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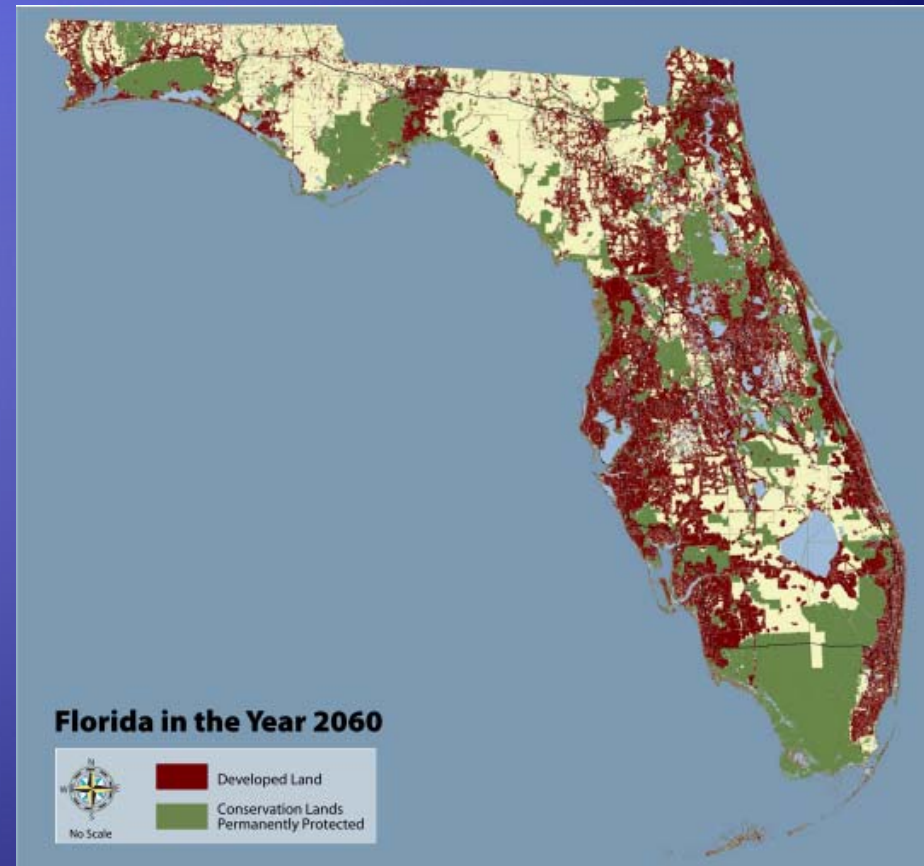
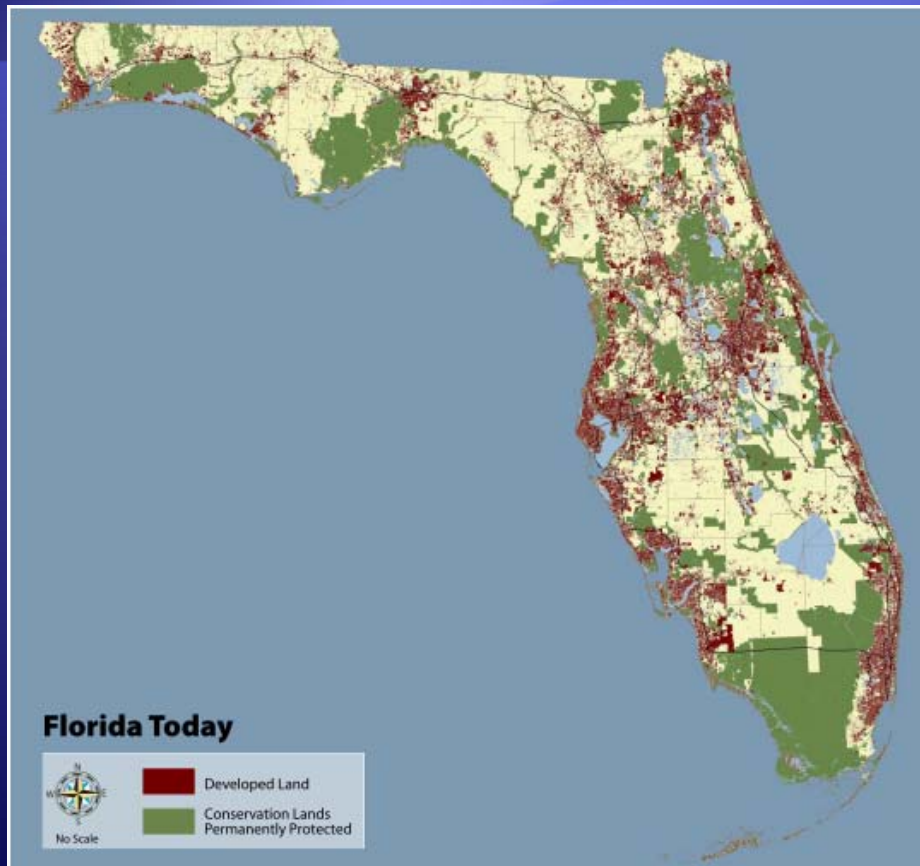
SUMMARY OF SMART CONTROLLER TESTING IN FLORIDA & LESSONS LEARNED

Michael D. Dukes, Ph.D., P.E.

University of Florida, Agricultural & Biological Eng. Dept.

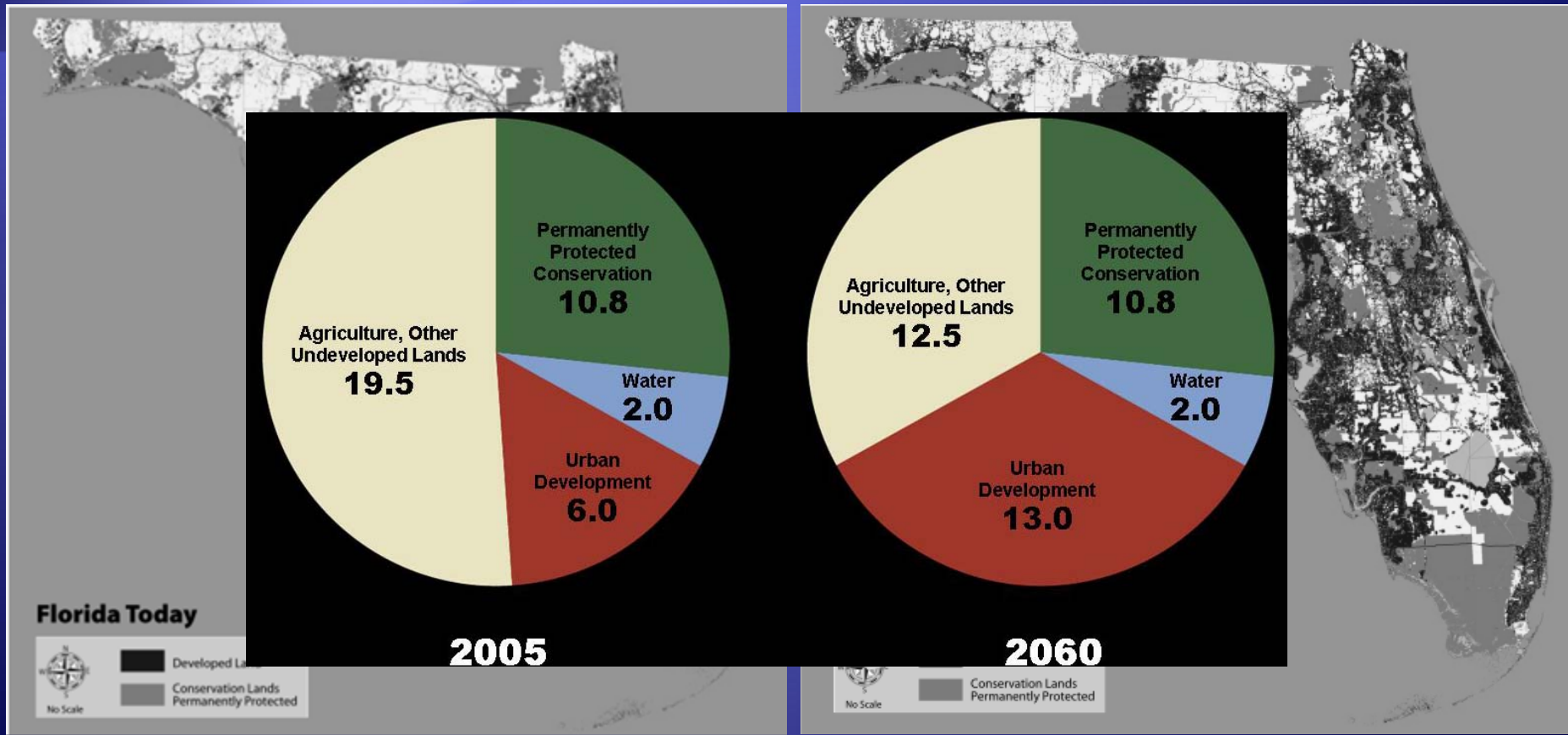
Institute of Food and Agricultural Sciences (IFAS)

