



## EVALUATION OF HIGH EFFICIENCY SPRINKLER NOZZLES AND RAIN SENSOR REBATE PROGRAM

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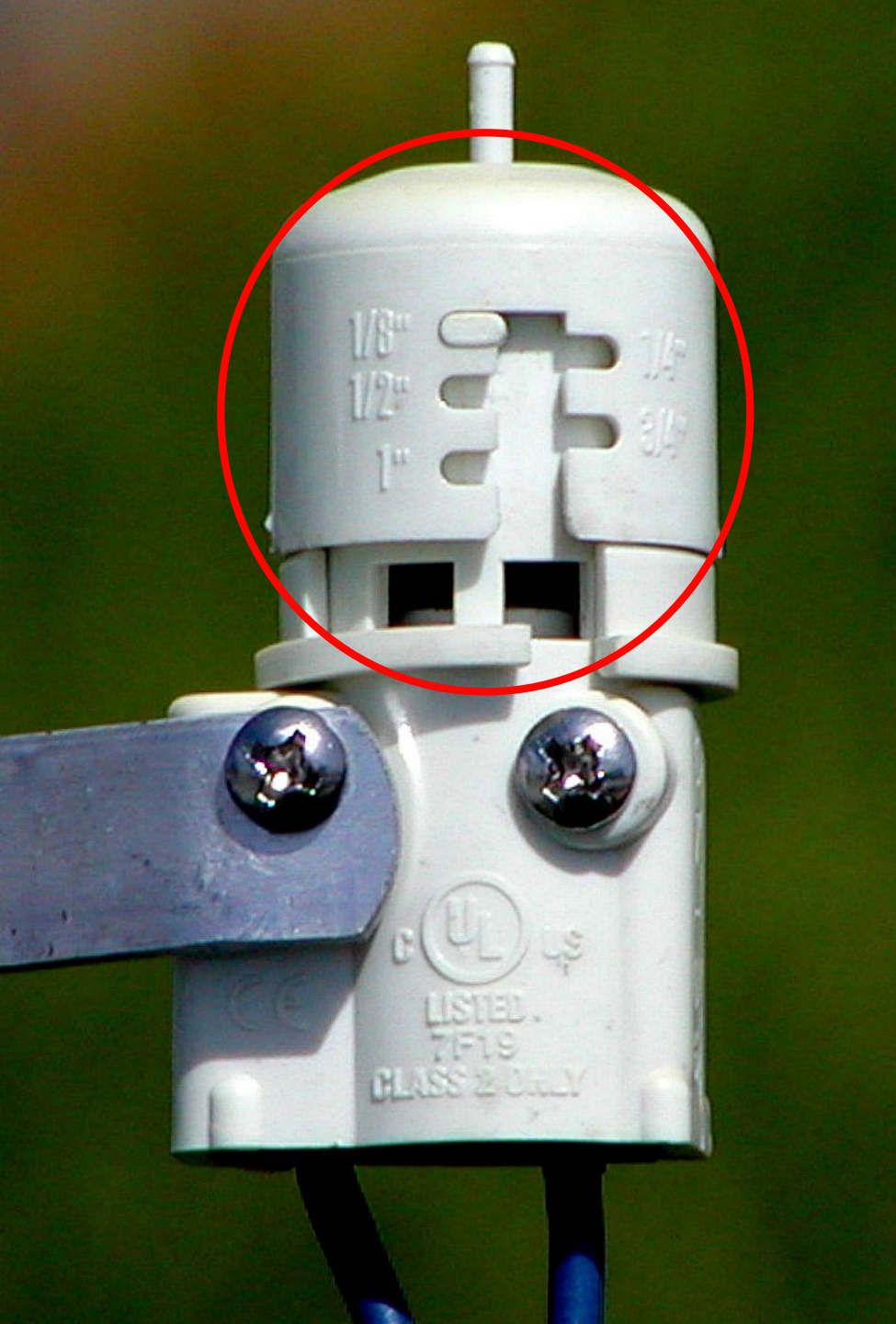
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Center for Land Use Efficiency

