

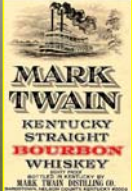







Famous Words

**"Whiskey is for drinking;
water is for fighting over."**

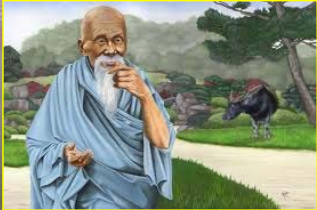


MARK TWAIN
KENTUCKY STRAIGHT BOURBON WHISKEY
BOTTLED BY MARK TWAIN DISTILLING CO.
MEMPHIS, TENNESSEE

Simple Fact

Turfgrasses, like any other plant, is a biological organism. Biological organisms need moisture – water – to survive.

Famous Words



He who knows that enough is enough will always have enough.
Lao Tzu - 6th century BCE

Questions?

Is “brown” the new “green”?

- ☞ Would that meet expectations?
- ☞ Is this safe?
- ☞ Who does that satisfy?
- ☞ As a professional, are you better than that?
- ☞ What are possible solutions?
 - ✓ Water Conservation
 - ☐ Thoughts



Questions?

When it comes to having a real impact on water conservation, will it come from indoor or outdoor efforts?

- ✓ What can be seen?
- ✓ What can be enforced?





Approaches & Plans

No Plan / Indifference – no longer an option

Rigid Regulations

- ★ Command and control mentality

Best Management Practices (BMPs)

- ★ “Gold Standard Model”
- ★ History of success



BMPs Approach

Science-based

- ★ Cutting edge science
- ★ Evolve with time & knowledge

Holistic

- ★ All possible strategies are included

Integration of new concepts

- ★ Technology, devices, grasses, practices, etc.



BMPs Approach

Site-specific Management

- ★ Flexibility for site to meet environmental goal
- ★ Input is controlled – only when needed

Dynamic / Flexible

- ★ Over time on a specific site
 - ✓ sites change with time
- ★ Incorporation of new technology & concepts

BMPs Approach

Involves the site manager

Values education, experience & training

Proactive & on-going

Consider all stakeholders

- ★ Economic & site-use
- ★ potential adverse impacts

Applicable on site-specific & State level



BMPs Education

Do not be ashamed of using water

Continuing Education for staff

Clients

- ? Is less than perfect acceptable?

Neighbors

Advocacy

- ★ We have a great story to tell!
- ★ Newsletters, Email, Blogs, etc.



BMPs Template



The BMPs Document

Formal, Step-wise, Written Plan

- ★ Required
 - ✓ Water conservation pressures are great
 - ✓ Water is limited
 - ✓ Irrigation water source is saline
 - ✓ Planning
 - ✓ Justification for
 - ✎ Infrastructure
 - ✎ Personnel

The BMPs Document

Goal Statement

- ★ Define goals of water conservation
 - ✔ Develop, implement, monitor, and revise the water management plan
 - ✔ Achieve maximum water-use efficiency & conservation
 - ✔ Considered “routine” practices & management
 - ✔ Not a “paper” plan

The BMPs Document

Past, Present, and Future

- ★ What has been done?
 - ✔ Not starting at “ground zero”
 - ✔ For members, regulatory agencies, public, etc.
- ★ What are the current practices?
- ★ Define areas for improvement
 - ✔ Management Practices, Personnel, & Education
 - ✔ Infrastructure Improvements

The BMPs Document

Past, Present, and Future

- ★ Document
 - ✔ BMP Template
 - ↓ www.GeorgiaTurf.com
 - ✔ Water Management BMPs Scorecard
 - ↓ www.terc.ncsu.edu



The BMPs Document

Site Assessment

- ★ Required
 - ✔ Identify current water use
 - ✔ Identify future water use needs
 - ✦ Do not plan on the minimum
 - ✦ Plan for the future
 - ✔ Necessary licenses, permits, & regulations
 - ✔ Decision will arise from the site assessment

Site Assessment

Important Information Areas

- ★ Water Source
 - ✔ Quantity
 - ✔ Quality
- ★ Irrigation System
 - ✔ Uniform
 - ✔ Flexibility
 - ✔ Scheduling

Site Assessment

Possible Outcomes

- ★ Water audits – irrigation system evaluation
- ★ Irrigation system – enhancements or design
- ★ Locating alternative irrigation source
- ★ Water or soil treatments – water quality
- ★ Salt management
- ★ Increased soil, water, or tissue testing







