Standards and Codes Update

Brent Mecham—Irrigation Association
Brian Vinchesi—Irrigation Consulting, Inc.
Chairman, IA Standards and Codes Committee
Chair, IA SWAT Imitative
Irrigation BMPs

• Just finalized and released.
• Collaborative effort between ASIC and IA.
• Special thanks from Brent Mecham to those who contributed in the development and review.
• Very timely, being promoted widely and is already influencing codes and other initiatives.
  – Design
  – Installation
  – Management
ASABE/ICC

- Landscape Irrigation Sprinkler and Emitter Standard (3rd draft being released soon for 30 day review.)
  - Dual designated between ASABE and ICC.
  - Voluntary standard.
  - Spray sprinklers shall have integral pressure regulation.
    - Optional: missing nozzle flow reduction
    - Optional: integral check valves (7 feet of head or more)
- Breaking News: EPA trying to add flush stops
ASABE/ICC

• Landscape Irrigation Sprinkler and Emitter Standard Definitions:
  – Drip emitters
    • Maximum flow: 6.2 gph at 30 psi after flushing
  – Bubbler (fills the gap)
    • Flow greater than 6.3 gph at 30 psi
  – Micro-sprays
    • Maximum flow: 30 gph at 30 psi after flushing
  – EPA is considering this standard for WaterSense labeling of sprinklers (NOI).
• Labeling/marketing
  – Sprinklers:
    • Flow rate (publically available)
    • Coverage (performance)
    • $D_{ULQ}$ (based on modeling)
  – Emitters:
    • Flow rate (Deviation +/- 7%)
    • Coefficient of variation (7% maximum)
    • Emitter exponent (0.2 maximum)
• X623 Determining Landscape Plant Water Requirements
  – Second draft coming for public comment
• Plant Factors for minimum acceptable appearance of established landscape plants.
• Recently presented at ASABE ET Symposium
• To be presented at American Society of Horticultural Science
## Plant Factors

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Recommended plant factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool-season turfgrass</td>
<td>0.8</td>
</tr>
<tr>
<td>Warm-season turfgrass</td>
<td>0.6</td>
</tr>
<tr>
<td>Annual flowers</td>
<td>0.8</td>
</tr>
<tr>
<td>Woody plants &amp; herbaceous perennials (wet climate or riparian)</td>
<td>0.7</td>
</tr>
<tr>
<td>Woody plants &amp; herbaceous perennials (dry climate)</td>
<td>0.5</td>
</tr>
<tr>
<td>Desert plants</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Wet environment is annual precipitation greater than 25 inches.
Dry environment is non-desert, non-riparian climate
Tropical plants: for tropical plants with precipitation every month, a plant factor of 0.7 applies. Where monsoonal climates are present, 0.7 applies for the wet season, and 0.5 during the dry season.
ASABE

• X626 Uniformity Test for Landscape Irrigation Systems
  – Second draft being prepared
    • Catch can tests
      – Requirements for catch can spacing and test times
    • Using portable soil moisture sensor
      – Requirements for collection spacing and set time
    • Auditing landscape drip irrigation systems
• X627 Environmentally Responsive Landscape Irrigation Control Systems

• Follows SWAT testing procedure with modifications:
  – Hourly soil moisture balance calculation instead of daily.
  – 6 zones, root zone depths changed (shallower
  – 30 day test, but three zones must irrigate at least once.
• **X627 Environmentally Responsive Landscape Irrigation Control Systems**
  – Frequency and length of run time reported compared to minimum number of watering days as dictated by soil moisture balance.
    • No more gaming
    • Looks at least frequent correct watering
    • Requires drawdown to close to fielded capacity
    • What trying to do in the first place by leaving room for storage
X633 Testing Soil Moisture Sensors for Landscape Irrigation

Will most likely replace SWAT testing procedure:
- 1st draft
- Beta testing of draft with 3 labs.
- Once beta testing is done and draft modified will go out for public comment.
- Testing for water content and water tension sensors.
- Ability to enable/disable irrigation based on threshold setting.

