Memo

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To: Kevin Stewart and Chad Kudym

From: Markus Ritsch

Subject: **February 2007 ALERT Data Analysis**

I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's Nova Star 4.0 base station (ALERT 2) were analyzed for the period February 1 through February 28, 2007.

II. General System Analysis Summary

A total of 161,869 individual data records were analyzed. Meteorological sensors account for 84 percent, water level sensors 7 percent, and rain sensors 3 percent of the total monthly transmissions.

Ninety-seven percent of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 4,367 reports were flagged as "bad". Of these "bad" reports, 3,523 originated from the wind sensor (ID 2189 and 2187) at Squaw Mountain.

Of interest this month was the reception of 47 invalid data reports from the average wind speed sensor at Aurora Reservoir (ID 905).

The system-wide radio traffic loading this month was 5,781 reports per day with an average hourly loading of 241 reports. The peak hourly traffic loading was 377 reports, which occurred on February 16th between 12:00 PM and 1:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

A total of zero (0) reports were received from the Hayman gages this month. The Hayman gages were winterized toward the end of October, 2006 and they will be activated again in the spring 2007.

The sensors reporting most frequently this month include:

1. Stapleton (ID 1463) with 6,265 reports (this barometric pressure sensor failed and was reported to be malfunctioning by OneRain on February 23, 2007)
2. Salisbury Park (ID 2727) with 3,201 reports,
3. Ward C-1 (ID 4707) with 4,883 reports,
4. Sugarloaf (ID 4727) with 2,867 reports,
5. Stapleton (IDs 1464 and 1466) with 2613, and 2,605 reports respectively.

The reports from the above sensors are distributed evenly throughout the month.

III. Rain Sensor Timer Reporting Summary

The following analysis assumes that each rain sensor has a 12-hour timer reporting interval. System-wide the ALERT 2 base station received approximately 91 percent of the non-incrementing timer reports. The 5 worst-performing rain sensors for the month are summarized (Table 1).

Table 1. Monthly Summary of Sensors with Poor Timer Performance

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
750	1330										
4470	1460										
4560	2330										
4240	4170										
4510	4470										

Roslyn (1330), Stapleton (1460), Morrison (2330), Pine Brook (4170), and Little Narrows (4470)

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.

The non-incrementing count series was manually inspected for those sensors with a timer reporting percentage of less than 80%. A brief description of the results from the manual inspection is provided below.

1. Roslyn (ID 1330)

This sensor had a timer reporting percentage of 7%. Timer reports from this sensor began on 2/27/2007. This sensor was most likely placed into service after being winterized for the entire month. Accurate timer reports were received on 2/28/2007.

2. Stapleton (ID 1460)

This sensor had a timer reporting percentage of 48%. The timer reports received from this sensor are indicative of a 24-hour reporting interval rather than a 12-hour timer reporting interval.

3. Morrison (ID 2330)

This sensor had a timer reporting percentage of 77% with missing timer reports located sporadically throughout the month.

IV. Rain Sensor Event Reporting Summary

A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors that reported for the entire month were analyzed to quantify the District-wide statistical total monthly tip summary (Table 2).

Table 2. February District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	5.40	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	3.50	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	15.90	Several sensors for the month are outside the Mean +/- 3 Std Dev
Minimum total count	1	Several sensors
Maximum total count	15	Blue Mountain (ID 140)

A monthly summary of the District-wide mean total tip/count is presented (Table 3).

Table 3. 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											

The average precipitation experienced district-wide in February was close to that experienced in the same month in 2006.

There were no sensors this month that experienced a change in tip count exceeding the system-wide mean plus three standard deviations.

The rain sensor at the Justice Center experienced 14 tips in February, the second most of any sensor. The Justice Center was the highest reporting rain sensor in November and December of 2006 and in January of 2007.

B. Sensors with a Jump of Six or More in the Sequential Count

No rain sensors experienced a jump in their sequential tip count of more than 6 this month. If there were, the tip count series for these sensors would be manually inspected and explored in the following paragraphs.

C. 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 372 incrementing reports were received and a total of 386 were expected. The total loss of incrementing reports for the month was approximately 3.63 percent. Those sensors with the worst rain event transmission characteristics are summarized (Table 4).

Table 4. Monthly Summary of Sensors with the Most Missed Tips

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2320	1330										
2190	4080										
4710	1640										
4090	4050										
4820	4180										

*Roslyn (1330), Twin Sisters (4080), SPR at Union Ave (1640), Walker Ranch (4050), Gold Lake (4180)

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.