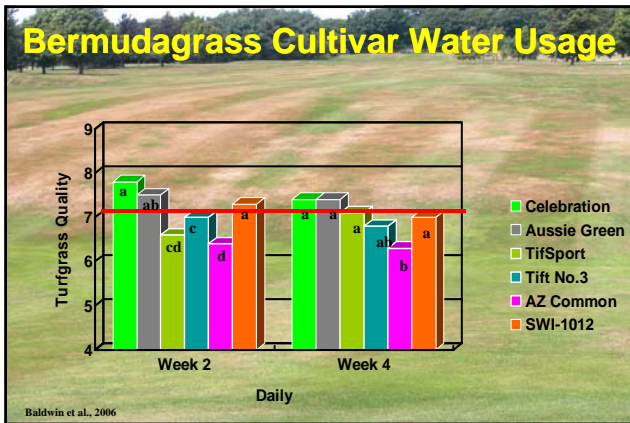
Water Conservation BMPs

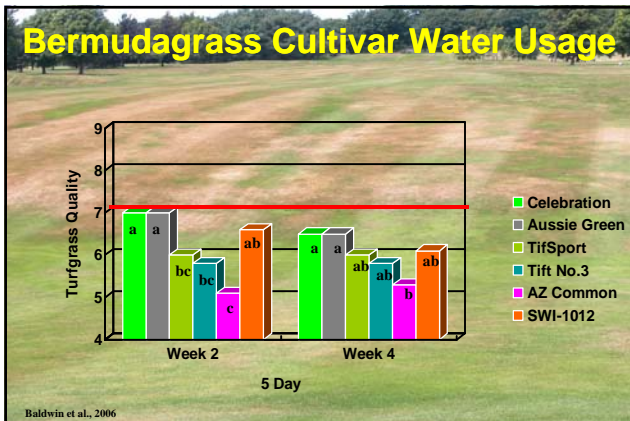
1. Plant selection & adaptation
2. Root zone modification
3. Manage extrinsic stresses
4. Cultural practices to promote root growth
5. Irrigation system design