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# Rain Sensors

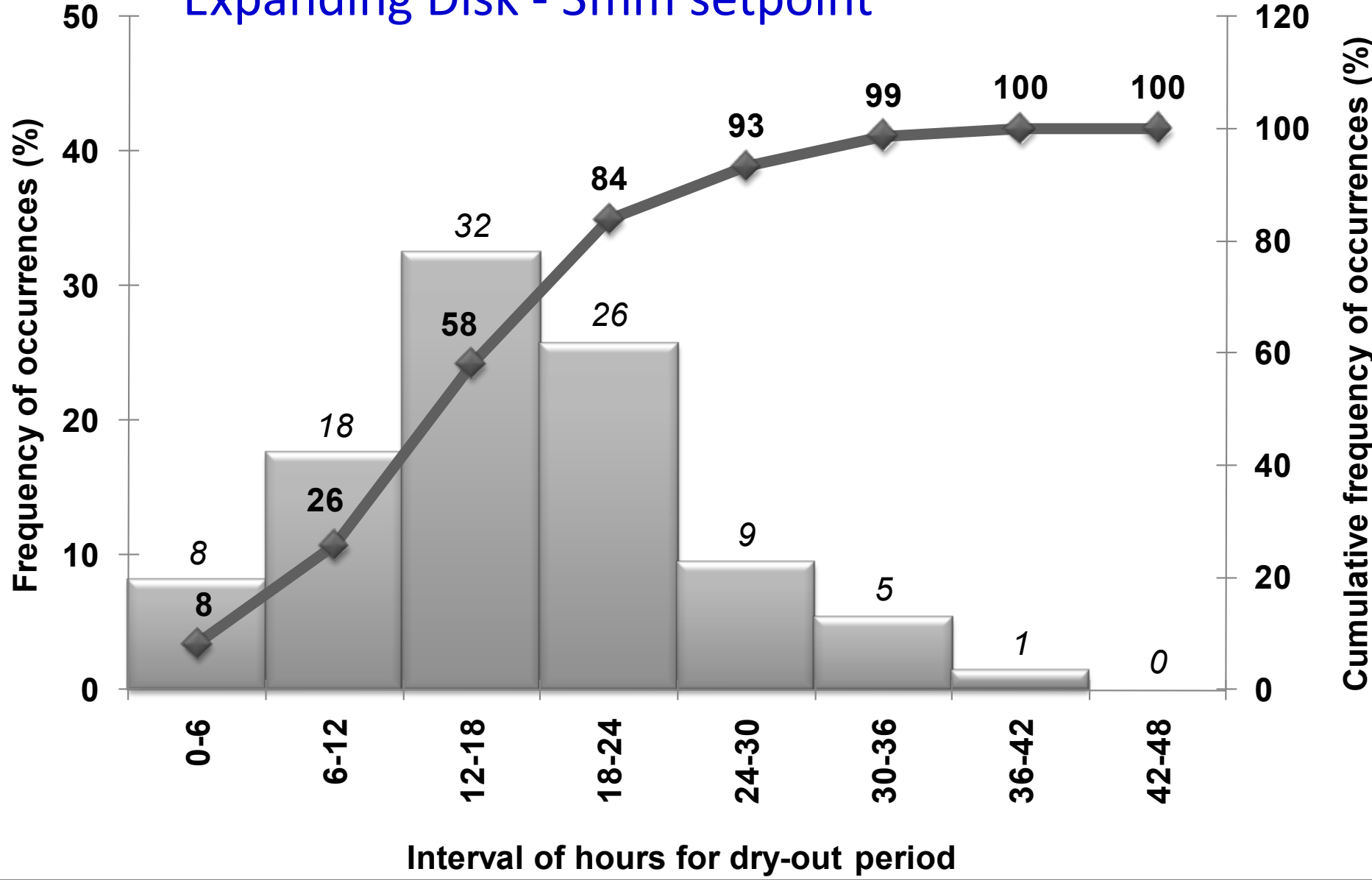


**Expanding Disks**

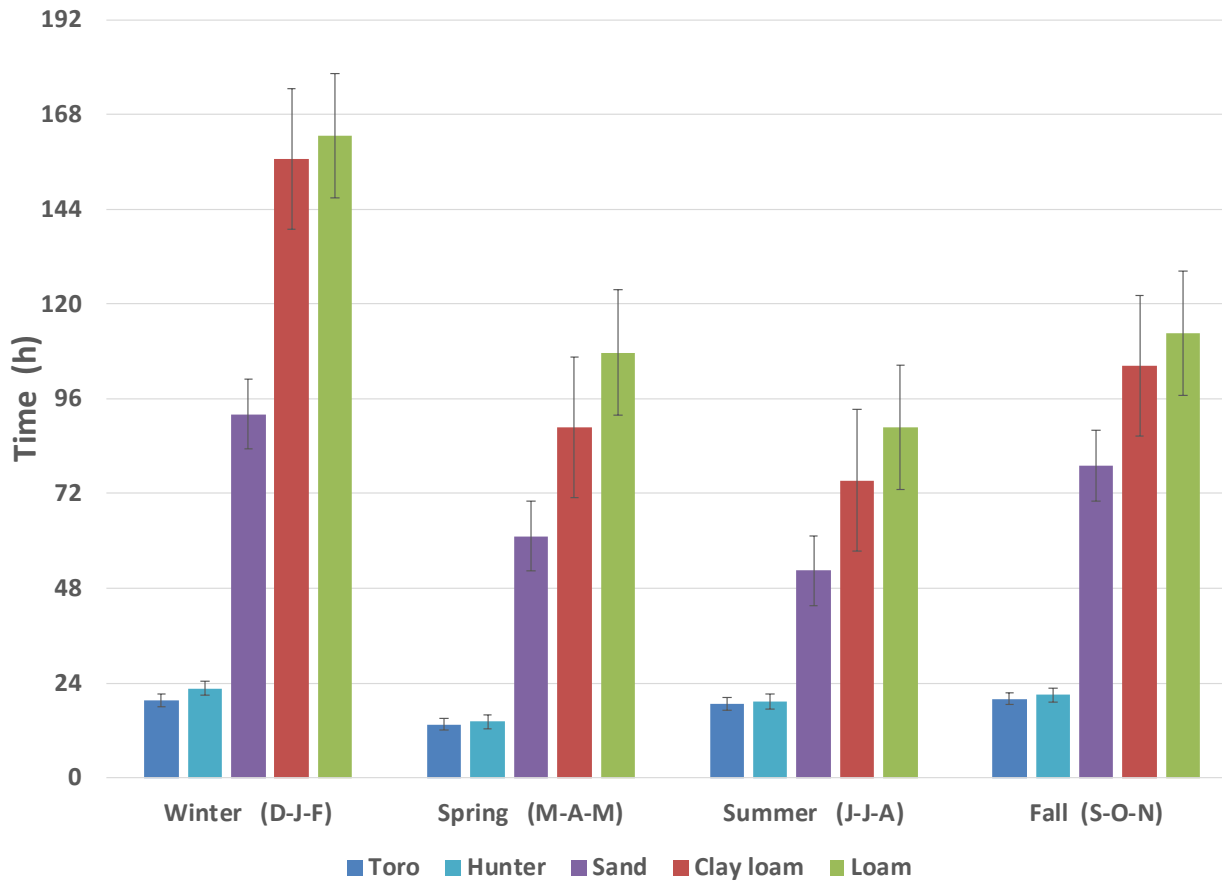
