Memo

Water & Earth Technologies, Inc.
Water Resources and Environmental Consulting

Date: October 2, 2008

To: Kevin Stewart and Chad Kudym

From: Markus Ritsch

Subject: **September 2008 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 September 1 through September 31, 2008.

II. General System Analysis Summary

A total of 328,613 data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 60 percent, water level sensors 8 percent, and rain sensors 4 percent of the total monthly records.

More than ninety-nine percent (99.80%) of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 664 reports were flagged as "bad". Of these "bad" reports, 121 originated from Third Creek at DIA (ID 1484) and 54 originated from Quincy Reservoir (ID 755).

The system-wide radio traffic loading was 10,954 reports per day with an average hourly loading of 456 reports. The peak hourly traffic loading was 1,212 reports, which occurred on September 11, between 8:00 PM and 9:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 1,591 reports were received from the Hayman rain sensors this month. These reports make up less than 1% of the total reports for 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 89 percent of the non-incrementing timer reports. The worst performing rain sensors for the month are summarized (Table 1).

Table 1. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2190	1660	1350	1710	1600	1600	1600	4130	1540			
140	2190	110	540	540	110	1660	4560	1700			
4150	140	2190	1600	1710	950	4140	4240	740			
4060	4170	1370	1350	4080	1710	1350	4570	1360			
4470	4150	620	710	4060	540	1710	1710	1660			
4530	4530	840	4330	4150	4530	4530	4080	1480			

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.

Sensor ID 1460 has a 24-hour timer reporting interval and is not included in the timer reporting analysis.

Sensor ID 1810 has an 18-hour timer reporting interval and this site has shown poor timer performance in August of only 51% and in September of only 70%.

IV. Rain Sensor Event Reporting Summary

A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors (excluding Hayman sensors) were analyzed to quantify the District-wide statistical total monthly tip summary (Table 2).

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

Statistical Parameter	Value	Comments
Mean	37.54	Only the 1-mm rain sensors were included in the analysis
Median	37	Only the 1-mm rain sensors were included in the analysis
Standard deviation	9.71	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	66.66	Only the 1-mm rain sensors were included in the analysis
Minimum total count	6	Kinney Peak (ID 2280)
Maximum total count	100	Expo Park (ID 420)

The highest reporting rain sensor this month was Expo Park (ID 420) with 100 tips. This sensor is influenced by irrigation sprinklers.

Other than Expo Park, two other sensor, Powers Park (ID 1500) and Temple Pond at DTC (ID 630) reported more than the system-wide mean plus 3 standard deviations. Both Powers Park and Temple Pond are influenced by irrigation sprinklers.

B. Monthly Average Tip/Count Summary

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	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				

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

Several sensors had a jump in sequential count of more than six (Table 4). These large jumps are investigated below.

Table 4. Sensors with a Jump of More than 6 in Sequential Count

Sensor Description	Sensor ID	Comment
West Woods	120	This sensor experienced a large jump in count on September 11 between 7:47 PM and 9:09 PM during a large storm.
Denver West	1010	This sensor experienced a large jump in count on September 11 between 7:45 PM and 9:08 PM during a large storm.
Murphy Creek Golf Course	870	This sensor experienced a large jump in count on September 11 between 8:19 AM September 13 at 8:19 AM. The two received reports were timer reports. No incrementing reports were received during this period.

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 86 percent. A total of 4,756 incrementing reports were received and a total of 5,519 were expected. The total loss of incrementing reports for the month was approximately 14 percent. Those sensors with the worst rain event transmission performance characteristics are summarized (Table 5).

Table 5. Monthly Summary of Sensors with the Most Missed Tips

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1640	4520	2930	1710	1600	1600	1660	1600	870			
2190	4820	540	1600	2320	2750	4820	1100	1350			
750	4530	2730	540	4150	2710	4080	1660	4090			
4570	4470	2210	700	1710	310	2340	870	1050			
2990	4810	110	110	4710	4090	2330	1710	2370			
--	700	1350	840	1350	4170	4060	410	120			

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 data series for those sensors with an event performance value of less than 68 % are manually inspected.

a. Murphy Creek Golf Club (ID 870)

This sensor recorded data for the entire month. Only timer reports were received from this station from September 1 through September 14, 2008. It looks like the site was inspected during a maintenance visit on September 15 at around 2:000 PM. A number of incrementing test reports were received on September 15 and the station reported only timer reports for the remainder of the month.

b. Chatfield COE (ID 1350)

This sensor recorded data for the entire month. A large number of incrementing tip reports were lost on September 11, 2008 during a large storm in the evening between 7:00 PM and 10:20 PM.

V. Heavy Radio Traffic Analysis

Periods exceeding 700 messages per hour are analyzed independently in an attempt to identify rain tip sequences where 3 or more, sequential messages are lost.