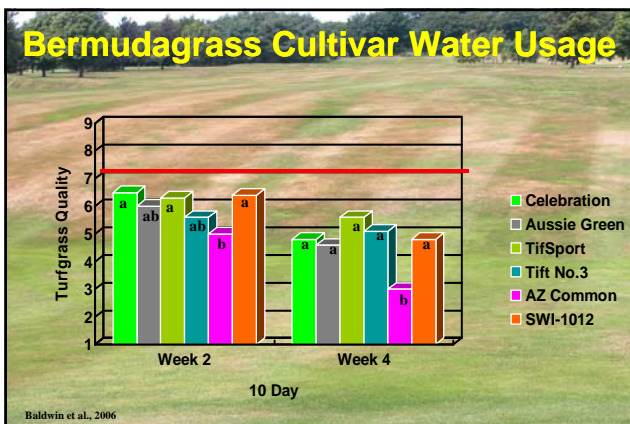
Water Conservation BMPs

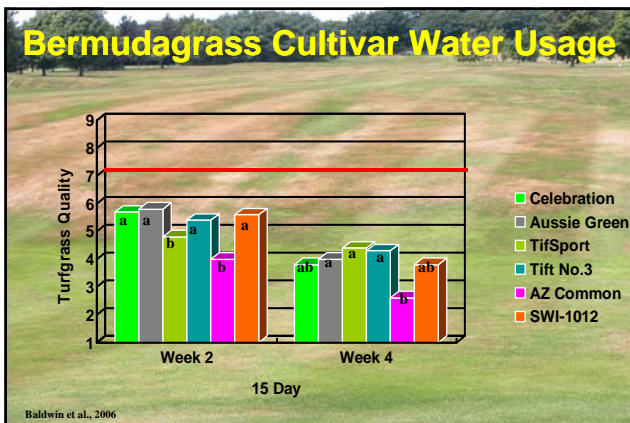
Plant selection & adaptation

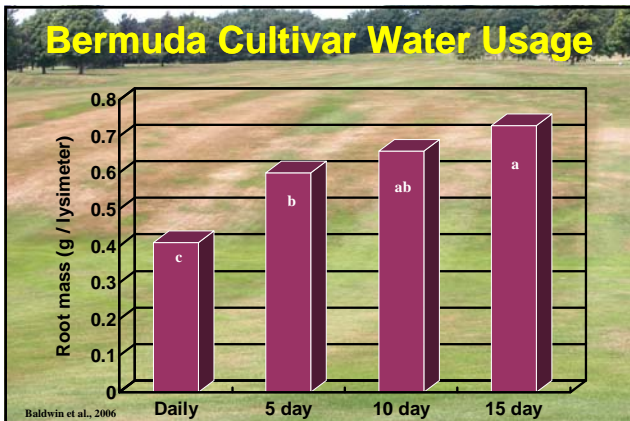
- ★ Turfgrass species
 - ✓ Warm- and cool-season species
 - ✓ Technological advancements
 - ✓ Thank you turfgrass breeders
- ★ Landscape ornamentals
 - ✓ Perennials vs. annuals
 - ✓ Native vs. best adapted

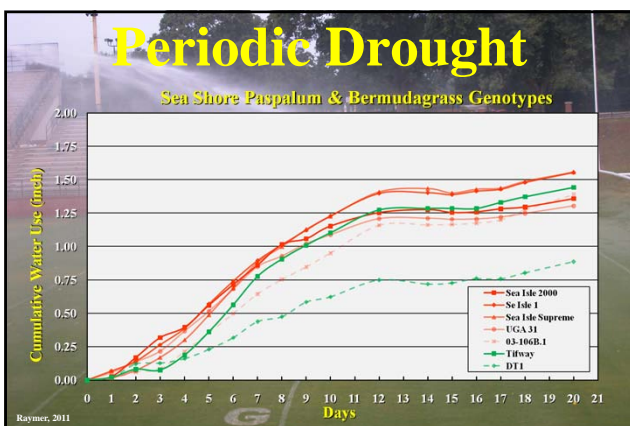













Water Conservation BMPs

1. Plant selection & adaptation
2. **Rootzone modification**
 - ✓ Know the soil type
3. Manage extrinsic stresses
4. Cultural practices to promote root growth
5. Irrigation system design

Objective

Ability of water to move into the root zone

- ★ Infiltration vs. percolation
 - ✓ K_{sat}
 - ✓ Get water into the soil
- ★ Aerification
- ★ Venting
- ★ Reduce thatch
- ★ Wetting Agents



