Water Efficiency Assessments (Audits)

Helping with management on the other side of the meter

AWWA N.W. Section
April 25, 2018

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Water Efficiency Assessments (Audits)

- Please turn off cell phones
- Refreshments
- Restrooms
- Questions /comments
- Breaks
- Lunch

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Welcome

Kevin D. McCaleb
Water Conservation Specialist
City of Lake Oswego

- **Landscape and Irrigation Industry since 1980's**
  - Contracting, Consulting, maintenance
- **Municipal Water Professional since 1999**
  - City of Denver 1999 - 2003
  - Tucson (Oro Valley Water) 2003-2007
  - Lake Oswego 2007 –

- **Certifications**
  - Irrigation Designer
    - Residential
  - Irrigation Contractor
  - Landscape Irr. Auditor
  - Golf Irr. Auditor
  - Accredited Professional ARCSA
  - WaterSense Partner

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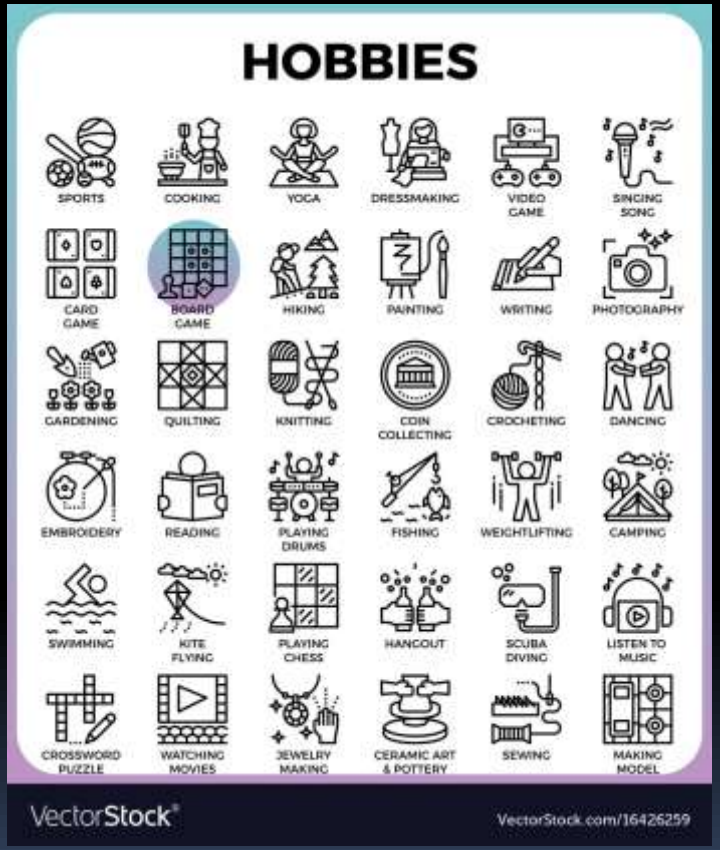
Tell us a little about You

- Where do you work? Title?
- Job Duties
- What you hope to get from this class.
- Why are you taking it?
- Something you do for fun...hobby etc.



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Take Aways

- Broader understanding of the need to Manage as it may pertain to your municipality/district
- Recognizing the benefits of adding assessments(audits)
- Interest in adding assessments (audits) to current suite of management programs
- Basic skills and tools to begin setting up and performing general assessments (audits) of water use efficiency for residential customers

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Course Outline

- Current issues and trends (water) View from 30000 feet
- Defining Assessments (audits): What they are and what they're not.
- Meter reading 101 and how to use them in an assessment
- Leaks: Significance and how to identify if and where they exist.
- Assessing the interior (Brief discussion: What to look for and how to assess.)
- Outside the home: Irrigation and landscaping assessments (Main Focus)
- Making recommendations based on observations (creating a schedule)
- Pools and ponds
- Field observation
- Creating an assessment report
- End of day

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A Reality Check

At some point the sun will burn itself out

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A Reality Check

We will all die

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A Reality Check

No new water will ever be made

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A Reality Check

We will continue to have shortages and droughts

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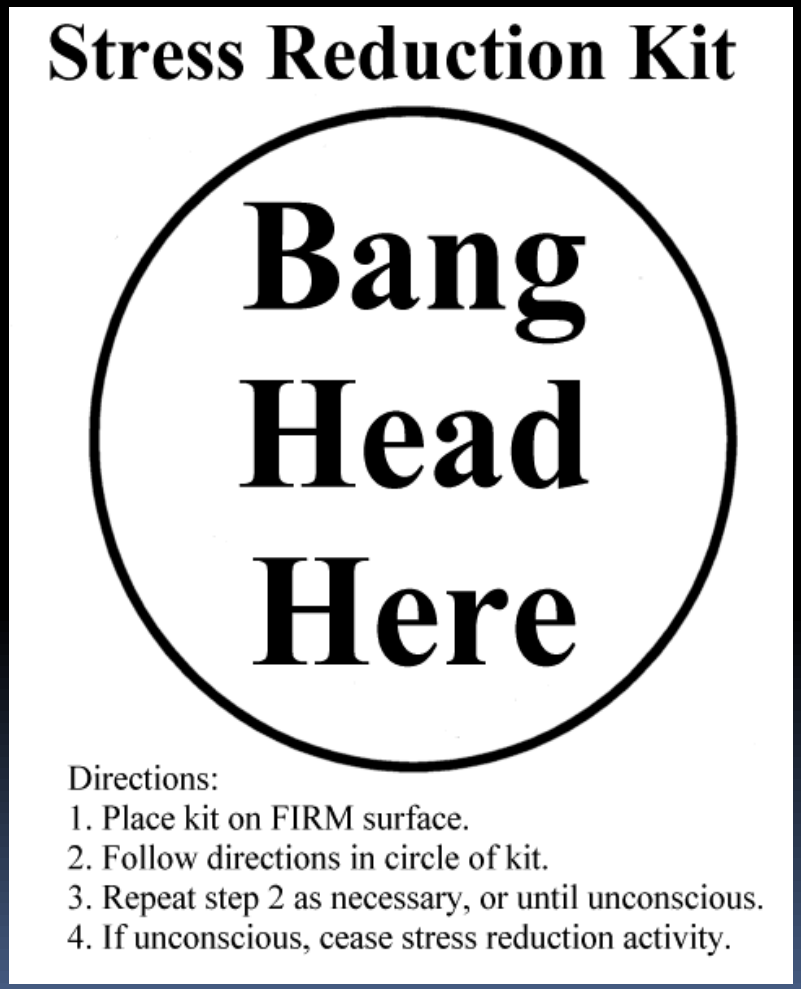
A Reality Check

