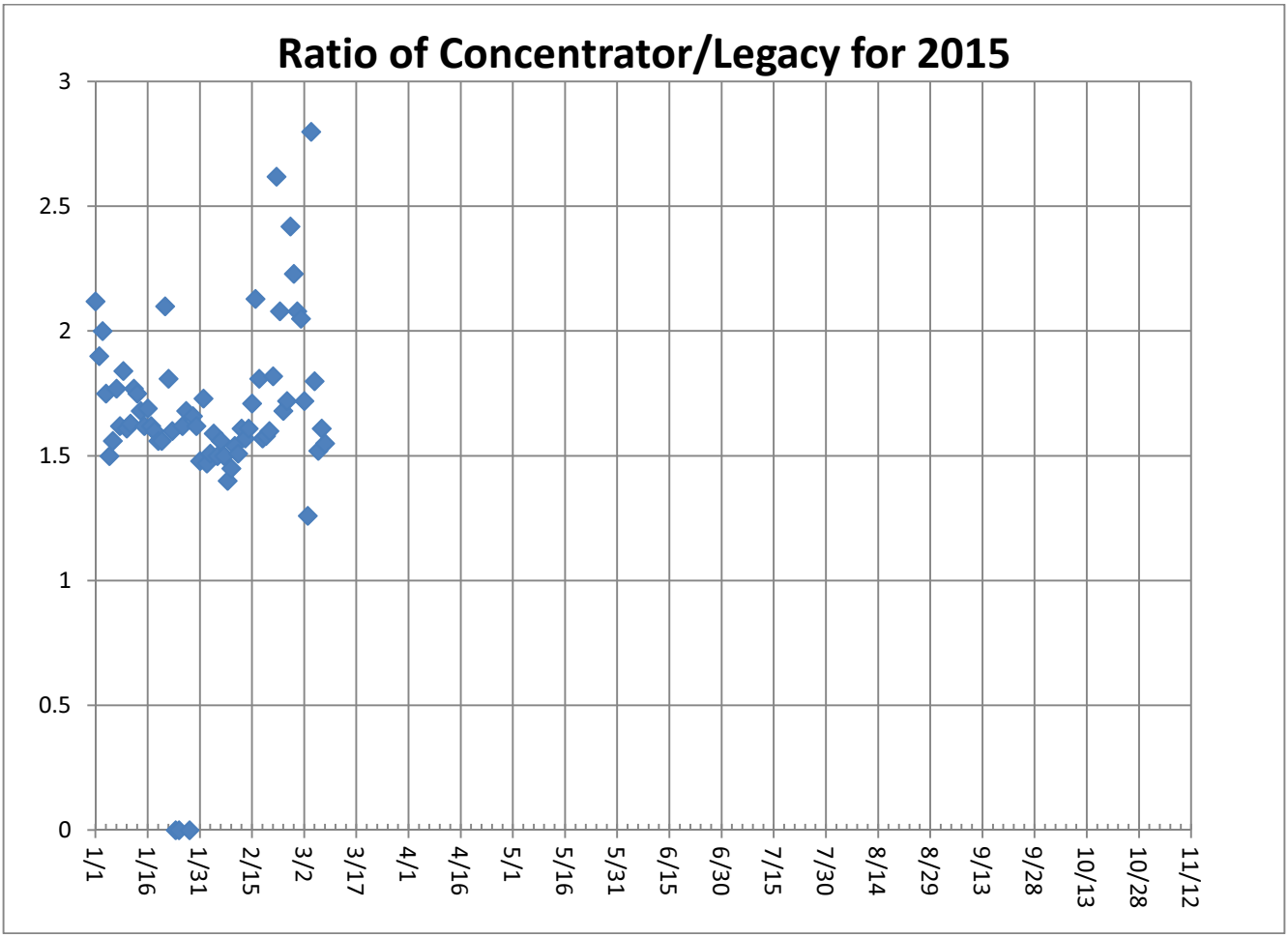


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

Several days in February experienced ratios exceeding 2.0. These are typically very cold days when the legacy feed from the Blue Mountain repeater is impaired which increases the ratio.