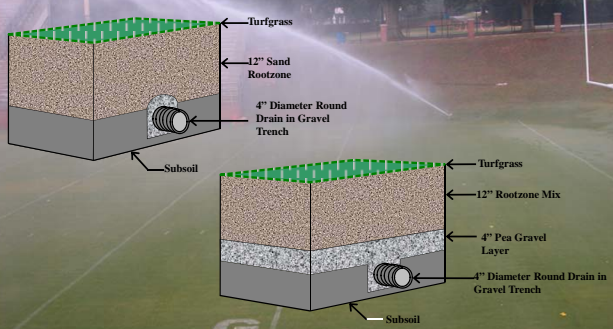
Ideal Soil

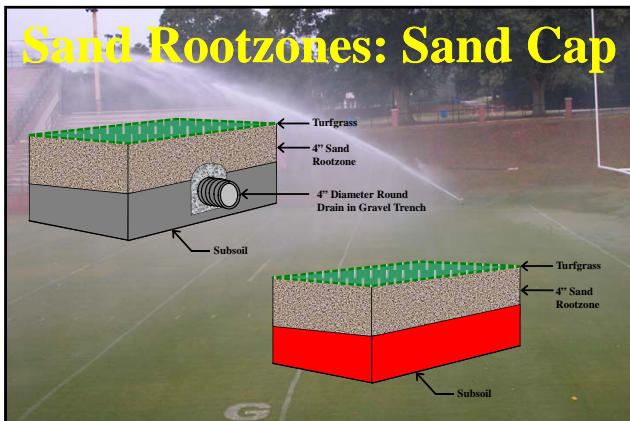
Four components

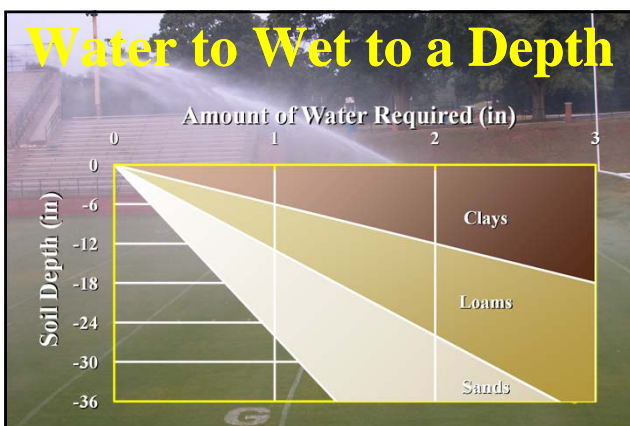
- ★ Mineral
 - ✓ Sand
 - ✓ Silt
 - ✓ Clay
- ★ Organic
- ★ Air
- ★ Water



Sand Rootzones: USGA









Why Soil Amendments?

- ✓ Improve Drainage
- ✓ Resist Compaction
- ✓ Increase Aeration
- ✓ Nutrient Availability
- ✓ Improve Nutrient Retention
- ✓ Improve Water-holding
- ✓ Increase Infiltration
- ✓ Decrease Bulk Density
- ✓ Create Soil Structure
- ✓ Improve Microbial Activity

Water Conservation BMPs

1. Plant selection & adaptation
2. Root zone modification
3. Manage extrinsic stresses
 - ✓ Traffic
 - ✓ Light
4. Cultural practices to promote root growth
5. Irrigation system design

Regulating Field Use



Traffic Types

Equipment Traffic

- ✓ Maintenance
- ✓ Construction



Traffic Types

Foot Traffic

- ✓ Maintenance
- ✓ Track hourly use.
- ✓ Signage
 - ✦ "Field closed for recovery"
- ? Other ideas





Types of Light

↳ **Irradiance**

- ★ **Direct**
 - ✓ Full sunlight
- ★ **Filtered**
 - ✓ Trees
- ★ **Indirect**
 - ✓ Clouds – variable
 - ✓ Building or structure – continuous



Plant Response

↳ **Limited light**

- ★ **Decreased photosynthesis**
 - ✓ Decreased CHO production
- ★ **Morphological changes**
 - ✓ Longer, thinner, low density leaf blades
 - ✓ vertical growth habit
 - ✓ Thinner cell walls and cuticle
 - ✓ Decreased lateral growth
 - ✓ Increased shoot to root ratio

Plant Response

Limited light

- ★ Decreased turfgrass quality
- ★ Cumulative impact
 - ✓ Bermudagrass - 1 to 2 d, not several
 - ✓ Rainy season - continuous
 - ✓ Closer to equator – less daily change

Screenshots SUNSEEKER APP. iPhone | iPad

Today
33°50'15\" S
151°14'15\" E
Rise: +7h34m
Sets: +3h54m

Solar Azimuth: 322.11°
Elevation: 41.33°
Shadow Ratio: 1.16
Path Length: 1.91

20 Mar 2009 9:10 am
Sun
Elevation: +20°
Azimuth: 73° (E)

Water Conservation BMPs

Cultural practices to promote root growth

- ✓ Moderate nitrogen fertility
- ✓ Proper mowing heights
- ✓ Employ cultivation practices
- ✓ Manage pest problems



Favorable Cultural Factors

Nutritional

- ✓ moderate to low nitrogen
- ✓ adequate soil potassium

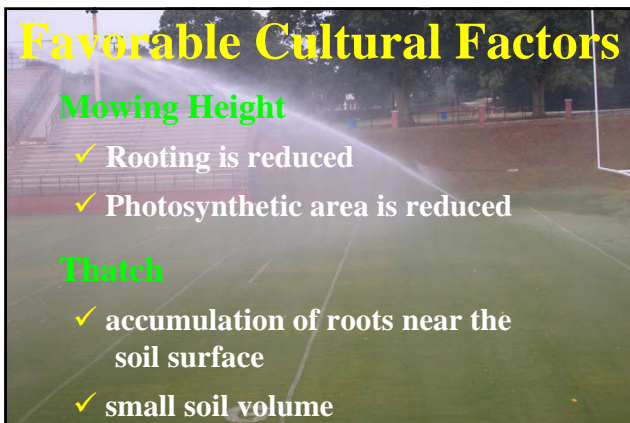
Irrigation

- ✓ moderate to low intensity

Optimal Sunlight

BMP - Fertilizer

- Do not over feed
- Balance using soil test results
- Watch water quality
- Apply considering the most efficient water use – wait until it is dry enough to water in