The incrementing count series was manually inspected for those sensors with an event performance of less than 80%. A brief description of the results from the manual inspection is provided below.

1. Roslyn (ID 1330)

This sensor was newly activated on 2/27/2007. Several tips were recorded on the 27th including a jump of 4 counts in the sequential count series. These reports were most likely the result of field work being conducted at the station.

2. Twin Sisters (ID 4080)

Two of 5 tips were missed from this sensor. A visual inspection of the monthly count series for this sensor revealed nothing that would indicate a problem at this station.

3. SPR at Union Ave (ID 1640)

One of 1 of 4 tips was missed from this sensor. A visual inspection of the monthly count series for this sensor revealed nothing that would indicate a problem at this station.

4. Walker Ranch (ID 4050)

One of 4 tips was missed from this sensor. A visual inspection of the monthly count series for this sensor revealed nothing that would indicate a problem at this station.

V. Heavy Radio Traffic Hour Analysis

Beginning in 2007 every hour exceeding 600 messages will be analyzed independently. The heavy hour analysis will attempt to identify rain gage sequences where 2, 3, or more, sequential messages are lost. The loss of 3 or more sequential data reports forms a limit of data degradation that causes a serious problem in the evaluation of alarm threshold conditions to support the flood mitigation needs of emergency responders within the District.

There were no occurrences of hourly traffic exceeding 600 messages this month.

The peak hour of radio traffic loading occurred on 2/16/2007 between 12:00 PM and 1:00 PM when 377 reports were received. The data for this period was examined more closely to characterize the distribution of sensor traffic (Table 5). During this hour the radio traffic was dominated by wind reports.

Table 5. Peak Traffic Hour Sensor Report Distribution

Sensor Group	Reports	Percent
Wind Speed Average & Azimuth	120	31.8%
Wind Gust	52	13.8%
Relative Humidity	49	13.3%
Water Level PT-HSE	50	13.0%
Temperature	29	7.7%
Wind Speed Average	21	5.6%
Wind Direction	15	4.0%
Precipitation	8	2.1%
Battery Voltage HSE	4	1.1%
Solar Radiation	8	2.1%
Battery Voltage Digital	5	1.3%
Water Level Float	6	1.6%
Barometric Pressure	5	1.3%
Fuel Moisture	2	0.5%
Fuel Temperature	2	0.5%
Battery Voltage Analog	0	0%
Soil Moisture	1	0.3%
Total	**377**	**100%**

A summary of the past peak radio traffic hours is presented (Table 6) for the District's 1-mm rain sensors. The peak hour for February is shown. No single incrementing tip reports were lost during this peak hour. The rainfall accumulation totals as tracked by NovaStar for the peak hour were accurate. There were no sensors that under-reported rainfall due to the loss of sequential tip counts.

Table 6. Peak Traffic Hour Rain Reporting Summary – Annual Reporting

Heavy Traffic Period	Traffic Msgs/hr	Rain reports expected	Rain reports received	Loss of reports	Accurate rain totals
2/16/07 12:00 PM-1:00 PM	377	8	8	0.0%	Yes
1/8/07 7:00 AM – 8:00 AM	347	2	2	0.0%	Yes
12/24/06 12:00 PM – 1:00 PM	394	16	16	0.0%	Yes
11/14/06 1:00 PM – 2:00 PM	374	12	12	0.0%	Yes
10/29/06 1:00 AM – 2:00 AM	567	19	19	0.00%	Yes
9/21/06 3:00 AM – 4:00 AM	620	117	114	2.56%	Yes
8/13/06 9:00 PM – 10:00 PM	1,107	346	286	17.34%	Yes

The table above will be used to track the heavy hour radio traffic analysis for each month so that over a period of time a correlation can be developed between peak hour loading and loss of single increment reports.

VI. Unknown Device Analysis – Received Data Log

The ALERT IDs present in the audio signal received by the decoder are compared against a list of "active" device IDs that are defined within NovaStar. Those IDs received by the decoder that are not defined within NovaStar are considered to be "unknown" and may be the result of radio noise or problems with the telemetry systems. The reception of "unknown" device reports for the month is summarized (Table 7).

Table 7. Summary of Unknown IDs

Description	Quantity
Total number of unknown IDs (IDs without a device definition)	85
Total reports received from unknown IDs	1,424
Unknown IDs with only a single received report (potential noise)	64
Unknown IDs with multiple reports	21
Total reports from active "known" IDs	161,869
Unknown reports as a fraction of total active "known" reports	0.88%

The total reports from unknown IDs is small relative to the total reports received for the month from the active sensors defined within NovaStar.