A. The Heaviest Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month include:

Peak Traffic Periods	Reports/hour	Hour Beginning
Peak Hourly Traffic	1,212	9/11/08 8:00 PM
2nd Max	1,060	9/11/08 11:00 PM
3rd Max	1,059	9/11/08 7:00 PM
4th Max	949	9/11/08 9:00 PM
5th Max	945	9/11/08 12:00 AM

B. September 11, 2008

The heaviest traffic period occurred on September 11th. The distribution of hourly traffic around the peak hour is summarized:

- September 11 from 6:00 PM to 7:00 PM (572 reports)
- September 11 from 7:00 PM to 8:00 PM (1,059 reports)
- September 11 from 8:00 PM to 9:00 PM (1,212 reports)
- September 11 from 9:00 PM to 10:00 PM (949 reports)
- September 11 from 10:00 PM to 11:00 PM (802 reports)
- September 11 from 11:00 PM to 12:00 AM (1,060 reports)
- September 12 from 12:00 AM to 1:00 AM (945 reports)
- September 12 from 1:00 AM to 2:00 AM (733 reports)

Incrementing rain records from the 1-mm gages for the heavy radio traffic period were examined to characterize the loss of sequential incrementing tip transmissions (Table 6). During the heavy traffic period, a total of 2,550 reports were expected and only 2,068 were received yielding a loss of approximately **18.90%** of the incrementing transmissions.

Table 6. Peak Traffic Analysis - Loss of Incrementing Tip Reports

	Occurrences of lost sequential tip reports during period			
Heavy Traffic Period (Sep 11-12, 2008)	**Loss of 3 sequential tips**	**Loss of 4 sequential tips**	**Loss of 5 sequential tips**	**Loss of 6 or more sequential tips**
6:00 PM to 2:00 AM	12	3	1	2

September 11th, 2008 from 6:00 PM to 2:00 AM on September 12th represents a critical period due to the fact that only 80% of the incrementing rain reports were received on the ALERT2 base station.

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 system. 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)	186
Total reports from unknown IDs	1,019
Unknown IDs with only a single received report (potential noise)	138
Total reports from all IDs – RecData Log entire month	272,033
Unknown reports as a fraction of total reports	0.37%

The total number of reports from unknown sensors is very small relative to the total reports received for the month.

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 8).

Table 8. Reports Received by Unknown IDs

Sensor ID	Reports
8102	271
8101	237
8100	236
2725	12
2726	10
4549	8
1311	8
4093	7
1663	6
1661	6
2736	6
1657	5
4094	4
4858	4
3008	3
4607	3
4083	3
4091	3
4092	3
2239	3
1317	3
1314	3
2254	3

The “unknown” device reports are analyzed temporally to understand when they are 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
0:00-00:59	77	12:00-12:59	71
1:00-1:59	30	1:00-1:59	39
2:00-2:59	17	2:00-2:59	16
3:00-3:59	80	3:00-3:59	80
4:00-4:59	25	4:00-4:59	38
5:00-5:59	3	5:00-5:59	5
6:00-6:59	76	6:00-6:59	71
7:00-7:59	38	7:00-7:59	38
8:00-8:59	38	8:00-8:59	9
9:00-9:59	92	9:00-9:59	68
10:00-10:59	46	10:00-10:59	44
11:00-11:59	7	11:00-11:59	11

A large number of timer reports were received on a three-hour interval from sensors 8100, 8101, and 8102. These reporting interval is 1:00, 4:00, 7:00 and 10:00.

VII. Issues Identified this Month

Sensors with a large number of invalid reports:

Sensor ID	Count of Invalid Reports	Description	Group
1484	121	Third Creek at DIA	Water Level PT-HSE
755	54	Quincy Reservoir	Battery Voltage Analog
2744	32	Castle Rock	Wind Gust
4774	31	Cal-Wood Ranch	Barometric Pressure
2191	25	Squaw Mountain	Relative Humidity
2724	25	Salisbury Park	Wind Gust
2704	22	Highlands Ranch WTP	Wind Gust
4744	19	Louisville Lake	Wind Gust
2732	19	Salisbury Park	Temperature
4724	17	Sugarloaf	Wind Gust
1103	14	Louisville Rec Ctr	Water Level PT
4704	12	Ward C-1	Wind Gust
503	12	Havana Park	Water Level PT-HSE
4764	11	Cal-Wood Ranch	Wind Gust
1914	11	Brighton	Wind Gust
5900	11	Hayman	Hayman Precipitation
4423	10	Bridge	Water Level PT-HSE
903	10	Aurora Reservoir	Barometric Pressure

Sensors reporting frequently (over reporting):

Sensor ID	Reports	Group	Description
749	4953	Wind Gust	Quincy Reservoir
2747	3049	Wind Speed Average & Azimuth	Castle Rock
2188	2856	Wind Direction	Squaw Mountain
141	2855	Relative Humidity	Blue Mountain
144	2853	Fuel Temperature	Blue Mountain
137	2852	Wind Speed Average	Blue Mountain
143	2849	Fuel Moisture	Blue Mountain
138	2844	Wind Direction	Blue Mountain
752	2841	Temperature	Quincy Reservoir
139	2840	Wind Gust	Blue Mountain
751	2839	Relative Humidity	Quincy Reservoir
754	2835	Barometric Pressure	Quincy Reservoir
908	2832	Solar Radiation	Aurora Reservoir
2192	2830	Temperature	Squaw Mountain
2191	2828	Relative Humidity	Squaw Mountain
755	2823	Battery Voltage Analog	Quincy Reservoir
2187	2808	Wind Speed Average	Squaw Mountain
1439	2804	Wind Gust	Elbert

Sensors reporting infrequently (under reporting):

Sensor ID	Reports	Group	Description
704	2	Battery Voltage Analog	Toll Gate @ 6th
4433	2	Water Level PT-HSE	Rowena
1113	3	Water Level PT	Gunbarrel
1545	4	Battery	Sanderson at Xavier
1540	8	Precipitation	Sanderson at Xavier
654	11	Water Level PT-HSE	Iliff Pond
953	12	Water Level PT	Piney at Liverpool
723	12	Water Level PT-HSE	WTG above Conf Pond
978	20	Battery	Pump Sta 3
1468	30	Battery Voltage Digital	Stapleton
1403	31	Water Level PT-HSE	Upper Sloan Det.
603	32	Water Level PT-HSE	Harvard Gulch Park
863	32	Water Level PT-HSE	Sand Cr at Colfax
970	38	Precipitation	Pump Sta 3
844	39	Battery Voltage Digital	Fire Station 12
803	39	Water Level PT-HSE	Sable Ditch @ 18th

Poor timer reporting:

The following sensors reported for the entire month and showed poor timer performance.