Development of Land in Florida



Maps from 1,000 Friends of Florida
<http://www.1000friendsofflorida.org/planning/2060.asp>

Development of Land in Florida

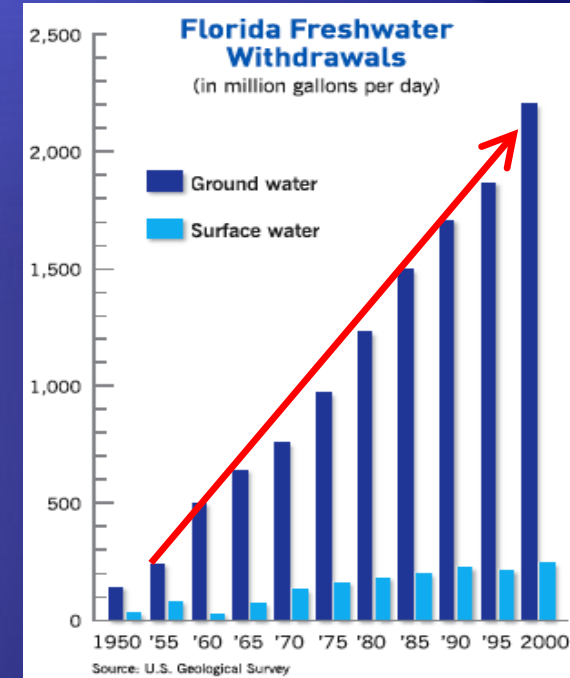


Maps from 1,000 Friends of Florida

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Significance of Irrigation in FL

- ♦ Population served by public supply
 - ♦ 5.4 million 1970
 - ♦ 17 million 2004
 - ♦ 20 million 2020 (est.)
- ♦ 11% U.S. new home construction in FL
- ♦ + ~1,000 people/day
- ♦ FL uses the most groundwater in the U.S.
- ♦ Most new homes in FL include irrigation
- ♦ ~60% household water use for irrigation
- ♦ High quality landscapes and low water holding capacity



Irrigation is a Standard “Appliance”



Smart Irrigation Controller Technology

- ◆ Substantial wasted irrigation is due to wrong time & wrong amount of irrigation
 - ◆ Homeowner convenience issues
 - ◆ Lack of understanding of plant water needs
 - ◆ Irrigation system is an “appliance” to maintain a desired landscape
- ◆ Smart Irrigation Controllers aim to automate these decisions based on feedback from the irrigated system

Overall Objectives



Evapotranspiration (ET) based controllers

Soil moisture controllers (SMS)



Compare irrigation applied & turf quality on SMS, ET & RS controlled irrigation to time clock irrigation

Rain sensors (RS)

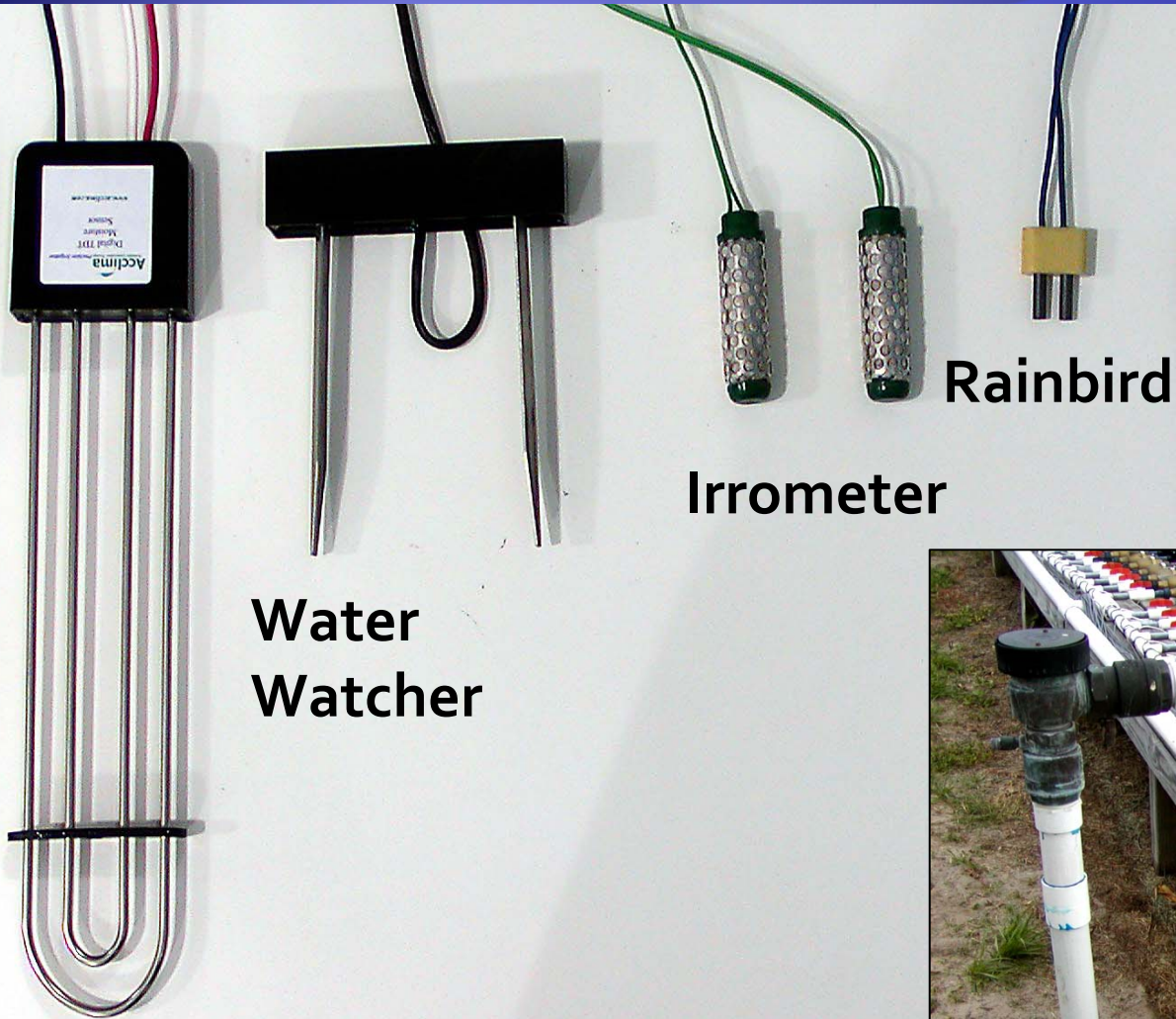


SMS Testing 2004-05, Normal Rainfall Frequency

- ◆ 1 d/wk four brands SMS
 - ◆ 2 d/wk four brands SMS
 - ◆ 7 d/wk four brands SMS
 - ◆ Time 2 d/wk with rain sensor
 - ◆ 60% of time 2 d/wk with rain sensor
 - ◆ Time 2 d/wk without rain sensor
 - ◆ Non-irrigated
- 3 SMS frequencies
- Comparisons