Favorable Cultural Factors

Mowing Height

- ✓ Rooting is reduced
- ✓ Photosynthetic area is reduced

Thatch

- ✓ accumulation of roots near the soil surface
- ✓ small soil volume

BMP – Heights of cut

- Do heights of cut matter?
- Recovery from damage
- Limited resource situations
- Stress

Favorable Soil Factors

Temperatures

- ✓ Cool-season species – 50° - 75° F
- ✓ Warm-season species - 75° - 95° F

pH

- ✓ 5.5 to 6.5
- ✓ 1 to 3 year intervals

Favorable Soil Factors

Compaction

- ✓ Core cultivation

Waterlogging

- ★ soil gas exchange (O₂ & CO₂)
- ✗ layering
- ★ drainage (surface & sub-surface)
- ✗ excess irrigation

BMP – Cultivation Practices

- Aeration – increase channels, improve root growing medium
- Topdress –
- Thatch removal
- Grooming
- A substitute for wetting agents

To aerate or not to aerate?



BMP – Pest Management

- Application coincide with irrigation timing to reduce loss
- Recovery uses more water
- Post emerge controls damage to turf
- Use enough water for healthy turf



Sanford Stadium Irrigation

With current cannon system we use 3.5 million gallons of water, with a new up to date system we will use 1.25 million gallons of water

We will be installing a new irrigation system this year.

Butts Mehre Complex

- 120 mft2 Football practice field
- 75 mft2 Track Infield
- 115 mft2 Baseball Field
- 2 acres of plant beds

- All irrigated off a well
- Football Practice Field has a 144,00 gallon cistern underneath that catches all the rain from around the complex

Jack Turner Soccer Softball

- All 350 mft2 irrigated with a well
- Well produces 130 gals per minute and is 250 ft deep.
- Have 2 retention ponds with Flowtronics Pumps as back up

BMP – Know how much water you need!

- Rain supplemental vs. Arid regions
- Record keeping (math)
- Source – is it adequate and what is the quality?
- Review alternative sources

BMP - Water Sources

- Surface impoundment
- Underground
- Brackish
- River
- Reuse – another seminar but most BMPs apply
- combination

BMP – Know your storage and delivery systems

- Review of total system
- Pump station - Audit
- Control System
- Field equipment – Audit
- Time conveniences
- Efficient water distribution
- Remote accessibility

BMP - Know your site

- Climate – Is it ever correct to irrigate during rain events?
- Variations across state
- Soils
- Terrain

BMP – Staffing

- Record keeping (math)
- Scouting
- Repairs and Maintenance
- Manual watering – how much time do you spend dragging a hose
- Dollars are important – people don't realize how many resources go into efficient water distribution.

Water Conservation BMPs

6. Allow soil & plant factors dictate irrigation
 - ✓ Water when grass needs water
 - ✓ Wet only the root zone
7. Use non-potable water / reclaimed water
8. Irrigate in early morning
9. Perform an irrigation audit
10. Install rain shutoff sensors

Proper Irrigation



No good BMPs for growing concrete!

Proper Irrigation

- ✗ Only wets the turfgrass root zone!
- ✗ Does not saturate the soil!
- ✗ Does not allow water to run off!

When to Irrigate?

Signs of water stress

- ✓ Visual Symptoms
- ✓ Guidance
- ✗ Avoid Schedules



Wilt on ryegrass

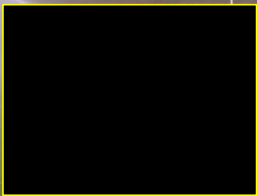
Irrigation Guidance

Water application based on soil or plant moisture status is more efficient than applying water based on a set schedule

How Much to Irrigate?