A low ratio of 1.26 was experienced on March 3rd.

At 21:45 on March 2nd, the A2 decoder went down when it would not reboot properly after a newly installed upgrade. At 6:39 AM on March 3rd the decoder successfully recovered without outside intervention. The following email was received from OneRain on March 3rd.

Last evening David Van Wie reset the Diamond Hill decoder after attempting to improve the logging capability of the decoder. This logging information is a valuable tool in diagnosing the latency issues we have been seeing. Unfortunately, the decoder did not recover from the reset.

Around 6:40 this morning the decoder recovered. Since that time the unit has been fully operational with no lost data. Our current plan is to leave the equipment in place and continue the path of diagnosing the specific issue, rather than freely replacing equipment.

This Friday we will be performing a site visit at Diamond Hill to research a plan of re-locating all equipment from the roof to the server room. Our goal is to have the system in the server room by the start of the flood season. I will provide plans to Kevin next week for Diamond Hill building approval.

Spare decoder boards are located at OneRain. If the equipment cannot be relocated by April 1, it may be in our best interest to replace the equipment on the roof. By replacing the equipment we will not be able to locate the specific issue and may not solve the problem. However, in the interest of flood season this will by our last resort.

A. Continuous Operation of Base Receiver/Decoder

The ns5 base stations were in continuous operation for the entire month of February. The B2010 ALERT2 decoder was down for a 6 hour period from the evening of March 2nd to the early morning of March 3rd.

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	Comments
2330	Morrison	Poor event performance
4470	Little Narrows	Poor event performance
100167	Sand Creek @ Colfax Stage	Receive Time 2/6/2015 2:59:49 PM Report Time 2/6/2015 5:15:02 AM
100168	Sand Creek @ Colfax Battery	Large A2 latencies from Feb 6 – Feb 19, same as 100167 above
4471, 4472, 4474, 4477	Unknown IDs	Little Narrows (4470)

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).

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		0.909	0.987	0.903	0.971
ETG @ Hampden (10011)	830		--	--	--	--
Murphy Creek (10019)	870		0.997	0.995	0.997	0.994
Maple Grove (10013)	1000		0.981	0.978	0.995	0.989
Lena @ Nolte Pond (10025)	1020		0.996	1.000	0.985	0.966
Newlin Gulch	3070	--	--	--	--	--
Heritage Regional Park	3090		--	--	--	--
Lower Left Hand (10018)	4453		1.000	--	0.978	0.223
Magnolia	6601		0.989	0.986	0.991	0.987
Blackstone**	100100		0.134	0.059	0.044	0.149
Upper Sellers	100140	0.886				
Haystack Road	100150	0.718				
Sand Cr at Colfax	100160		0.889	0.745	0.889	0.912
James Creek	100177		0.223	--	0.988	0.117
S. St. Vrain at Berry Ridge	100210		--	--	0.976	0.475
Arvada/Blunn Reservoir	100220		--	--	--	--
Havana Pond	100237		0.994	0.994	0.989	0.990
Westerly Creek Dam	100240		--	--	--	--

**the APDUID for Blackstone is not incrementing

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) and the distribution of reports by time slot (Table 7). This quantifies repeater loading for the ALERT2 backbone.

Table 6. Concentrator and ALERT2 Reports Received Through Each Repeater

Month	West Creek (6001)	Smoky (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)	Magnolia (6507)	TOTAL
Jan	136,708	109,327	137,273	70,886	84,962	0	539,156
Feb	145,066	126,810	151,256	102,130	113,565	0	638,827

Table 7. Messages Received by Time Slot (Concentrator and A2 Self Reports)