Soil Moisture Control Sensors



Rainbird

Irrrometer

Water
Watcher

Acclima





Acclima



Rain Bird



Irrrometer



Water Watcher

TIME vs. SMS Control 2004+05

Treatment	TOTAL (mm)*	Savings compared to 2-WORS (%)
2-WORS	1514	0
2-WRS	995	34
2-DWRS	623	59
Sms Avg	420	72

WRS = With Rain Sensor

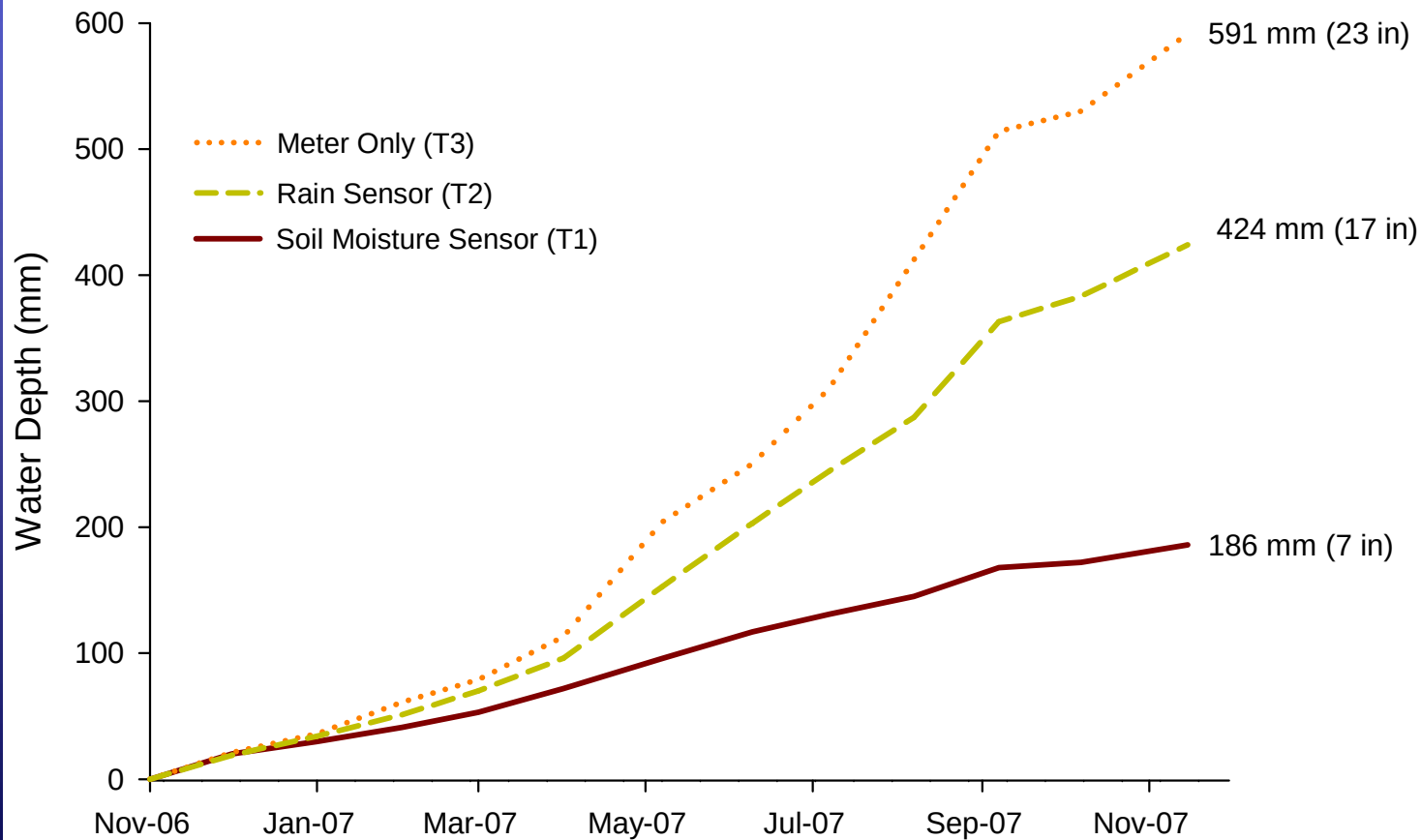
DWRS = 60% Deficit With Rain Sensor
Sensors

Avg = Average

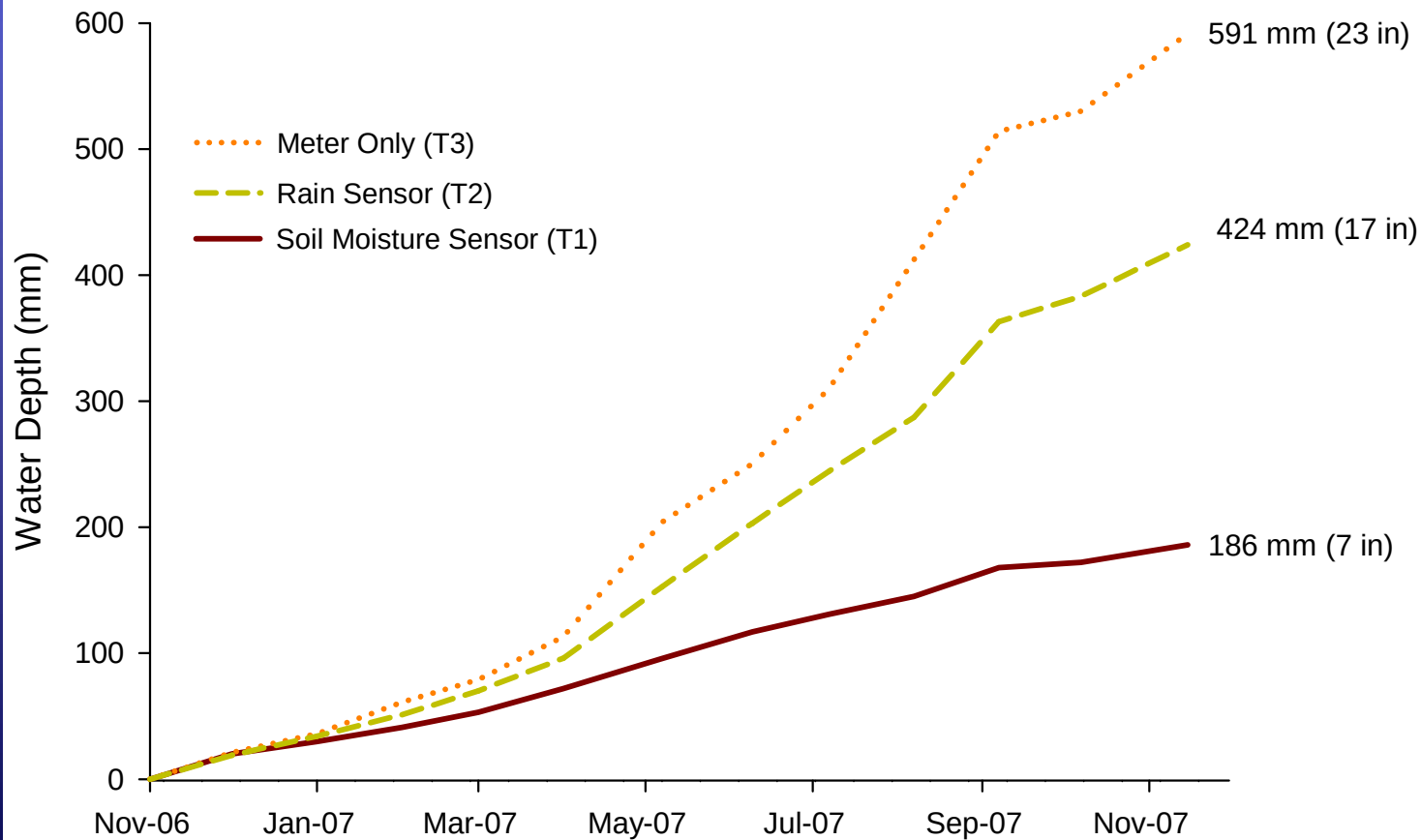
WORS = Without Rain Sensor

Sms = Soil Moisture

SMS Controllers on Homes in Pinellas Co.