# Long Term Rain Sensor Testing



# Expanding Disk - 3mm setpoint



# RS Dryout & Soil Dryout



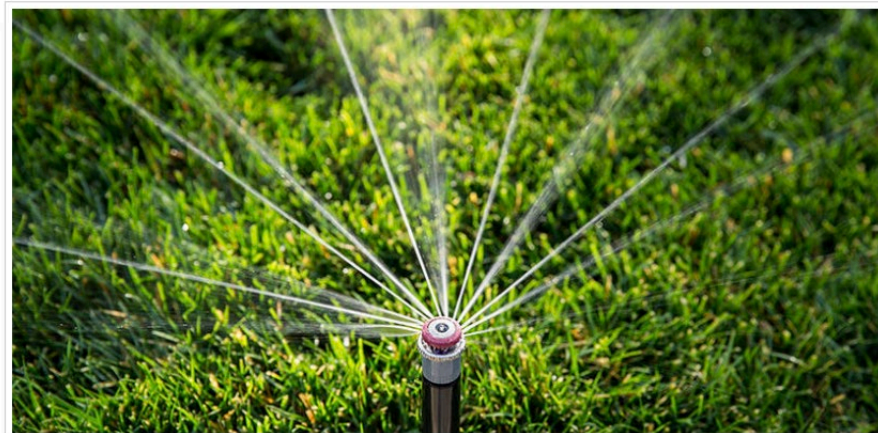
# High Efficiency Sprinkler (HES) nozzles

