



2016 Water Symposium

Cactus and Pine AGCSA

The Intelligent Use of Water.™

LEADERSHIP • EDUCATION • PARTNERSHIPS • PRODUCTS

Available Technology

- **Pump Station Integration with Central Control**
- **Soil Monitoring**
- **Advanced Nozzles and Uniformity**
- **Smart Sensors**
- **25 Ways to Save 25%**

What is Smart Pump?

- **Smart Pump is a software module that links specially integrated VFD pump stations and Rain Bird central control software in order to optimize Flow Management and react in real time to environmental conditions.**



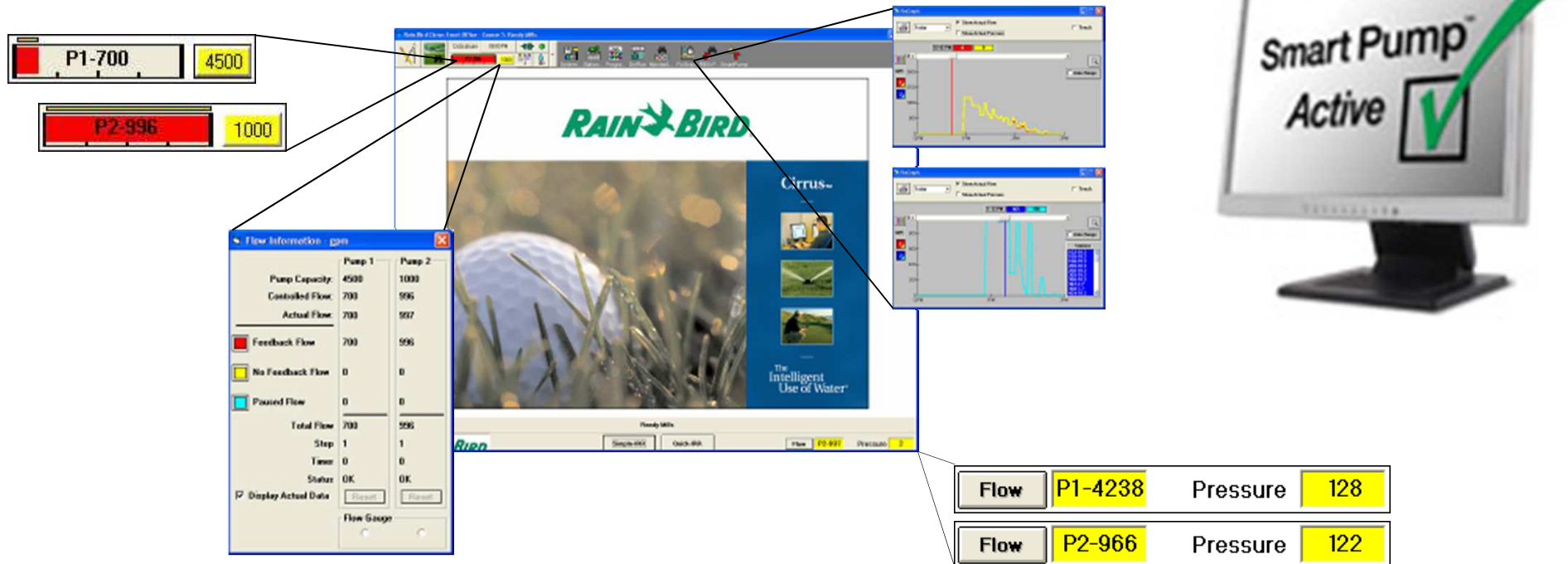
The Two Critical Values

- **Actual Flow** – Flow measured at the pump station by the pump station's built-in flow meter
- **Controlled or Theoretical Flow** – Flow demand calculated by the central control based on nozzle data in the software