Water rates will continue to rise



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A Reality Check

Water Conservation will become sexier and sexier

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The View from 30,000 feet

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Water: Today and Tomorrow

Aging & Failing infrastructures

Drinking Water: ASCE 2017 Report Card = D

- Many pipes date early to mid-20th century with a lifespan of 75 to 100 years.
- AWWA estimates 240,000 water main breaks per year in the United States.
- EPA states that over two trillion gallons of treated drinking water is wasted annually.
- AWWA estimates $1 trillion necessary to maintain and meet demands over the next 25 years

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Water: Today and Tomorrow

Weather anomalies (changes in normal)

- Extended droughts
- Super storms
- Erratic/less consistent seasonal changes (uncharacteristically warm/cold, late snow falls etc.)
- Rising sea levels

Population Growth

- Development/increases in hardscape/landscape
- Heat Islands
- Non-point source Pollution
- Water intensive industries: (Manufacturing: automobiles, plastics, beverages, textiles etc.)

Agriculture

- Population increases
- Water intensive crops

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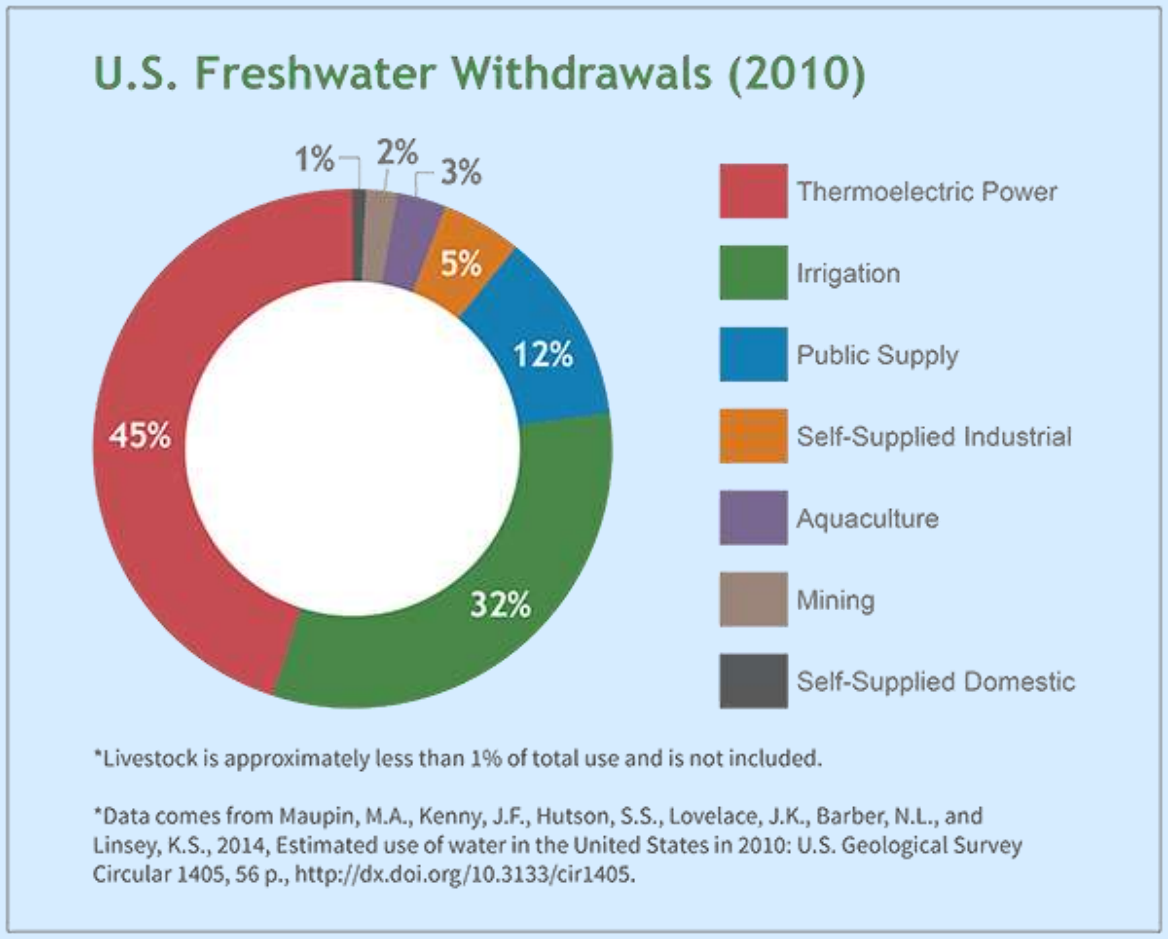
The Energy connection

Fresh Water Withdrawals in the U.S. (2010) 306 Billion Gallons per Day



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The Energy connection

Ppopulation, Plants and Power:

Population of Oregon (1850): 12,093
Population of Oregon (1950): 1,521,241
Population of Oregon (2010): 3,831, 074

Columbia River Basin irrigated acreage
(1900) 500,000 acres
(2000) 8,000,000 acres

Flow reduction on Columbia River exceeds 14.4 million acre ft. annually to accommodate irrigation and other seasonal needs. (1 Crater Lake)
Reduction in Hydroelectricity production: (2006) 625 megawatts at a cost of $274 million in displaced power. (170,000 homes for 1 year)