	West Cr. (6001)		Smoky (6502)			Blue Mt. (6503)				Lee Hill (6505)			Gold Hill (6506)			Magnolia (6507)				
Tot	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Feb	44953	2081	61230	7111	460	91118	7794	728	101	16508	1164	87	21639	190	80	98	112	120	105	116
	51875	1235	37128	2122	56	7494	140	16	5	20849	151	7	24801	91	19	8	14	11	13	18
	44104	906	18449	636	65	37967	2040	110	62	61740	2007	285	66785	471	191	215	176	263	304	203
638,827	140,932	4,222	116,807	9,869	581	136,579	9,974	854	168	99,097	3,322	379	113,225	752	290	321	302	394	422	337

The following tables summarize the system-wide latency of ALERT2 self-reports (Table 8 and Table 9). The latency is computed as the difference in seconds between the reception time of an ALERT2 self-report at the base station and the report time stamp issued by the transmitter.

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

Statistical Parameter	Value	Comments
Mean	340	Too large but driven by the large latencies from Sand Creek, Feb 6-19
Minimum	5	
Maximum	35,209	Large latencies were identified for the period Feb 6 through Feb 19 From one transmitter: Sand Creek at Colfax Stage (100167) and battery (100168)

Table 9. Summary of ALERT2 System-Wide Latency (seconds)

Statistical Parameter	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	340										
Minimum	5										
Maximum	35,209										

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 10).

Table 10. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470	4470										
700	2330										
2330	4870										
4240	3010										
3010	1660										
4870	4240										

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

Statistical Parameter	Value	Comments
Mean	24.42	Only the 1-mm rain sensors were included in the analysis
Median	23	Only the 1-mm rain sensors were included in the analysis
Standard deviation	14.88	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	69.06	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	Wx-Aurora Town Hall (920)
Maximum total count	65	SBC @ Sb Road (4870)
Sensors showing **NO** rain for the month		Several
Sensors greater than 3 SD (over reporting)	0	

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 12).

Table 12. 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	35.54
2015	9.88	24.42											

***- 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 13).

Table 13. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
Choke Cherry Reservoir	2320	

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 1,943 incrementing reports were received and a total of 2,027 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 14).

Table 14. Monthly Summary of Sensors with the Worst Performance

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470	2330										
700	4470										
4750	700										
4330	2320										
2790	4330										
4870	4870										

***-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 15).

Table 15. Summary of Unknown IDs

Description	Concentrator	Legacy
Total number of unknown IDs (IDs without a device definition)	266	240
Total reports from unknown IDs	9,137	8977
Unknown IDs with only a single received report (potential noise)	160	165
Total reports from all IDs – RecData Log entire month	405,210	241,285
Unknown reports as a fraction of total reports	2.25%	3.72%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 16) are the total reports received from unknown sensor IDs for each month of the year.

Table 16. 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										

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 17).

Table 17. 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%										

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 18).

Table 18. Reports Received by Unknown IDs

Concentrator		Legacy ALERT		
Unknown ID	**Reports**	**Unknown ID**	**Reports**	**Comment**
4471	1,974	4471	1,965	Unknown ID coming from Little Narrows (4470)
4472	1,942	4472	1,938	Unknown ID coming from Little Narrows (4470)
4474	1,739	4474	1,735	Unknown ID coming from Little Narrows (4470)
4477	1,557	4477	1,552	Unknown ID coming from Little Narrows (4470)
4478	1,374	4478	1,367	Unknown ID coming from Little Narrows (4470)
1430	11	1470	10	
1934	10	1923	10	

V. Sensors with Invalid Reports

The sensors below (Table 19 and Table 20) 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 19. Rain Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunset 4240	na	6										
Bear Creek @ Lowell 1530	5	6										
Pine Cliff Road 2810	4	5										
Wx-Diamond Hill 1420	3	3										
Roslyn 1580	2	0										
Red Garden 4030	2	4										
Wx-Brighton Ditch 1570	2	0										

Table 20. Level Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ferril Lake 1383	666	667										
A2-Lena @ Nolto Pond 1023	na	545										
Little Narrows 4473	33	208										
Powers Park 1503	6	4										
Green Ditch 4593	4	4										
Marston Lake North 1523	na	3										
SPR at Henderson 1663	4	1										
Bear Creek @ Lowell 1533	4	0										

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.