EPA considering for WaterSense labeling purposes with proposed Notice of Intent for early next month (May).
• American Society of Plumbing Engineers and American Rainwater Catchment Systems Association
  – ASPE/ARCSA 63 Rainwater Catchment Systems (ANSI Standard)
  – ASPE/ARCSA 78 Storm water Harvesting System, Design for Direct and Indirect End-Use Applications
    • 2nd draft coming soon for public comment
    • Both of these are scary....
New Standards

- ICC Rain Sensors – to ASABE
- ICC/UL Controllers – dead in the water
  - Just getting started
  - Competing with existing IAPMP/ARCSA Standard
New Standards

- IAPMO creating a standard about containers/tanks for rain water harvesting
- ASABE also involved
- IAPMO creating a standard about gray water systems (under 400 gallons per day)
• What they have in common:
  – Reduce turfgrass areas.
  – More use of native plants.
  – Irrigation using non-potable water sources.
  – Reduce the number of inputs required for managing landscapes.
    • Water
    • Fertilizers/pesticides
    • Mowing
Green Codes

• Overlay existing codes, provide additional requirements for greener building and includes site development.

• Primary codes:
  – ASHRAE 189.1 (American Society of Heating, Refrigeration and Air-conditioning Engineers)
  – IgCC (International Code Council)
  – IAPMO Green Supplement
ASHRAE

• Voluntary standard that is written in code.
• Current version is 2011 working on 2014.
• Alternate compliance path for IgCC.
• Anticipate:
  – Heated battle about turf limitations.
    • it still has a 40% turf restriction
    • it is about more than just water
  – More irrigation requirements.
    • Similar to IgCC
    • BMPs will be useful as a reference
• IgCC committee meeting in Memphis (4/27-5/1)
  – Modify 2012 version for 2015 version
  – Proposal to include sprinkler (likely) and plant standards into code.

• Overlay code
  – Currently 10 states
  – International Plumbing Code is used in 35 states

• Gaining momentum and will end up in more states
INTERNATIONAL GREEN CONSTRUCTION CODE ADOPTION MAP

The IgCC is in use or adopted in 10 states.

- IgCC administered statewide
- IgCC administered at the state and/or local level
INTERNATIONAL PLUMBING CODE ADOPTION MAP
The IPC is in use or adopted in 35 states, the District of Columbia, NYC, Guam, and Puerto Rico.
Confusion

- It's not always straightforward, for example as you can see by the map Oregon is an IAPMO State (Universal Plumbing Code), but has adopted the IgCC for electrical and building but IAPMO for Green.
- Can pick and choose, so local input is good.
• **Green Supplement** to plumbing and mechanical codes.

• CalGreen plumbing code is based on Universal Plumbing Code.
  – Graywater provisions
  – Rainwater provisions

• Using BMPs to give guidance to changes
  – Maximum velocity for irrigation piping (per ASABE 376.2)
  – Minimum depth of pipe bury for irrigation

• Big discussion about marking of pipes including irrigation piping with type of water in the pipes.

• Good news slowly distinguishing irrigation as not plumbing in this code but not in rain/storm water.
Green Initiatives

• LEED
  – 2009 expires in 2015
  – LEED v4 in place
  – Projects choose which program to follow
  – LEED v4 uses WaterSense water budget tool
  – LEED varies whether new construction, core and shell, schools, homes, etc.

