

This presentation premiered at WaterSmart Innovations

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Assessment of Single- Family Home Leaks with Firefly

**Conservation Knowledge and
Support Team**

Why conduct a study?

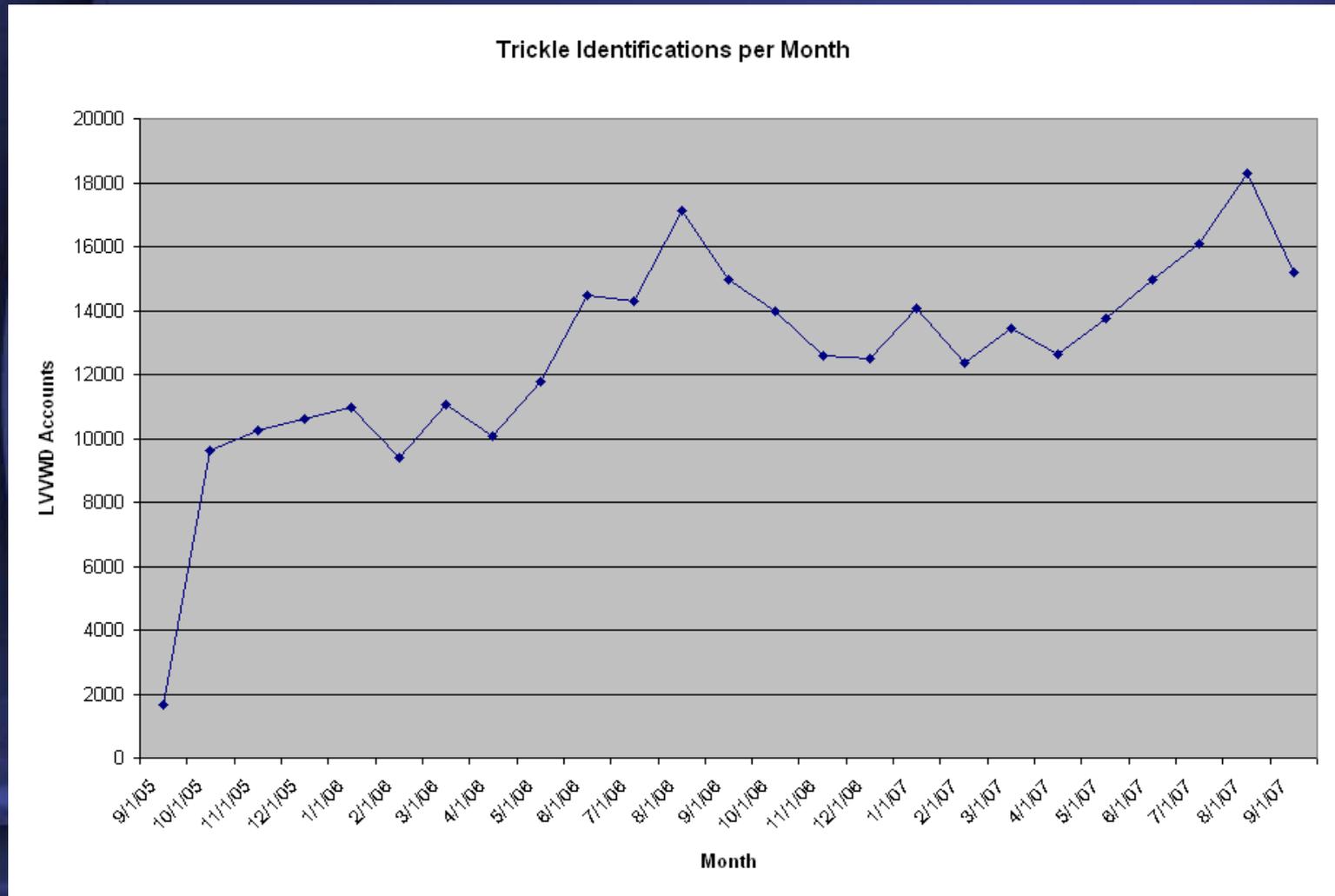
- Preliminary data from LVVWD indicates that there are more than 12,000 accounts each month with trickles.
- There has been a need for field verification of automated leak identification process.
- Determine conservation potential of leak abatement.
- How much might peak reduction be reduced by leak abatement.