ID	Description	Alarm Description	Date/Time	Threshold (in)	Total Rain (in)
	None this month				

General System Analysis

Database Name	P:\A207-UDFCD-Data-Analysis\2015\02-2015\Novastar_extract_2015Feb.mdb

First Date in Database	1/31/15 11:59 PM	**Total Days**	28.0
Last Date in Database	2/28/15 11:59 PM	**Total Hours**	672.0

Total Records Analyzed 405,210

Records by Group	Concentrator	Percent	Legacy	Percent
Wind Data	169,252	41.8%	92,554	38.4%
Temperature	65,665	16.2%	32,892	13.6%
Relative Humidity	59,254	14.6%	33,781	14.0%
Barometric Pressure	32,842	8.1%	19,699	8.2%
Battery Voltage	18,152	4.5%	9,680	4.0%
Water Level	14,222	3.5%	13,371	5.5%
Solar Radiation	9,920	2.4%	9,139	3.8%
Unknown	9,137	2.3%	8,977	3.7%
Precipitation	6,485	1.6%	5,618	2.3%
Fuel Temperature	5,363	1.3%	4,823	2.0%
Fuel Moisture	5,359	1.3%	4,808	2.0%
Wind Direction	4,013	1.0%	0	0.0%
Soil Moisture	2,630	0.6%	2,153	0.9%
Repeater Status Report	1,883	0.5%	2,386	1.0%
ET-Hourly	661	0.2%	663	0.3%
12Hr Status Report	177	0.0%	162	0.1%
Repeater Pass List	60	0.0%	494	0.2%
Not Used	54	0.0%	51	0.0%
GPS Lock	44	0.0%	0	0.0%
ET-Daily	27	0.0%	28	0.0%
Solar Power	4	0.0%	4	0.0%
ALERT/A2 Testing	3	0.0%	0	0.0%
Handar 585 ALARM Status	3	0.0%	2	0.0%
Total	**405,210**	**100.0%**	**241,285**	**100.0%**

Traffic Loading Summary	Concentrator	Peak Hour	Legacy	Peak Hour
Alert Reports	405,210		241,285	
Average Daily Traffic	13,973		8,617	
Average Hourly Traffic	582		359	
Median Hourly Traffic	587	hour beginning	365	hour beginning
Peak Hourly Traffic	939	Feb 8, 11:00 AM	658	Feb 6, 9:00 AM
2nd Max	927	Feb 6, 9:00 AM	656	Feb 8, 11:00 AM
3rd Max	921	Feb 8, 1:00 PM	649	Feb 8, 12:00 PM
4th Max	919	Feb 8, 12:00 PM	635	Feb 7, 8:00 PM
5th Max	917	Feb 8, 2:00 PM	631	Feb 8, 12:00 AM