New Water Resources: None

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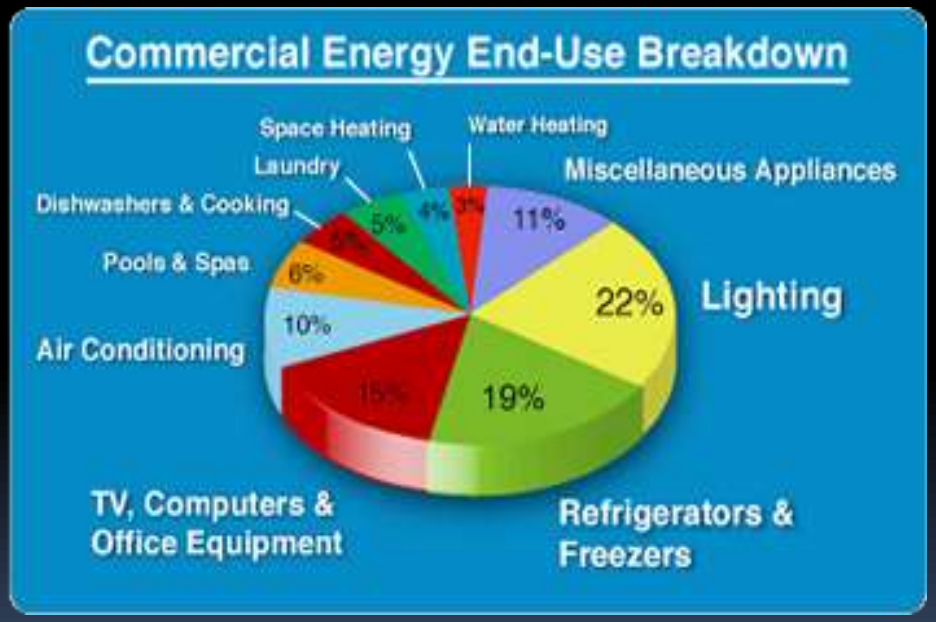
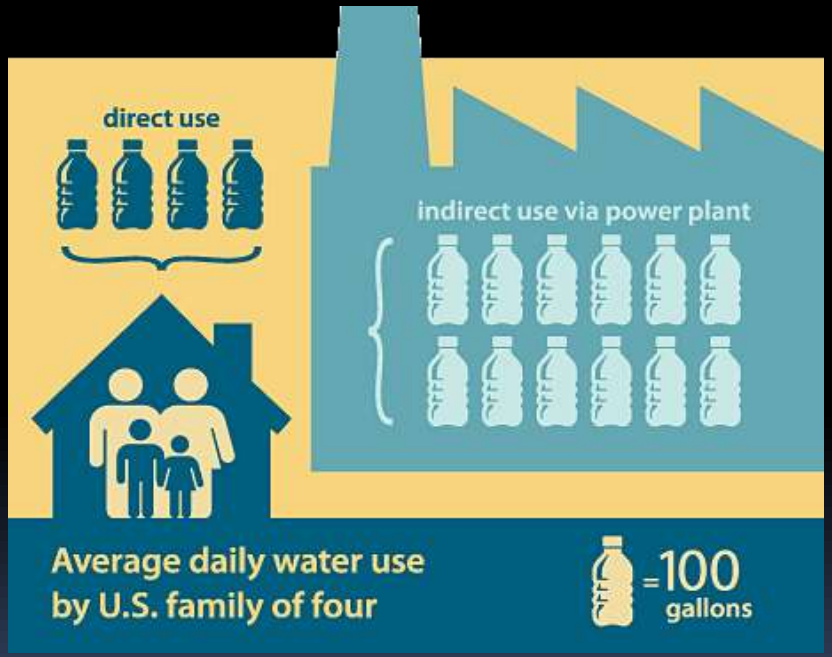
The Energy connection

Running hot water for 5 minutes through a faucet uses about the same amount of energy as burning a 60-watt bulb for 14 hours.

-EPA





13% of the total electricity produced in the U.S. (520 Billion KW Hours), is used to treat, transport and heat water

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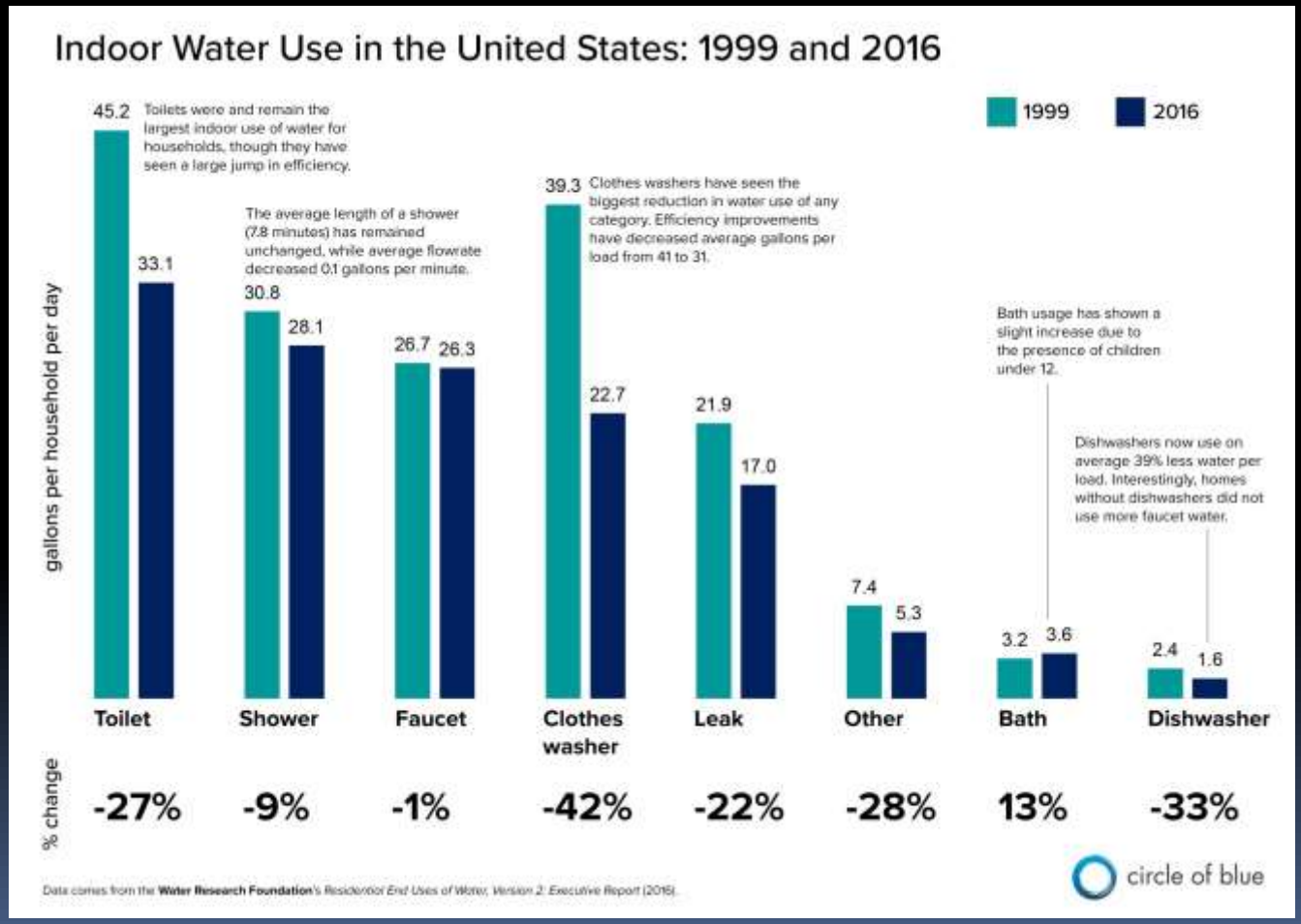
Typical Residential Indoor Usage