**RAIN BIRD**



**MP ROTATOR® MP800**

Radius: 6' to 16'



# Conventional Spray Head

- Misting (supply pressure typically >30 psi)
- Poor spacing
- High instantaneous application rates (>1.0 in/hr)

# Misting and Drift







2308

Orange, FL

2312

This Home Built For  
**Leon**

| ADDRESS                 | PLAN  |
|-------------------------|-------|
| 2312 Adams Ave. St. Dun | 1001P |
| PERMIT #                | 1001P |
| 2002010264              | HL 64 |

# High Application Rates



# Runoff

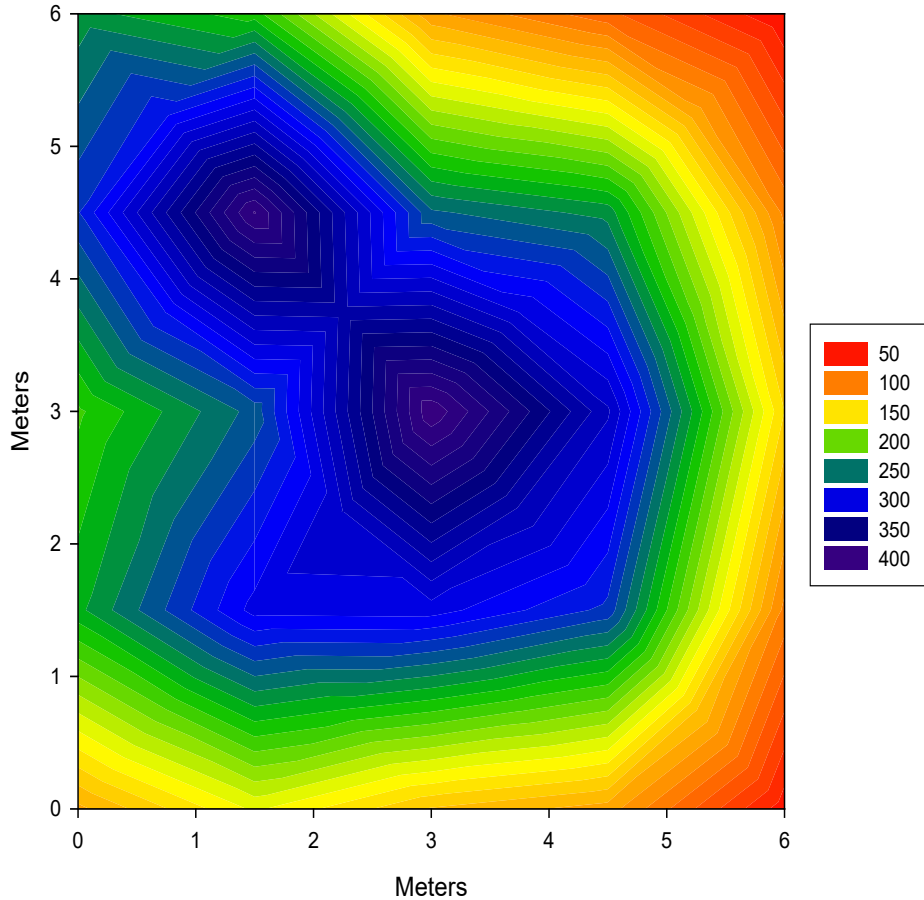


Photo by: Michael D. Dukes ([irrigation@ifas.ufl.edu](mailto:irrigation@ifas.ufl.edu))