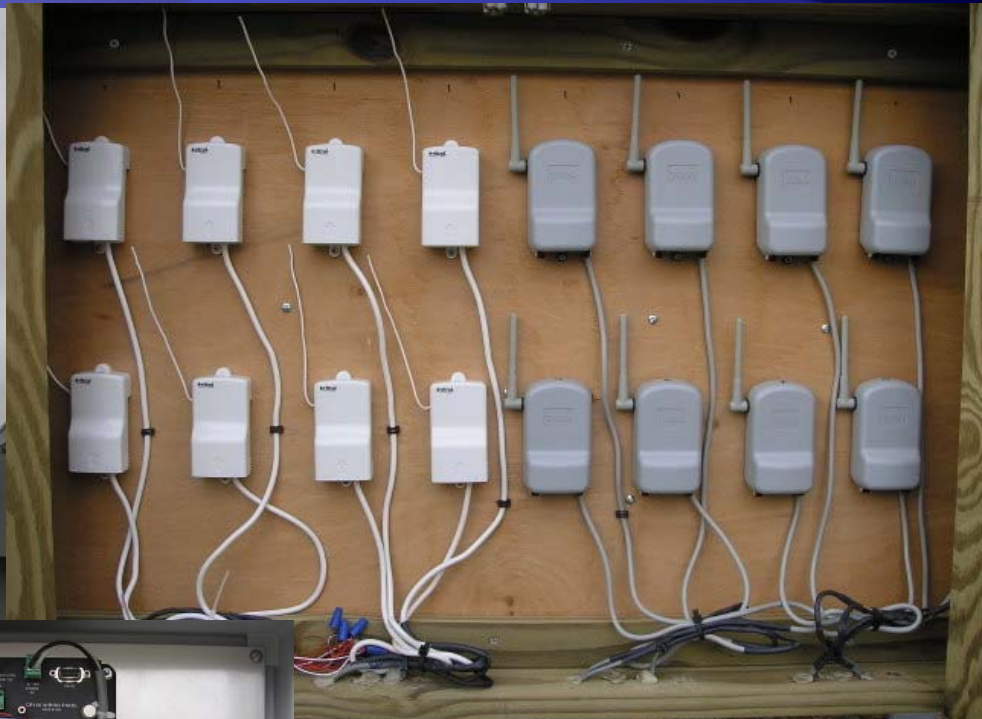
SMS Controllers on Homes in Pinellas Co.



