Evaluation of Sensor Based Residential Irrigation Water Application

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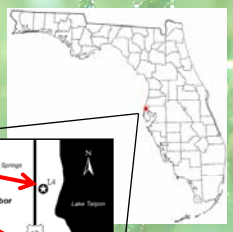
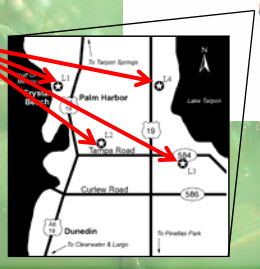
UF University of Florida
The Foundation for The Gator Nation

Southwest Florida Water Management District

Experimental Design

- Residential Cooperators
  - Palm Harbor Florida
    - Historical water use
    - Landscape level





Experimental Design

All homes have the following

Automatic in-ground irrigation

Water and irrigation meters

Automatic meter recording device

Experimental Treatments

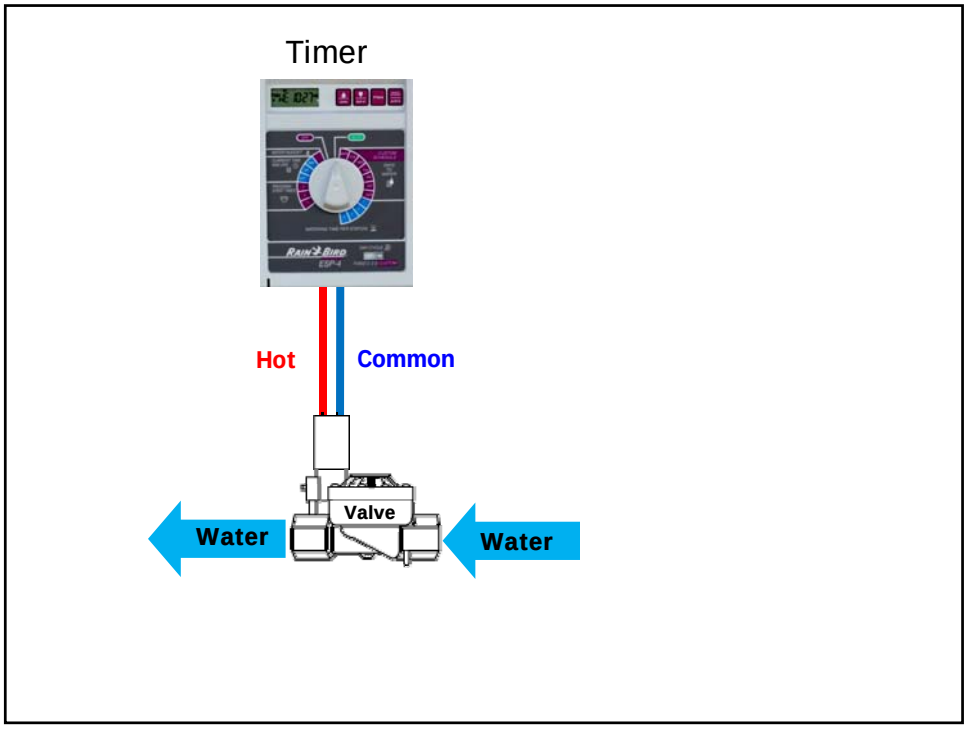
Homes are subdivided into 4 groupings

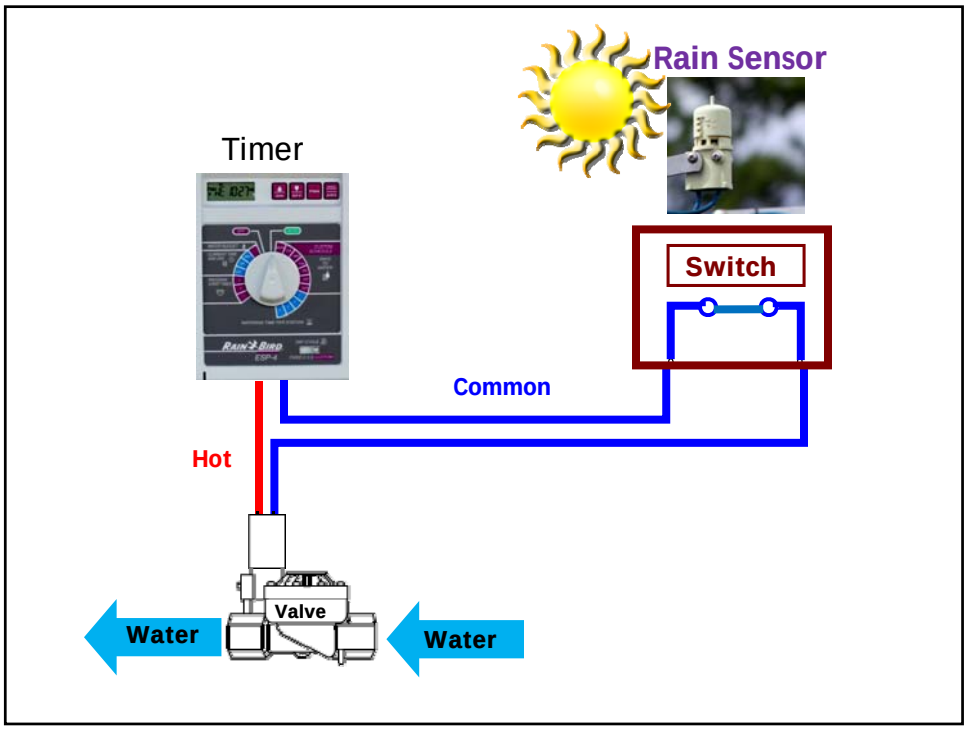
1. Monitoring only……

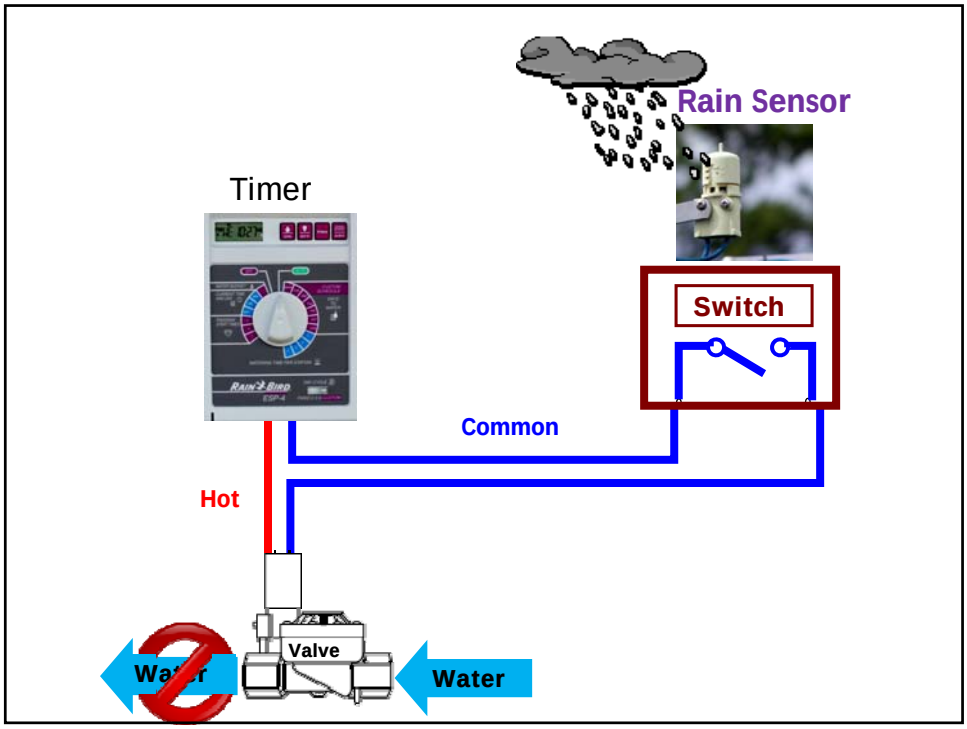
2. Current irrigation system plus rain sensor (6 mm)……