Sensor ID	Description	Performance
1540	Sanderson at Xavier	10%
1700	Cherry Cr @ Champa	42%
740	Smoky Hill	65%
1360	Denver Zoo	68%
1660	SPR at Henderson	68%
1810	Sand Creek at mouth	70%
1480	Third Creek at DIA	73%
150	Nott Creek	75%
2750	Castle Rock	75%
870	Murphy Creek GC	77%

Poor event reporting:

The following sensors reported for the entire month and showed poor event performance.

Rain Sensor	Performance
870	10%
1350	63%
4090	68%
1050	69%
2370	69%
120	70%

Low rain total:

Rain Sensor	Tips
2280	6
2750	18

High rain total:

Rain Sensor	Tips
420	100
1500	72
630	68

Irrigation sprinklers influence all.

Large Jump in Sequential Count (bit flip errors/contention loss/transmitter problems):

Sensor Description	Sensor ID	Comment
West Woods	120	This sensor experienced a large jump in count on September 11 between 7:47 PM and 9:09 PM during a large storm.
Denver West	1010	This sensor experienced a large jump in count on September 11 between 7:45 PM and 9:08 PM during a large storm.
Murphy Creek Golf Course	870	This sensor experienced a large jump in count on September 11 between 8:19 AM September 13 at 8:19 AM. The two received reports were timer reports. No incrementing reports were received during this period.

Reports from "Unknown Sensors":

The following table shows the "unknown" sensor IDs and the number of reports received for the month.

Sensor ID	Reports
8102	271
8101	237
8100	236
2725	12
2726	10
4549	8
1311	8
4093	7
1663	6
1661	6
2736	6
1657	5
4094	4
4858	4
3008	3
4607	3
4083	3
4091	3
4092	3
2239	3
1317	3

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2008_Sep/Novastar_extract_2008Sep.mdb

First Date in Database	9/1/08 12:00 AM	**Total Days**	30.0
Last Date in Database	9/30/08 11:59 PM	**Total Hours**	720.0

Total Records Analyzed 328613

Records by Group

None-ALERT-ID	57067	17%
Wind Gust	42484	13%
Temperature	41226	13%
Relative Humidity	41218	13%
Water Level PT-HSE	20783	6%
Wind Direction	19464	6%
Barometric Pressure	18263	6%
Wind Speed Average	15318	5%
Precipitation	13424	4%
Wind Speed Average & Azimuth	11719	4%
Solar Radiation	8279	3%
Battery Voltage HSE	7047	2%
Fuel Moisture	3565	1%
Fuel Temperature	3559	1%
Water Level Float	3449	1%
Battery Voltage Analog	3346	1%
Battery Voltage Digital	3248	1%
Soil Moisture	2586	1%
Water Level PT	1981	1%
Precipitation - Mean	1835	1%
Hayman Precipitation	1591	0%
Repeater Pass List	594	0%
Repeater Status Report	463	0%
12Hr Status Report	332	0%
Precipitation - Test	234	0%
Battery	173	0%
Battery Voltage	120	0%
Longmont Flow Gage	100	0%
Handar 585 ALARM Status	58	0%
Longmont Water Level PT	49	0%
Solar Power	1	0%
Total	323576	

Records by Major Group

Meteorologic Sensors	197971	60%
Water Level Sensors	26362	8%
Sensor Status Transmissions	15089	5%
Rain Sensors	13424	4%
Soil and Fuel Sensors	9710	3%
Total	262556	

Records by Validation Type

Good	0	327949	99.80%
Questionable	1	664	0.20%
	Total	328613	

Sensors With Most Invalid Data

Description	Sensor	Reports
Third Creek at DIA	1484	121
Quincy Reservoir	755	54
Castle Rock	2744	32
Cal-Wood Ranch	4774	31
Squaw Mountain	2191	25

Traffic Loading Summary

Alert Reports	328613	
Average Daily Traffic	10954	
Average Hourly Traffic	456	
Median Hourly Traffic	448	hour beginning
Peak Hourly Traffic	1212	9/11/08 8:00 PM
2nd Max	1060	9/11/08 11:00 PM
3rd Max	1059	9/11/08 7:00 PM
4th Max	949	9/11/08 9:00 PM
5th Max	945	9/12/08 12:00 AM