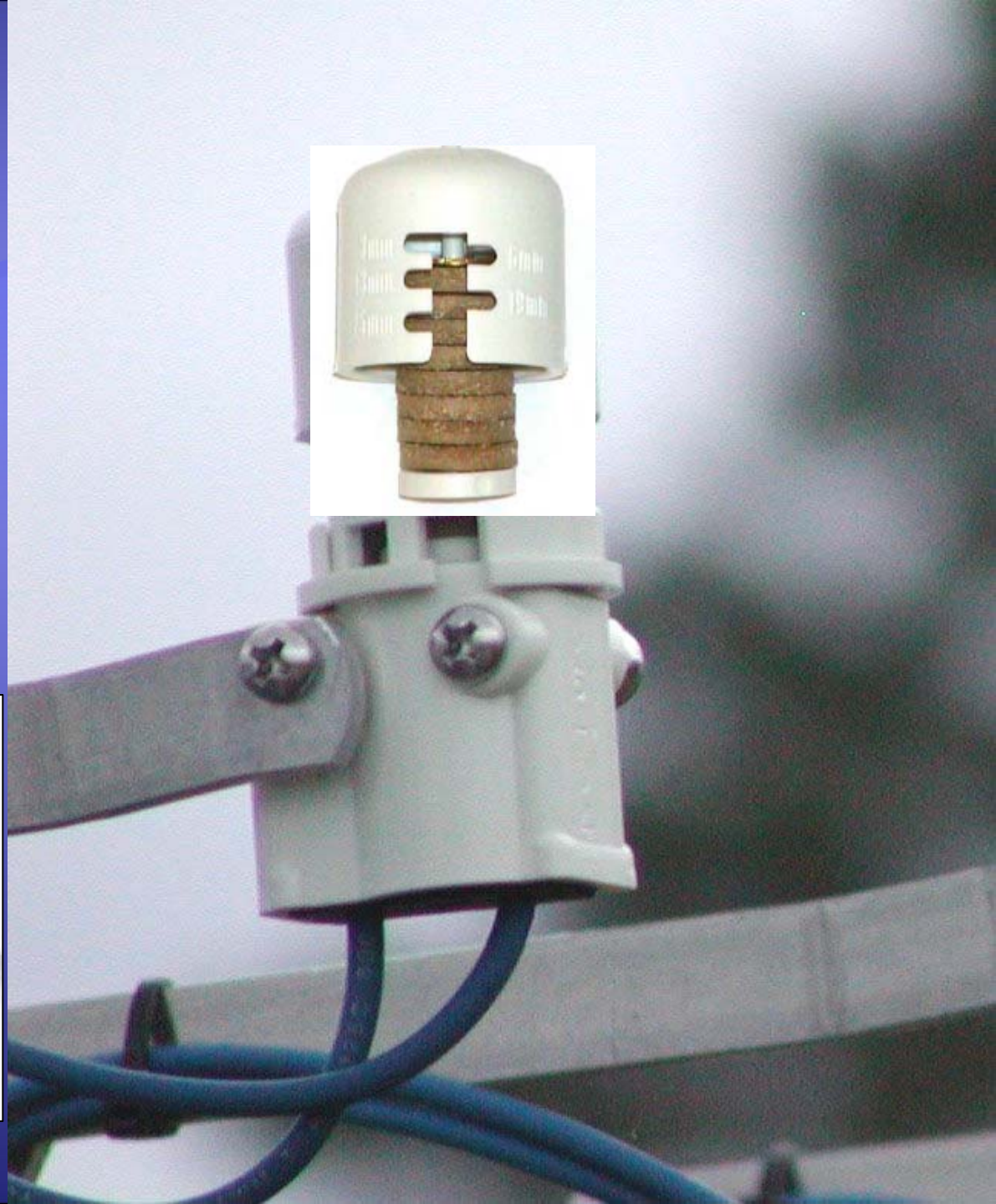
69%

56%

Rain Sensor Testing, 2005

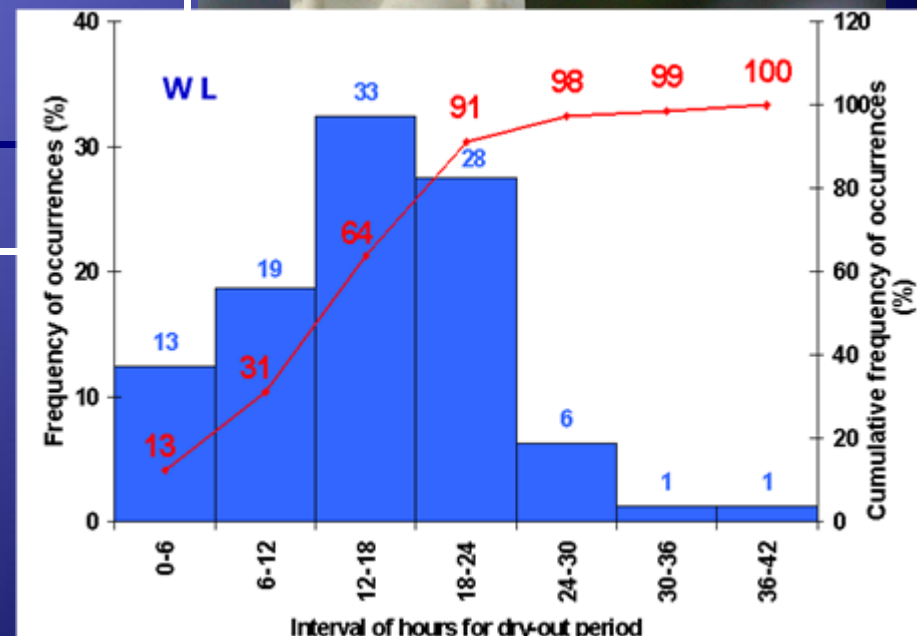
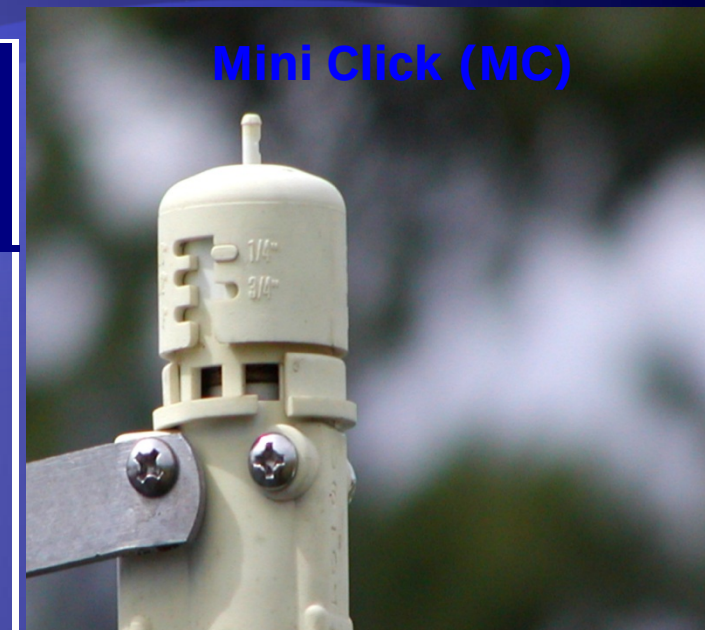


Expanding Disk Rain Sensor



Rain Sensor Performance

Treatment	Water savings vs. WORS (%)
WL	44
1/8-MC	30
1/2-MC	17
1-MC	3
WORS	0
WORS = without RS	



SMS/ET Controllers 2006-07, Drought Conditions

St. Augustinegrass testing ongoing since March 2006

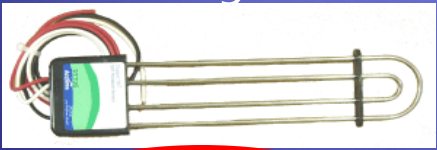


72 plots
18 treatments & 4 replicates
A: Rain Sensors
B: Soil Moisture Sensors
ET Controllers

Photo May 2006, M.L. Shedd

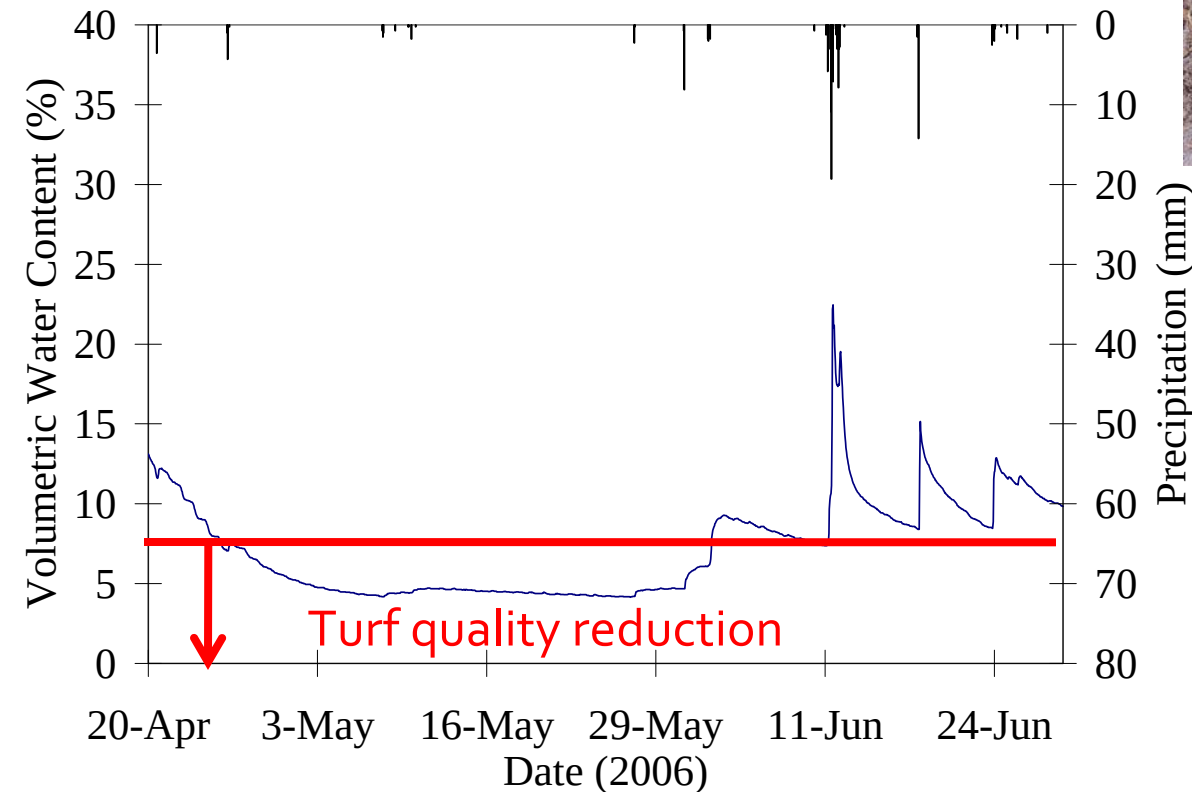


Technology Being Tested

Soil Moisture Sensors	Rain Sensors	ET Controllers
Lawn Logic® LL1004 	Hunter Mini-Clik® 	TORO Intelli-sense TIS612 
Acclima Digital TDT® RS500 		RainBird ET Manager™ 
▪ 2 days/week ▪ 3 levels of soil moisture content (Low, Medium and High)	▪ 1, 2, or 7 days/week ▪ 2 depths of rainfall	▪ 2 days/week ▪ Signal from a weather station to calculate ET

Volumetric Water Content, Spring 2006

- ◆ Each plot monitored individually with TDR probes



Non-irrigated plots

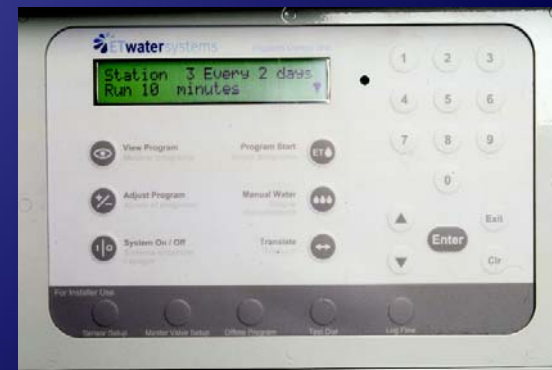
- Shows rainfall events
- Dry Spring Season

SMS/ET Testing Results

- ◆ Sandy soil threshold, 10% volumetric water content
- ◆ 1 d/wk may lead to poor turf quality
- ◆ Savings
 - ◆ SMS: 18-53%
 - ◆ ET: 25-63%
 - ◆ RS: 7-30%