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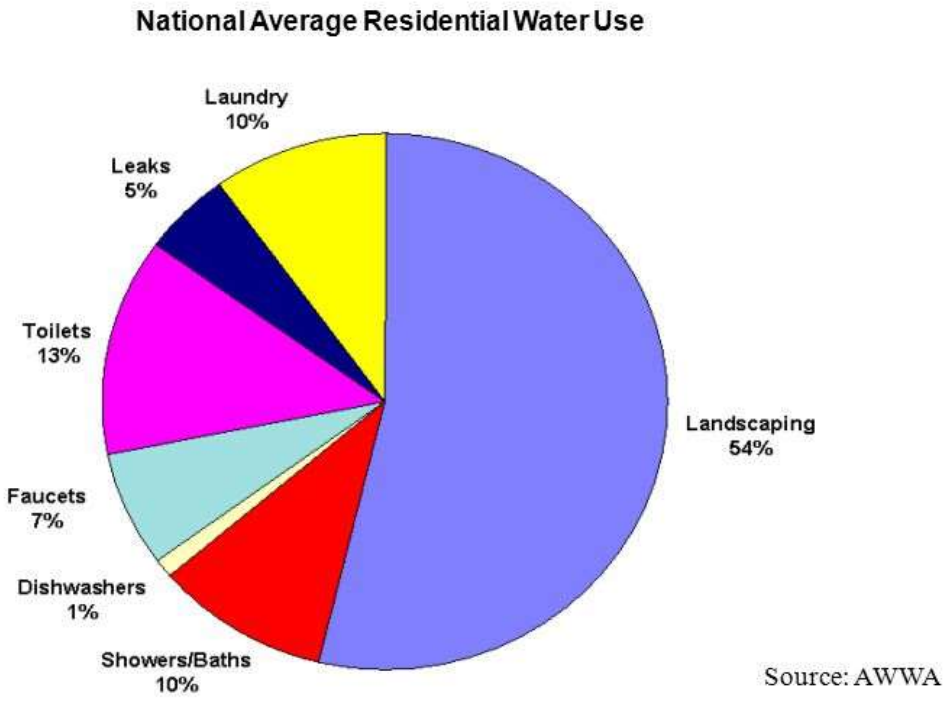
Outdoor Water Use: Irrigation

Outdoor Watering

Represents over 50% of Residential Water Use



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Defining Assessments/audits

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Assessments V.S. Audits

- **Audit?**

  The general definition of an **audit** is an evaluation of a person, organization, system, process, enterprise, project or product.

- **Assessment?**

  The evaluation or estimation of the nature, quality, or ability of someone or something. (organization, system, process, enterprise, project or product)

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What an Assessment (Audit) is

- **Time consuming:** Residential: 1-2 hours ea. Commercial: days/weeks
- **Reasonably accurate:** Specific to the needs of the property being assessed.
- **Educational:** One on one time with customers. Illustrate methodologies, tips, information, programs
- **Assists in Identifying and locating leaks** (generally)
- **Good customer service**

A PICTURE: SNAPSHOT OF THE WATER USAGE ON A SPECIFIC PROPERTY AT A SPECIFIC TIME

From that picture we can make some educated assumptions/estimates as to:

- What factor(s) may be causing excessive usage: (equipment, design, management)
- What steps can be taken(according to current practices) to improve efficiency.

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Who can we assess?

All retail water customers

- Residential: Single family, duplexes and condominiums (meter per dwelling)

- Commercial: Multi-family /multi residential: condominium complexes, apartment complexes, duplexes, hotels & motels, assisted living facilities and hospitals, offices, office buildings, restaurants, industry, manufacturing, warehouses etc.

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What can we assess?

	Commercial	Residential
Leaks	✓	✓
Irrigation System (design)	✓	✓
Irrigation System (equipment)	✓	✓
Irrigation System (maintenance)	✓	✓
Irrigation System (habits/management)	✓	✓
Indoor appliances (equipment)	✓	✓
Indoor appliances (maintenance)	✓	✓
Indoor appliances (habits/management)	✓	✓

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What do we hope to accomplish?

- Mitigate the effects of rate increases/ costs on customers
- Educate end users. Making them better stewards of water
- Reduce peak period demands
- Reduce Non-point source pollution
- Reduce impacts on municipal infrastructure and there by extend the life of existing infrastructure
- Retard the immediate impacts of population growth on infrastructure