# Sprayhead Pool Uniformity



# Poor Uniformity

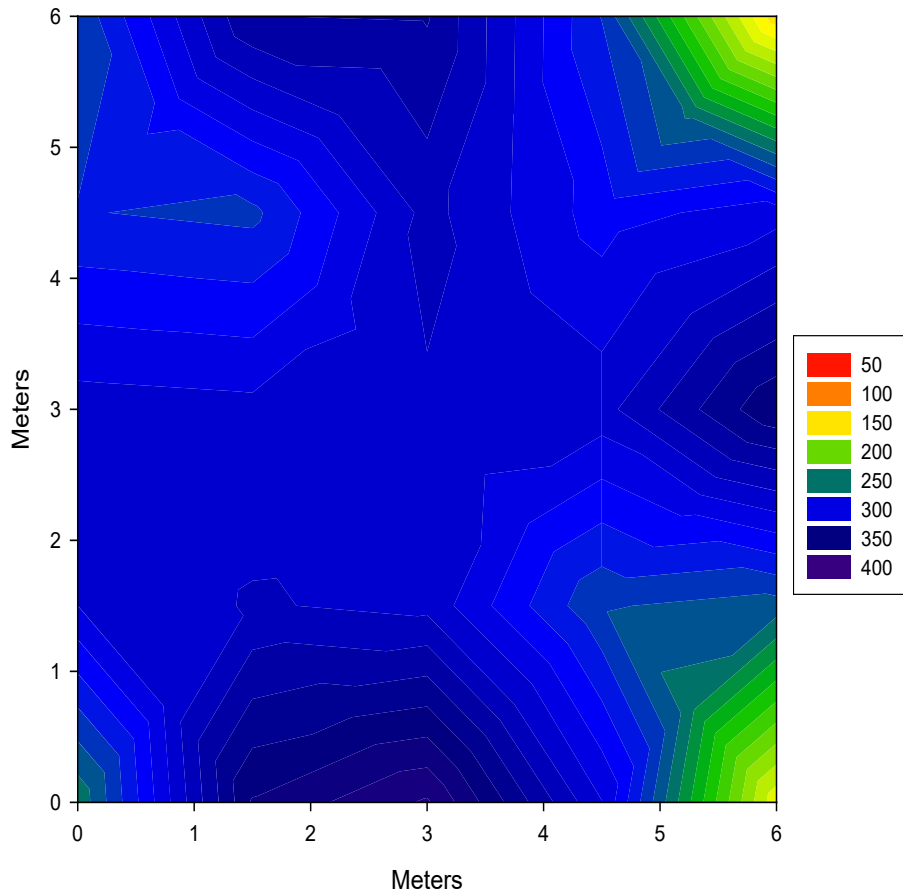


- Spray head at low pressure
- average  $DU_{lq}$  of 0.33

# Sprayhead Acceptable Uniformity



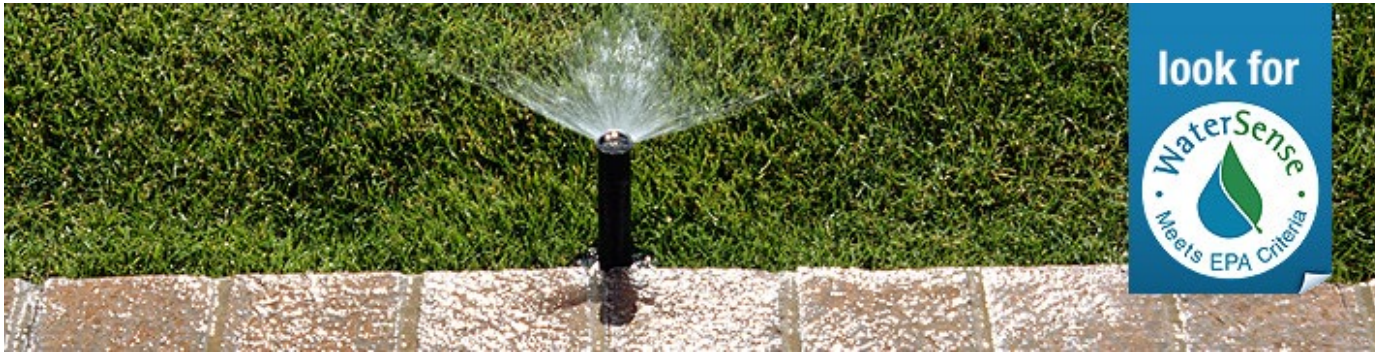
# Good Uniformity



- Spray head with quarter circle nozzle at recommended pressure
- average  $DU_{lq}$  of 0.66

# EPA WaterSense Spray Sprinkler Bodies (SSBs)

- Tests pressure regulating sprinkler bodies
- Often paired with high efficiency sprinkler (HES) nozzles
- CA mandates EPA WS SSBs after Oct 2020
- Similar legislation in CO, WA, HI, VT





# Utility Program Implementation

- Single family homes
- Several customer categories (meter/water source)
  - Dual potable (DP)
    - With pool (WP)
    - No pool (NP)
  - Single potable
    - With pool (WP)
    - No pool (NP)
  - Dual reclaimed water (DR)