ET Controller Testing, Hillsborough Co. 2006-07, Drought Conditions

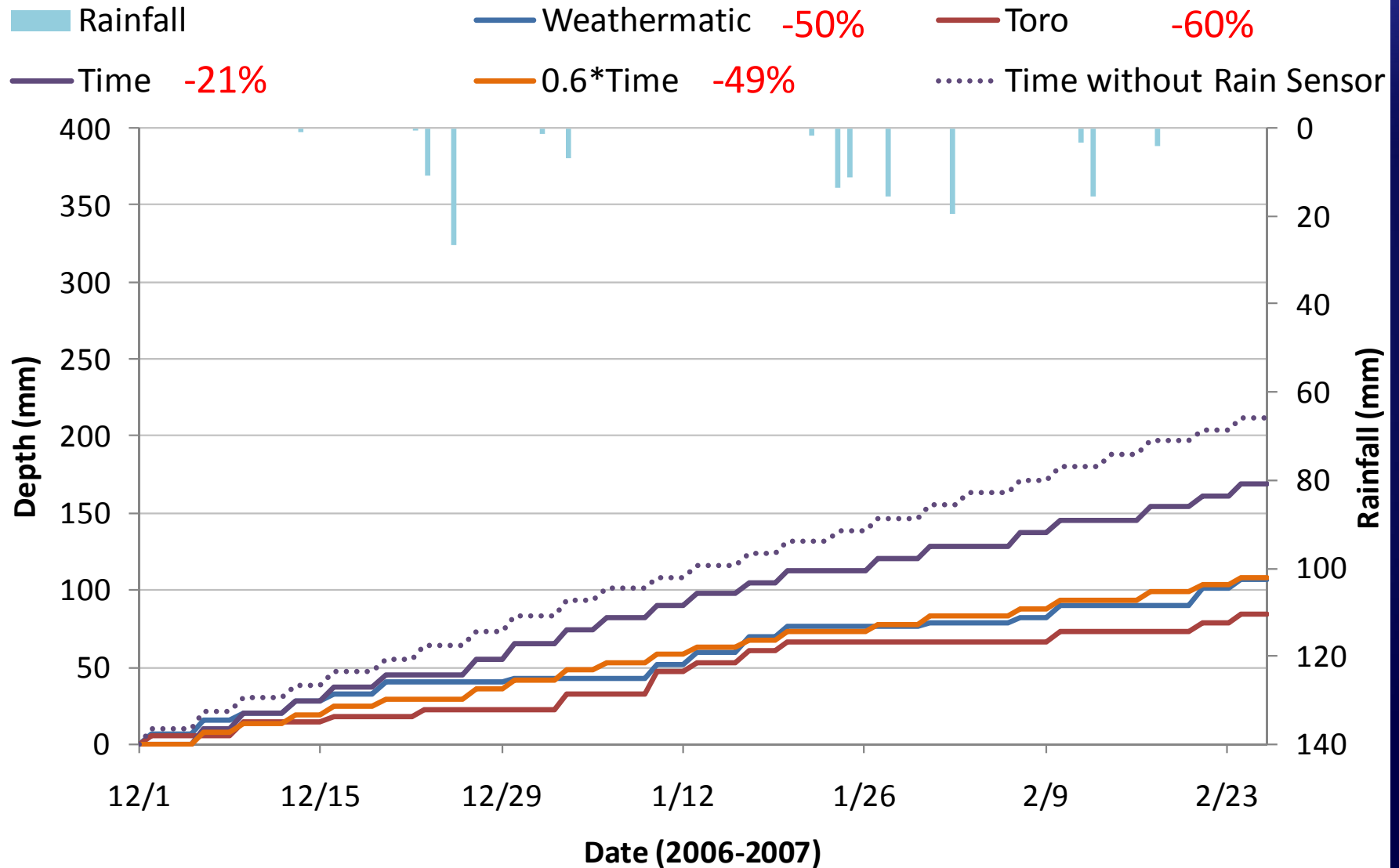
- ♦ Three ET controllers:
 - ♦ T1, Weathermatic, Smartline SL800
 - ♦ T2, Toro, Intellisense TIS-612OD
 - ♦ T3, ETwater, Smart Controller 100
- ♦ T4: Timeclock with RS
- ♦ T5: 60% of T4



Hillsborough Co. Test Plots



Controller Performance Example



Hillsborough Co. Testing Results

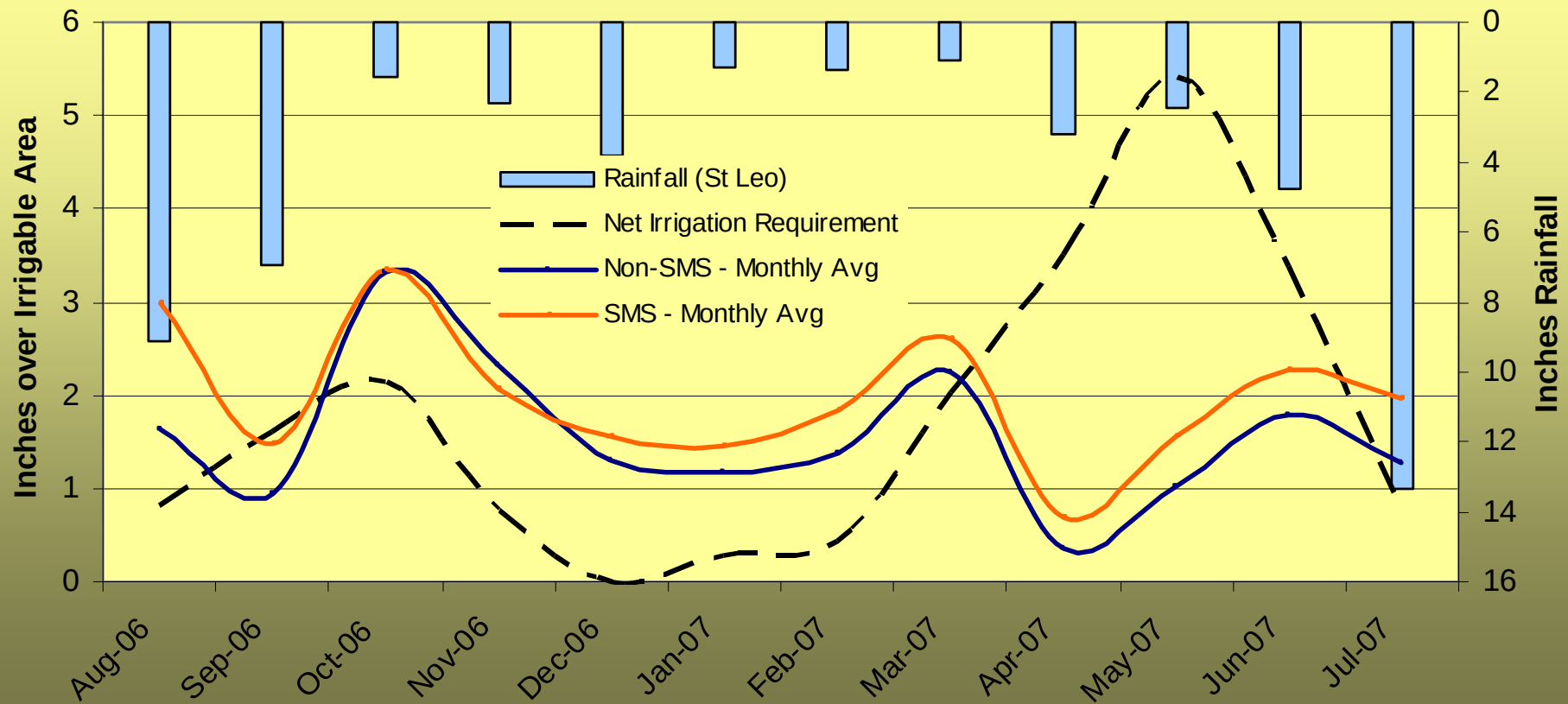
- ◆ Savings compared to time schedule adjusted monthly & no rain sensor
- ◆ Spring: 9-30%
- ◆ Summer: 11-49%
- ◆ Fall: 15-17%
- ◆ Winter: 50-60%

SMS Implementation Example Lake Jovita, Pasco Co.