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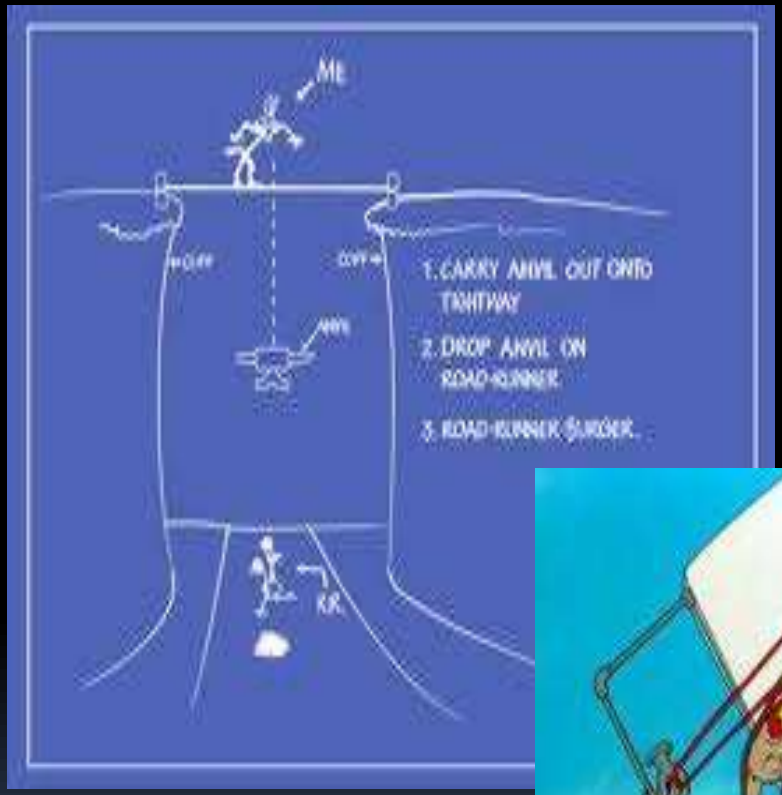
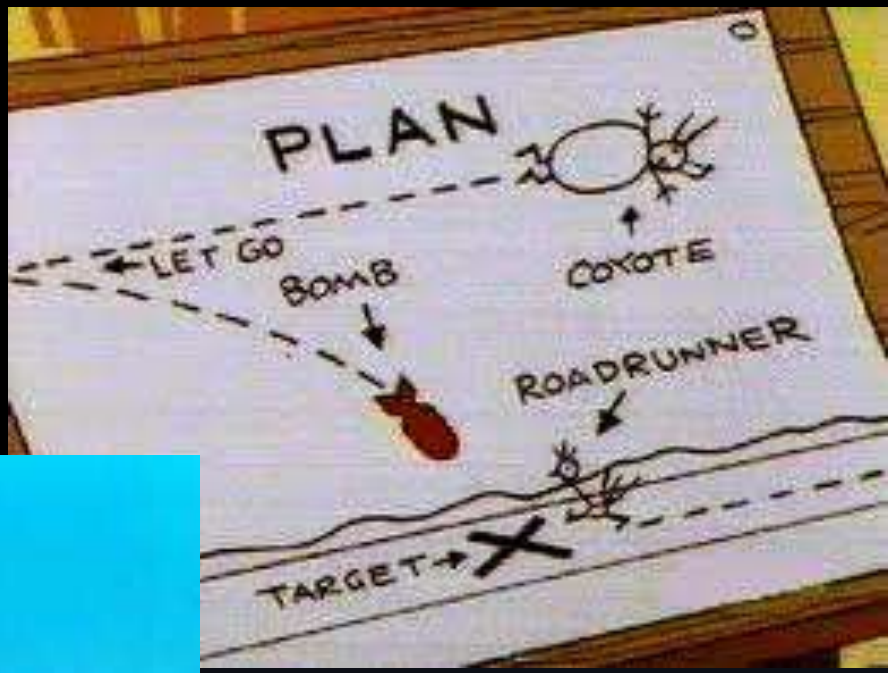
Do Assessments Work?





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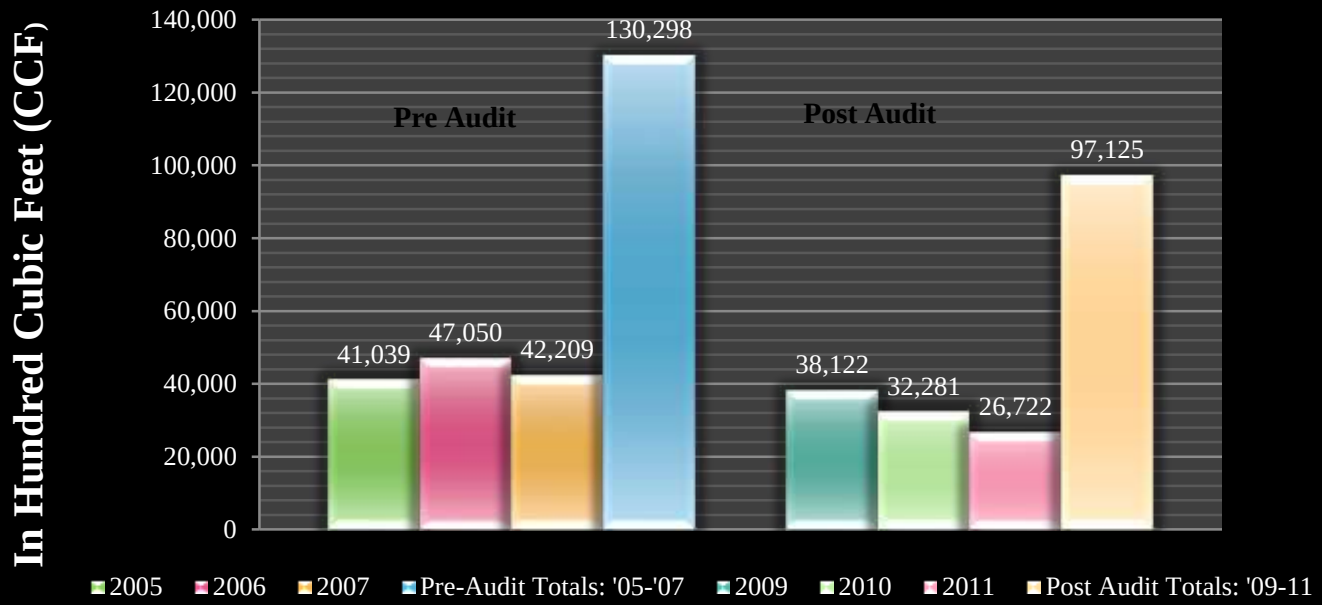
A Tale of Two Cities