How does a Firefly automatically identify a “leak”?

- It doesn't.
- Looks for continuous consumption (i.e. “trickle”) in every hour in the last 24 hrs prelude to meter reading activity.
- Trickle means at least one sweep of the hand past the sensor eye each of those 24 hrs.
- Means the defining of a trickle is partially based on the size of service. For the SFR properties we looked at equates to 10 gallons per hour.
- Accounts with a trickle identified in this manner are flagged and LVVWD has a list of these.



Trickles per month



Sampling of accounts likely to have leaks.

- We extracted accounts that were flagged with a trickle indicator every month for the previous 6 months.
- Selected for a statistically valid randomized sample of SFR accounts with a 1-1 relationship between services and premises.
- Sent out staff to collect detailed hourly firefly data in a manner similar to what we do for the watering restrictions research. Came up with 353 good for analysis.



Analysis of Data

- Compiled data on an hourly basis
- Could easily see the leaks in each set of data.
- Took the *mode* of hourly consumption over a week's time as the leak*.

mode (noun ˈmōd):
the most frequent value
of a set of data

*Note: novel analytical method

Analysis of Data

SampleID	Date	Total	12 A	1 A	2 A	3 A	4 A	5 A	6 A	7 A	8 A	9 A	10 A	11 A	12 P	1 P	2 P	3 P	4 P	5 P	6 P	7 P	8 P	9 P	10 P	11 P	LeakTotal	WeekMode	GalMin	NonLeakUse	
1	20-Jul	1110	50	40	50	50	40	50	40	50	40	50	50	40	50	50	40	50	50	40	50	40	50	50	40	50	40	1110	50	0.83	0
1	21-Jul	2420	50	40	50	40	50	390	140	40	50	40	50	40	50	50	40	50	40	50	40	50	50	390	220	410	1200	50	0.83	1220	
1	22-Jul	2430	50	40	50	50	50	390	130	50	40	50	50	40	50	50	40	50	40	50	50	40	50	400	220	400	1200	50	0.83	1230	
1	23-Jul	1100	50	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	1100	50	0.83	0	
1	24-Jul	2430	40	50	40	50	50	390	130	50	50	40	50	40	50	60	50	40	50	40	50	40	50	400	220	400	1200	50	0.83	1230	
1	25-Jul	1080	50	40	50	40	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	1080	50	0.83	0	
1	26-Jul	2420	40	50	40	50	50	390	130	50	40	50	50	40	50	40	50	40	50	50	40	50	50	390	220	410	1200	50	0.83	1220	
1	27-Jul	1080	40	50	40	50	40	50	40	50	40	50	40	50	40	50	50	40	50	40	50	40	50	40	50	40	1080	50	0.83	0	
1	28-Jul	2410	50	40	50	40	50	390	140	40	50	40	50	40	50	50	40	50	40	50	40	50	50	390	220	400	1200	50	0.83	1210	