- ◆ Fall 2005: Requested variance from 50/50 county landscape ordinance
- ◆ All new homes required to have SMS irrigation control
- ◆ Fully irrigated landscapes installed under variance
- ◆ Extensive SMS installs began in 2006
- ◆ SMS controllers did not seem to be effective initially

Lake Jovita SMS Performance

Water Usage versus Net Irrigation Requirement



SMS Controller Installations

- ◆ Original “indoor” controllers installed outside

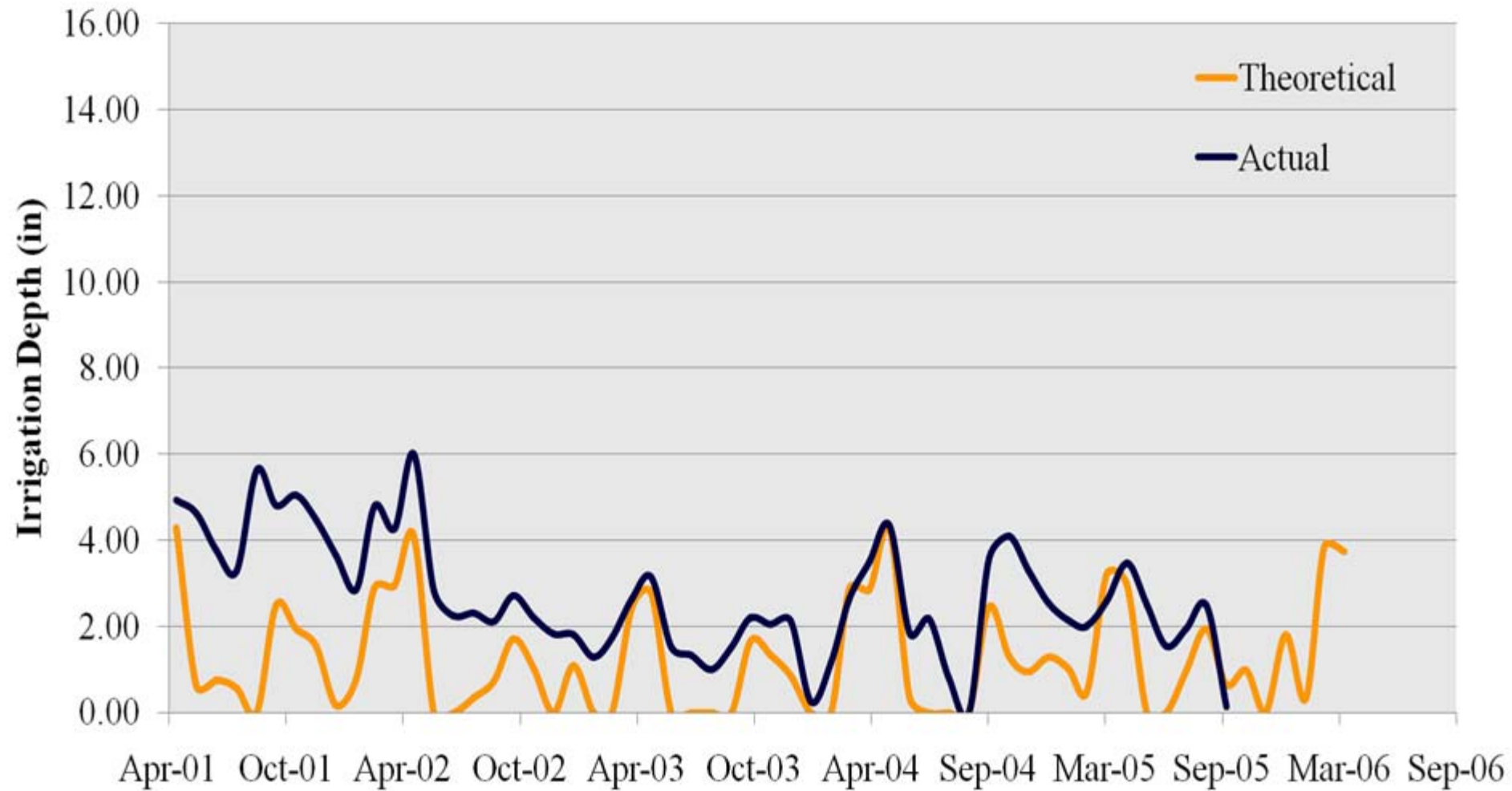


Lake Jovita Case Study

- ◆ Mapped as Arredondo, Sparr, Kendrick fine sands
- ◆ Actual soil significantly disturbed