Lake Oswego, OR **(26% savings)**

Lake Oswego Residential Pre and Post Audit Water Usage



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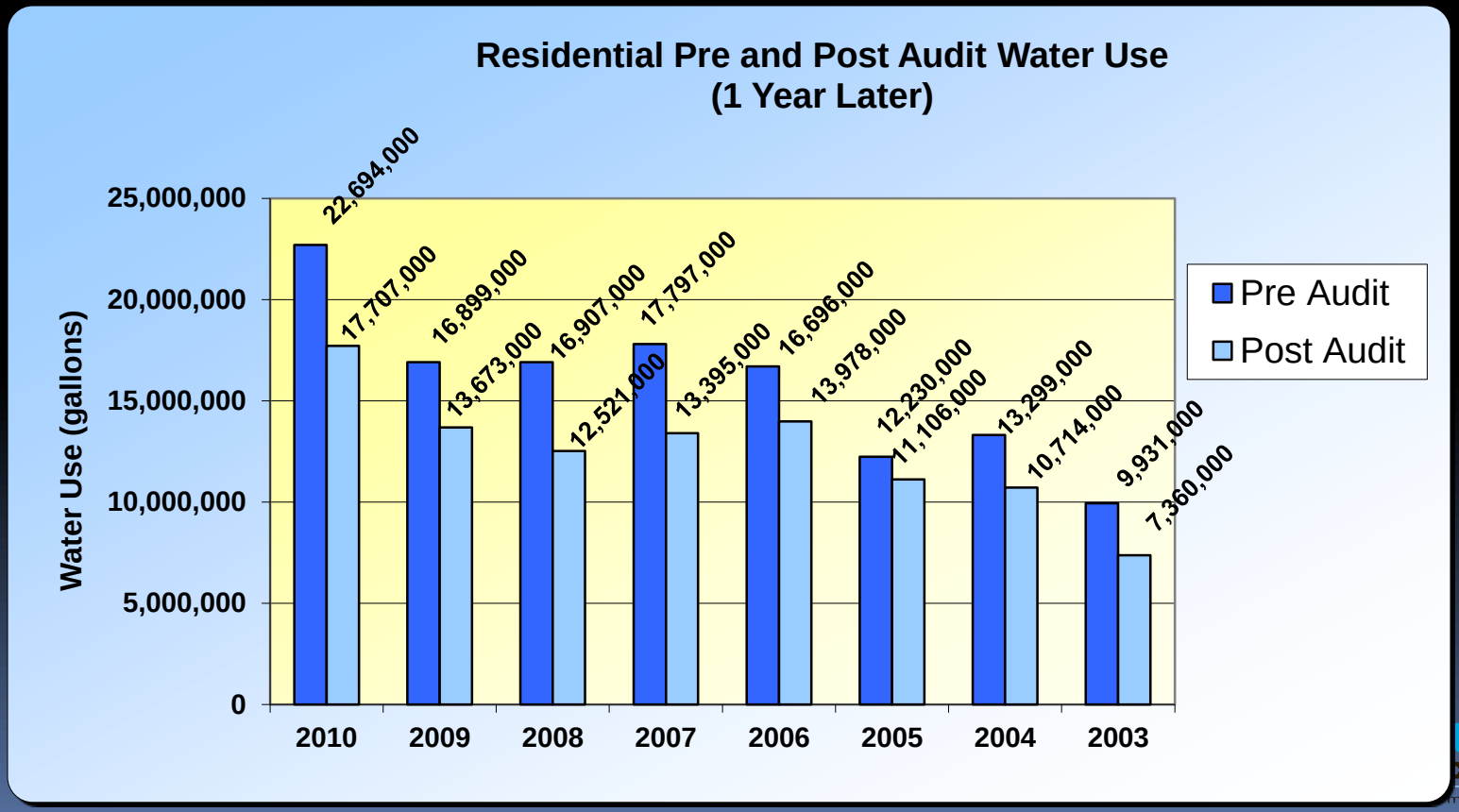
A Tale of Two Cities

Oro Valley AZ (19% savings)



Water Meter (Auditor's best friend)

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Meter Reading 101

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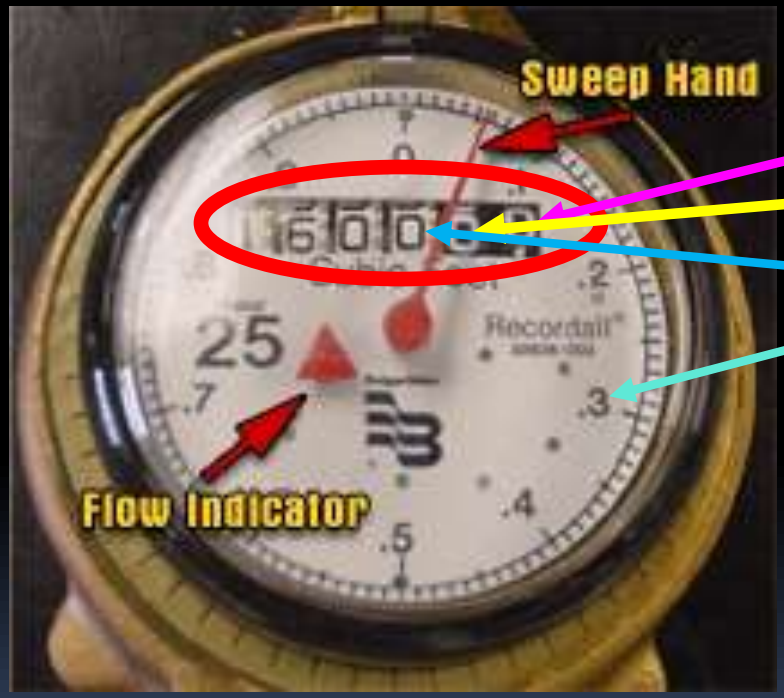
Water Meter Basics: CCF
The Read



1 cubic foot = 7.48 gallons

10 cubic Feet = 74.8 gallons

100 cubic feet = 748 gallons

1/10th of a Cubic Foot = .748 gallons

Use 7.5

Water Meter Basics: 1000 gallons
The Read

The Basics: Starting the Assessment

The Approach

- Be on time. Call if running late.
- Be friendly
- Ready to listen - Issues that customer is having can lead to directing or focusing the assessment
- Your job is to educate and assist; not criticize
- When you observe a problem, point it out and offer some solutions
- Be mindful of your customer's limitations: age, physical health etc.

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Detecting and diagnosing leaks

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The Importance of identifying Leaks?

- Commonly overlooked
- Frequent offender (1 in 4 homes have a leak)
- < 50% of leaks ever reach the surface
- Contributes to customers cost

If you are able , calculate the volume of lost water for account holders.
(Gallons per minute, hour, day , year etc.)

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What to look for at the meter

- **Intermittent/irregular movement**: Can be a flapper leak, or a malfunctioning fill valve on a toilet. May be excessive pressure in the system during times of reduced demand. Customer will often complain of hearing sound of running water at night. May be a fill valve for a pool or pond or may also be a failing or leaking irrigation valve.

- **Steady movement**: Leaky flapper on toilet, worn out fill valves, pipe leak.

Leaks never get better on their own!

"My husband said he could fix anything so if you find him, tell him he was wrong!"

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Isolating Leaks: A process of elimination

The Initial check

- Insure that no one uses any water
- Observe meter for 5 minutes
- Look for movement in the flow indicator
- If no movement , system is tight.

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Isolating The Leak

Eliminating outdoor possibilities

If movement on the Meter

- Verify no water was being used at the time
- Turn off main valves to pools/spas/ water features (if any)
- Turn off irrigation at the main valve
- Recheck meter

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Isolating The Leak

If no movement

The leak is likely in one of the systems you just shut down. Open those valves one at a time. Recheck the meter each time until you identify which component(s) are leaking. (There can be more than one)

Frequent offenders:

Auto fill valves on pools and water features

Open test ports on backflow preventers or manual drain valves.