Rain Timer Performance

Analyze Rain Sensors

			systemwide average (days)		
			0.5274		89%
Sensor	**Description**	**Rcvd**	**Interval**	**Exp**	**Performance**
1540	Sanderson at Xavier	6	11:57	60.00	10%
1700	Cherry Cr @ Champa	25	12:37	60.00	42%
740	Smoky Hill	39	11:03	60.00	65%
1360	Denver Zoo	41	12:40	60.00	68%
1660	SPR at Henderson	41	15:31	60.00	68%
1810	Sand Creek at mouth	28	18:00	40.00	70%
1480	Third Creek at DIA	44	12:00	60.00	73%
150	Nott Creek	45	12:34	60.00	75%
2750	Castle Rock	45	12:17	60.00	75%
870	Murphy Creek GC	46	13:42	60.00	77%
1110	Gunbarrel	48	13:38	60.00	80%
1370	West Metro FS13	48	13:36	60.00	80%
4710	Ward C-1	48	12:36	60.00	80%
4820	Doudy Draw	48	14:39	60.00	80%
1020	Lena @ Nolte Pond	49	14:14	60.00	82%
2250	Rosedale	49	13:54	60.00	82%
4140	Logan Mill	49	13:23	60.00	82%
4510	Pinewood Springs	49	13:54	60.00	82%
4560	Lyons Diversion NSV	49	13:59	60.00	82%
110	Ralston Reservoir	50	14:05	60.00	83%
120	West Woods	50	14:07	60.00	83%
4130	Swiss Peaks	50	13:59	60.00	83%
220	Upper Leyden	51	13:36	60.00	85%
310	Guy Hill Ranch	51	13:15	60.00	85%
540	Parker/Mississippi	51	13:15	60.00	85%
600	Harvard Gulch Park	51	13:14	60.00	85%
760	Mission Viejo Park	51	11:57	60.00	85%
1100	Louisville Rec Ctr	51	13:21	60.00	85%
2370	Red Rocks Park	51	13:35	60.00	85%
2840	Sulphur Gulch	51	13:29	60.00	85%
4080	Twin Sisters	51	13:38	60.00	85%
4180	Gold Lake	51	13:26	60.00	85%
4240	Sunset	51	13:08	60.00	85%
4470	Little Narrows	51	12:46	60.00	85%
4520	Eagle Ridge	51	14:00	60.00	85%
4790	Button Rock	51	13:40	60.00	85%
4810	Shanahan Ridge	51	13:54	60.00	85%
100	Carr Street	52	13:00	60.00	87%
830	Side Creek Park	52	13:28	60.00	87%
1520	Marston Lake North	52	12:45	60.00	87%
1600	Englewood Dam	52	13:27	60.00	87%
4010	Cresent	52	13:16	60.00	87%
4220	Fling's	52	12:48	60.00	87%
4570	St. Antons	52	13:57	60.00	87%
4770	Cal-Wood Ranch	52	13:20	60.00	87%
140	Blue Mountain	53	13:21	60.00	88%
630	Temple Pond at DTC	53	11:57	60.00	88%
1300	Hidden Lake	53	13:11	60.00	88%
4090	Magnolia	53	13:03	60.00	88%
4190	Slaughterhouse	53	12:30	60.00	88%
4230	Golden Age	53	13:19	60.00	88%
4340	Riverside	53	12:30	60.00	88%
4530	Winiger Ridge	53	13:01	60.00	88%
4730	Sugarloaf	53	12:49	60.00	88%
4750	Louisville Lake	53	12:49	60.00	88%
300	Van Bibber Park	54	12:56	60.00	90%
520	Jewell Detention	54	13:02	60.00	90%