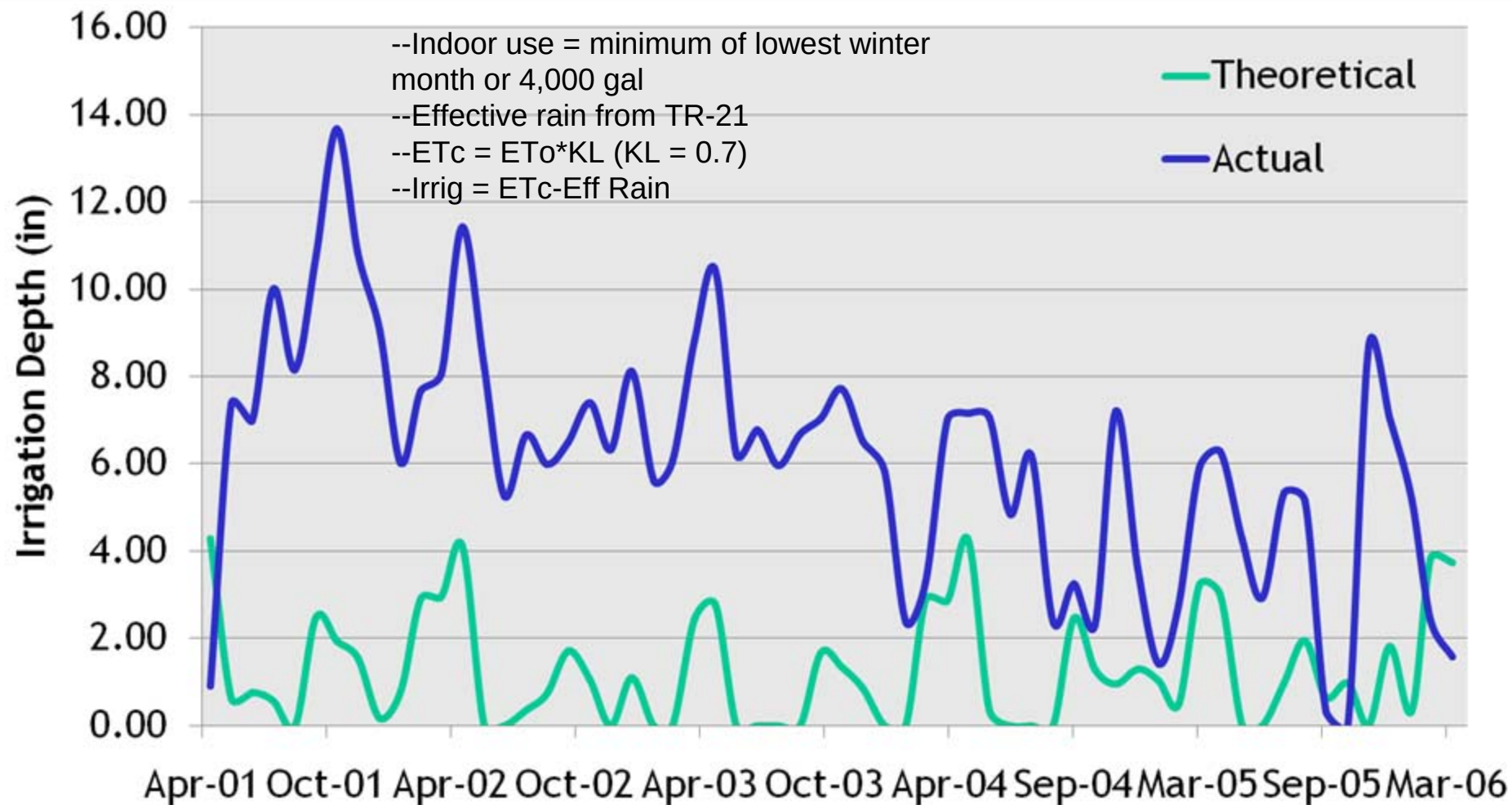


Lake Jovita Water Use



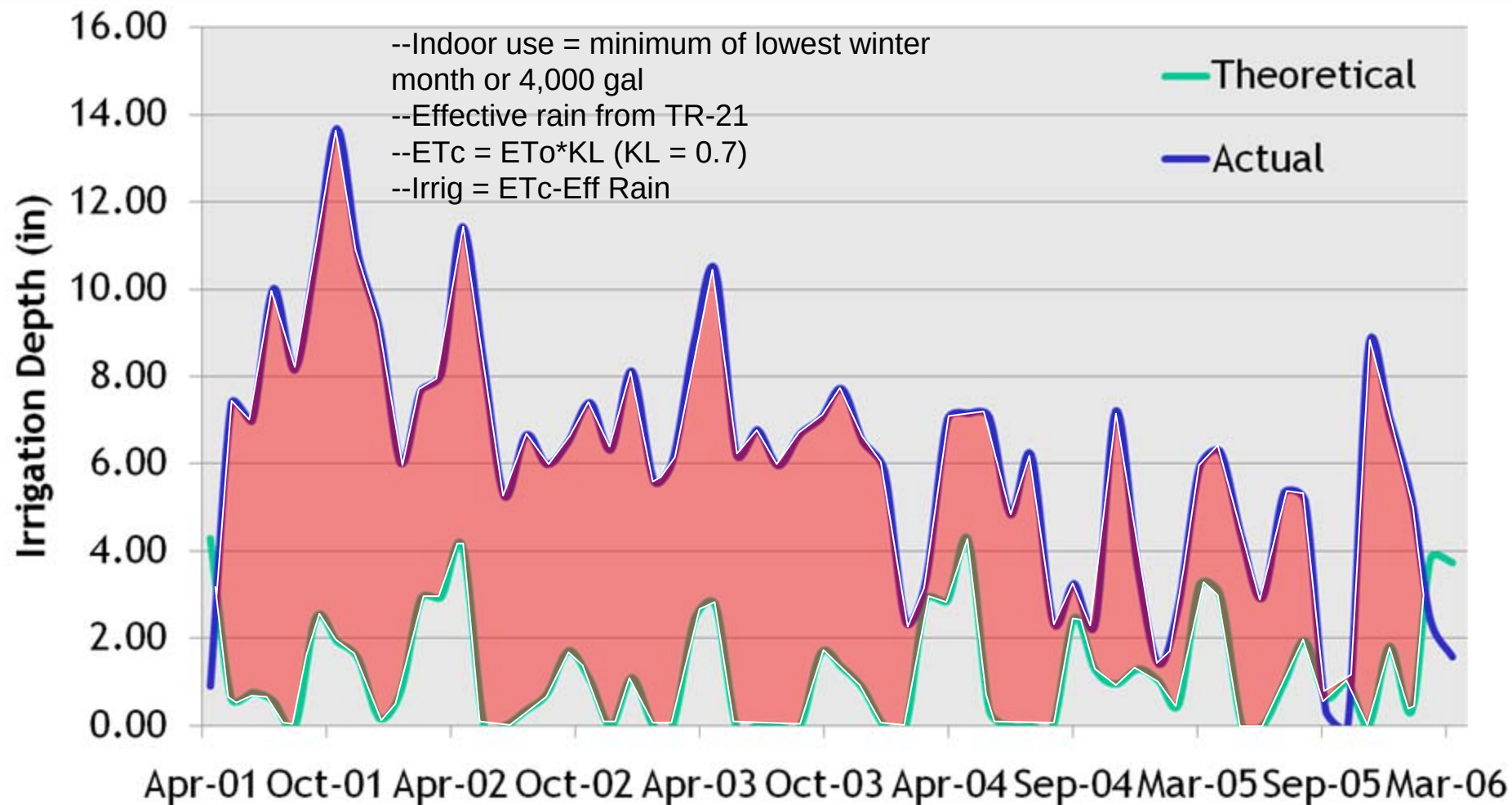
Development Example

Key Vista, Pasco Co. ~700 homes



Development Example

Key Vista, Pasco Co. ~700 homes



Development Water Use Characteristics

◆ Lake Jovita

- ◆ The 25% highest water use records result in 60% of the irrigation water
- ◆ The 50% highest water use records result in 90% of the irrigation water

◆ Key Vista

- ◆ The 25% highest water use records result in 42% of the irrigation water
- ◆ The 50% highest water use records result in 85% of the irrigation water

Implementation Examples

- ◆ Municipal Water District of Orange County
 - ◆ 899 Smart Controllers (ET based) on single family homes
 - ◆ 8 brands
 - ◆ 33% → decreased use
 - ◆ 18% → increased use
 - ◆ ~50% no change
 - ◆ Similar trends on commercial installations

Implementation Examples (cont'd)

- ◆ San Antonio Water Systems
 - ◆ No change between “water efficient homes” and comparison group
 - ◆ Actual use (~170 kgal/yr) double water budget (~80 kgal/yr)
- ◆ Irvine Ranch
 - ◆ After pilot program ended, 50% of homeowners refused to pay controller subscription fee of \$5/month
 - ◆ Statewide ET network in development
- ◆ Otay Water District
 - ◆ Nearly half of Smart Controllers not set up properly

Smart Irrigation Controller

Irrigation Reduction *Potential*

Method	Location	Irrigation Savings	Weather	Funding agency
Time clock adjustment w/ rain sensor	Homes in Central Fla.	30%	Normal to rainy	SJRWMD
Rain sensor	Plots in Gainesville	34%	Normal to rainy	SWFWMD
		15%	Dry	
Soil moisture sensor control	Plots in Gainesville	70-90%	Normal to rainy	SWFWMD
		Up to 40%	Dry	
	Homes in Pinellas Co.	Up to 70%	Dry (1 d/wk)	SWFWMD
ET controllers	Plots in Hillsborough Co.	Up to 60%	~Normal	Hillsborough Co./FDACS
		Up to 40%	Dry	

The Answer is **NOT** Only Smart Controllers

- ◆ Smart Controllers have **potential**
- ◆ Should be targeted to “**high**” water users
- ◆ Must be implemented with **hands on training** of contractors
- ◆ Ongoing **certification/verification** program should be implemented

Funding Partners

- ◆ Irrigation efficiency study
 - ◆ SJRWMD
- ◆ Soil moisture sensor research
 - ◆ Pinellas Anclote Basin Board, SWFWMD
 - ◆ Florida Dept. Ag. and Consumer Services
 - ◆ Florida Nursery Growers & Landscape Association
 - ◆ Florida Turfgrass Association
- ◆ ET controller research
 - ◆ Hillsborough County Water Dept.
 - ◆ Florida Dept. Ag. and Consumer Services
 - ◆ Florida Nursery Growers & Landscape Association
 - ◆ Florida Turfgrass Association
- ◆ Industry Partners

Questions?

mddukes@ufl.edu
<http://irrigation.ifas.ufl.edu>