# RS program

- Single family homes
- Implementation Mar 2016-Feb 2017
- n = 1,067 homes

| Meter                | 2 0 1 6    |            |     |            |            |           |            |            |           |          | 2 0 1 7  |          | Total       |
|----------------------|------------|------------|-----|------------|------------|-----------|------------|------------|-----------|----------|----------|----------|-------------|
|                      | Mar        | Apr        | May | Jun        | Jul        | Aug       | Sep        | Oct        | Nov       | Dec      | Jan      | Feb      |             |
| Dual Potable Water   | 3          | 7          |     | 90         | 90         | 26        | 55         | 66         | 29        | 1        |          | 3        | 370         |
| Dual Reclaimed Water |            |            |     | 1          | 1          | 5         |            | 17         | 2         |          |          |          | 26          |
| Single               | 157        | 137        |     | 101        | 22         | 62        | 89         | 85         | 13        |          | 1        | 4        | 671         |
| <b>Total</b>         | <b>160</b> | <b>144</b> |     | <b>192</b> | <b>113</b> | <b>93</b> | <b>144</b> | <b>168</b> | <b>44</b> | <b>1</b> | <b>1</b> | <b>7</b> | <b>1067</b> |

# HES program

- Single family homes
- Implementation Apr – Oct 2015
- n = 160 homes

| Meter                | Apr      | May | Jun       | Jul       | Aug       | Sep | Oct      | Total      |
|----------------------|----------|-----|-----------|-----------|-----------|-----|----------|------------|
| Dual Potable Water   | 1        |     | 7         | 23        | 15        |     | 1        | 47         |
| Dual Reclaimed Water |          |     |           |           | 1         |     |          | 1          |
| Single               |          |     | 14        | 19        | 79        |     |          | 112        |
| <b>Total</b>         | <b>1</b> |     | <b>21</b> | <b>42</b> | <b>95</b> |     | <b>1</b> | <b>160</b> |

# Data Filtering

- Data sorted by zip code
- Other SFH in zip code used as comparison homes
- Eliminated zip codes <5 RS or HES homes
- Eliminated homes w/ multiple practices

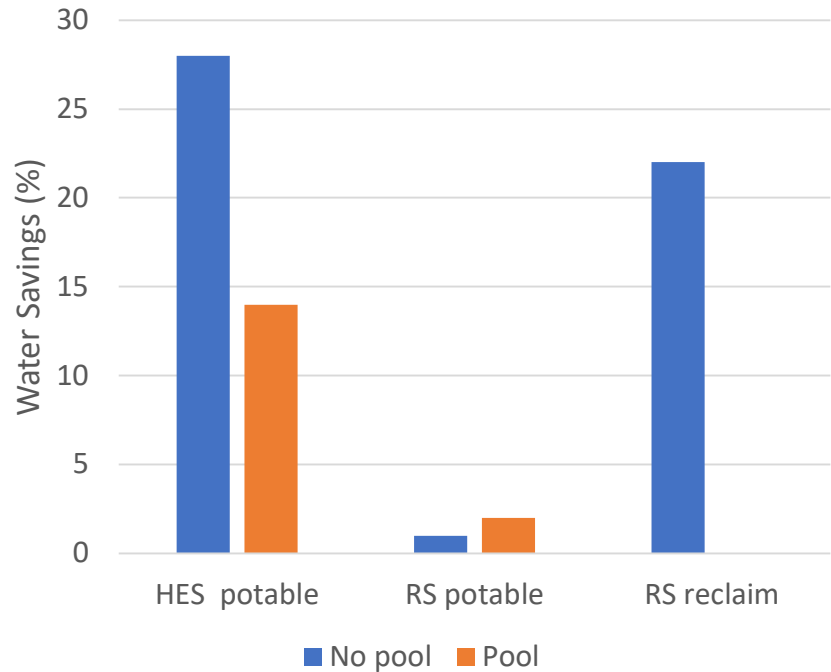
| Meter                | HES          |           | RS           |            |
|----------------------|--------------|-----------|--------------|------------|
|                      | Participated | Analyzed  | Participated | Analyzed   |
| Dual Potable Water   | 47           | 20        | 370          | 241        |
| Dual Reclaimed Water | 1            | 0         | 26           | 19         |
| Single               | 112          | 14        | 671          | 438        |
| <b>Total</b>         | <b>160</b>   | <b>34</b> | <b>1067</b>  | <b>698</b> |