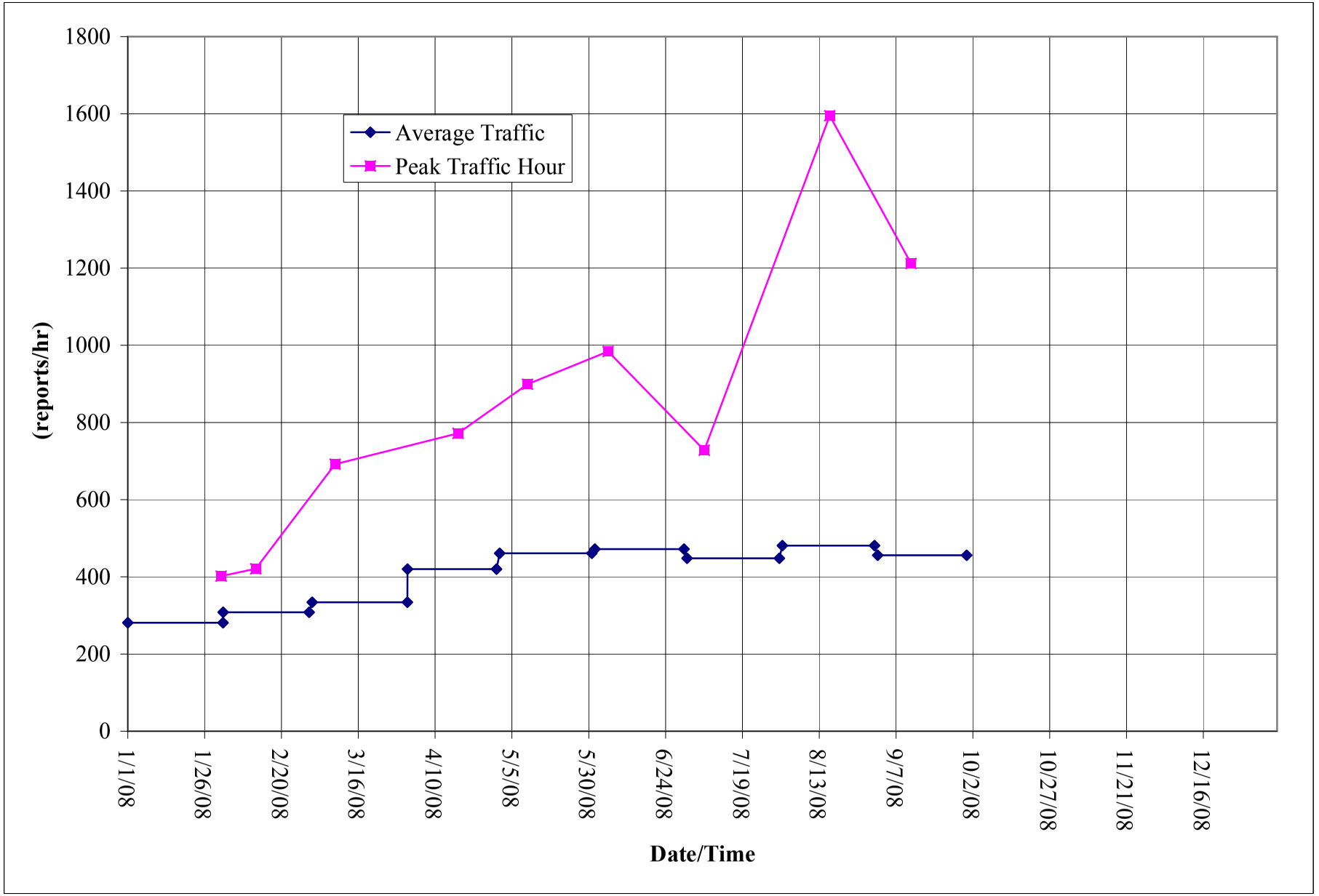
610	Harvard @ Jackson	54	12:41	60.00	90%
810	Granby Ditch @ 6th	54	13:11	60.00	90%
920	Aurora Town Hall Wx	54	12:16	60.00	90%
1000	Maple Grove Resv.	54	13:14	60.00	90%
1010	Denver West	54	12:41	60.00	90%
1040	Lena @ U.S. Hwy 6	54	12:43	60.00	90%
1060	Heritage Square	54	13:14	60.00	90%
1350	Chatfield COE	54	12:28	60.00	90%
1550	Lakewood CC	54	13:12	60.00	90%
1710	Shop Creek	54	12:44	60.00	90%
2260	Brook Forest	54	13:01	60.00	90%
2270	Cub Cr below Blue	54	12:29	60.00	90%
2310	Genesee Village	54	13:00	60.00	90%
2340	El Rancho	54	12:41	60.00	90%
2820	Haskins Gulch Conf	54	12:58	60.00	90%
2930	Spring Valley Rd - DougCnty	54	13:12	60.00	90%
4040	Martin Gulch	54	12:57	60.00	90%
4060	Lakeshore	54	12:59	60.00	90%
4100	Filter Plant	54	13:17	60.00	90%
4170	Pine Brook	54	13:16	60.00	90%
4200	Lazy Acres	54	12:45	60.00	90%
130	Simms Street	55	12:51	60.00	92%
200	Leyden Reservoir	55	12:56	60.00	92%
640	Goldsmith at Eastman	55	12:56	60.00	92%
840	Fire Station 12	55	12:29	60.00	92%
1050	Jeffco Fairgrounds	55	12:27	60.00	92%
1340	Sanderson at Xavier	55	12:28	60.00	92%
2810	Pine Cliff Road	55	12:42	60.00	92%
2850	Cherry Cr bl Bayou Glch	55	12:39	60.00	92%
4270	Cannon Mountain	55	12:12	60.00	92%
4360	Justice Center	55	12:28	60.00	92%
4490	Apple Valley	55	11:58	60.00	92%
4830	SBC @ San Souci	55	12:43	60.00	92%
320	Sports Complex	56	12:41	60.00	93%
330	Van Bibber @ Hwy 93	56	12:55	60.00	93%
440	Fire Station #7	56	12:12	60.00	93%
800	Sable Ditch @ 18th	56	12:12	60.00	93%
820	ETG @ Buckley	56	12:39	60.00	93%
850	Flying J	56	12:21	60.00	93%
1610	Holly Dam	56	12:50	60.00	93%
1900	Niver Detention	56	12:26	60.00	93%
2280	Kinney Peak	56	12:55	60.00	93%
4020	Rio Grande	56	12:12	60.00	93%
4030	Red Garden	56	12:25	60.00	93%
4070	Bear Peak	56	12:42	60.00	93%
4110	Betasso	56	12:29	60.00	93%
4150	Gold Hill	56	12:46	60.00	93%
4160	Sunshine	56	12:12	60.00	93%
4250	Geer Canyon	56	12:27	60.00	93%
4260	Taylor Mountain	56	12:27	60.00	93%
4350	Conifer Hill	56	12:13	60.00	93%
410	Kelly Dam	57	11:58	60.00	95%
500	Havana Park	57	12:27	60.00	95%
530	Fire Station #19	57	12:24	60.00	95%
620	Quincy/Highline	57	12:11	60.00	95%
650	Iliff Pond	57	12:38	60.00	95%
700	Toll Gate @ 6th	57	12:27	60.00	95%
1330	Roslyn	57	12:28	60.00	95%
1500	Powers Park	57	12:17	60.00	95%
1570	Brighton Ditch Wx	57	12:00	60.00	95%
2190	Squaw Mountain	57	12:14	60.00	95%
2230	Bear Cr below Cub	57	12:12	60.00	95%