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
100100	A2-Blackstone Precip	4	18:00	672	1%
950	Piney at Liverpool	7	11:57	58	12%
940	Aurora Regional Pond	8	11:58	58	14%
700	Toll Gate @ 6th	11	14:00	58	19%
100160	A2-Sand Creek at Colfax Precip	234		672	35%
4470	Little Narrows	26	18:14	58	45%
2330	Morrison	36	15:50	58	62%
4870	SBC @ SB Road	38	13:23	58	66%
3010	WX-EPC at Hwy 105	39	13:05	58	67%
1660	SPR at Henderson	41	15:46	58	71%
4240	Sunset	43	14:25	58	74%
4270	Cannon Mountain	45	14:48	58	78%
4330	Hansen Rain	46	13:32	58	79%
4030	Red Garden	47	13:11	58	81%
2790	Wx-W. Cherry Creek	48	12:52	58	83%
2320	Choke Cherry Resvr	49	12:18	58	84%
4510	Pinewood Springs	49	11:58	58	84%
1520	Wx-Marston Lake North	49	13:37	58	84%
4180	Gold Lake	50	13:00	58	86%
1640	SPR at Union Ave.	50	12:35	58	86%
1440	Wx-Elbert	50	13:01	58	86%
4080	Twin Sisters	51	12:30	58	88%
4790	Wx-Button Rock	51	12:34	58	88%
2730	Wx-Salisbury Park	51	12:32	58	88%
1700	Cherry Cr @ Champa	52	12:15	58	90%
4820	Doudy Draw	52	12:33	58	90%
4220	Fling's	52	12:31	58	90%
1000	A2-Maple Grove Resv.	610	0:00	672	91%
100	A2-Carr Street	612	0:00	672	91%
4490	Apple Valley	53	12:28	58	91%
4300	Big Elk Park	53	11:57	58	91%
4550	Boulder Jail	53	12:14	58	91%
2980	Dakan Rd	53	12:27	58	91%
4230	Golden Age	53	12:12	58	91%
4310	Johnny Park	53	11:58	58	91%
4060	Lakeshore	53	11:58	58	91%
4200	Lazy Acres	53	12:15	58	91%
4320	Lee Hill Rain 2012	53	12:31	58	91%
4290	Red Hill	53	12:46	58	91%
4340	Riverside	53	12:13	58	91%
4570	St. Antons	53	12:14	58	91%
4750	Wx-Louisville Lake	53	12:00	58	91%
4350	Conifer Hill	54	12:15	58	93%
4010	Cresent	54	12:14	58	93%
4520	Eagle Ridge	54	12:00	58	93%
4860	Fairview Peak	54	12:15	58	93%
4100	Filter Plant	54	11:59	58	93%
4250	Geer Canyon	54	12:29	58	93%
200	Leyden Reservoir	54	12:13	58	93%
4040	Martin Gulch	54	12:14	58	93%
4170	Pine Brook	54	12:14	58	93%
4830	SBC @ San Souci	54	12:15	58	93%
4810	Shanahan Ridge	54	12:15	58	93%
4190	Slaughterhouse	54	12:13	58	93%