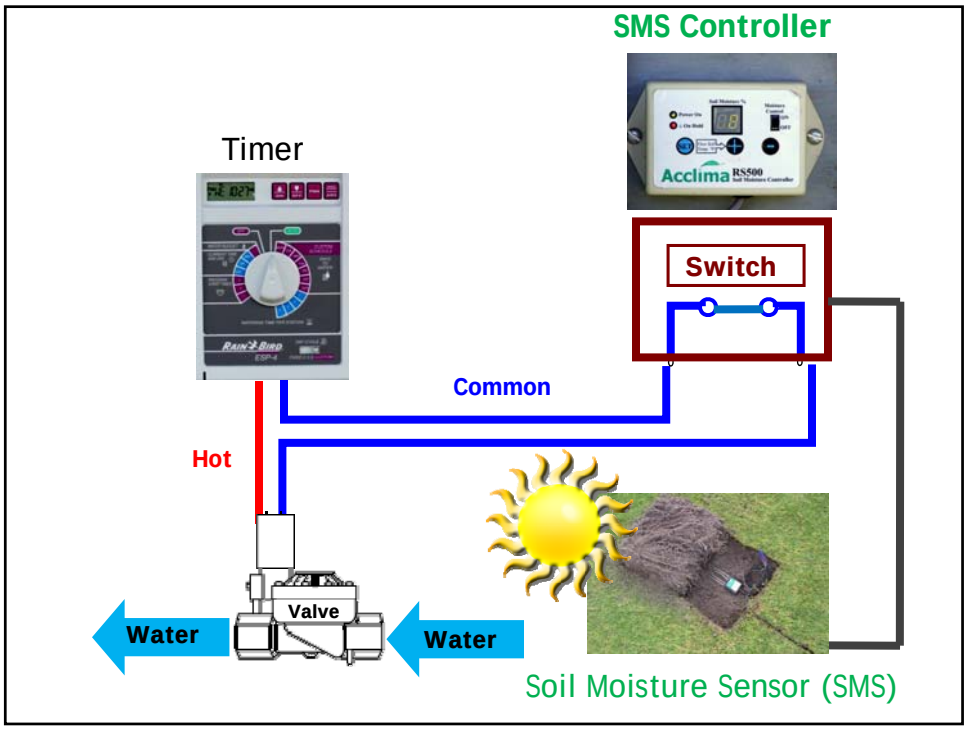
3. Current irrigation system plus rain sensor and educational materials……

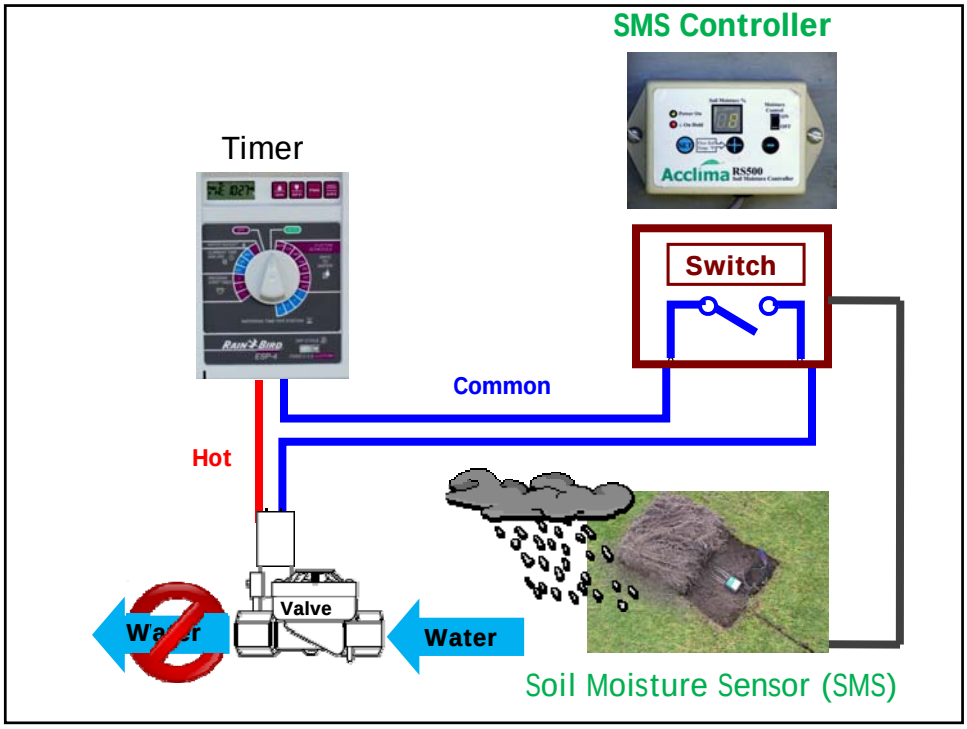
4. Current irrigation system plus a soil moisture sensor……