# Savings Estimate

- Consumption 12 month post implementation
- Comparison homes dual potable by zip code
- Comparison indoor used for estimate on single meter program homes
- Savings = Comparison outdoor – Program home outdoor

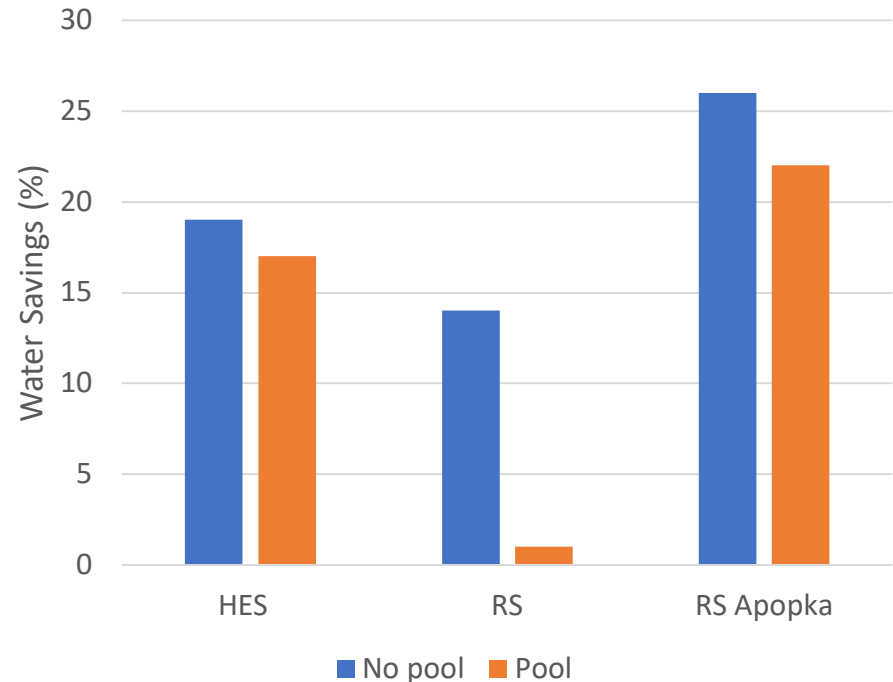
# Dual meter savings

- HES
  - No pool 28% (n=9)
  - Pool 14% (n=11)
- RS potable
  - No pool 1% (n=132)
  - Pool 2% (n=109)
- RS reclaim
  - No pool 22% (n=12)
  - Pool 0% (n=7)



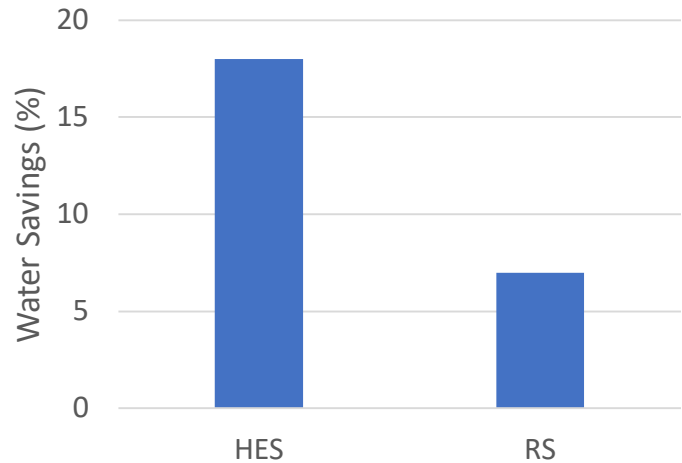
# Single potable savings

- HES
  - No pool 19% (n=9)
  - Pool 17% (n=5)
- RS
  - No pool 14% (n=355)
  - Pool 1% (n=52)
- RS Apopka
  - No pool 26% (n=17)
  - Pool 22% (n=14)



# Overall Weighted Avg Savings

- HES 18% (n=34)
- RS 7% (n=698)



- RS savings significant?
- Pool homes savings reduced due to pool refilling?



# Savings and Cost

- HES: 7-13 kgal/yr; \$6-10/kgal
- RS: 5 kgal/yr; \$38/kgal
- Smart controllers: 23-68 kgal/yr; \$1.8/kgal



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