If movement continues after shutting off all of the outdoor main valves, then the leak is likely in the house or the service line.

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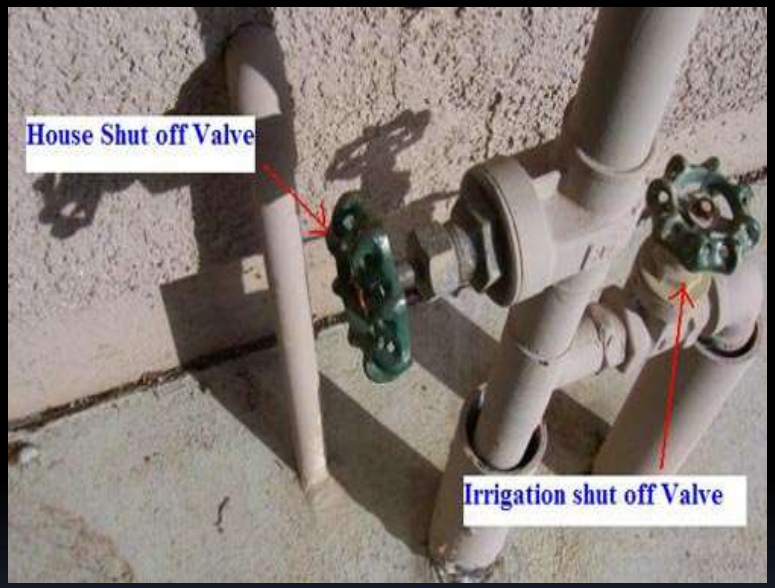
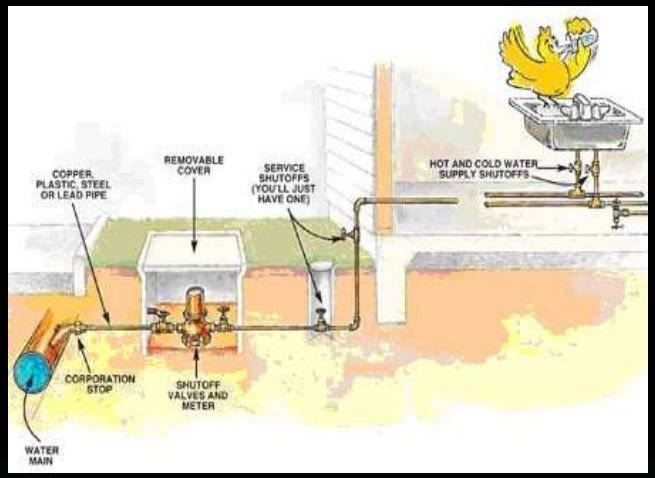
Isolating The Leak

Locate the main valve to house: Shut it off and check meter again for movement.





If movement stops: Leak is in the house

If movement continues: Leak is between the valve and the meter

<u>Likely the service line</u>

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Isolating The Leak

If No Main Valve: Check all faucets and fixtures for visible leaks.
If leaks are discovered, turn off individual stops . Turn off stops at all toilets.
Check meter for movement.

If the flow continues, then the leak is most likely in the service line

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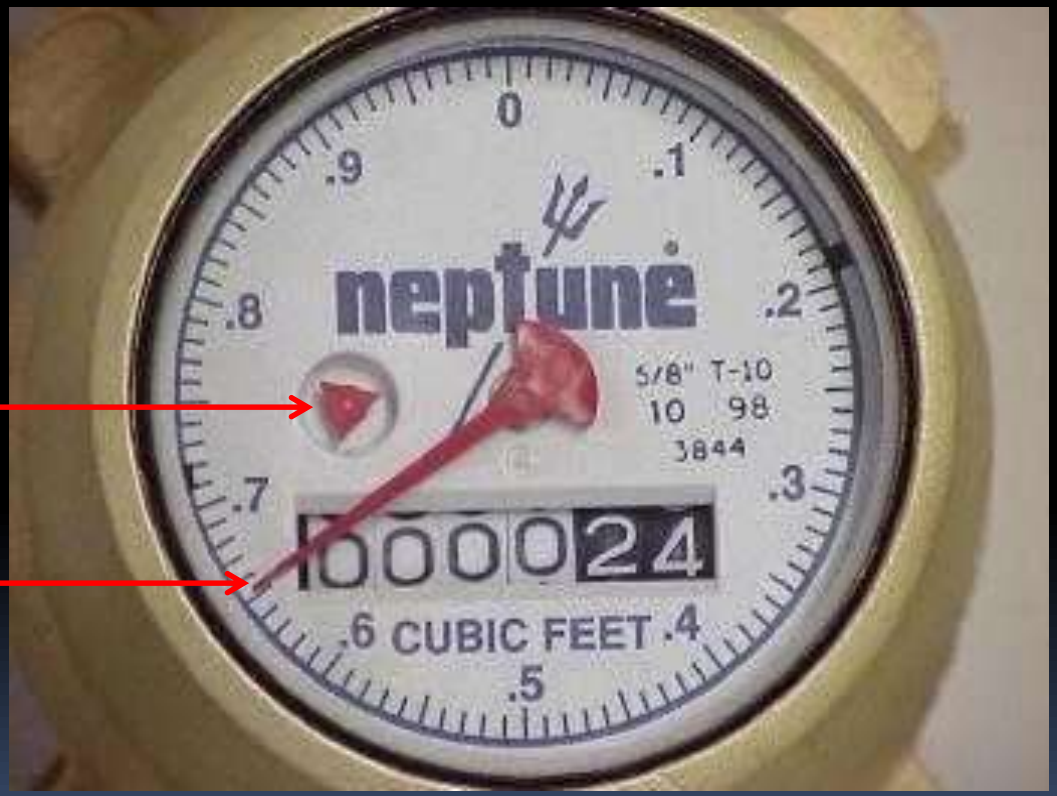
Calculating Leaks

Observe the meter: Minimum 5 minutes



Use a wax pencil to mark position of sweep hand. Observe for five minutes and calculate volume.

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No leak is insignificant

Two ticks : 5 minutes = .15 gallons X 12 or 1.8 gallons per hour
24 hours = 43.2 gallons per day
1314 Gallons per month (1.76 CCF)
365 days = 15,768 gallons per year (21 CCF)

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Inside the home

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Interior Assessments

- Primarily observation and conversation
- Ask what their particular issues are? High bills, etc.
- Good time to look at and explain water bills. Fees, additional charges (sewer, streets etc.)
- Ask to see their equipment: toilets, faucets showers
- Have them follow you around and explain what you are looking for

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Toilets

(Tank Type)

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Physical Assessment

Assess overall appearance; any signs of leakage? Cracks?