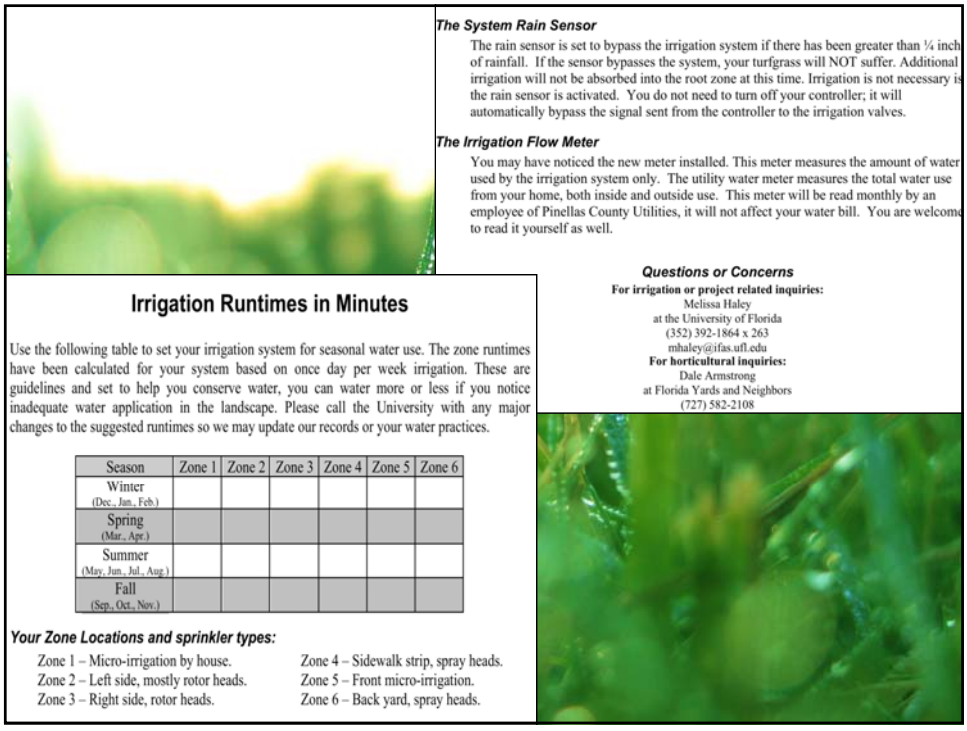

Timer
Hot
Common
Valve
Water
Water


Rain Sensor
Timer
Switch
Common
Hot
Valve
Water
Water


Rain Sensor
Timer
Switch
Common
Hot
Valve
Water
Water


SMS Controller
Timer
Switch
Common
Hot
Valve
Water
Water
Soil Moisture Sensor (SMS)





The System Rain Sensor

The rain sensor is set to bypass the irrigation system if there has been greater than ¼ inch of rainfall. If the sensor bypasses the system, your turfgrass will NOT suffer. Additional irrigation will not be absorbed into the root zone at this time. Irrigation is not necessary is the rain sensor is activated. You do not need to turn off your controller; it will automatically bypass the signal sent from the controller to the irrigation valves.

The Irrigation Flow Meter

You may have noticed the new meter installed. This meter measures the amount of water used by the irrigation system only. The utility water meter measures the total water use from your home, both inside and outside use. This meter will be read monthly by an employee of Pinellas County Utilities, it will not affect your water bill. You are welcome to read it yourself as well.

Questions or Concerns

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For horticultural inquiries:
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Irrigation Runtimes in Minutes

Use the following table to set your irrigation system for seasonal water use. The zone runtimes have been calculated for your system based on once day per week irrigation. These are guidelines and set to help you conserve water, you can water more or less if you notice inadequate water application in the landscape. Please call the University with any major changes to the suggested runtimes so we may update our records or your water practices.

Season	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Winter (Dec., Jan., Feb.)						
Spring (Mar., Apr.)						
Summer (May, Jun., Jul., Aug.)						
Fall (Sep., Oct., Nov.)						