Smart Pump Features

Comparative Displays

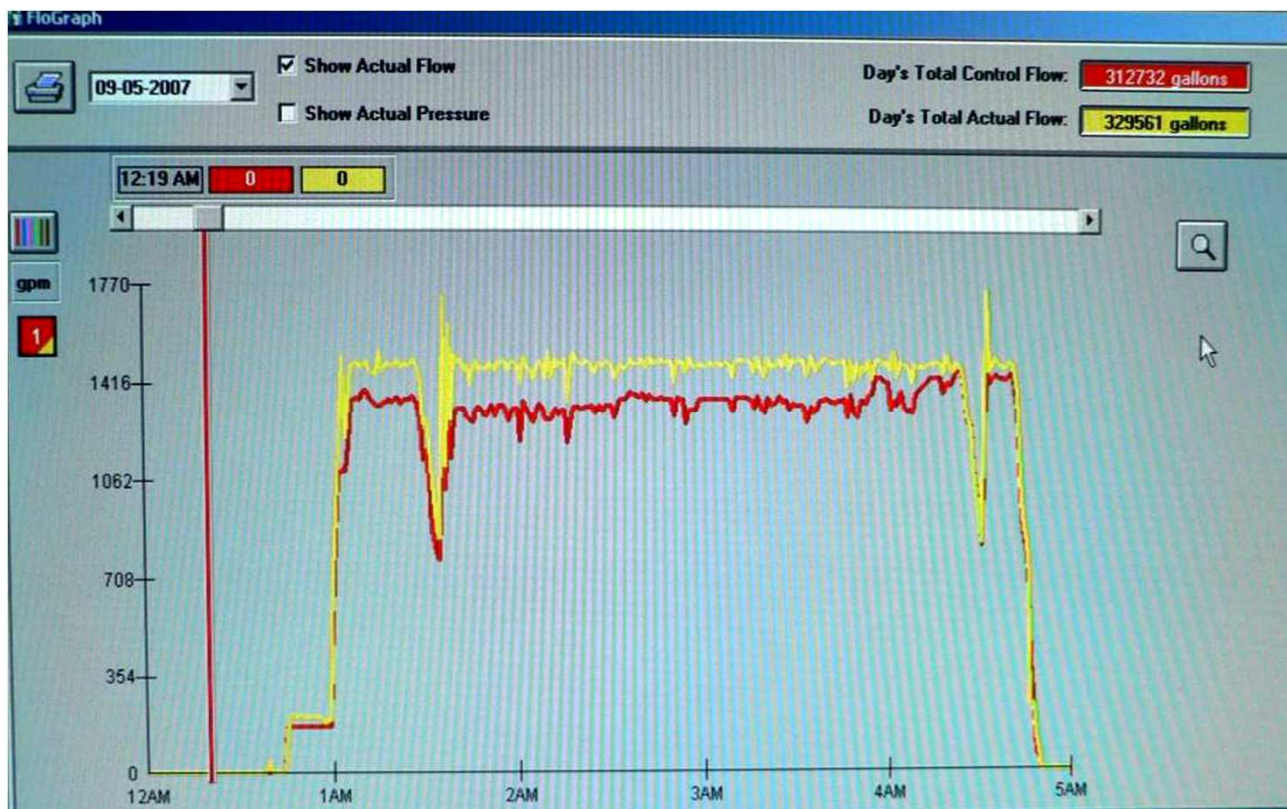
Displays Controlled and Actual flow



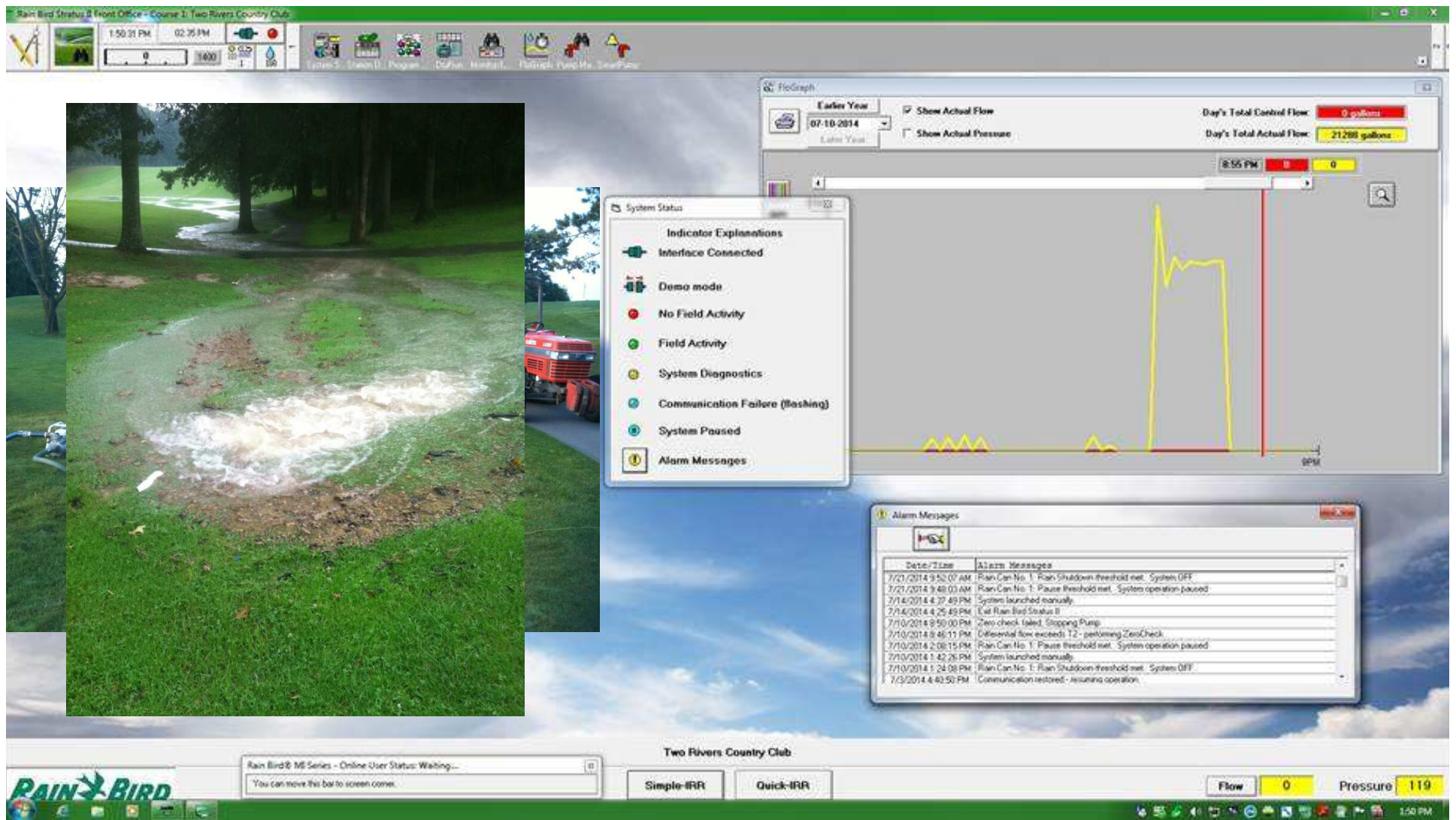
Smart Pump Features

Comparative Graphs

Displays Controlled and Actual Flow

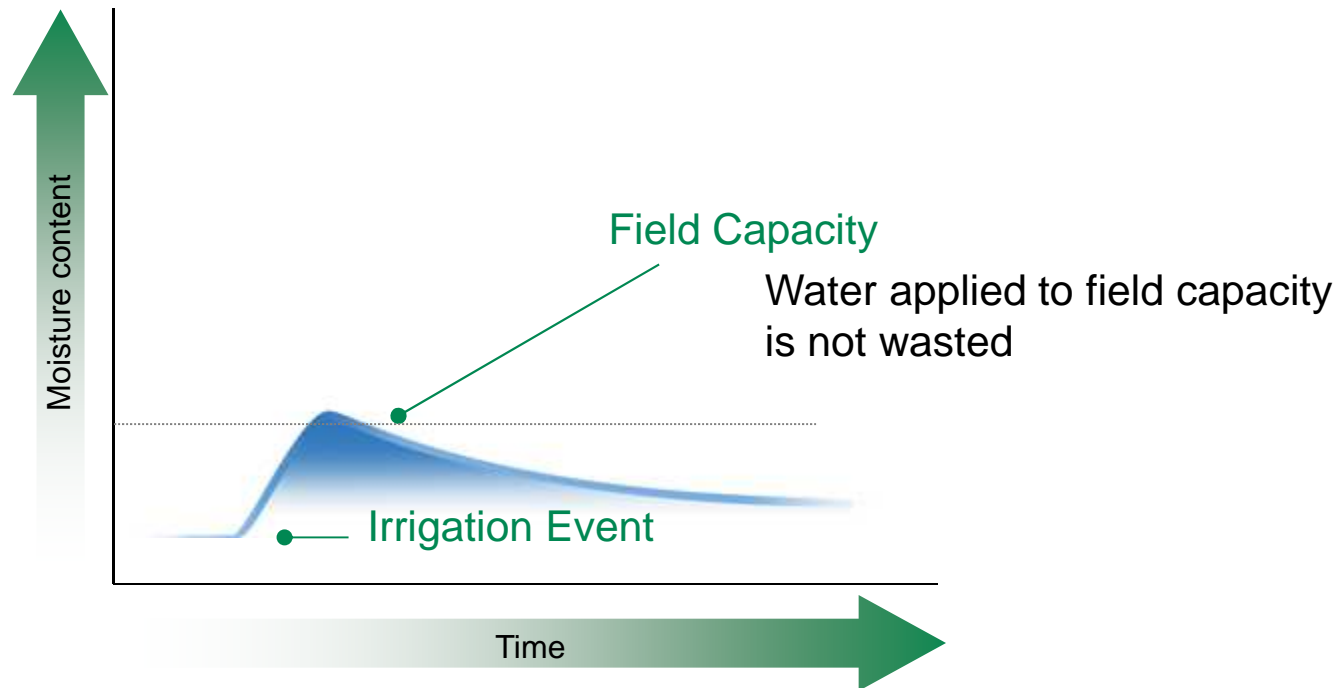


Real world results!