2240	Cold Sprg Glch conf	57	12:39	60.00	95%
2360	Indian Hills	57	12:26	60.00	95%
2710	Highlands Ranch WTP	57	12:27	60.00	95%
2940	Willow Creek - DougCnty	57	12:27	60.00	95%
4050	Walker Ranch	57	12:26	60.00	95%
4290	Red Hill	57	12:12	60.00	95%
4300	Big Elk Park	57	12:28	60.00	95%
4310	Johnny Park	57	12:13	60.00	95%
4840	SBC@S Boulder Ditch	57	12:13	60.00	95%
420	Expo Park	58	11:57	60.00	97%
720	Confluence Pond	58	12:12	60.00	97%
950	Piney at Liverpool	58	12:11	60.00	97%
1030	NREL/S. Table Mtn.	58	12:11	60.00	97%
1310	LDC at 64th	58	12:11	60.00	97%
1420	Diamond Hill	58	12:00	60.00	97%
1440	Elbert	58	12:14	60.00	97%
1460	Stapleton	29	23:59	30.00	97%
1530	Bear Creek @ Lowell	58	11:57	60.00	97%
1630	SPR at Dartmouth	58	12:02	60.00	97%
1720	Cherry Cr @ Steele	58	11:57	60.00	97%
1920	Brighton	58	12:00	60.00	97%
2210	Hiwan G.C.	58	12:13	60.00	97%
2220	Evergreen Lake	58	12:10	60.00	97%
2330	Morrison	58	12:24	60.00	97%
2350	Idledale	58	12:11	60.00	97%
710	Horseshoe Park Drop	59	11:57	60.00	98%
750	Quincy Reservoir	59	12:11	60.00	98%
860	Sand Cr at Colfax	118	6:03	120.00	98%
940	Sampson Gulch	59	11:57	60.00	98%
1320	SPR at 3rd Ave	59	11:57	60.00	98%
1620	Slaughterhouse Glch	59	11:58	60.00	98%
2730	Salisbury Park	59	12:00	60.00	98%
2920	West Cherry Head-Douglas Cnty	59	12:00	60.00	98%
2990	Tomah Rd-Douglas Cnty	59	12:00	60.00	98%
730	No Name @ Quincy	60	11:57	60.00	100%
900	Aurora Reservoir	60	11:49	60.00	100%
4550	Boulder Jail	63	10:48	60.00	105%
4850	Porphory Mtn	53	12:34	60.00	88%
4860	Fairview Peak	51	13:34	60.00	85%
5720	Hayman	54	12:45	60.00	90%
5730	Hayman	57	12:00	60.00	95%
5740	Hayman	51	12:51	60.00	85%
5760	Hayman	55	12:43	60.00	92%
5770	Hayman	51	12:31	60.00	85%
5780	Hayman	24	22:48	30.00	80%
5790	Hayman	56	12:14	60.00	93%
5800	Hayman	30	15:21	60.00	50%
5810	Hayman	53	13:04	60.00	88%
5820	Hayman	57	12:30	60.00	95%
5830	Hayman	55	12:45	60.00	92%
5860	Hayman	54	12:32	60.00	90%
5880	Hayman	57	12:00	60.00	95%
5900	Hayman	49	13:20	60.00	82%
5930	Hayman	101	7:05	103.00	98%
5940	Hayman	57	12:27	60.00	95%
5960	Hayman	44	13:53	60.00	73%