• GBI
  – Call for committee members to revise standard
  – Most points for non-irrigated landscapes
<table>
<thead>
<tr>
<th>Green Globes 2010/2013</th>
<th>Prerequisites/Points</th>
<th>LEED 2013 v4</th>
<th>Prerequisites/Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>None</td>
<td>Prerequisites</td>
<td>No Irrigation Required or Landscape Water Use Reduced by 30% or More</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Construction Activity Pollution Prevention</td>
</tr>
<tr>
<td>Potential Points</td>
<td>1,000</td>
<td>Potential Points</td>
<td>110</td>
</tr>
<tr>
<td>Levels of Certification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 4 Green Globes</td>
<td>≥850</td>
<td>Levels of Certification</td>
<td>≥80</td>
</tr>
<tr>
<td>• 3 Green Globes</td>
<td>700 – 849</td>
<td>• Platinum</td>
<td>60 – 79</td>
</tr>
<tr>
<td>• 2 Green Globes</td>
<td>550 – 699</td>
<td>• Gold</td>
<td>50 – 59</td>
</tr>
<tr>
<td>• 1 Green Globe</td>
<td>350 – 549</td>
<td>• Silver</td>
<td>40 – 49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Certified</td>
<td></td>
</tr>
<tr>
<td>Irrigation Related Points</td>
<td>12</td>
<td>Irrigation Related Points (Water Efficiency)</td>
<td>3</td>
</tr>
<tr>
<td>Landscape Related Points</td>
<td>42</td>
<td>Landscape Related Points (Sustainable Sites)</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL RELATED TO LANDSCAPE &amp; IRRIGATION</td>
<td>54 (5% of total)</td>
<td>TOTAL RELATED TO LANDSCAPE &amp; IRRIGATION</td>
<td>11 (10% of total)</td>
</tr>
</tbody>
</table>

### Irrigation Related Points

<table>
<thead>
<tr>
<th>Potential Points</th>
<th>Irrigation Related Points</th>
<th>Potential Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate Sources of Water</td>
<td>0 – 5</td>
<td>Outdoor Water Use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ≥50% Reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 100% Reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(No Irrigation)</td>
</tr>
<tr>
<td>Irrigation Meter on Potable Water</td>
<td>0 – 3</td>
<td>Water Meter for Irrigation &amp; One Other Use</td>
</tr>
<tr>
<td>Directed Downspouts, Cisterns or Water Harvesting</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Drip Irrigation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Smart Controller</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pressure Regulation</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Swing Joints</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>POTENTIAL TOTAL</td>
<td>12</td>
<td>POTENTIAL TOTAL</td>
</tr>
<tr>
<td>Landscape Related Points</td>
<td>Potential Points</td>
<td>Landscape Related Points</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Landscape &amp; Irrigation Plan</td>
<td>6</td>
<td>Site Assessment</td>
</tr>
<tr>
<td>Soil Type Identified</td>
<td>2</td>
<td>Protect/Restore Habitat</td>
</tr>
<tr>
<td>Structural Limitations</td>
<td>1</td>
<td>Rainwater Management</td>
</tr>
<tr>
<td>Drought Tolerant Plants</td>
<td>0 – 3</td>
<td>Heat Island Reduction</td>
</tr>
<tr>
<td>Native Plants</td>
<td>0 – 4</td>
<td></td>
</tr>
<tr>
<td>% of Vegetation Not Requiring Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• ≥75%</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>• 50 – 74%</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>• 25 – 49%</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>• &lt;25%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Minimal Turfgrass</td>
<td>3</td>
<td></td>
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<tr>
<td>Soil Prep</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Organic Mulch</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hydrozone Grouping</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Plants Spaced for Maturation at Five Years</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15% Pervious Materials</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>POTENTIAL TOTAL</strong></td>
<td><strong>42</strong></td>
<td><strong>POTENTIAL TOTAL</strong></td>
</tr>
</tbody>
</table>

Points awarded if turfgrass is minimal, meaning that it is limited to within 20 feet of buildings and does not extend beyond 5 feet from parking lots, driveways, walkways, rain gardens, swales and retention ponds.
Sites

- Sustainable Sites 2009
- Newest version (v2.0) was supposed to be released but there seems to be internal problems and currently there is litigation going on.
- Combines water use credits from 2009 in v2.0 so less points available.
New Normal

• Landscapes are evolving
  – More “sustainable”
  – Less turfgrass areas
  – Potable water is limited for irrigation.
  – Landscapes that minimize inputs.
    • Irrigation
    • Mowing
    • Fertilizers/pesticides
Get Involved!