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 including the number of reports received by each are quantified (Table 8).

Table 8. Reports Received by Unknown IDs

Unknown Sensor ID	Number of Reports Received
2754	832
4793	220
4544	62
4365	52
4089	50
4013	48
1645	47
1470	12
761	5
1007	4
4768	4
2222	3
1815	3
4644	3
4643	3
2237	2
764	2
4095	2
4606	2
2239	2
2255	2
2249	1
2254	1
2267	1
2332	1
2334	1
2359	1
2748	1
2766	1
2780	1
2963	1
2329	1
2238	1
2235	1
1925	1
1647	1
1528	1
1501	1
1487	1
1456	1
1418	1
1163	1
910	1
767	1
762	1
428	1
1996	1
4796	1
4091	1
4739	1
4740	1
4742	1
4748	1
4765	1
4775	1

Unknown Sensor ID	Number of Reports Received
4642	1
4786	1
4609	1
4808	1
4823	1
4828	1
4839	1
4862	1
5805	1
5933	1
4776	1
4344	1
169	1
4134	1
5949	1
4147	1
4232	1
4236	1
4256	1
4654	1
4303	1
4031	1
4352	1
4361	1
4378	1
4419	1
4464	1
4472	1
4599	1
4298	1

The “unknown” device reports are analyzed temporally to understand when they were received during the day (Table 9). The goal of this analysis is to determine a pattern of occurrence that may correspond to a source of noise in the system, such as the use of a wireless microphone nearby.

Table 9. Temporal Distribution of Unknown Reports

Hour (AM)	Reports	Hour (PM)	Reports
0:00-12:59	121	12:00-12:59	85
1:00-1:59	54	1:00-1:59	26
2:00-2:59	60	2:00-2:59	33
3:00-3:59	102	3:00-3:59	77
4:00-4:59	64	4:00-4:59	21
5:00-5:59	46	5:00-5:59	24
6:00-6:59	106	6:00-6:59	94
7:00-7:59	52	7:00-7:59	42
8:00-8:59	38	8:00-8:59	36
9:00-9:59	73	9:00-9:59	85
10:00-10:59	28	10:00-10:59	49
11:00-11:59	39	11:00-11:59	69

Unknown reports were received during each hour and are generally distributed evenly throughout the day (Figure 1). The hours between midnight and 7:00 AM experienced slightly more unknown device reports than the remainder of the day.

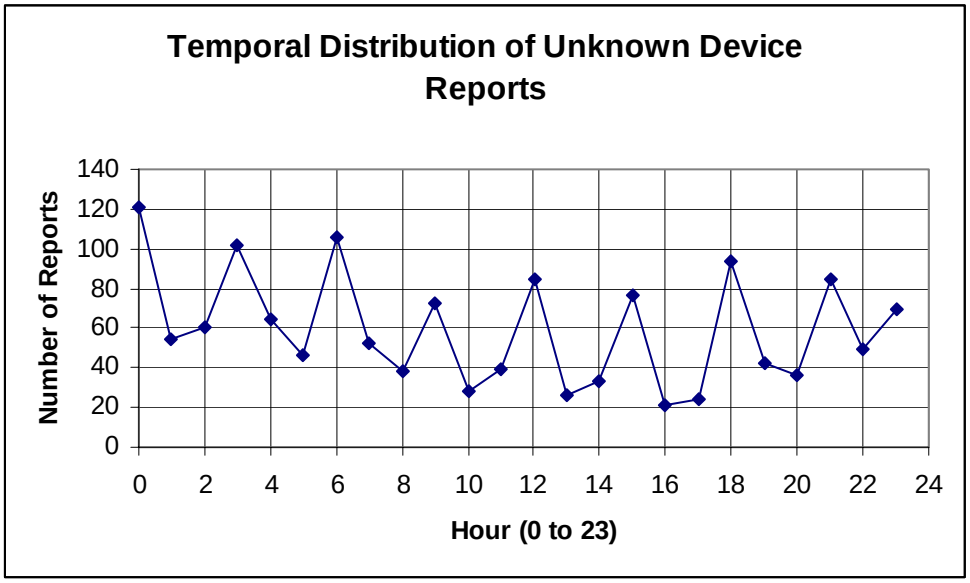

Figure 1. Daily Distribution of Unknown Device Reports

VII. Issues Continued from Previous Month

The following issues were identified last month.