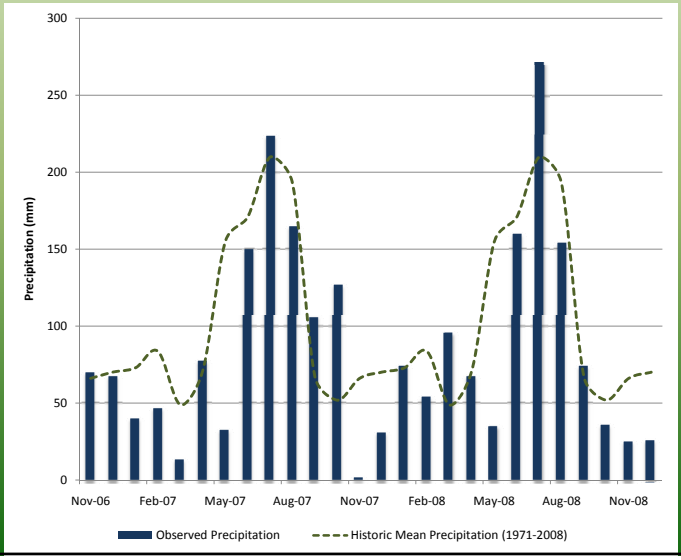
Your Zone Locations and sprinkler types:

Zone 1 – Micro-irrigation by house.
Zone 2 – Left side, mostly rotor heads.
Zone 3 – Right side, rotor heads.
Zone 4 – Sidewalk strip, spray heads.
Zone 5 – Front micro-irrigation.
Zone 6 – Back yard, spray heads.

Turf Quality

- Turf Quality ratings based on NTEP procedures (1-9 scale)
  - 1 dead turf
  - 5 minimally acceptable turf quality
  - 9 perfect density and color

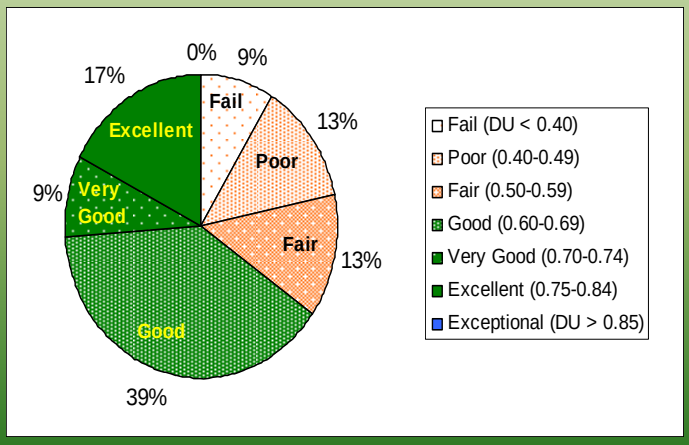
Observed monthly precipitation (avg. of four weather stations) for the treatment period compared to historic monthly mean precipitation (St. Petersburg, FL)



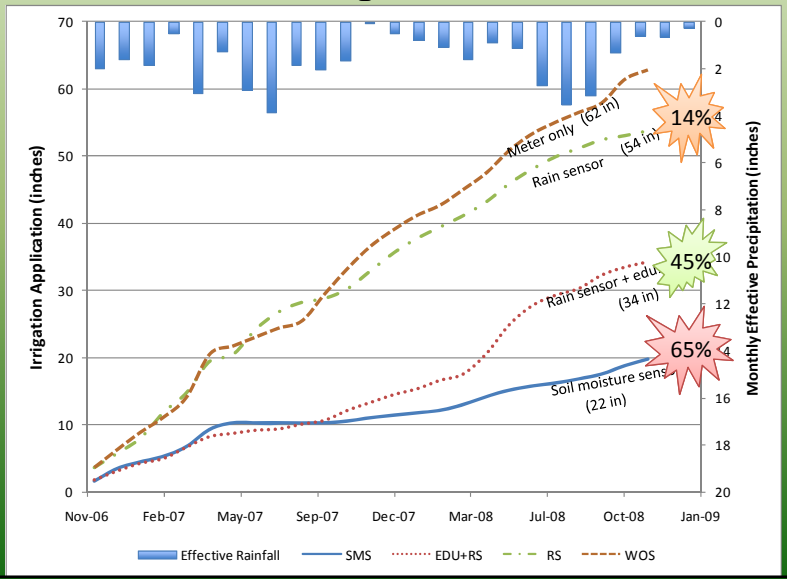
Estimated water use statistics two years prior to the study beginning, used for treatment determination.