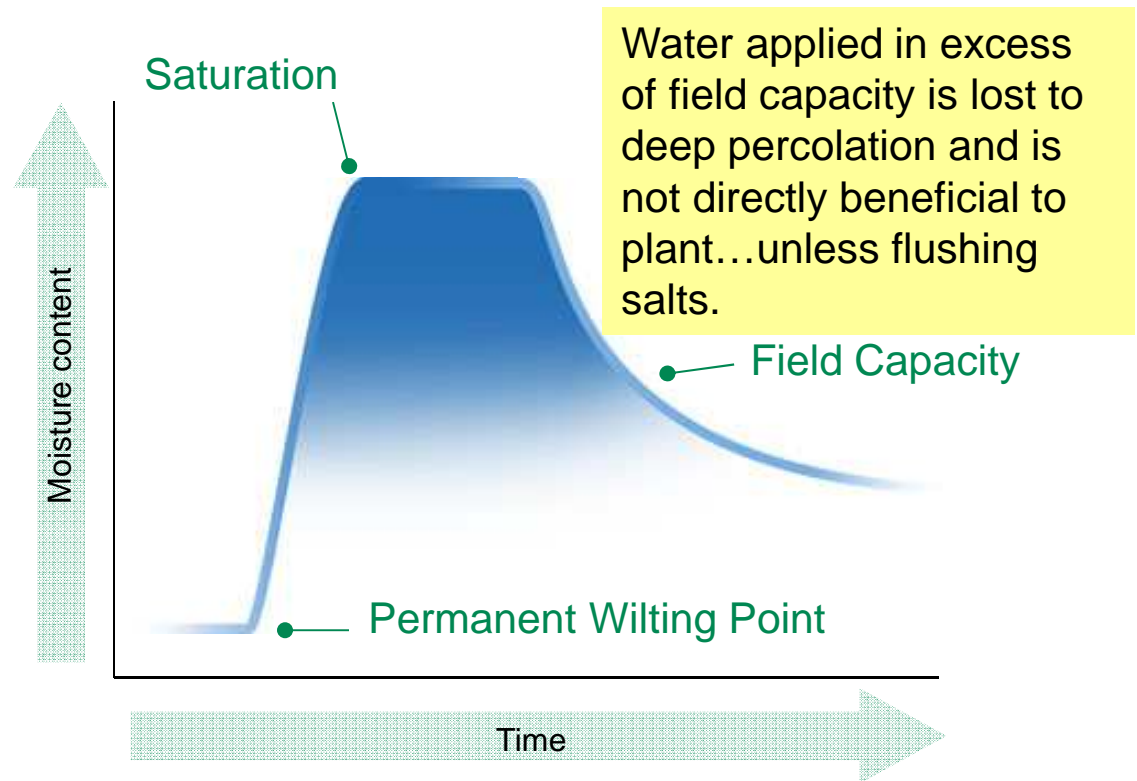
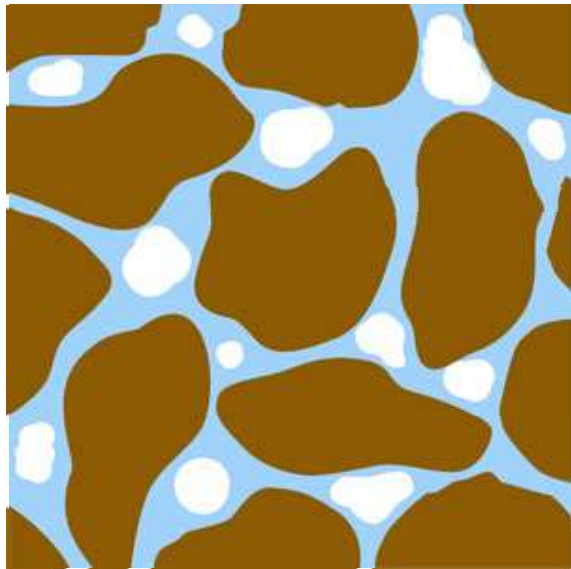