• The codes are model codes, can be modified locally.
• Standards show signs of a maturing industry.
• Be pro-active or be acted upon.
20% of the World’s Energy Demands Come From Pumping Water...

Are you paying attention?
Making electricity uses more water than anything in the US. When you turn off the lights, you’re saving as much water as when you turn off the faucet.

- Charles Fishman, The Big Thirst
What’s the point?

• Water = Energy
• A delivery shift is occurring...
• It’s a reality... and an opportunity!
Per Capita Electricity Consumption: California vs. Rest of Nation

Source: U.S. Energy Information Administration
Annual Electricity and Natural Gas Energy Efficiency Program Spending or Budgets

Program Spending (Billion $)

- Natural Gas Programs
- Electricity Programs

<table>
<thead>
<tr>
<th>Year</th>
<th>Program Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>$1.8</td>
</tr>
<tr>
<td>1996</td>
<td>$1.2</td>
</tr>
<tr>
<td>1997</td>
<td>$1.0</td>
</tr>
<tr>
<td>1998</td>
<td>$0.9</td>
</tr>
<tr>
<td>1999</td>
<td>$1.0</td>
</tr>
<tr>
<td>2000</td>
<td>$1.1</td>
</tr>
<tr>
<td>2003</td>
<td>$1.4</td>
</tr>
<tr>
<td>2004</td>
<td>$1.4</td>
</tr>
<tr>
<td>2006</td>
<td>$1.6</td>
</tr>
<tr>
<td>2007</td>
<td>$2.2</td>
</tr>
<tr>
<td>2008</td>
<td>$2.6</td>
</tr>
<tr>
<td>2009*</td>
<td>$3.4</td>
</tr>
<tr>
<td>2010*</td>
<td>$4.6</td>
</tr>
</tbody>
</table>

U.S. Energy Efficiency Spending (in billions)
**kW Demand Charge Examples:**

- **Scenario 1**
  100 kW run for 1 hour = 100 kWh
  **Demand = 100 kW**

- **Scenario 2**
  10 kW run for 10 hours = 100 kWh
  **Demand = 10 kW**

- **Bill for Scenario 1**
  Demand Charge: 100 kW x $5.00/kW = $500.00
  Usage Charge: 100 kWh x $0.1125/kWh = $11.25
  **Total Bill: $511.25**

- **Bill for Scenario 2**
  Demand Charge: 10 kW x $5.00 = $50.00
  Usage Charge: 100 kWh x $0.1125 = $11.25
  **Total Bill: $51.25**
Figure 1. The percentage allotted to each cost for a typical pump over its lifetime. Although exact values may differ, these percentages are consistent with those published by leading manufacturers and end-users, as well as industry associations and government agencies worldwide.
## Overall pumping plant efficiency ranges

<table>
<thead>
<tr>
<th>Motor HP</th>
<th>Low %</th>
<th>Fair %</th>
<th>Good %</th>
<th>Excellent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5</td>
<td>41.9 or less</td>
<td>42-49.9</td>
<td>50-54.9</td>
<td>55 or above</td>
</tr>
<tr>
<td>7-10</td>
<td>44.9 or less</td>
<td>45-52.6</td>
<td>53-57.9</td>
<td>58 or above</td>
</tr>
<tr>
<td>15-30</td>
<td>47.9 or less</td>
<td>48-55.9</td>
<td>56-60.9</td>
<td>61 or above</td>
</tr>
<tr>
<td>40-60</td>
<td>52.9 or less</td>
<td>53-59.9</td>
<td>60-64.9</td>
<td>65 or above</td>
</tr>
<tr>
<td>75-up</td>
<td>55.9 or less</td>
<td>56-62.9</td>
<td>63-68.9</td>
<td>69 or above</td>
</tr>
</tbody>
</table>