1. Justice Center (ID 4360): This sensor reported the second highest tip count accumulation for the month. This was the third month in a row that this sensor experienced the highest or nearly the highest tip count. The series for this sensor should continue to be watched in upcoming months.
2. Lyons Diversion, (ID 4560): This sensor had a 79% timer reporting percentage in January and improved slightly to 86% in February.
3. Little Narrows (ID 4470): This sensor had 74% timer reporting percentage in January and improved slightly to 82% in February.

VIII. Issues Identified this Month

Further investigation into the following issues is recommended:

1. Aurora Reservoir average wind speed sensor (ID 905) had 47 invalid data reports. The validation criteria on the ALERT2 base should be checked to confirm they are correct.
2. The barometric pressure at Urban Farm (ID 1463) had an excessive number of reports this month at 6,265 reports (over-reporting of sensor was noted by OneRain and fixed by month's end).
3. Little Narrows (ID 4470) had poor timer performance for the second month in a row.
4. The Stapleton rain gage (ID 1460) had a timer reporting interval of 24 hours instead of 12 hours.
5. The following unknown sensor IDs had multiple reports (these may be active ALERT transmitters deployed in the field that are configured incorrectly or these are active IDs that should be defined on the ALERT2 base station):
    a. 2754 (832 reports for the month) - Checked with Chad and it is not clear whether this is an actual sensor deployed within the district.
    b. 4793 (220 reports for the month) - Checked with Chad and it is not clear whether this is an actual sensor deployed within the district.
    c. 4544 (62 reports for the month) - This sensor ID should be confirmed with OneRain.
    d. 4365 (52 reports for the month) - This sensor ID should be confirmed with OneRain.
    e. 4089 (50 reports for the month) - This sensor ID should be confirmed with OneRain.
    f. 4013 (48 reports for the month) - This sensor ID should be confirmed with OneRain.
    g. 1645 (47 reports for the month) - This sensor ID should be confirmed with OneRain.
    h. 1470 (12 reports for the month) - This sensor ID should be confirmed with OneRain.

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2007_Feb\Novastar_extract_2007Feb.mdb

First Date in Database	2/1/07 12:00 AM	**Total Days**	28.0
Last Date in Database	2/28/07 11:59 PM	**Total Hours**	672.0

Total Records Analyzed 161869

Records by Group

Wind Gust	29265	18%
Relative Humidity	25015	15%
Temperature	23067	14%
Wind Speed Average & Azimuth	22199	14%
Wind Direction	14234	9%
Wind Speed Average	10838	7%
Barometric Pressure	8433	5%
Water Level PT-HSE	7997	5%
Precipitation	4438	3%
Solar Radiation	3658	2%
Battery Voltage HSE	2829	2%
Battery Voltage Digital	2382	1%
Water Level Float	1886	1%
Fuel Moisture	1319	1%
Fuel Temperature	1298	1%
Repeater Pass List	556	0%
Battery Voltage Analog	500	0%
Longmont Flow Gage	386	0%
Precipitation - Mean	372	0%
Precipitation - Test	222	0%
Water Level PT	217	0%
Battery	108	0%
12Hr Status Report	105	0%
Soil Moisture	98	0%
Handar 585 ALARM Status	62	0%
Longmont Water Level PT	51	0%
Solar Power	2	0%
Total	161537	

Records by Major Group

Meteorologic Sensors	136709	84%
Water Level Sensors	10537	7%
Sensor Status Transmissions	6436	4%
Rain Sensors	4438	3%
Soil and Fuel Sensors	2715	2%
Total	160835	

Records by Validation Type

Good	0	157502	97%
Questionable	1	4367	3%
	Total	161869	

Sensors With Most Invalid Data

Description	Sensor	Reports
Squaw Mountain	2189	2648
Squaw Mountain	2187	875
Elbert	1439	267
Elbert	1437	113
Aurora Reservoir	905	47

Traffic Loading Summary

Alert Reports	161869	
Average Daily Traffic	5781	
Average Hourly Traffic	241	
Median Hourly Traffic	245	hour beginning
Peak Hourly Traffic	377	2/16/07 12:00 PM