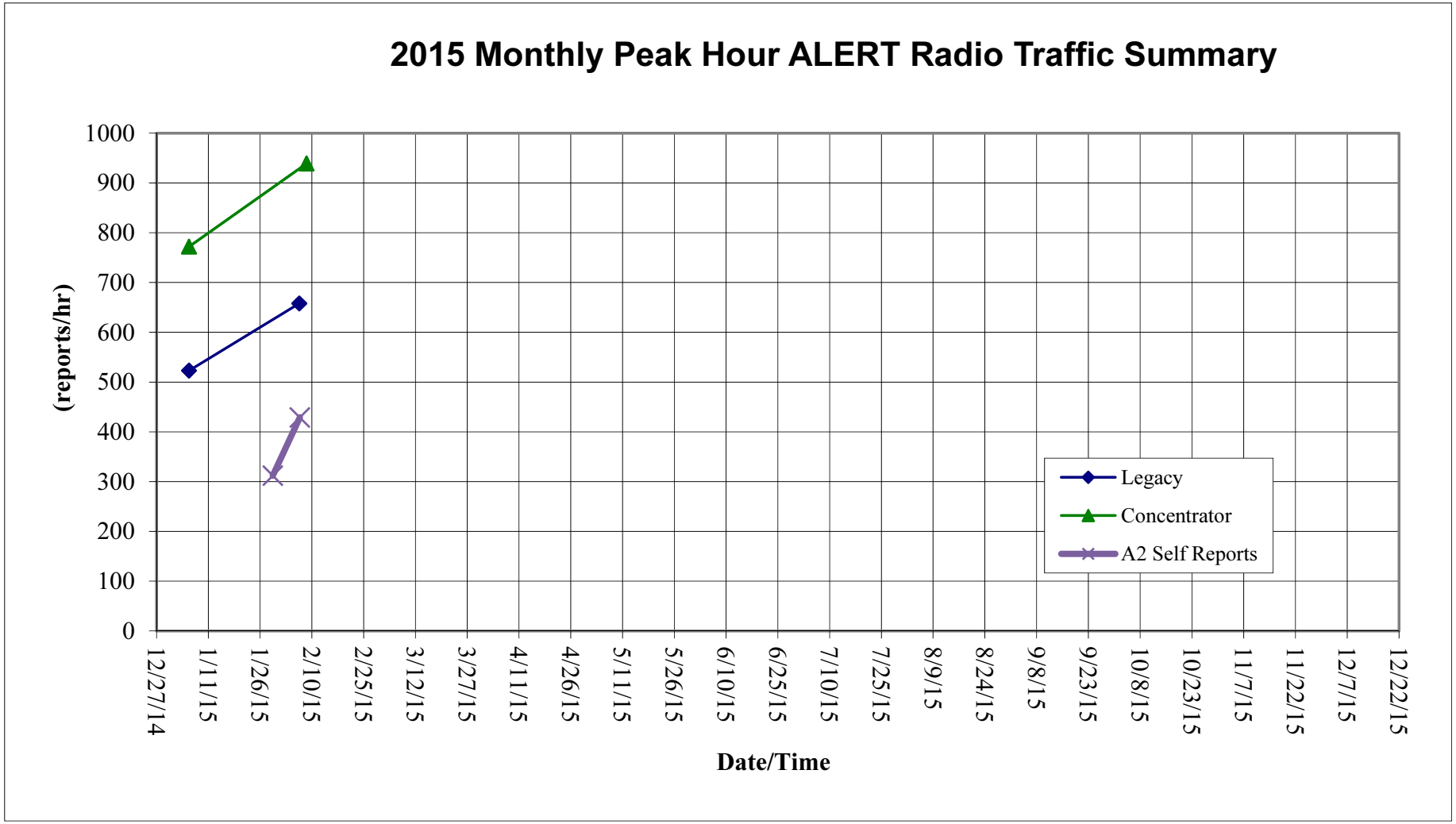
4130	Swiss Peaks	54	11:59	58	93%
4260	Taylor Mountain	54	12:14	58	93%
4050	Walker Ranch	54	12:13	58	93%
3030	WX-Bingham Lake Park	54	12:32	58	93%
1920	Wx-Brighton	54	12:00	58	93%
4770	Wx-Cal-Wood Ranch	54	12:00	58	93%
2750	Wx-Castle Rock	54	12:00	58	93%
2710	Wx-Highlands Ranch WTP	54	12:16	58	93%
2930	Wx-Spring Valley Rd-DougCnty	54	12:00	58	93%
2990	Wx-Tomah Rd-DougCnty	54	12:00	58	93%
1460	Wx-Urban Farm	54	12:16	58	93%
4710	Wx-Ward C-1	54	12:16	58	93%
4070	Bear Peak	55	11:57	58	95%
4150	Gold Hill	55	11:58	58	95%
4360	Justice Center	55	11:57	58	95%
4140	Logan Mill	55	11:58	58	95%
970	Pump Sta 3	55	12:00	58	95%
4020	Rio Grande	55	11:57	58	95%
4840	SBC@S Boulder Ditch	55	11:57	58	95%
4160	Sunshine	55	11:58	58	95%
4880	Whispering Pines	55	11:57	58	95%
4530	Winiger Ridge	55	11:58	58	95%
920	Wx-Aurora Town Hall	55	12:00	58	95%
1570	Wx-Brighton Ditch	55	12:00	58	95%
1420	Wx-Diamond Hill	55	12:00	58	95%
4730	Wx-Sugarloaf	55	12:00	58	95%
3020	Wx-West Creek WX	55	12:00	58	95%
4110	Betasso	56	11:59	58	97%
4090	Magnolia	56	11:58	58	97%
900	Wx-Aurora Reservoir	56	11:59	58	97%
2210	Wx-Hiwan G.C.	56	11:44	58	97%
140	Wx-Blue Mountain	57	11:29	58	98%
6601	A2-Magnolia WX-Precip	83	8:00	84	99%
870	A2-Murphy Creek GC	671	0:00	672	100%
750	Wx-Quincy Reservoir	60	10:58	58	103%