	Estimated Irrigation Water Application Depth (in/30d)			Estimated Irrigation Water Volume Usage (gal/30d)		
Quartile	Average	Min.	Max.	Average	Min.	Max.
Low	1.2	0.8	1.4	5,029	1,875	9,000
Medium	2.4	1.6	3.4	9,999	4,281	17,063
High	5.3	3.6	8.4	19,517	6,719	33,000

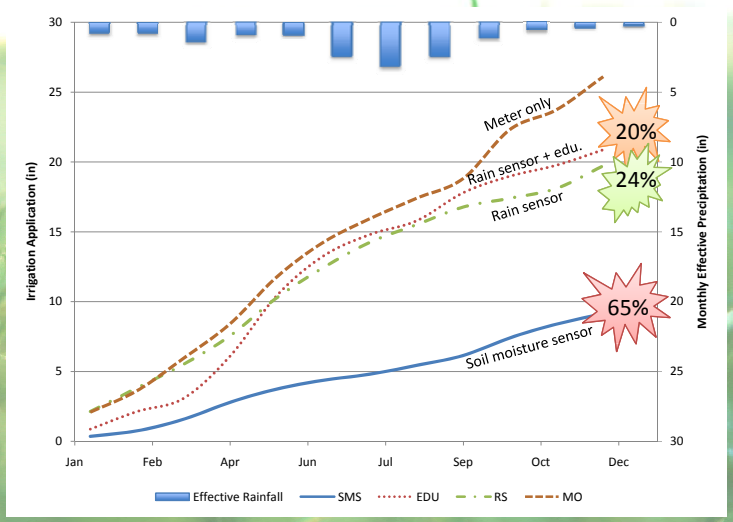
Distribution Uniformity of Cooperating Homes



Results from treatment designation through Dec '09

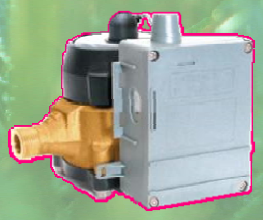


Results for 2008 only



Automatic Meter Recorded Data

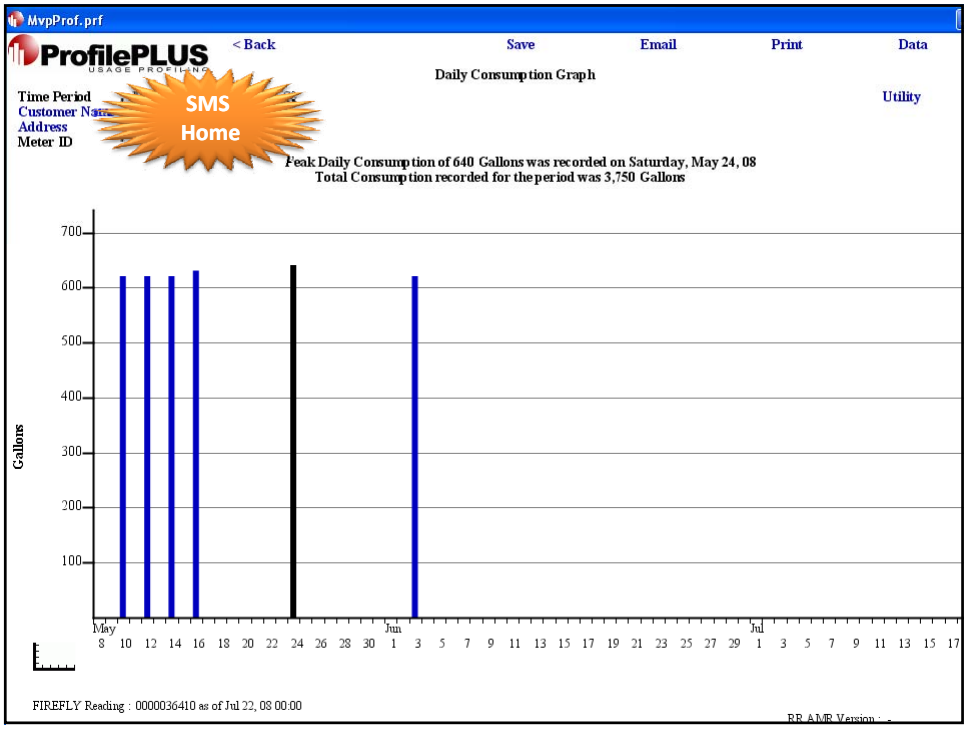
- Data-loggers installed at all homes
  - Attached to existing water meter
  - Installation in May 2007
  - Water use data collection interval
    - Initially 10 minute
    - Now collecting hourly