Note: The above values developed by Center for Irrigation Technology (CIT)

Table 1. Overall pumping plant efficiency ranges. Brand-new pumps should fall in the excellent range.
### Table 4.1.1c. Results of Pump Station Hydraulic Tests

<table>
<thead>
<tr>
<th>Pumping System</th>
<th>Motor Efficiency</th>
<th>Pump Efficiency</th>
<th>System Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole 6 PS #1 (75 HP)</td>
<td>90.2%</td>
<td>67.7%</td>
<td>61.1%</td>
</tr>
<tr>
<td>Hole 6 PS #2 (75 HP)</td>
<td>90.2%</td>
<td>67.6%</td>
<td>61.0%</td>
</tr>
<tr>
<td>Hole 12 PS #1 (75 HP)</td>
<td>90.2%</td>
<td>69.1%</td>
<td>62.3%</td>
</tr>
<tr>
<td>Hole 12 PS #2 (75 HP)</td>
<td>90.2%</td>
<td>65.3%</td>
<td>58.9%</td>
</tr>
</tbody>
</table>

### Table 4.1.3b. Results of Well Pumps Hydraulic Tests

<table>
<thead>
<tr>
<th>Pumping System</th>
<th>Motor Efficiency</th>
<th>Pump Efficiency</th>
<th>System Efficiency</th>
<th>kWh/AcFt*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arapahoe 5</td>
<td>N/A</td>
<td>49.7%</td>
<td>N/A</td>
<td>2,443.9</td>
</tr>
<tr>
<td>Denver 5</td>
<td>N/A</td>
<td>50.0%</td>
<td>N/A</td>
<td>667.2</td>
</tr>
<tr>
<td>Denver 12</td>
<td>N/A</td>
<td>55.0%</td>
<td>N/A</td>
<td>1,227.7</td>
</tr>
</tbody>
</table>

* kWh/AcFt numbers as identified in the pump efficiency tests.
<table>
<thead>
<tr>
<th>ID</th>
<th>Electrical Savings (kWh/yr)</th>
<th>Peak Demand Savings (kW&lt;sub&gt;peak&lt;/sub&gt;)</th>
<th>Natural Gas Savings (Therms/yr)</th>
<th>Cost Savings ($/yr)</th>
<th>Gross Measure Cost ($)</th>
<th>Xcel Incentive ($)</th>
<th>Net Measure Cost ($)</th>
<th>Simple Payback Period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO-1</td>
<td>44,019</td>
<td>130.7</td>
<td>0</td>
<td>$20,637</td>
<td>$50,650</td>
<td>$26,990</td>
<td>$23,660</td>
<td>1.1</td>
</tr>
<tr>
<td>ECO-2</td>
<td>13,738</td>
<td>49.2</td>
<td>0</td>
<td>$6,409</td>
<td>$19,200</td>
<td>$6,000</td>
<td>$13,200</td>
<td>2.1</td>
</tr>
<tr>
<td>Total</td>
<td>57,757</td>
<td>180.0</td>
<td>0</td>
<td>27,045</td>
<td>69,850</td>
<td>32,990</td>
<td>36,860</td>
<td>1.4</td>
</tr>
</tbody>
</table>

* Please Note: The values noted above are estimates based on the information provided at the time this report was written. Exact Project Costs should be verified for their accuracy.
Desert Mountain Golf Club – Renegade Course  
Scottsdale, AZ

Night #1 – No adjustment  
(2,100 gpm)  
• 426,840 gallons pumped  
• 634.53 kWh  
• 484.4 kWh/Ac Ft

Night #2 – Reduced flow  
(1,450 gpm)  
• 430,795 gallons pumped  
• 597.22 kWh  
• 451.7 kWh/Ac Ft