Wet 6 to 8 inch depth

- clay soils
 - ✓ 1 to 1½ inches / week
- sandy soils
 - ✓ ½ inch, 3 times a week



Audio by Dr. Jim Prusa

Evapotranspiration

➤ **Combined loss of water**

- ✓ Evaporation of water from the soil
- ✓ Plant transpiration

Turfgrass ET Classification

Classification	ET Rate (in / d)
Very Low	0.16
Medium	0.24 – 0.27
Very High	0.35

Beard, 1985

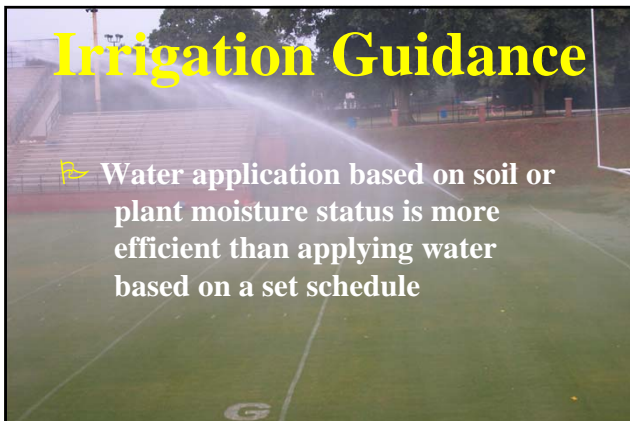
Turfgrass ET Rankings

Turfgrass	Mean ET (in / d)	Drought Resistance
Common Bermuda	0.12 b	VH
Tifway Bermuda	0.12 b	VH
Raleigh St. Augustine	0.13 ab	H
Meyer Zoysiagrass	0.14 ab	M-L
Rebel II Tall Fescue	0.14 ab	M-H
K-31 Tall Fescue	0.15 a	M
Centipedegrass	0.15 a	H

Carrow, 1995

Irrigation Guidance

- Water application based on soil or plant moisture status is more efficient than applying water based on a set schedule



Irrigation Guidance

- Evapotranspiration (ET)
- Soil water potential
- Soil volumetric moisture status



Probe Guidance

Water Potential

- Tensiometers

Volumetric Water Content

- TDR & Capacitance Probes



Water Conservation BMPs

6. Allow soil & plant factors dictate irrigation
7. Use non-potable water / reclaimed water
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What is Reclaimed Water?

Wastewater that has received treatment to urban water reuse standards.



Are there other names?

✓ Reclaimed	✓ Wastewater
✓ Recycled	✓ Regenerate
✓ Effluent	✓ Gray water
✓ Non-potable	✓ Brackish water
✓ Irrigation quality (IQ)	



What are the treatment levels?

- ? Primary
- ✎ Secondary
- ✎ Tertiary (advanced)


Reclaimed Water

Good quality for turfgrass irrigation

- ✓ "Free" nutrients
- ✓ Nitrogen
- ✓ Phosphorus
- ✓ Chemical characteristics

Routine Testing

- 🕒 Monthly



Reclaimed Water

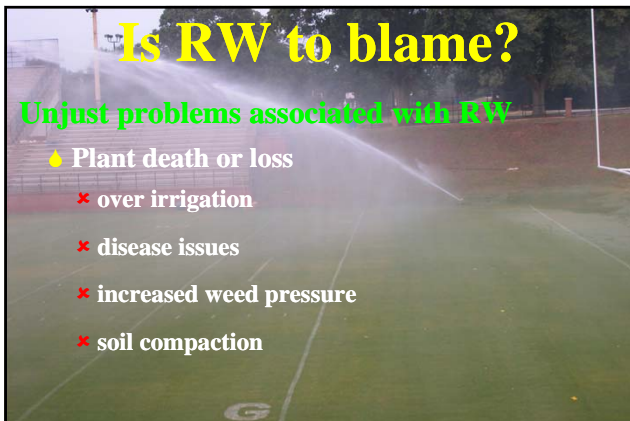
Water quantity not quality

- 💧 1- to 1 ½ - inches / week
- 💧 Supplemental to rainfall
- 💧 Problems associated with over irrigation
 - 🍄 Disease
 - 🍄 Compaction

Is RW to blame?

Unjust problems associated with RW

- Plant death or loss
 - ✗ over irrigation
 - ✗ disease issues
 - ✗ increased weed pressure
 - ✗ soil compaction



Environmental benefits?