Average Number of Irrigation Events per Month

			Number of Irrigation Events						
			I_{actual}[Z] (#[S]/mth)	N[Y] (#)	Max (#/mth)	Min (#/mth)	Std Dev (#/month)	CV (%)	I_{calc}[T] (#/month)
Treatment[R]	SMS		2.1c[Q]	185	11	0	2.8	136	4
	RS		4.7a	195	22	0	5.6	114	
	MO		5.2a	173	29	0	6.5	125	
	EDU		3.6b	187	20	0	4.1	113	
Season[P] by Year	2007	Spring	—[N]	—	—	—	—	—	—
		Summer	2.1	32	21	0	4.3	210	5
		Fall	4.5	81	29	0	6.7	153	4
		Winter	4.1	46	21	0	4.9	137	2
	2008	Spring	5.6a	144	29	0	5.6	109	7
		Summer	4.1b	138	26	0	5.0	135	3
		Fall	2.8c	117	20	0	3.6	143	5
		Winter	3.5bc	138	29	0	4.7[O]	151	2

Note: Uppercase superscript letters indicate footnotes.
[Z] Monthly average number of irrigation events applied.
[Y] N = number of observations in the comparison.
[T] Number of irrigation events per month, calculated from the SWB.
[S] Conversion: 1 inch = 25.4 mm
[R] Treatments are: SMS, time-based controller plus soil moisture sensor system; RS, time-based controller plus rain sensor; MO, time-based controller only; EDU, time-based controller plus rain sensor and educational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ProfilePLUS
< Back
Save
Email
Print
Data
Daily Consumption Graph
Time Period
Customer Name
Address
Meter ID
Utility
SMS Home
Peak Daily Consumption of 640 Gallons was recorded on Saturday, May 24, 08
Total Consumption recorded for the period was 3,750 Gallons
Gallons
700
600
500
400
300
200
100
May
Jun
Jul
FIREFLY Reading : 0000036410 as of Jul 22, 08 00:00

MvpProf.prf
ProfilePLUS
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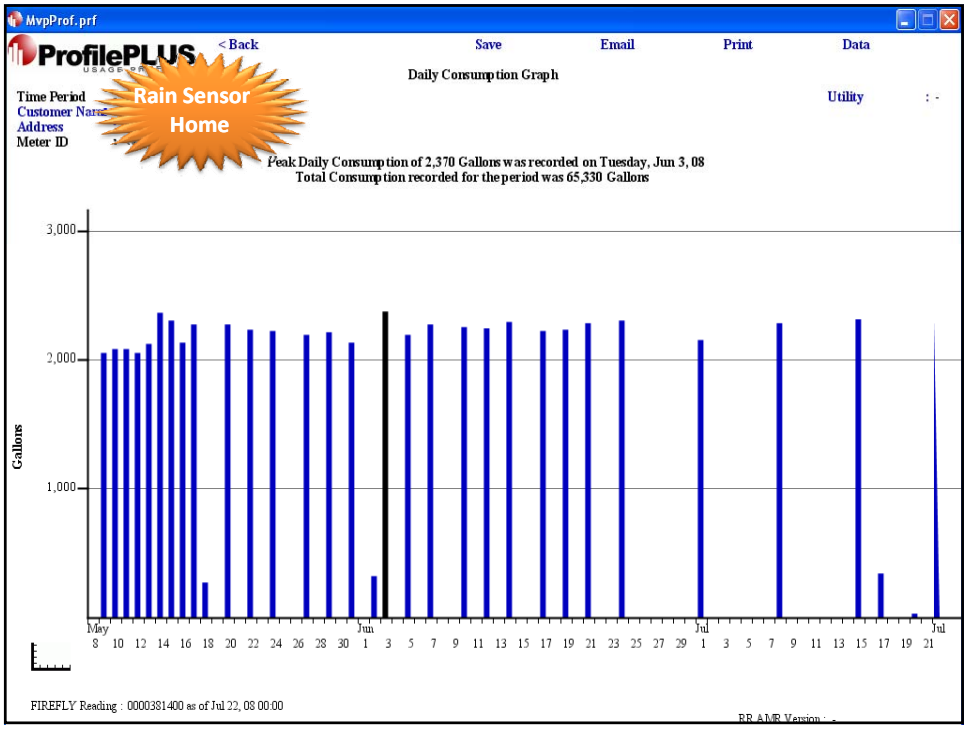
Forward >
Save
Email
Print
Data
Daily Consumption Graph
Time Period
Customer Name
Address
Meter ID
Utility
Rain Sensor + Edu Home
Peak Daily Consumption of 2,790 Gallons was recorded on Tuesday, May 13, 08
Total Consumption recorded for the period was 25,120 Gallons
Gallons
3,000
2,000
1,000
Mar
Apr
May
Jun
Jun