Comment

Rain Event Performance

	Reports Received	Reports Received	1,943		Analyze Rain Sensors				0 <<show stations with zero rain (1-yes, 0-no)								
	Systemwide Avg	Total Tips	2,027														
	95.86%	Data Loss	4.14%														
Description	**Sensor**	**Performance**	**1-tips**	**2-tips**	**3-tips**	**4-tips**	**5-tips**	**6-tips**	**>6-tips**	**Rcv**	**Exp**	**Miss**	**Hold**	**Bucket**		
Morrison	2330	66%	16	4	1	2	0	0	0	23	35	12	0	0.03937		
Little Narrows	4470	74%	18	5	2	0	0	0	0	25	34	9	0	0.03937	Mean	24.42169
Toll Gate @ 6th	700	75%	7	1	1	0	0	0	0	9	12	3	1	0.03937	Median	23
Choke Cherry Resvr	2320	75%	26	1	0	0	0	0	1	27	36	1	0	0.03937	St. Dev	14.87847
Hansen Rain	4330	76%	20	4	2	0	0	0	0	26	34	8	0	0.03937	Mean plus	69.05709
SBC @ SB Road	4870	83%	44	9	1	0	0	0	0	54	65	11	0	0.03937	Min	1
Wx-Button Rock	4790	83%	16	4	0	0	0	0	0	20	24	4	0	0.03937	Max	65
Wx-Aurora Reservoir	900	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937		
SPR at Henderson	1660	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937		
Martin Gulch	4040	89%	37	5	0	0	0	0	0	42	47	5	0	0.03937		
Red Garden	4030	91%	28	1	1	0	0	0	0	30	33	3	0	0.03937		
Pinewood Springs	4510	91%	28	3	0	0	0	0	0	31	34	3	0	0.03937		
Twin Sisters	4080	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937		
A2-Sand Creek at Colfax Precip	100160	92%	11	1	0	0	0	0	0	12	13	1	1	0.03937		
Rio Grande	4020	93%	13	1	0	0	0	0	0	14	15	1	0	0.03937		
Bear Peak	4070	94%	29	2	0	0	0	0	0	31	33	2	0	0.03937		
Wx-Cal-Wood Ranch	4770	95%	17	1	0	0	0	0	0	18	19	1	0	0.03937		
Red Hill	4290	95%	40	2	0	0	0	0	0	42	44	2	0	0.03937		
Fling's	4220	96%	25	1	0	0	0	0	0	26	27	1	0	0.03937		
Shanahan Ridge	4810	96%	53	2	0	0	0	0	0	55	57	2	0	0.03937		
Conifer Hill	4350	97%	30	1	0	0	0	0	0	31	32	1	0	0.03937		
Doudy Draw	4820	97%	35	1	0	0	0	0	0	36	37	1	0	0.03937		
SBC @ San Souci	4830	98%	50	1	0	0	0	0	0	51	52	1	0	0.03937		
Justice Center	4360	98%	52	1	0	0	0	0	0	53	54	1	0	0.03937		
Wx-Blue Mountain	140	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937		
Leyden Reservoir	200	100%	29	0	0	0	0	0	0	29	29	0	0	0.03937		
Wx-Quincy Reservoir	750	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937		
A2-Murphy Creek GC	870	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937		
Wx-Aurora Town Hall	920	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Piney at Liverpool	950	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Pump Sta 3	970	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
A2-Maple Grove Resv.	1000	100%	34	0	0	0	0	0	0	34	34	0	0	0.03937		
Wx-Diamond Hill	1420	100%	51	0	0	0	0	0	0	51	51	0	0	0.03937		
Wx-Elbert	1440	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937		
Wx-Urban Farm	1460	100%	28	0	0	0	0	0	0	28	28	0	0	0.03937		
Wx-Marston Lake North	1520	100%	42	0	0	0	0	0	0	42	42	0	1	0.03937		
SPR at Union Ave.	1640	100%	30	0	0	0	0	0	0	30	30	0	0	0.03937		
Cherry Cr @ Champa	1700	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937		
Wx-Brighton	1920	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Wx-Hiwan G.C.	2210	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937		
Wx-Highlands Ranch WTP	2710	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937		
Wx-Salisbury Park	2730	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937		
Wx-Castle Rock	2750	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937		
Wx-W. Cherry Creek	2790	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Wx-Spring Valley Rd-DougCnty	2930	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
Wx-Tomah Rd-DougCnty	2990	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937		
Wx-West Creek WX	3020	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937		
WX-Bingham Lake Park	3030	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937		
Cresent	4010	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937		
Walker Ranch	4050	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937		
Lakeshore	4060	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937		
Magnolia	4090	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937		
Filter Plant	4100	100%	24	0	0	0	0	0	0	24	24	0	0	0.03937		
Betasso	4110	100%	57	0	0	0	0	0	0	57	57	0	0	0.03937		
Swiss Peaks	4130	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937		
Logan Mill	4140	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937		
Gold Hill	4150	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937		
Sunshine	4160	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937		
Pine Brook	4170	100%	28	0	0	0	0	0	0	28	28	0	0	0.03937		
Gold Lake	4180	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Slaughterhouse	4190	100%	35	0	0	0	0	0	0	35	35	0	0	0.03937		
Lazy Acres	4200	100%	38	0	0	0	0	0	0	38	38	0	0	0.03937		