Night #2 reduced use by 6.75%
Desert Mountain Golf Club – Chiricahua Course
Scottsdale, AZ
Programming concept

- **Pump 5:**
  - 75hp
  - 750 gpm*
  - **1,800,000 gallons**

- **Pump 4:**
  - 75hp
  - 750 gpm*
  - **1,440,000 gallons**

- **Pump 3:**
  - 75hp
  - 750 gpm*
  - **1,080,000 gallons**

- **Pump 2:**
  - 75hp
  - 750 gpm*
  - **720,000 gallons**

- **Pump 1:**
  - 75hp
  - 750 gpm*
  - **360,000 gallons**

*Pump size required to confirm actual GPM.
*Estimated GPM = HP * 750 gpm hp.
Possible Proposed Flow Graph Snap Shot

Total Flow = 1,527,828 gallons

748 gpm
758 gpm
743 gpm

753 gpm
Silverstone Golf Club's Energy Savings Goal
20% Reduction - 2013-14
DSIRE is a comprehensive source of information on state, federal, local, and utility incentives and policies that support renewable energy and energy efficiency. Established in 1995 and funded by the U.S. Department of Energy, DSIRE is an ongoing project of the North Carolina Solar Center and the Interstate Renewable Energy Council, Inc.
$25,137.16 rebate
Take aways...

1. Understand the local power co.
2. Understand your pumping
3. Programs to match pump output
4. Apply for rebates
QUESTIONS?

Andy Staples, ASGCA Assoc.
C. 480-206-1134
www.StaplesGolfDesign.com
Sam Moore
Toro Irrigation
National/Northwest Field Service Manager
Understanding your Automated Data Transfer Options
How I Learned to Stop Wiring and Love the Radio
Key Takeaways

• Understand Radio Type Differences
• Recommended Best Practices for Installation
• Common Questions
• Site Survey Importance
• Licensing
• Best Maintenance Practices
Radio Waves

- Waveforms
  - Frequency – Number of Wave/Second past a Point
  - Wavelength – Distance Between Points on a Wave
  - Amplitude – Size/Power

(a) Two complete cycles of wavelength $\lambda$

(b) Wavelength half of that in (a); frequency twice as great as in (a)

(c) Same frequency as (b), smaller amplitude

- 450 MHz
- 900 MHz

Amplitude - Size
Analog/Digital

- Analog
  - Good Signal - Good Info
  - Marginal Signal – Okay Info
- Digital
  - Good Signal – Great Info
  - Marginal Signal – No Info
- More Digital Radios Coming – More Information in the Same Space
RF Communication Types

- UHF/VHF
  - 450-470Mhz
  - License by FCC Required
- Mobile
- Handheld
- Data
Narrow Band

- FCC Mandated
- More Users same Bandwidth
- Narrow Band Signal is not as Robust
- May not apply to all the Americas
- Added 5 or 0 to Frequency (4 Decimal Places)
900 MHz

- 902-928 MHz - 33 centimeter band
- Very Local Communication - 1 Mile Direct Line of Site - or 60 Miles Direct Line of Site
- Very Line of Site
- Analog – Old Voice Phone
- Digital – DSS
  - Digital Spread Spectrum
  - Frequency Hopping
900 MHz

- No License Required
- Can Use Repeaters
- Most can set to specific Frequency Hopping Channels
- OMNI and Yagi Antennas Available
2.4GHz

- Very Local Communication – Within Cabinet or Room
- Spread Spectrum
- Frequency Hopping
- 600 milli-Watts is “Extreme”
Cellular Modems

- IP Addressed
- Data Plans Coming Down in Cost
- Very Fast as Infrastructure Improves
- Serial or Ethernet
- Same Antenna Types and Issues
Radio Range