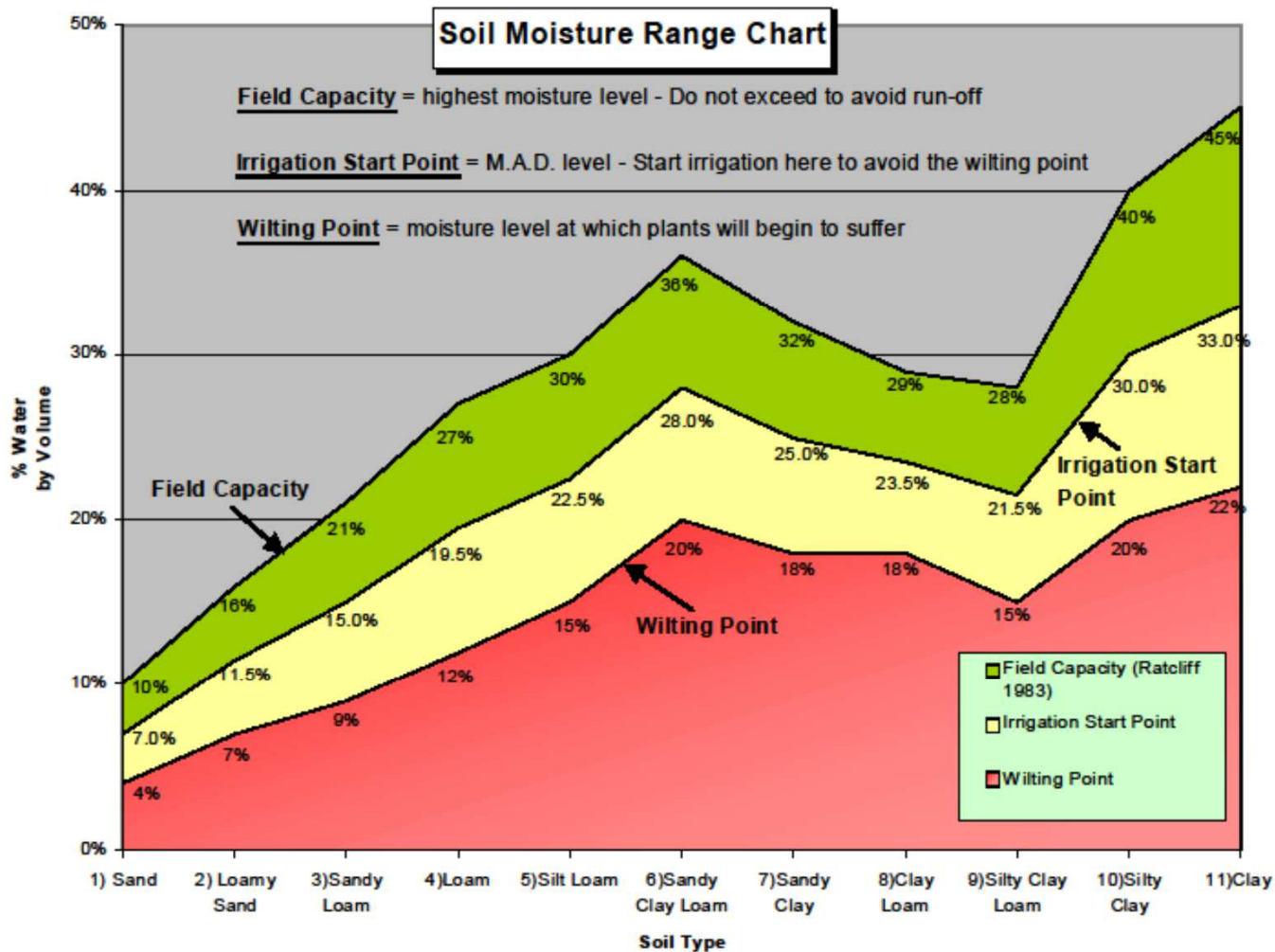
Soil Monitoring

- Ideally, moisture content during irrigation should look like this:



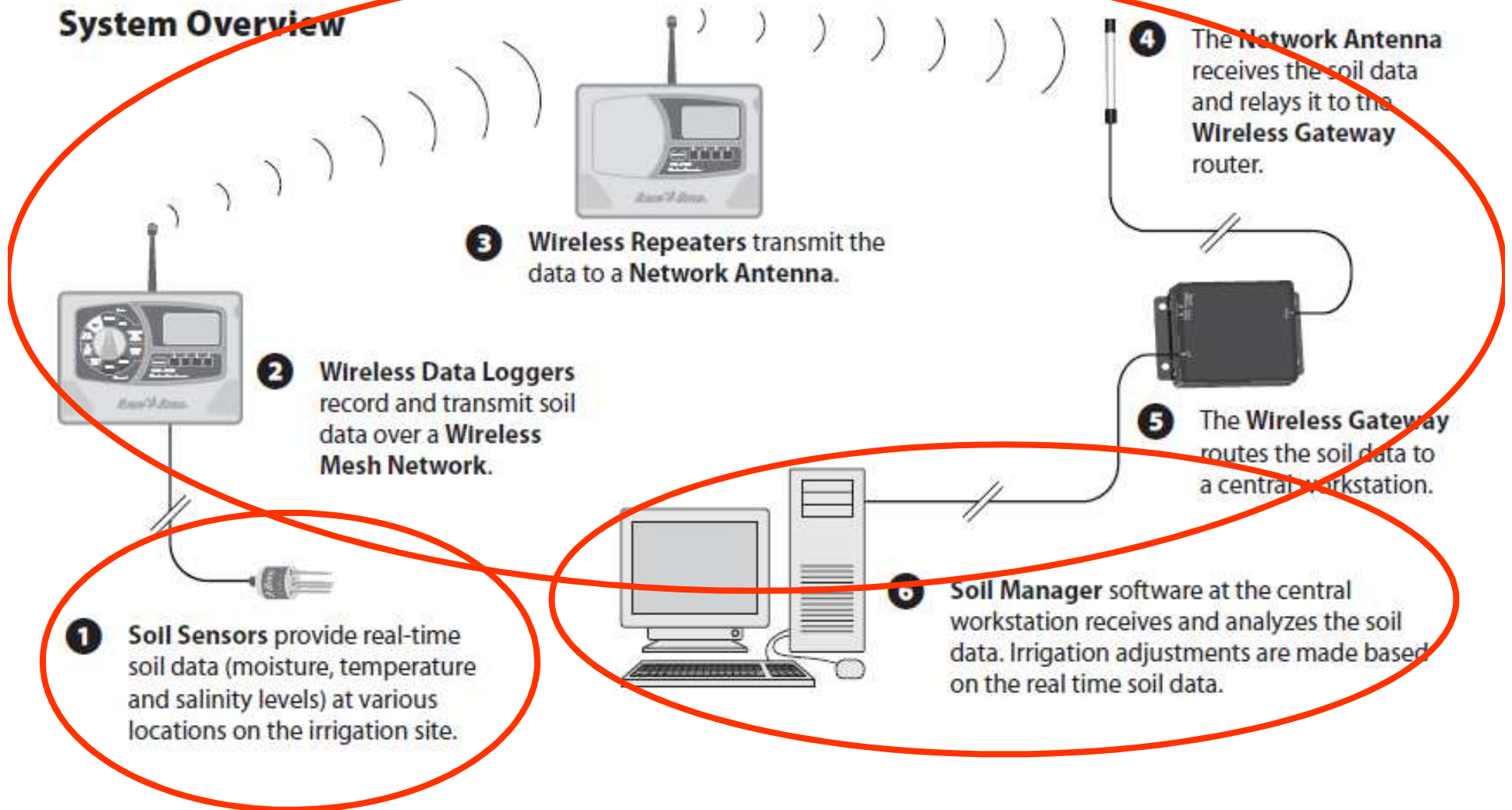
Results of Over Watering





ISS Wireless Mesh Network

System Overview



TSM-3 Sensor

- **Only system giving accurate soil readings following installation and without sensor calibration**
 - Absolute sensors give accurate readings with immediate response
 - No calibration needed
 - Simultaneously measures Moisture, Salinity and Temperature
 - Research-grade sensors with years of field proven performance and reliability
 - Maintenance free robust construction for hostile conditions
 - Sensor sampling rate is adjustable between two minutes and up to two hours
 - Accurate in high salinity