Golden Age	4230	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		
Sunset	4240	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937		
Geer Canyon	4250	100%	38	0	0	0	0	0	0	38	38	0	0	0.03937		
Taylor Mountain	4260	100%	24	0	0	0	0	0	0	24	24	0	0	0.03937		
Cannon Mountain	4270	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
Big Elk Park	4300	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937		
Johnny Park	4310	100%	44	0	0	0	0	0	0	44	44	0	0	0.03937		
Lee Hill Rain 2012	4320	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937		
Riverside	4340	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937		
Apple Valley	4490	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937		
Eagle Ridge	4520	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937		
Winiger Ridge	4530	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937		
Boulder Jail	4550	100%	41	0	0	0	0	0	0	41	41	0	0	0.03937		
St. Antons	4570	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		
Wx-Ward C-1	4710	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937		
Wx-Sugarloaf	4730	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Wx-Louisville Lake	4750	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937		
SBC@S Boulder Ditch	4840	100%	61	0	0	0	0	0	0	61	61	0	0	0.03937		
Whispering Pines	4880	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937		
A2-Blackstone Precip	100100	100%	2	0	0	0	0	0	1	2	2	0	0	0.03937		
Aurora Regional Pond	940	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
		Total Tips	1879	54	8	2	0	0	2	1943	2027	76	3			
Fairview Peak	4860	96%	22	1	0	0	0	0	0	23	24	1	0	0.01		
WX-EPC at Hwy 105	3010	96%	53	2	0	0	0	0	0	55	57	2	0	0.01		
A2-Magnolia WX-Precip	6601	100%	29	0	0	0	0	0	0	29	29	0	0	0.01		


2015 Monthly Peak Hour ALERT Radio Traffic Summary
(reports/hr)
1000
900
800
700
600
500
400
300
200
100
0
12/27/14
1/11/15
1/26/15
2/10/15
2/25/15
3/12/15
3/27/15
4/11/15
4/26/15
5/11/15
5/26/15
6/10/15
6/25/15
7/10/15
7/25/15
8/9/15
8/24/15
9/8/15
9/23/15
10/8/15
10/23/15
11/7/15
11/22/15
12/7/15
12/22/15
Date/Time
Legacy
Concentrator
A2 Self Reports