- Recycling
- Increased filtration
- Groundwater recharge
- Increase in potable water
- Water conservation technique



BMPs for Minimizing Exposure

- Use highest quality reclaimed water available
- Alter irrigation events to minimize human contact
- Separate delivery system (purple pipe)
- Posting / signing



Water Conservation BMPs

6. Allow soil & plant factors dictate irrigation
7. Use non-potable water / reclaimed water
8. Irrigate in early morning
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Water Audit

Irrigation System Inventory

- ★ Pump station
- ★ Sprinkler heads
 - ✓ Configuration
 - ✓ Zoning
 - ✓ Catch-can method



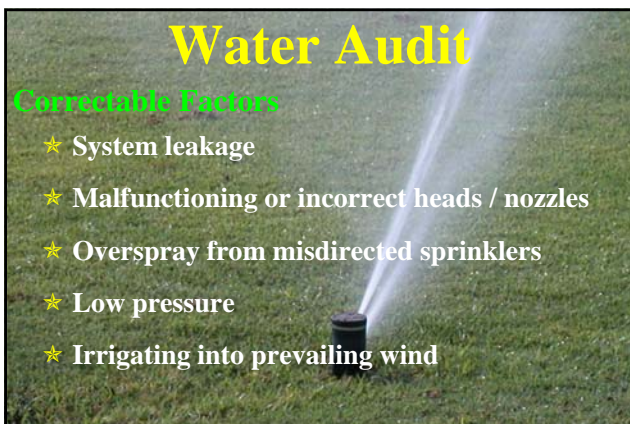
Water Audit

Irrigation System Inventory

- ★ Control system
 - ✓ Components
 - ✓ Flexibility
 - ✓ Programmability
- ★ Sensors
 - ✓ Soil moisture
 - ✓ Rain shutoff









BMP - Technology

- Weather Stations
- Moisture Sensors
- Rain cut off switches
- New Software for control systems
- Others



BMP Template

- Start your own BMP program

BMPs

- Record keeping
- Assessment of current system
- Assessment of current sources
- Scouting Daily
- Loss Control (labor/parts)
- Future Upgrade Planning
- Natural Areas
- Landscape Material Choices

BMPs - Continued

- Pest Management
- Fertility Management
- Cultivation
- Education
- Irrigation Audit
- Wetting Agents
- Technology – sensors, rain cut off
- Heights of cut

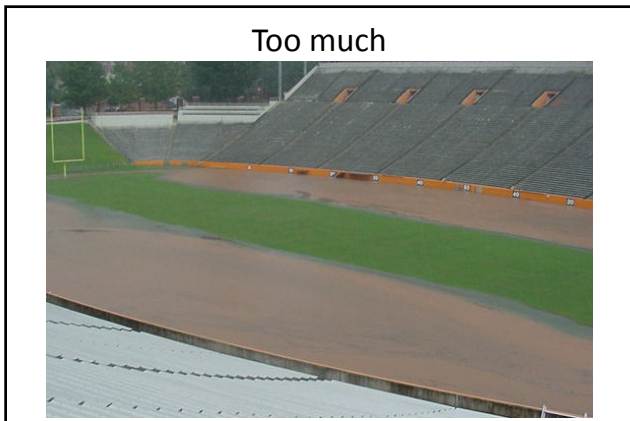
BMP – Natural Areas

- Remove areas from maintenance altogether
- Convert or install plant material that provides cover and food for wildlife.



BMP – Drought Conservation Plan

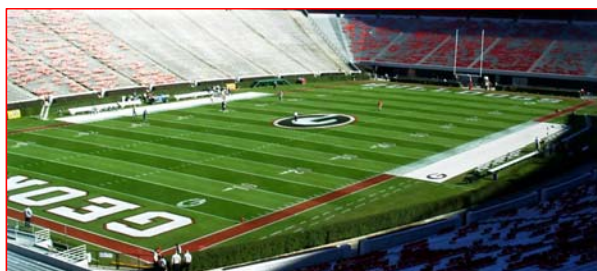
- 10% reduction – cut _____
- 20% reduction – cut large areas by 10% more
- Add counter measures to reduce effect
 - Raise height of cut
 - Stop mowing
 - Reduce traffic
 - Increase hand watering
 - Patron education



Too little



Just right!



Promote public awareness

- Tell the story that sports field managers are doing their part to enhance the environment!



Questions?

How does the turfgrass industry change its image and accentuate the benefits?

- ✓ Communication
- ✓ Continued stewardship
- ✓ Continued education
- ✓ Sound science
- ✓ Best Management Practices (BMPs)



Challenges

Old and New

- ? Education & Research
- ? Staying engaged
 - ✓ Academia
 - ✓ Industry



Where do we go from here?



Thank You

Visit
www.GeorgiaTurf.com