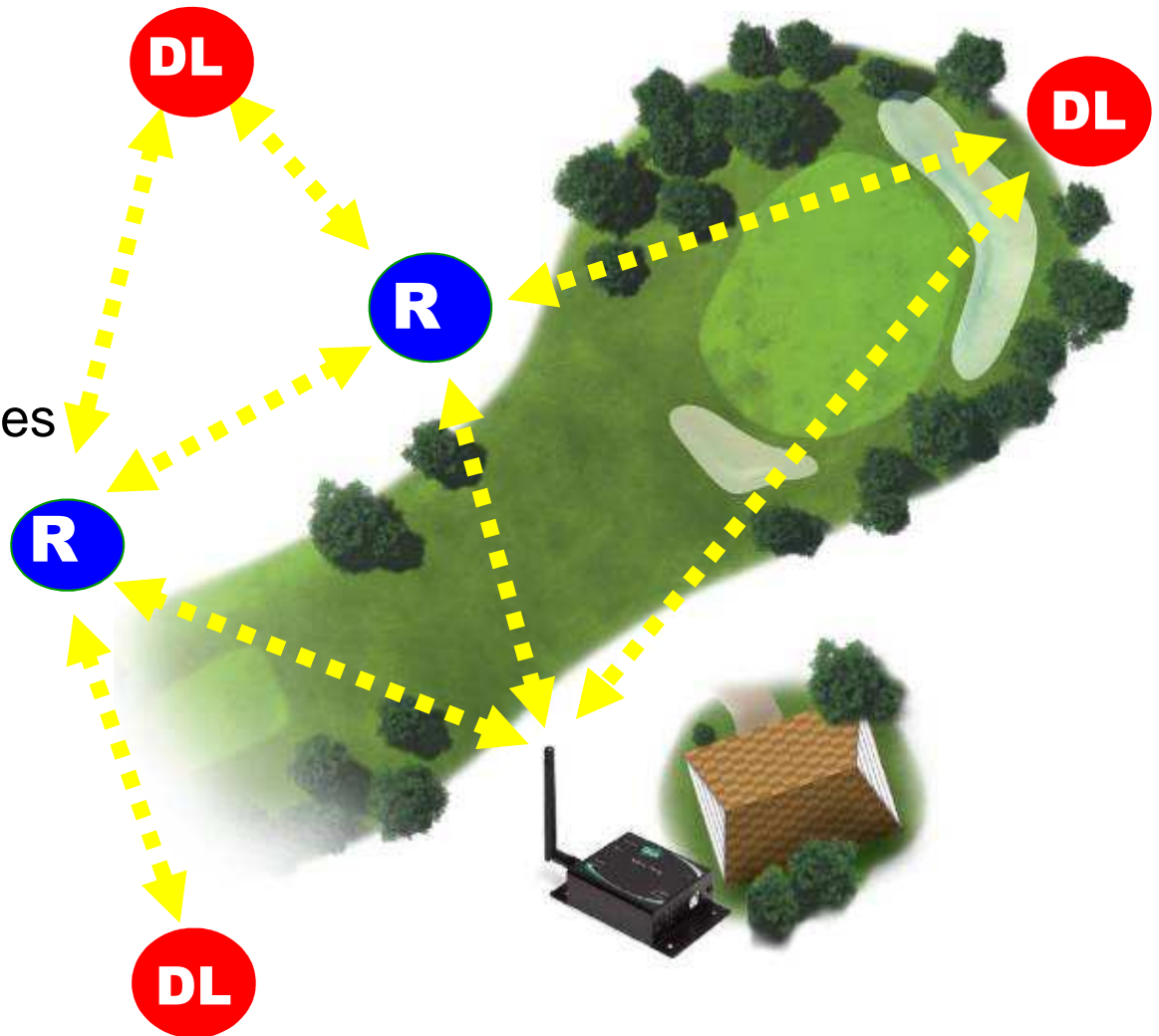
Sensor Installation

- Place sensor in the active and undisturbed root zone, not too deep. Typically a depth of between 1-½" and 3" is acceptable.
- When inserting the sensor make sure that the stainless steel plate at the base of the tines makes full contact with the soil, leaving no air gaps
- When installing a second, deeper, sensor make sure that it is slightly offset compared to the top sensor



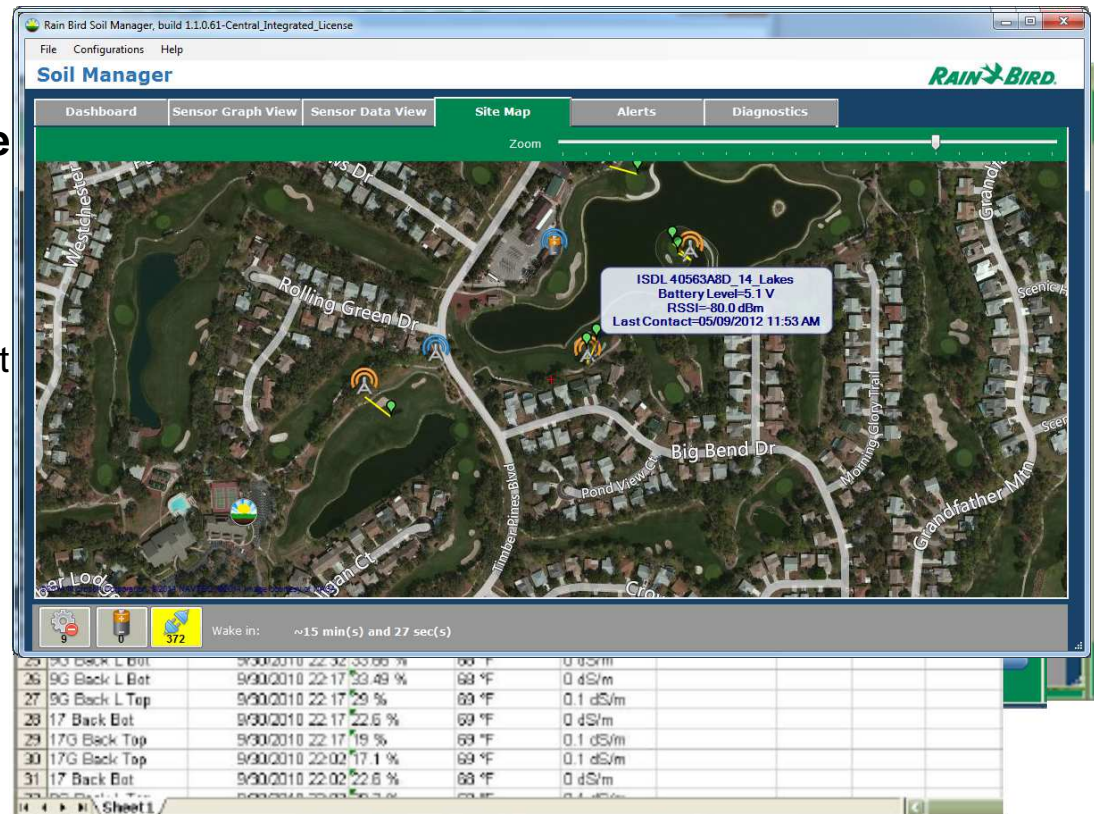
ISS Wireless Mesh Network

- 2.4 GHz DSSS (Direct Sequence Spread Spectrum) with no license required
- Range extended and signal strength increased by adding repeaters to network
- Self-healing → Signal is re-routed through alternate devices if primary path is not available



Soil Manager™ – Monitoring and Integration

- Monitoring mode works with any irrigation system
- Integrated mode works with any Rain Bird Golf central v7.1 and Site Control v4.0.3
- Dashboard, Graph and Table View
 - Snap shot view of course conditions
 - Graph view and table view with export to Excel
 - Annotations
 - Data import from SDHC card
 - Water budget recommendation
- Alerts and Diagnostics
 - Individual sensor thresholds
 - Email alerts for excess conditions
 - Battery and signal strength status
 - Diagnostics
- Site Map
 - Components entered with GIS values
 - Component status and operation displayed



Michigan State University Installation

- Research partnership with Michigan State University
- Sensors installed in USGA speed research putting green.