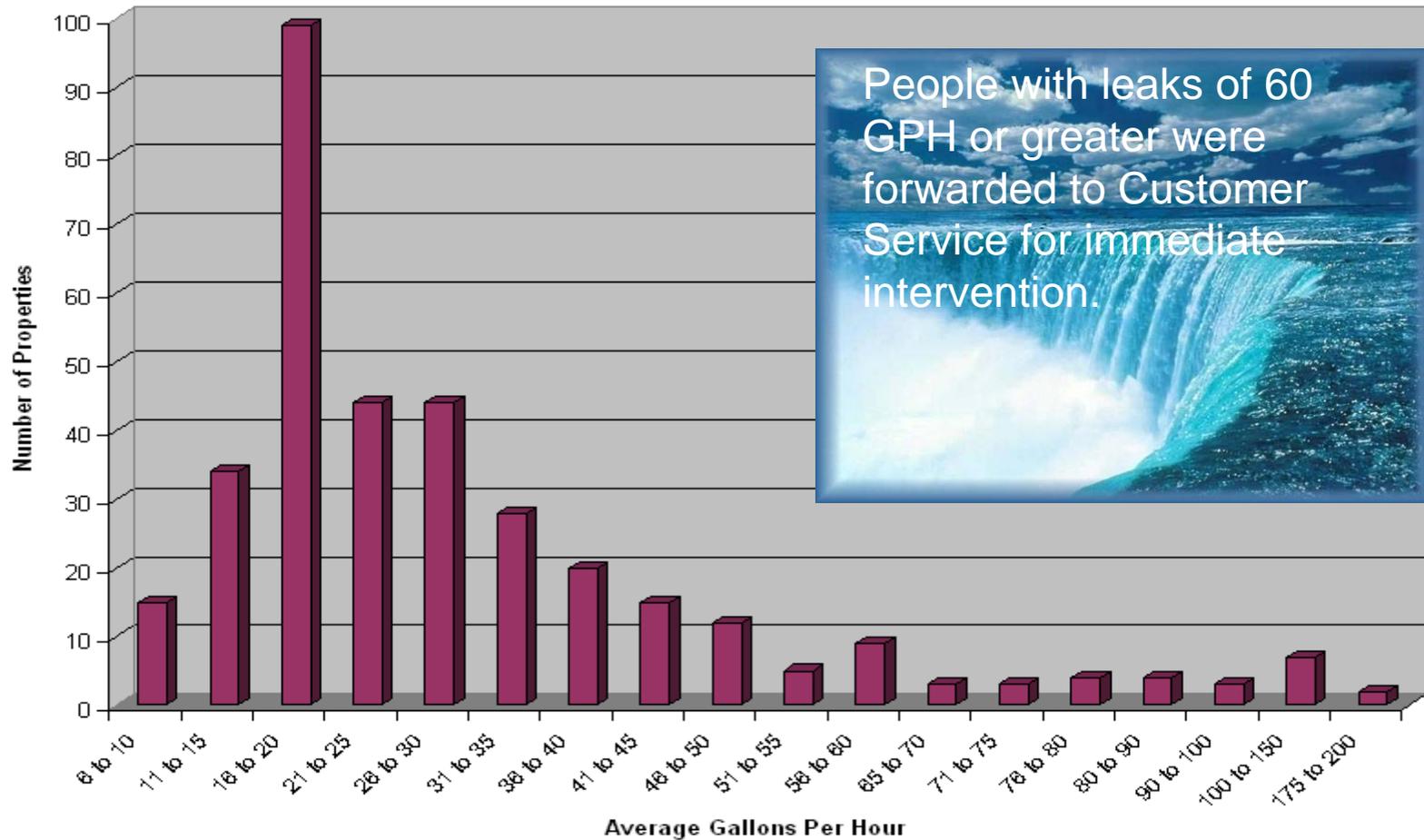
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC			
1	SampleID	Date	Total	1A	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	LeakTotal	WeekMo	G		
2	1	20-Jul	1110	50	40	50	50	40	50	40	50	40	50	50	40	50	50	40	50	40	50	50	40	50	40	50	40	1110	50	50		
3	1	21-Jul	2420	50	40	50	40	50	390	140	40	50	40	50	40	50	50	40	50	40	50	40	50	50	390	220	410	1200	50	50		
4	1	22-Jul	2430	50	40	50	50	50	390	130	50	40	50	40	50	40	50	50	40	50	40	50	50	400	220	400	1200	50	50			
5	1	23-Jul	1100	50	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	50	40	50	40	50	1100	50	50			
6	1	24-Jul	2430	40	50	40	50	50	390	130	50	50	40	50	40	50	60	50	40	50	40	50	40	50	400	220	400	1200	50	50		
7	1	25-Jul	1080	50	40	50	40	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	1080	50	50			
8	1	26-Jul	2420	40	50	40	50	50	390	130	50	40	50	40	50	40	50	40	50	40	50	40	50	40	390	220	410	1200	50	50		
9	1	27-Jul	1080	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	1080	50	50			
10	1	28-Jul	2410	50	40	50	40	50	390	140	40	50	40	50	40	50	50	40	50	40	50	40	50	50	390	220	400	1200	50	50		
11	1	29-Jul	2460	50	50	40	50	50	390	130	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	400	250	410	1200	50	50	
12	1	30-Jul	1180	50	50	40	50	40	50	40	50	50	90	70	50	40	50	40	50	40	50	40	50	40	50	60	40	1180	50	50		
13	1	31-Jul	2980	50	40	50	40	50	390	130	50	50	80	90	60	50	40	50	100	450	40	50	50	40	400	210	410	1200	50	50		
14	1	1-Aug	1270	40	50	40	50	40	50	50	70	90	110	40	50	40	50	50	40	50	40	50	40	60	60	50	60	1200	50	50		
15	1	2-Aug	2630	60	40	50	40	50	400	130	50	70	90	80	40	50	50	40	50	40	50	70	70	40	80	400	220	410	1200	50	50	
16	1	3-Aug	1310	60	50	50	40	50	40	50	40	50	40	50	50	60	50	60	50	50	50	80	130	40	50	40	60	1200	50	50		
17	1	4-Aug	2080	40	50	40	50	50	390	130	70	60	70	50	50	40	50	40	50	40	50	40	50	40	50	400	130	90	1200	50	50	
18	1	5-Aug	1520	450	50	40	50	40	50	50	40	50	40	50	40	50	50	40	50	40	50	40	50	40	50	50	40	1520	50	50		
19	1	6-Aug	1170	40	50	50	40	50	40	50	40	50	40	50	60	30	60	40	50	40	50	40	50	40	50	50	40	1170	50	50		
20	1	7-Aug	2080	40	50	40	50	50	400	120	50	40	50	40	50	40	60	40	50	40	50	40	60	60	400	170	90	1200	50	50		
21	1	8-Aug	1660	460	50	40	50	40	50	50	60	50	70	50	50	50	50	40	60	50	80	50	40	60	40	50	50	70	1200	50	50	
22	1	9-Aug	2420	50	50	40	50	60	390	130	60	60	50	90	140	110	100	60	60	50	60	60	60	50	70	400	130	80	1200	50	50	
23	1	10-Aug	1680	470	40	50	50	40	50	50	60	60	90	50	50	50	40	50	50	60	40	70	60	40	60	40	60	1200	50	50		
24	1	11-Aug	2290	50	50	60	50	70	390	150	50	60	60	60	50	60	60	80	90	60	50	50	40	60	400	140	110	1200	50	50		
25	1	12-Aug	1790	450	50	40	50	50	40	50	40	50	70	80	70	60	50	60	60	50	50	50	50	100	50	50	70	80	1200	50	50	
26	1	13-Aug	1200	50	60	50	40	50	50	80	70	70	40	50	50	40	50	40	50	40	50	40	50	40	50	40	50	40	960	40	40	