(A) Top View

(B) Side View

TRANSMITTER

RECEIVER

SHADOW ZONE

3ENV0010
• Diffraction effects are greater for long wavelength waves
• Diffraction effects are greater for small holes
OMNI Directional
- 360 Degree of RF Emission Energy
- Typically Used at Central or when Transmission is needed to several Areas
OMNI Directional
- 360 Degree of RF Emission Energy
- Vandal Resistant
- 3dB Gain
Radio Range - Antennas

- Directional - YAGI
  - Focuses Energy
- 7.1 dB gain
- 72° H Beamwidth
- 57° V Beamwidth
Radio Range - Antennas

- Directional - YAGI
  - Focuses Energy
- 11.5db Gain
- 42° H Beamwidth
- 37° V Beamwidth
- Alignment is Critical!
Radio Range - Antennas

- OMNI
- Directional Pattern
Radio Range - Antennas

- OMNI
  Directional Pattern – 10 dB Gain
Radio Range - Antennas

• Yagi – 10dB Gain
Cables

- Maximum length for RG/8U = 50’
- Over 50’ - use 1/2” Heliax
- Never kink the coax - #1 reason cited for failure
- Use extension or jumper cable into the Interface Module – 2’ - 3’ coax (1/4”) from end of antenna cable into radio
- Connectors replaced by knowledgeable RF technician - #1 Cause of Failure
Site Survey

- How far can you go
- I don’t know
- But I know how we can quantify it!
Site Survey Equipment

- RF Signal Strength Meter
- Antenna’s
- Cables
Site Survey

- Insist on Documentation!
• Similar Documentation – Specify it gets Done
Radio Range – Repeaters

- Receives Signal
- Resend Signal
- Usually on a Different Frequency
- Transfer Signal around Obstacles
Best Practices

- Seal all Connections
- Surge Devices
  - Install
  - Ground
Test and Record

• Signal Strength
  – Tough Sites
  – External Antennas

• Watt Meter
  – Reflected Power
  – Should barely bounce the Needle
    • Base Antenna
    • External Antenna
Licensing

- Please make sure this gets done as appropriate
- Keep our Industry “Clean”
- FCC Coordinators
- Try to Educate Users
COMMUNICATE CLEARLY, IMPROVE YOUR BOTTOM LINE!

Dr. Patty Malone, Ph D.
Speaker, Trainer, Professor, Author

Clear Communication Increases Productivity and Profitability
Miscommunication Impact

- Damaged relationships
- Dissatisfied customers
- Alienated colleagues
- Unhappy employees
- Decreased job satisfaction
- Decreased productivity
-Absenteeism
- Turnover
- Impacts bottom line
Miscommunication & Conflict

• Snowball effect
• Culture
  • Dysfunctional communication
  • Gossip
  • Extreme competition
  • Harassment, sabotage
• Legal issues
• Brand, reputation & customer satisfaction

How to prevent this?
My Communication Connection

• TV/Fortune 500
• Masters/Ph.D.
• Professor/Trainer

Handout
Shift Perspective

• Avoid “I already know that.”
• Break old habits (ways of thinking & doing things)
• Blind spots
Costly Communication Mistake #1
Not Listening

• Tune out, pretending, waiting
• Why?
• Shouting
Costly Communication Mistake #1
Not Listening

• Rambling
  Don’t:
  – Talk too much
  – Interrupt
  – Talk over them
  – Ignore what they say

• Judging

• Consciously listen
Costly Communication Mistake #2

Don’t Show Appreciation

- People leave people
- Include others
- Show appreciation and recognition
- Trickle up
Costly Communication Mistake #3
Misperceptions

• Conflicting messages
• Nonverbals: trap, inconsistent, instructions
  – Match nonverbal to verbal
  – Don’t assume meaning
Misperceptions continued

Ever explained something to someone, thought they understood, and they didn’t?