A4 08 18	Poa 08 17	Poa 08 16
A4 08 15	Poa 08 14	A4 08 13
Poa 08 12	USGA A4 08 11	Poa 08 10
A4 08 9	Poa 08 8	A4 08 7
A4 08 6	Poa 08 5	Poa 08 4
Poa 08 3	A4 08 2	A4 08 1



Nozzle design and performance

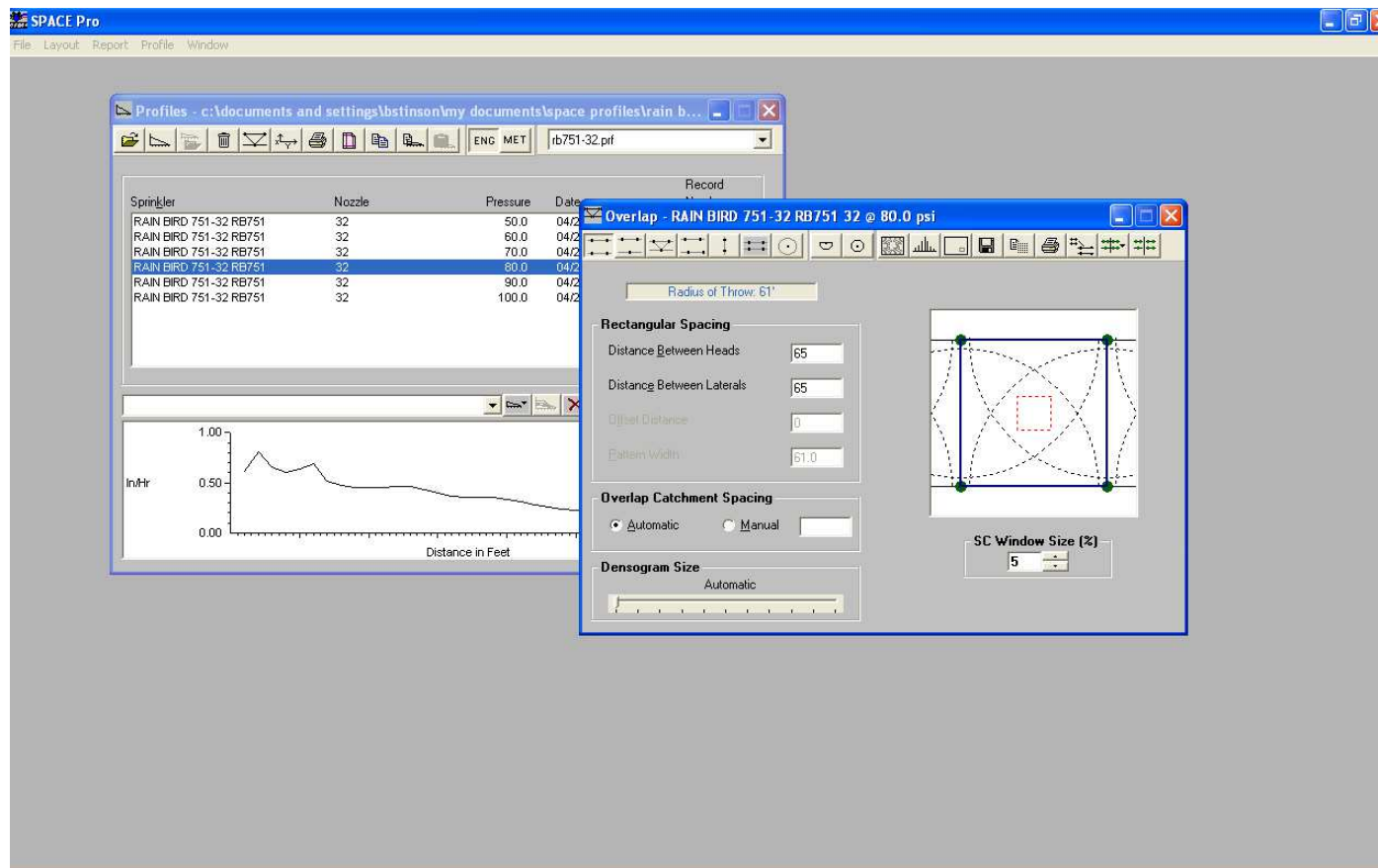


**Penta Nozzle Design of the
Rain Bird 751**



SPACE Pro™

Let's take a look at the program for a second.

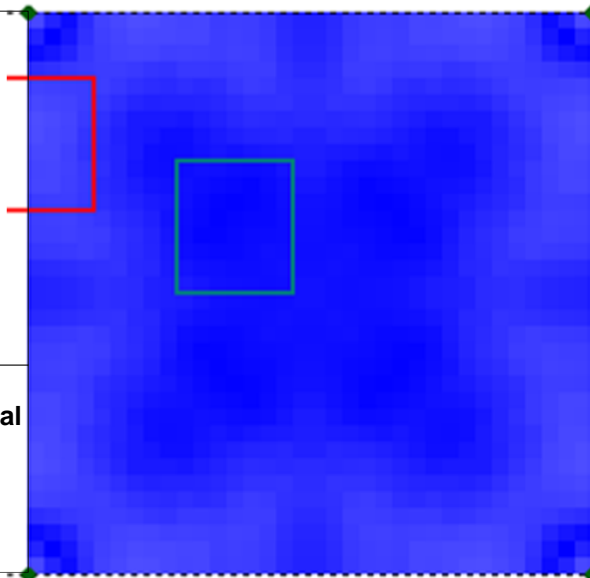


Densogram/Single Leg Profile

A700E-32-80 (65' Spacing)

Base Pressure (psi): 80
Radius (ft): 65
Flow (gpm): 24.90
Precip. Rate (in/hr): 0.588
Run Time (0.2"): 22
DU: 88%

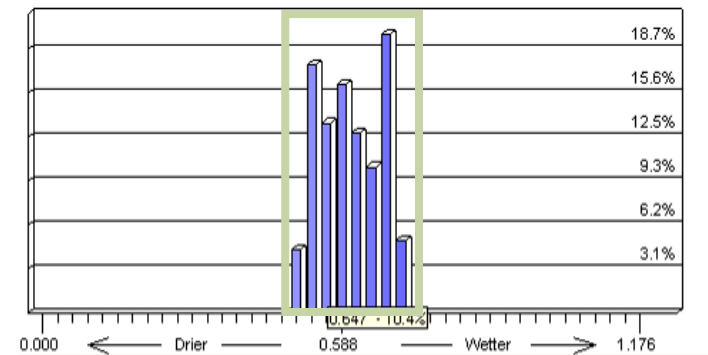
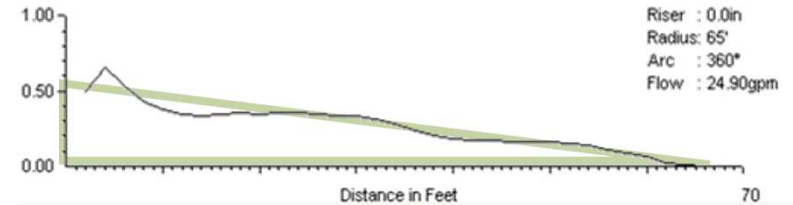
Quality Rating ¹: Exceptional
Run Time Multiplier: 1.08
Adjusted Run Time: 24