Rain Event Performance

		Reports Received	4756		Analyze Rain Sensors								
	Systemwide Avg	Total Tips	5519										
	86%	Data Loss	13.82%										
n Sensor	**Performance**	**1-tips**	**2-tips**	**3-tips**	**4-tips**	**5-tips**	**6-tips**	**>6-tips**	**Rcvd**	**Exp**	**Miss**	**Hold**	**Bucket**
870	10%	1	1	1	0	0	0	2	3	29	3	0	0.0393701
1350	63%	11	4	0	2	0	0	0	17	27	10	0	0.0393701
4090	68%	21	4	2	0	0	1	0	28	41	13	0	0.0393701
1050	69%	15	5	1	1	0	0	0	22	32	10	0	0.0393701
2370	69%	15	1	4	0	0	0	0	20	29	9	0	0.0393701
120	70%	23	2	1	0	0	0	1	26	37	4	0	0.0393701
2310	72%	20	3	2	1	0	0	0	26	36	10	0	0.0393701
4570	72%	26	4	3	1	0	0	0	34	47	13	0	0.0393701
1010	73%	22	2	0	0	0	0	1	24	33	2	0	0.0393701
1320	74%	19	4	1	1	0	0	0	25	34	9	0	0.0393701
2270	75%	21	3	3	0	0	0	0	27	36	9	0	0.0393701
1520	75%	19	4	0	0	1	0	0	24	32	8	0	0.0393701
2750	75%	16	0	1	0	1	0	0	18	24	6	0	0.0393701
110	76%	22	4	1	1	0	0	0	28	37	9	0	0.0393701
300	76%	17	8	0	0	0	0	0	25	33	8	0	0.0393701
600	76%	19	4	2	0	0	0	0	25	33	8	0	0.0393701
4470	76%	25	4	3	0	0	0	0	32	42	10	0	0.0393701
1920	77%	20	6	1	0	0	0	0	27	35	8	0	0.0393701
4360	77%	28	4	0	2	0	0	0	34	44	10	0	0.0393701
1440	77%	18	5	1	0	0	0	0	24	31	7	0	0.0393701
1360	78%	21	6	1	0	0	0	0	28	36	8	0	0.0393701
4140	78%	25	5	2	0	0	0	0	32	41	9	0	0.0393701
2810	78%	20	3	2	0	0	0	0	25	32	7	0	0.0393701
1330	78%	22	6	1	0	0	0	0	29	37	8	0	0.0393701
1340	78%	23	5	0	1	0	0	0	29	37	8	0	0.0393701
1810	79%	20	5	1	0	0	0	0	26	33	7	0	0.0393701
4040	80%	27	3	1	1	0	0	0	32	40	8	0	0.0393701
920	80%	21	7	0	0	0	0	0	28	35	7	0	0.0393701
2820	80%	16	3	1	0	0	0	0	20	25	5	0	0.0393701
100	81%	21	3	0	1	0	0	0	25	31	6	0	0.0393701
310	81%	19	6	0	0	0	0	0	25	31	6	0	0.0393701
2350	81%	19	6	0	0	0	0	0	25	31	6	0	0.0393701
4510	81%	31	5	2	0	0	0	0	38	47	9	0	0.0393701
4170	81%	23	7	0	0	0	0	0	30	37	7	0	0.0393701
1480	81%	18	3	1	0	0	0	0	22	27	5	0	0.0393701
1110	82%	25	5	1	0	0	0	0	31	38	7	0	0.0393701
4220	82%	34	4	1	1	0	0	0	40	49	9	0	0.0393701
1000	82%	24	0	3	0	0	0	0	27	33	6	0	0.0393701
1040	82%	22	4	1	0	0	0	0	27	33	6	0	0.0393701
1530	82%	25	7	0	0	0	0	0	32	39	7	0	0.0393701
4060	82%	25	7	0	0	0	0	0	32	39	7	0	0.0393701
4130	83%	30	8	0	0	0	0	0	38	46	8	0	0.0393701
1600	83%	20	3	1	0	0	0	0	24	29	5	0	0.0393701
2360	83%	19	5	0	0	0	0	0	24	29	5	0	0.0393701
1060	83%	24	4	1	0	0	0	0	29	35	6	0	0.0393701
4010	83%	29	3	2	0	0	0	0	34	41	7	0	0.0393701
4080	83%	29	5	1	0	0	0	0	35	42	7	0	0.0393701
530	83%	24	6	0	0	0	0	0	30	36	6	0	0.0393701
540	83%	25	4	1	0	0	0	0	30	36	6	0	0.0393701
2840	83%	16	4	0	0	0	0	0	20	24	4	0	0.0393701
4810	84%	35	4	2	0	0	0	0	41	49	8	0	0.0393701
610	84%	26	4	1	0	0	0	0	31	37	6	0	0.0393701
1460	84%	25	6	0	0	0	0	0	31	37	6	0	0.0393701
4730	84%	31	5	1	0	0	0	0	37	44	7	0	0.0393701
650	84%	28	3	0	1	0	0	0	32	38	6	0	0.0393701
1370	84%	22	5	0	0	0	0	0	27	32	5	0	0.0393701
4240	84%	32	5	1	0	0	0	0	38	45	7	0	0.0393701
520	85%	28	4	1	0	0	0	0	33	39	6	0	0.0393701
2850	85%	18	4	0	0	0	0	0	22	26	4	0	0.0393701
320	85%	24	3	1	0	0	0	0	28	33	5	0	0.0393701
1030	85%	25	1	2	0	0	0	0	28	33	5	0	0.0393701
1700	85%	25	2	0	1	0	0	0	28	33	5	0	0.0393701
4790	85%	30	2	2	0	0	0	0	34	40	6	0	0.0393701
4150	86%	36	5	1	0	0	0	0	42	49	7	0	0.0393701
2330	86%	31	4	1	0	0	0	0	36	42	6	1	0.0393701
820	86%	21	2	1	0	0	0	0	24	28	4	0	0.0393701
1900	86%	22	0	2	0	0	0	0	24	28	4	0	0.0393701
330	86%	31	6	0	0	0	0	0	37	43	6	0	0.0393701
640	86%	28	3	1	0	0	0	0	32	37	5	0	0.0393701
4710	87%	39	7	0	0	0	0	0	46	53	7	0	0.0393701
940	87%	29	3	1	0	0	0	0	33	38	5	0	0.0393699
4260	87%	29	3	1	0	0	0	0	33	38	5	0	0.0393701
4750	87%	30	1	2	0	0	0	0	33	38	5	0	0.0393701
860	87%	24	2	1	0	0	0	0	27	31	4	0	0.0393701
1100	87%	30	3	1	0	0	0	0	34	39	5	0	0.0393701
1500	88%	57	5	0	0	1	0	0	63	72	9	0	0.0393701
1570	88%	31	3	1	0	0	0	0	35	40	5	0	0.0393701
4030	88%	31	5	0	0	0	0	0	36	41	5	0	0.0393701
4070	88%	31	5	0	0	0	0	0	36	41	5	0	0.0393701