Total Number of Sensors Defined	Total Number of Sensors Reporting
806	300

Reports per Sensor

Description	Sensor	Reports	Fraction of Total
Stapleton	1463	6265	4%
Ward C-1	4707	4883	3%
Salisbury Park	2727	3201	2%
Sugarloaf	4727	2867	2%
Squaw Mountain	2189	2648	2%
Stapleton	1464	2613	2%
Quincy Reservoir	747	2611	2%
Stapleton	1466	2605	2%
Marston Lake North	1521	2537	2%
Stapleton	1465	2530	2%
Stapleton	1467	2514	2%
Squaw Mountain	2187	2504	2%
Elbert	1439	2487	2%
Castle Rock	2744	2389	1%

Rain Timer Performance

Analyze Rain Sensors

			systemwide average (days) 0.5201		Systemwide Average 91%
Rain Sensors	**Description**	**Received Reports**	**Average Timer Interval**	**Expected Reports**	**Performance**
1330	Roslyn	4	12:00	56.00	7%
1460	Stapleton	27	23:35	56.00	48%
2330	Morrison	43	15:50	56.00	77%
4170	Pine Brook	45	14:37	56.00	80%
4470	Little Narrows	46	13:21	56.00	82%
1810	Sand Creek at mouth	47	13:05	56.00	84%
4860	Fairview Peak	47	13:27	56.00	84%
1640	SPR at Union Ave.	48	13:21	56.00	86%
4560	Lyons Diversion NSV	48	13:31	56.00	86%
4730	Sugarloaf	48	13:49	56.00	86%
1000	Maple Grove Resv.	49	12:46	56.00	88%
4010	Cresent	49	13:36	56.00	88%
4240	Sunset	49	13:29	56.00	88%
4830	SBC @ San Souci	49	13:03	56.00	88%
1440	Elbert	50	13:15	56.00	89%
1480	Third Creek at DIA	50	12:45	56.00	89%
4060	Lakeshore	50	13:16	56.00	89%
4150	Gold Hill	50	12:30	56.00	89%
4510	Pinewood Springs	50	13:19	56.00	89%
4570	St. Antons	50	12:47	56.00	89%
4710	Ward C-1	50	13:05	56.00	89%
700	Toll Gate @ 6th	51	12:45	56.00	91%
2820	Haskins Gulch Conf	51	12:47	56.00	91%
4050	Walker Ranch	51	12:57	56.00	91%
4090	Magnolia	51	12:57	56.00	91%
4270	Cannon Mountain	51	12:57	56.00	91%
4340	Riverside	51	12:43	56.00	91%
4810	Shanahan Ridge	51	12:29	56.00	91%
1660	SPR at Henderson	52	12:14	56.00	93%
2190	Squaw Mountain	52	12:28	56.00	93%
2730	Salisbury Park	52	12:43	56.00	93%
4020	Rio Grande	52	12:42	56.00	93%
4030	Red Garden	52	12:32	56.00	93%
4220	Fling's	52	12:13	56.00	93%
4230	Golden Age	52	12:41	56.00	93%
4250	Geer Canyon	52	12:43	56.00	93%
4260	Taylor Mountain	52	12:42	56.00	93%
4490	Apple Valley	52	12:42	56.00	93%
4530	Winiger Ridge	52	12:28	56.00	93%
4820	Doudy Draw	52	12:44	56.00	93%
4840	SBC@S Boulder Ditch	52	12:28	56.00	93%
140	Blue Mountain	53	12:29	56.00	95%
900	Aurora Reservoir	53	12:28	56.00	95%
2210	Hiwan G.C.	53	12:28	56.00	95%
2750	Castle Rock	53	12:14	56.00	95%
4040	Martin Gulch	53	12:29	56.00	95%
4080	Twin Sisters	53	12:26	56.00	95%
4100	Filter Plant	53	12:29	56.00	95%
4130	Swiss Peaks	53	12:15	56.00	95%
4140	Logan Mill	53	12:12	56.00	95%
4160	Sunshine	53	12:13	56.00	95%
4200	Lazy Acres	53	12:14	56.00	95%
4330	Indian Ruins	53	12:12	56.00	95%
4350	Conifer Hill	53	12:12	56.00	95%
1420	Diamond Hill	54	12:00	56.00	96%
1540	Sanderson at Xavier	54	12:12	56.00	96%
1700	Cherry Cr @ Champa	54	12:13	56.00	96%
1920	Brighton	54	12:13	56.00	96%
2220	Evergreen Lake	54	12:11	56.00	96%
2710	Highlands Ranch WTP	54	12:00	56.00	96%
4110	Betasso	54	12:14	56.00	96%
4180	Gold Lake	54	12:12	56.00	96%
4190	Slaughterhouse	54	12:12	56.00	96%
4290	Red Hill	54	12:28	56.00	96%
4300	Big Elk Park	54	12:12	56.00	96%
4520	Eagle Ridge	54	12:14	56.00	96%
4750	Louisville Lake	54	12:00	56.00	96%
4790	Button Rock	54	12:00	56.00	96%
4850	Porphory Mtn	54	12:14	56.00	96%
740	Smoky Hill	55	11:59	56.00	98%
750	Quincy Reservoir	55	12:00	56.00	98%
1520	Marston Lake North	55	12:00	56.00	98%
4070	Bear Peak	55	11:58	56.00	98%
4360	Justice Center	55	11:57	56.00	98%
4770	Cal-Wood Ranch	55	12:00	56.00	98%
4310	Johnny Park	56	11:57	56.00	100%