Wettest Area



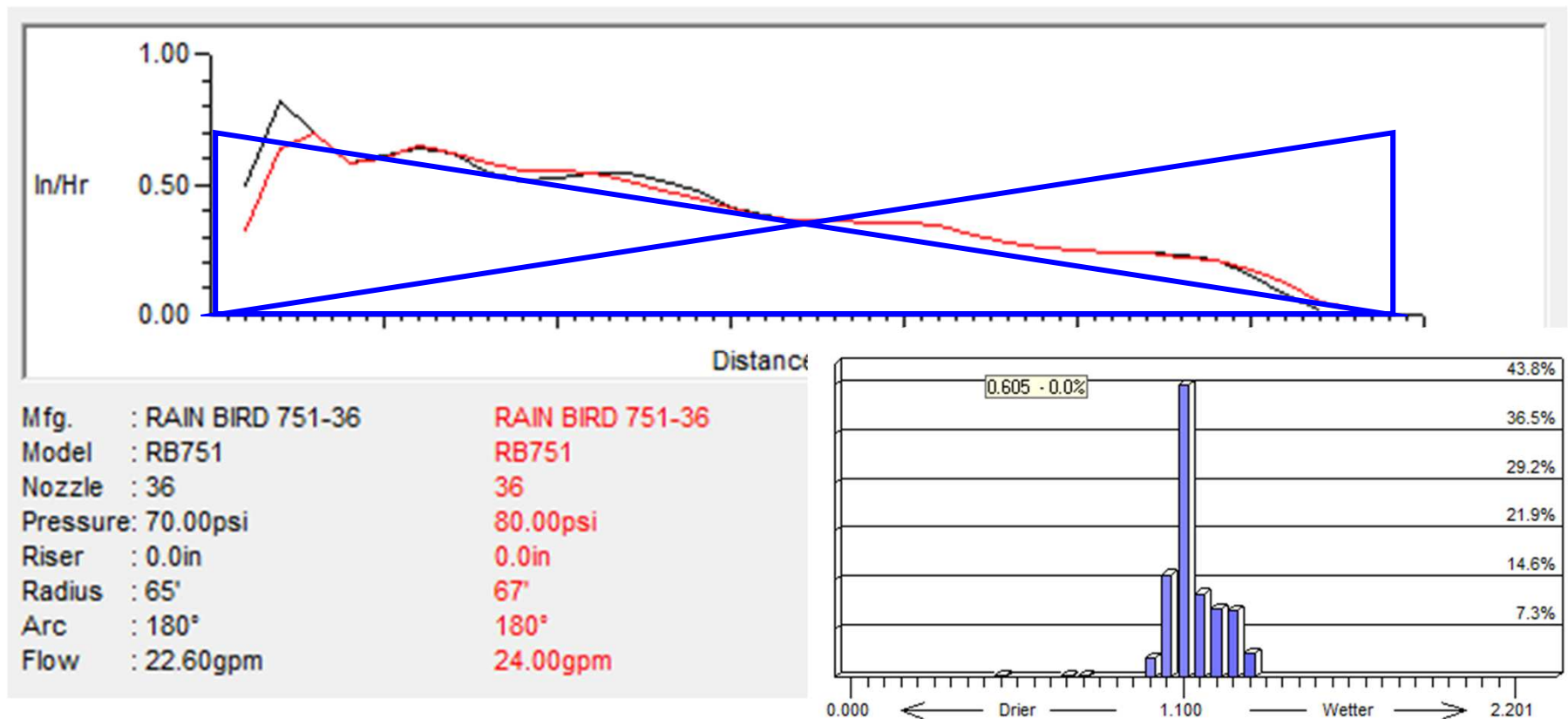
Driest Area



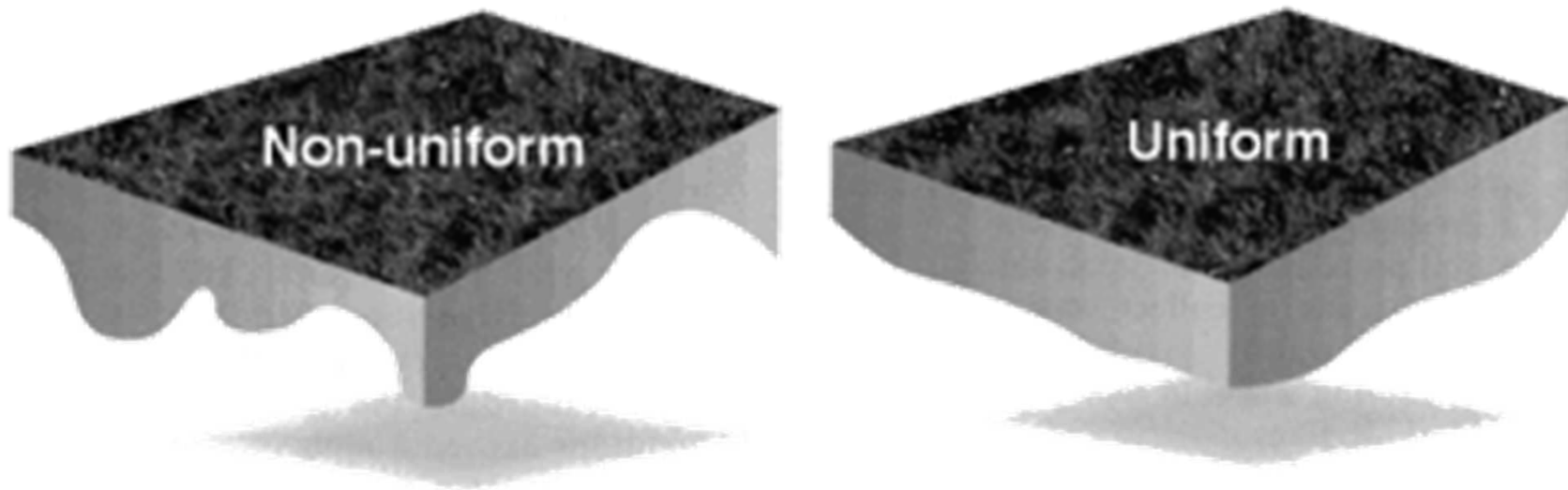
•Notes: (1) "Landscape Irrigation Scheduling and Water Management" – March 2005

Ideal Distribution

- 751-36 @ 65' T, 70 and 80 psi



How it look below the surface



These models illustrate Uniform and non-uniform water depths in soil after irrigation

Importance of an Audit?