1310	88%	25	4	0	0	0	0	0	29	33	4	0	0.0393701
4530	88%	33	3	1	0	0	0	0	37	42	5	0	0.0393701
750	88%	21	1	1	0	0	0	0	23	26	3	0	0.0393701
150	89%	27	4	0	0	0	0	0	31	35	4	0	0.0393701
140	89%	35	3	1	0	0	0	0	39	44	5	0	0.0393701
4200	89%	34	5	0	0	0	0	0	39	44	5	0	0.0393701
4350	89%	34	5	0	0	0	0	0	39	44	5	0	0.0393701
4820	89%	34	5	0	0	0	0	0	39	44	5	0	0.0393701
4830	89%	35	5	0	0	0	0	0	40	45	5	0	0.0393701
1550	89%	28	4	0	0	0	0	0	32	36	4	0	0.0393701
2710	89%	22	1	1	0	0	0	0	24	27	3	0	0.0393701
4520	89%	37	3	1	0	0	0	0	41	46	5	0	0.0393701
2210	89%	23	1	1	0	0	0	0	25	28	3	0	0.0393701
2240	89%	22	3	0	0	0	0	0	25	28	3	0	0.0393701
630	90%	54	7	0	0	0	0	0	61	68	7	0	0.0393701
220	90%	31	4	0	0	0	0	0	35	39	4	0	0.0393701
4180	90%	40	3	1	0	0	0	0	44	49	5	0	0.0393701
4300	90%	32	4	0	0	0	0	0	36	40	4	0	0.0393701
440	90%	24	3	0	0	0	0	0	27	30	3	0	0.0393701
900	90%	33	4	0	0	0	0	0	37	41	4	0	0.0393699
1420	90%	33	4	0	0	0	0	0	37	41	4	0	0.0393701
4230	90%	33	4	0	0	0	0	0	37	41	4	0	0.0393701
810	91%	26	3	0	0	0	0	0	29	32	3	0	0.0393701
2920	91%	26	3	0	0	0	0	0	29	32	3	0	0.0393701
4050	91%	28	0	0	1	0	0	0	29	32	3	0	0.0393701
4270	91%	36	4	0	0	0	0	0	40	44	4	0	0.0393701
4840	91%	38	4	0	0	0	0	0	42	46	4	0	0.0393701
700	91%	29	3	0	0	0	0	0	32	35	3	0	0.0393701
4100	92%	30	3	0	0	0	0	0	33	36	3	0	0.0393701
2250	92%	41	4	0	0	0	0	0	45	49	4	1	0.0393701
730	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701
2730	92%	22	2	0	0	0	0	0	24	26	2	0	0.0393701
830	93%	23	2	0	0	0	0	0	25	27	2	0	0.0393701
4340	93%	36	3	0	0	0	0	0	39	42	3	0	0.0393701
2990	93%	25	2	0	0	0	0	0	27	29	2	0	0.0393701
710	93%	26	2	0	0	0	0	0	28	30	2	0	0.0393701
4160	93%	40	3	0	0	0	0	0	43	46	3	0	0.0393701
4190	93%	40	3	0	0	0	0	0	43	46	3	0	0.0393701
4310	93%	40	3	0	0	0	0	0	43	46	3	0	0.0393701
4550	93%	40	3	0	0	0	0	0	43	46	3	0	0.0393701
1300	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701
2230	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701
2930	94%	27	2	0	0	0	0	0	29	31	2	0	0.0393701
4290	94%	42	1	1	0	0	0	0	44	47	3	0	0.0393701
850	94%	42	3	0	0	0	0	0	45	48	3	0	0.0393701
4020	94%	43	3	0	0	0	0	0	46	49	3	0	0.0393701
4250	94%	44	1	1	0	0	0	0	46	49	3	0	0.0393701
200	94%	29	2	0	0	0	0	0	31	33	2	0	0.0393701
420	94%	88	6	0	0	0	0	0	94	100	6	0	0.0393701
620	94%	31	2	0	0	0	0	0	33	35	2	0	0.0393701
1720	94%	32	2	0	0	0	0	0	34	36	2	0	0.0393701
410	95%	34	2	0	0	0	0	0	36	38	2	0	0.0393701
720	95%	34	2	0	0	0	0	0	36	38	2	0	0.0393701
4490	95%	34	2	0	0	0	0	0	36	38	2	0	0.0393701
760	95%	39	2	0	0	0	0	0	41	43	2	0	0.0393701
4770	96%	42	2	0	0	0	0	0	44	46	2	0	0.0393701
2190	96%	24	1	0	0	0	0	0	25	26	1	0	0.0393701
1710	96%	26	1	0	0	0	0	0	27	28	1	0	0.0393701
950	97%	27	1	0	0	0	0	0	28	29	1	0	0.0393701
2940	97%	27	1	0	0	0	0	0	28	29	1	0	0.0393701
840	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
1620	97%	34	1	0	0	0	0	0	35	36	1	0	0.0393701
4110	98%	38	1	0	0	0	0	0	39	40	1	0	0.0393701
2260	98%	42	1	0	0	0	0	0	43	44	1	0	0.0393701
500	98%	48	1	0	0	0	0	0	49	50	1	0	0.0393701
800	100%	33	0	0	0	0	0	0	33	33	0	0	0.0393701
2340	100%	27	0	0	0	0	0	0	27	27	0	0	0.0393701
2280	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
	Total Tips	**4159**	**493**	**84**	**16**	**3**	**1**	**4**	**4756**	**5519**	**726**	**2**	


1800
1600
1400
1200
1000
800
600
400
200
0
(reports/hr)
Average Traffic
Peak Traffic Hour
1/1/08
1/26/08
2/20/08
3/16/08
4/10/08
5/5/08
5/30/08
6/24/08
7/19/08
8/13/08
9/7/08
10/2/08
10/27/08
11/21/08
12/16/08
Date/Time