• Paper Activity
• Check understanding
• Responsible for both sides
• Avoid ambiguous & technical words

Can’t change others!
Danger Zones for Miscommunication

- Organizational Change
- Conflict & Difficult people
- Building Teams
- Business Presentations
- Communication across teams, departments, all levels, generations
OPPORTUNITYISNOWHERE
Create Culture Where We: Communicate Clearly

• Are responsible for ALL communication
  • **Listen and connect**: Develop powerful listening habits
  • **Value others**: Show appreciation
  • **Check perceptions**: Ask questions
Questions?

Feedback Form

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“Communicate Clearly. Get Results.”
Thank You!

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Clear Communication Increases Productivity and Profitability
CIT Update

ASIC 2014 NATIONAL CONFERENCE
Portland, Oregon
WATER: Taking Charge of Change

David F. Zoldoske, Director
Center for Irrigation Technology
California State University, Fresno
Three MWD funded Projects

1) ECCO Professional (wireless sensor)
2) Aqua Cents
3) High Performance Nozzle study
ECCO Soil Moisture Sensor

Digital Spring LLC Proprietary

www.eccosoil.com

WIRELESS SOIL MOISTURE SENSORS AND SYSTEM

Measures Soil Moisture

°F

Measures Temperature

NaCl+

Measures Water Salinity

Tracks Time

4”
ECCO Sensor Installation

Digital Spring is developing smart sensors to be used to retrofit existing timer based sprinkler controllers to improve watering efficiency and help eliminate gross waste.

A typical installation in a residence would be to place one sensor in the ground per zone as shown on the right. Sensors cooperate with each other to enable daily communication with the sprinkler valve shutoff installed.
ECCO sensor architecture

- ECCO soil moisture sensors measure salinity of irrigation water, soil water content, and temperature.
- A bluetooth low energy transceiver is used to communicate with other sensors in the area utilizing a low power proprietary networking scheme.
- All data logging functions are stored in memory.
Polymer Study will be Replicated 3 Times
The study will be looking at both sprinkler and buried drip irrigation-

*we will be evaluating for increased spacing and reduction in striping when using the drip method*
Rodent Repellent

CIT will be evaluating a chemical treatment (injected) into buried drip lines that keeps rodents away from tubing—needs to re-applied every 6 months (unrelated to polymer study)
Injecting Polymers Horizontally Below the Root zone

- Polymers are injected horizontally six (6) inches below the surface
- Forms both a barrier and reservoir of available water for the turf grass
- Initial studies suggest a significant savings for water \((and\; energy)\) savings based on conventional practices
- Needs to be cost effective!
High Efficiency Nozzle Study
Footnotes
Pressure, 45 psi
Spacing, 15 ft both ways
Area, seven sprinklers spaced 15 ft c/c (circular)
Ave. app. rate, 1.48 in./hr
"85%" app. rate, 1.19 in./hr
Over spray loss, 19.5%
Pattern loss, 22.4%
Application Efficiency, 62.4%
Distribution Uniformity, 74.3

R^2 = 0.56
a + b*ln(x1) + c*ln(x1)^2 + d*ln(x1)^3 + e*ln(x1)^4 + f*ln(x1)^5 + g*ln(x2) + h*ln(x2)^2 + i*ln(x2)^3 + j*ln(x2)^4 + k*ln(x2)^5
Footnotes
Pressure, 30 psi
Spacing, 15 ft both ways
Area, 15 ft by 15 ft
Ave. app. rate, 1.60 in./hr
"85%" app. rate, 1.42 in./hr
Pattern loss, 10.2%
Over spray loss, 15%
App. Efficiency, 76.3%
Distribution Uniformity, 87.1%

R62+ 0.30
a+b*x1+c*x1^2+d*x2+e*x2^2+f*x2^3
Average: 1.321 in/hr  85.0%: 0.981 in/hr  DU: 66.7%  Pattern Loss: 28.0%

Catchment (in/hr)

Pressure, 30 psi

Area (%)
PRS SWAT testing

- One manufacturer completed
  - Three different sprinkler models
Pump Testing
Questions?

Thank You!