MvpProf.prf
ProfilePLUS
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Save
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Data
Daily Consumption Graph
Time Period
Customer Name
Address
Meter ID
Utility
Rain Sensor Home
Peak Daily Consumption of 2,370 Gallons was recorded on Tuesday, Jun 3, 08
Total Consumption recorded for the period was 65,330 Gallons
Gallons
3,000
2,000
1,000
May
Jun
Jul
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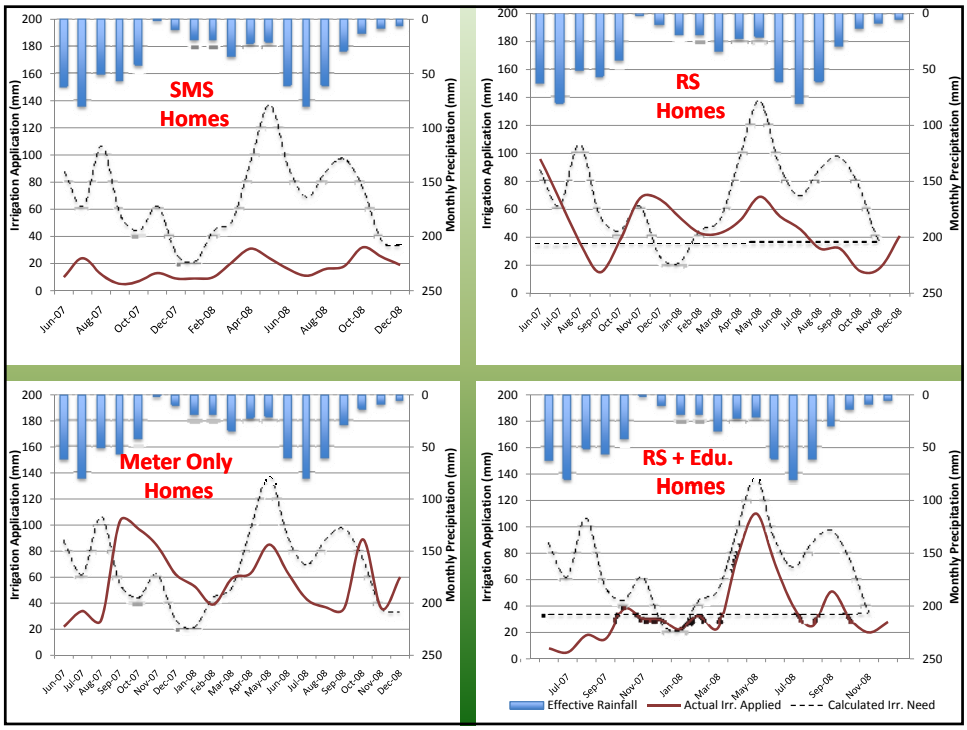
SMS Homes
RS Homes
Meter Only Homes
RS + Edu. Homes
Irrigation Application (mm)
Monthly Precipitation (mm)
Effective Rainfall
Actual Irr. Applied
Calculated Irr. Need

Summary

- The soil moisture sensor group
  - has statistically the lowest cumulative and mean irrigation application
  - least number of weekly irrigation events
- By inspection of the frequency of the irrigation events for each treatment (from AMR data)
  - the soil moisture sensor effectively bypasses irrigation events
    - this is the only treatment in which the range of monthly irrigation events is successfully governed

Next Household Phase Lessons Learned

- Location
  - Socioeconomics
  - Neighborhood aesthetics
- Educational Materials
  - Type
  - Distribution
    - Method
    - Timing
- Water Source Watering Day Restrictions

Thank You

I will gladly answer any questions…

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Acknowledgements

Robert Peacock, Sean Hannigan, Diane Weaver, and Sheryl Powers from the Pinellas County Utilities Conservation Department, and from the University of Florida, F. Wayne Williams, Bernard Cardenas-Lailhacar, Mary Shedd McCready, Stacia Davis, Daniel Rutland, Eban Bean, and Kristen Femminella for their assistance and on this project.

Average irrigated areas for each of the treatments.

Treatment	Irrigated Area (ft^2)			
	Mean	Med	Min	Max
SMS	5,318	5,176	2,018	8,605
RS	7,279	5,919	3,899	18,976
MO	7,118	6,559	2,929	12,773
EDU	6,113	6,042	2,788	10,736