- A detailed system evaluation and/or water distribution uniformity test(s)
- Will reveal precipitation rates
- Identify weak (dry) spots and wet spots
- *Experienced* IA Certified Golf Course Auditors are capable of conducting audits



Important Definitions

■ Distribution Uniformity – DU

- A measurement of sprinkler application uniformity. A number of catch cans are placed in the area of coverage during a timed application. Every can's value is recorded and sorted from high to low. The average of the lowest quarter of the catch cans is divided into the average of all the catch cans (the mean). The resulting value is expressed as a percentage and is termed the DU.

$$\text{DU} = \frac{\text{Average Catch in Lowest Quarter}}{\text{Average Catch Overall}} \times 100$$

Benefits Derived From Water Distribution Audits

- **Increased uniformity potential**
 - An increase of 20% DU can translate to a reduction of 10% water use
- **Identify maintenance issues**
 - A sprinkler that is 3 degrees from level may result in a 20% drop in distribution uniformity
- **Discovery and repair implementation may reduce irrigation run times**
 - Lower electrical and water consumption
 - Less wear and tear on infrastructure

Uniformity Rating

<i>Quality of the Irrigation System</i>	<i>Distribution Uniformity (DULQ %)</i>	<i>Run Time Multiplier (RTM)</i>
<i>Exceptional</i>	≥ 85	< 1.11
<i>Excellent</i>	75 - 84	1.11 – 1.18
<i>Very Good</i>	70 - 74	1.19 – 1.22
<i>Good</i>	60 - 69	1.23 – 1.32
<i>Fair</i>	50 - 59	1.33 – 1.43
<i>Poor</i>	40 - 49	1.44 – 1.56
<i>Fail</i>	< 40	> 1.56



What is Run Time Multiplier

Run Time Multiplier – RTM

- Used to adjust the calculated base run time so that the driest area in the pattern receives the desired application rate

- Sprinkler (X)
DU: 86%
RTM: 1.09

DU _{LG}	RTM	DU _{EQ}	RTM	DU _{1Q}	RTM
100	1.00	70	1.22	40	1.56
98	1.01	68	1.24	39	1.58
96	1.02	66	1.26	36	1.62
94	1.04	64	1.28	33	1.67
92	1.05	62	1.30	30	1.72
90	1.06	60	1.32	27	1.78
88	1.08	58	1.34	24	1.84
86	1.09	56	1.36	21	1.90
84	1.11	54	1.38	18	1.97
82	1.12	52	1.40	15	2.04
80	1.14	50	1.43	12	2.12
78	1.15	48	1.45	9	2.20
76	1.17	46	1.48	6	2.29
74	1.18	44	1.51	3	2.39
72	1.20	42	1.53	0	2.50

Application = 0.20"

Run Time = 20 minutes

Adjusted Run Time = 20 x 1.09 = **22 minutes**



Irrigation System Distribution Uniformity and Your Golf Course Expectations

DU_{LQ} below 65% following a tune-up is an indicator that major repairs, nozzle, sprinkler or complete system replacement may be warranted. Under these circumstances, a more extensive evaluation by a golf course irrigation designer is suggested. Remember that distribution uniformity of 80% is achievable and a realistic expectation with a properly designed properly installed and properly maintained system.

Irrigation System Distribution Uniformity

Table A.7. Irrigation system distribution uniformity (DU) for golf courses.^z

Sprinkler type	System quality		
	Excellent (achievable)	Good (expected)	Poor (if lower than this, consider not scheduling)
	----- <i>Estimated DU (%)</i> -----		
Rotary sprinklers	80	70	55
Spray sprinklers	75	65	50

Source: Irrigation Association CGIA Manual



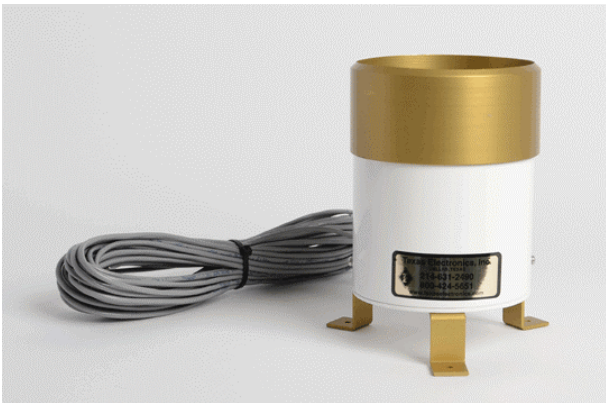
Inexpensive Nozzle Upgrades

- Evaluate and upgrade existing equipment



Smart Sensors™

- Rain Watch
- Wind





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Tip #1: Conduct Regular Maintenance Audits.

Manage your irrigation system maintenance through a regular maintenance audit. This includes cleaning nozzles and screens, ensuring proper rotation speed, and ensuring sprinklers are not leaking.

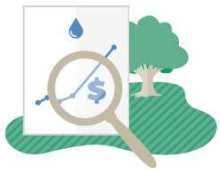
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Tip #2: Check The Height And Level Of Each Sprinkler.

Sprinklers can settle or get knocked off alignment over time, resulting in errant spray patterns and streams being obstructed. Each sprinkler should be flush and grade level when retracted to ensure the most efficient delivery of water once activated.

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Tip #3: Verify Database Settings.

Verify that the information in your database matches the sprinklers, nozzles and pressures in the field. This ensures proper run times and makes sure the precipitation data in the central control system is correct.



Tip #6: Perform an Irrigation Audit.

An irrigation audit will help to verify that your sprinklers are operating as originally intended. Correct nozzles, spacing and pressure will ensure proper uniformity. Be sure to adjust sprinklers as necessary to improve performance.



Tip #11: Adjust Watering Times.

Determine run times by using an ET calculation and the precipitation rate of the sprinklers. Utilize a weather station to accurately calculate the ET (evapotranspiration) losses and the corresponding run times.



Tip #12: Monitor Soil Moisture Levels

Use accurate (absolute) soil moisture sensors to monitor moisture levels and irrigate to a target Volumetric Water Content (VWC) for the different site-specific management zones on the golf course.



Tip #17: Install Smart Sensors™ or SmartPump™.

Utilize SmartPump™ with a Rain Bird pump station to optimize your irrigation system flow and to monitor, detect and react to pipe leaks to eliminate lost and wasted water. Utilize the Smart Sensors™ to react to environmental conditions in real time.

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Tip #23: Develop a Drought Management Plan.

Develop a drought management plan. Dry-run the system to see the water savings as each level of the plan is implemented.



Tip #24: Manage Localized Dry Spots.

Use wetting agents to help manage localized dry spots and improve the soil water uniformity. Wetting agents also help with moving and holding water in the soil profile.

Thank you for your time!

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