27	1	14-Aug	2020	50	40	50	50	50	390	130	40	50	40	50	40	50	40	50	40	50	40	50	40	50	400	130	80	960	40	40		
28	1	15-Aug	1480	450	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	960	40	40		
29	1	16-Aug	2010	50	40	50	40	60	390	130	40	50	40	50	40	50	40	50	40	50	40	50	40	60	400	120	90	960	40	40		
30	1	17-Aug	1460	450	40	50	40	50	40	50	40	40	50	40	50	40	40	50	40	50	40	50	40	50	40	40	50	960	40	40		
31	1	18-Aug	1960	40	40	40	50	50	400	120	40	40	50	40	40	50	40	50	40	50	40	50	40	40	50	410	120	80	1200	50	50	
32	1	19-Aug	1510	450	50	40	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	60	40	40	1200	50	50	
33	1	20-Aug	1280	50	40	40	50	40	40	50	40	80	140	110	50	50	40	50	40	50	40	50	40	50	50	40	50	40	50	1200	50	50
34	1	21-Aug	2080	40	50	40	50	50	390	130	60	60	50	100	40	50	40	50	40	50	40	50	40	50	400	130	80	1200	50	50		
35	1	22-Aug	1580	450	40	50	50	40	40	50	50	40	110	50	50	40	50	40	50	40	50	40	50	40	60	50	40	960	40	40		
36	1	23-Aug	2090	50	40	40	50	50	400	120	50	50	60	80	40	50	40	50	40	50	40	60	40	70	60	400	120	90	960	40	40	
37	1	24-Aug	1590	440	50	50	40	50	40	50	40	50	50	100	50	40	50	40	50	40	50	40	50	40	70	50	40	960	40	40		
38	1	25-Aug	2050	50	40	50	40	50	410	120	50	40	70	80	40	50	40	50	40	50	40	50	40	40	60	400	120	90	960	40	40	
39	1	26-Aug	1460	450	50	40	50	40	40	50	40	40	50	40	50	40	40	50	40	50	40	40	40	50	40	40	50	40	960	40	40	
40	1	27-Aug	1060	50	40	40	50	40	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	960	40	40	
41	1	28-Aug	1970	40	40	50	40	50	400	120	40	50	40	40	50	40	50	40	50	40	50	40	50	40	50	410	120	80	960	40	40	
42	1	29-Aug	1460	450	50	40	40	50	40	40	40	50	40	50	40	50	40	50	40	50	40	50	40	40	40	50	40	50	960	40	40	
43	1	30-Aug	1990	40	40	50	40	50	400	120	40	50	40	40	50	40	50	40	50	40	50	40	50	40	60	400	120	80	960	40	40	
44	1	31-Aug	1450	450	50	40	40	50	40	40	40	50	40	40	50	40	50	40	40	50	40	50	40	50	40	40	50	40	960	40	40	
45	1	1-Sep	1970	40	50	40	40	50	400	120	40	50	40	40	50	40	40	50	40	50	40	50	40	40	60	400	120	90	960	40	40	
46	1	2-Sep	1440	450	40	40	50	40	40	50	40	40	50	40	40	50	40	40	50	40	50	40	40	40	40	50	40	40	960	40	40	
47	1	3-Sep	1040	50	40	40	50	40	40	40	50	40	40	50	40	50	40	50	40	50	40	50	40	50	40	40	40	50	960	40	40	
48	1	4-Sep	1980	40	40	50	40	50	400	120	40	40	50	40	50	40	50	40	50	40	50	40	50	40	60	410	120	80	960	40	40	
49	1	5-Sep	1460	450	50	40	40	50	40	40	40	50	40	50	40	40	50	40	50	40	50	40	50	40	50	40	40	50	960	40	40	
50	1	6-Sep	2000	40	40	50	40	50	410	120	40	50	40	50	40	50	40	50	40	50	40	50	40	50	420	110	90	960	40	40		
51	1	7-Sep	1460	450	50	40	40	50	40	50	40	50	40	50	40	40	50	40	50	40	50	40	40	50	40	40	50	40	960	40	40	
52	1	8-Sep	2010	50	40	50	40	50	410	120	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	420	110	90	1200	50	50	
53	1	9-Sep	1470	450	50	40	50	40	50	40	40	50	40	50	40	40	5															