Rain Event Performance

Analyze Rain Sensors

	Reports Received	372	
Systemwide Avg	Total Tips	386	
96%	Data Loss	3.63%	

Rain Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Recvd	Expect	Miss	Hold-off	Bucket
1330	50%	2	0	0	1	0	0	0	3	6	3	0	0.0393701
4080	60%	1	2	0	0	0	0	0	3	5	2	0	0.0393701
1640	75%	2	1	0	0	0	0	0	3	4	1	0	0.0393701
4050	75%	2	1	0	0	0	0	0	3	4	1	0	0.0393701
4180	80%	3	1	0	0	0	0	0	4	5	1	0	0.0393701
2320	83%	4	1	0	0	0	0	0	5	6	1	0	0.0393701
4570	83%	4	1	0	0	0	0	0	5	6	1	0	0.0393701
1420	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701
4840	88%	6	1	0	0	0	0	0	7	8	1	0	0.0393701
4530	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701
4360	93%	12	1	0	0	0	0	0	13	14	1	0	0.0393701
140	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
700	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
740	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
750	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
900	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393699
1000	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701
1440	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
1460	100%	6	0	0	0	0	0	0	6	6	0	1	0.0393701
1480	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
1520	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
1540	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
1660	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
1700	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
1810	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
1920	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2190	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
2210	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2330	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
2710	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
2730	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
2750	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
2820	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
4010	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
4020	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
4030	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
4040	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
4060	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4070	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
4090	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
4100	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4110	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
4130	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
4140	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
4150	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
4160	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
4170	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
4190	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
4200	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4220	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4230	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
4240	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
4250	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
4260	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4270	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
4290	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
4300	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4310	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
4330	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4340	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4350	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4470	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
4490	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4510	100%	13	0	0	0	0	0	0	13	13	0	0	0.0393701
4520	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
4710	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4730	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
4750	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
4770	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
4790	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
4810	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701
4820	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
4830	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
	Total Tips	360	11	0	1	0	0	0	372	386	14		

Sensor ID	Tips	Outliers Removed
140	15	15
700	5	5
740	4	4
750	6	6
140	3	3
700	3	3
740	1	1
750	1	1
900	1	1
1000	12	12
1330	6	6
1420	7	7
1440	1	1
1460	6	6
1480	1	1
1520	3	3
1540	5	5
1640	4	4
1660	1	1
1700	1	1
1810	4	4
1920	1	1
2190	2	2
2210	1	1
2320	6	6
2330	9	9
2710	5	5
2730	1	1
2750	3	3
2820	10	10
4010	4	4
4020	2	2
4030	8	8
4040	9	9
4050	4	4
4060	6	6
4070	7	7
4080	5	5
4090	2	2
4100	6	6
4110	9	9
4130	8	8
4140	8	8
4150	11	11
4160	7	7
4170	5	5
4180	5	5
4190	8	8
4200	6	6
4220	6	6
4230	1	1
4240	1	1
4250	10	10
4260	3	3
4270	2	2
4290	11	11
4300	3	3
4310	8	8
4330	3	3
4340	3	3
4350	3	3
4360	14	14
4470	7	7
4490	3	3
4510	13	13
4520	3	3
4530	10	10
4570	6	6
4710	6	6
4730	1	1
4750	6	6
4770	4	4
4790	4	4
4810	12	12
4820	10	10
4830	7	7
4840	8	8

Compute Statistics

Bucket Tip Data Analysis

Mean	5.402597
Median	5
Std Deviation	3.499097
Mean + 3 st dev	15.89989
Mean - 3 st dev	-5.094693
Min	1
Max	15

Radio Traffic Plot