Results

- **Average firefly-assist identified leak is 31.24 GPH (.52 gpm).**
- Without intervention, over a year the average home with this average leak might loose 273,662 gallons.
- Considering all homes with leaks, the leaks constitute 49% of total consumption in these homes over the sample period.

Results - Histogram

Leak Histogram



Super-Leakers

- Those 26 homes in our sample with leaks averaging at least 60 GPH.
- High-leaker was 200 GPH.
- Collectively homes in this group, *in this sampling alone*, would waste 24.5 million gallons each year without intervention.
- This equates to the annual savings garnered by over 300 residential conversions.

Peaking intervention possibilities

- The number homes where a leak needs to be stopped in order to reach 1 MGD:

1333

- The total summertime potential could exceed 7.5 MGD that could be garnered from leaks in LVVWD service area.

Overall Findings

- The existing automated trickle identification process appears to do an excellent job of identifying leaks so long as looking at least a couple months worth of flags.
- The average leak identified is 31.24 GPH.
- There is significant water savings and peaking reduction obtainable from intervention at sites with persistent leaks.
- **Steps to consider from here:**
 - **First, intervention at high leak homes.**
 - **Mailing to already identified leak homes.**
 - **Future mailings (for persistent leaks) and bill messaging (for all trickles) should be tried.**