Flush and check for function.
Leaks? Valve shuts off tight?

After fill - drop in dye tabs
Check later for flapper leaks

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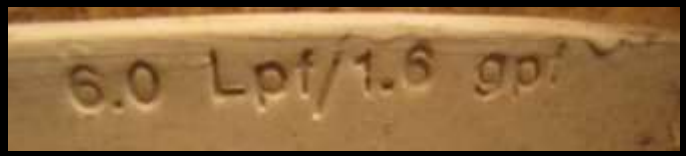
Determining Gallons Per Flush (GPF) (Tank Type)

Stamp on tank



Stamp on rim of bowl where the seat connects. All 1.6 gpf (6.1 liters) or less toilets should be marked at this location.

If no markings, check the underside of the tank lid or the tank's back inside wall for a date stamped in the porcelain. Toilets produced before 1985 are 5–7 gpf, a date between 1985 to 1991 would be 3.5 gpf. All toilets made after 1991 are 1.6 gpf or less.

Year the house was built or year of the last remodel

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Determining Gallons Per Flush (GPF) Tank Type

Tank Measurement

All Measurements are in inches

1) Measure the length of the tank . L x W x (A-B) = __ / 231
2) Measure the width of the tank.
3) Measure the full water level in the toilet tank (depth **A**).
4) Flush the toilet and measure the drop at the lowest level (depth **B**).
5) Subtract depth **B** from depth **A**. This will give you the **"drop** "measurement.
6) Multiply the **L** X **W** X **"drop"** to determine cubic inches of water used per flush.
7) Divide the volume by 231 to get the number of gallons per flush.

EX: Length: 19" Width: 7" High water level: 10" Low level: 4"

19 X 7 X (10-4)= 798 cubic inches /231 = 3.45 gallons

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Determining Gallons Per Flush (GPF) (commercial flushometers)

No readily visible markings or stamps

Sometimes have an identifiable handle or signage

Make and model # can help

Field observation:

Low flow toilets and urinals take between 4 to 5 seconds to complete a flush

Fairly uniform through out the industry

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Determining Gallons Per Flush (GPF)

If all else fails: Use the meter

CCF: 1.6 GPF

Gallons: 1.6 GPF

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Faucets: Kitchen/Bath/utility

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Assessment

Drips: Turn faucet on to full stream and then off. Water stream should shut off crisply.

Calculating the cost of drips:

30 Drops/Minute = 96 Gallons/Month

Leaks: Look at base of stem and seam along the bottom of the unit for water.

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Determining flow

Lavatory faucets: Small pitcher or glass – should not fill faster than 5 seconds (1.5 gallons per minute) (16oz)

Kitchen Faucets: Large pitcher (1qt) should not fill faster than between 6 and 7 seconds (2.25 GPM)

Utility Faucets: Same as kitchen faucets

Turn faucet on to full flow- then insert cup or pitcher to measure.

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Showers /Baths

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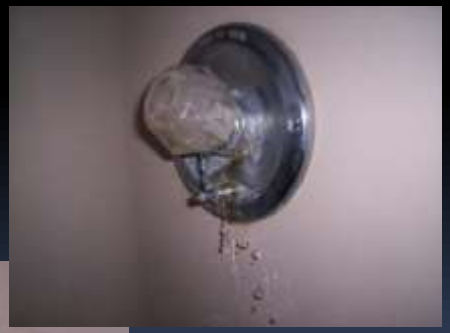
Assessment

Drips: Turn shower on to full stream and then off. Water stream should shut off crisply.

Calculating the cost of drips:

30 Drops/Minute = 96 Gallons/Month



Leaks: Look at base of handles for any water leaking.

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Determining Flow

Showers: Large pitcher (1qt) should not fill faster than between 6 and 7 seconds (2.25 GPM)

Less is better: < 1.5gpm is possible

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The Laundry

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Assessment

Leaks: Standing water on the floor or stains from standing water

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Calculating the Volume per Load

The Old VS the New

Older Washers

An old school washer will use approximately 35 to 45 gallons of water per load regardless of cycle selection. A family of four using a standard clothes washer will generate more than 300 loads per year, consuming 12,000 gallons of water annually.

High Efficiency Washers

New, High-Efficiency Washers (HEW) (front loading or top loading machines are available) can use 14 to 25 gallons of water per load. Replacing an old and inefficient clothes washer can reduce water use by more than 6,000 gallons per year), save energy, clean the clothes better, and reduce fabric wear.

Calculate volume per load:

- Manufacturers specifications
- Age

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Other potential water wasters in the home

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Putting it all together

Residential Interior Water Audit

Customer: ______________________________ **Reference/WO#:** ______________

Address: _______________________________ **Date:** ___________________

____

PH#: __________________

No of Residents in household: 3__ **Leaks** (meter): Y N (circled) **GPM:___** **Visible:** Y N **Location:** __________

Comments: ____

____

Kitchen:

Dishwasher _⊠_ Brand: _______________________________ **Water per load (Est):**________________

Sink Faucet _⊠_ GPM (gallons per minute):___________ **Comments:** ___________________________

____

Bathroom (s):

Faucets: _⊠ GPM: __ GPM __GPM __Water Closet: ⊠_ Type: **HE** LF ST **GPF (gal. per flush):_1.28___**

Showers: _⊠_ GPM: ___ Tub: ⊠_ Type: _________________ **Capacity:** ______ **in gallons**

Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush):** ____

Showers: ___ GPM: ___ Tub: __ Type: _________________ **Capacity:** ______ **in gallons**

Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush):** ____

Showers: ___ GPM: ___ Tub: __ Type: _________________ **Capacity:** ______ **in gallons**

Faucets: __ GPM: __ GPM __GPM __Water Closet: __ Type: HE LF ST **GPF (gal. per flush):** ____

Showers: ___ GPM: ___ Tub: __ Type: _________________ **Capacity:** ______ **in gallons**

Comments:____

____

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Review:

Step I: Leak detection

a) Water off/observe meter How long: 5 minutes. What to look for?
b) Isolate and locate

Step II: Indoor assessment (residential)

a) Toilets
b) Faucets: kitchen/ bath/utility
c) Sowers/baths
d) Laundry
e) Other
f) Write down what you find
g) Make recommendations

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Break

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Moving to the outside

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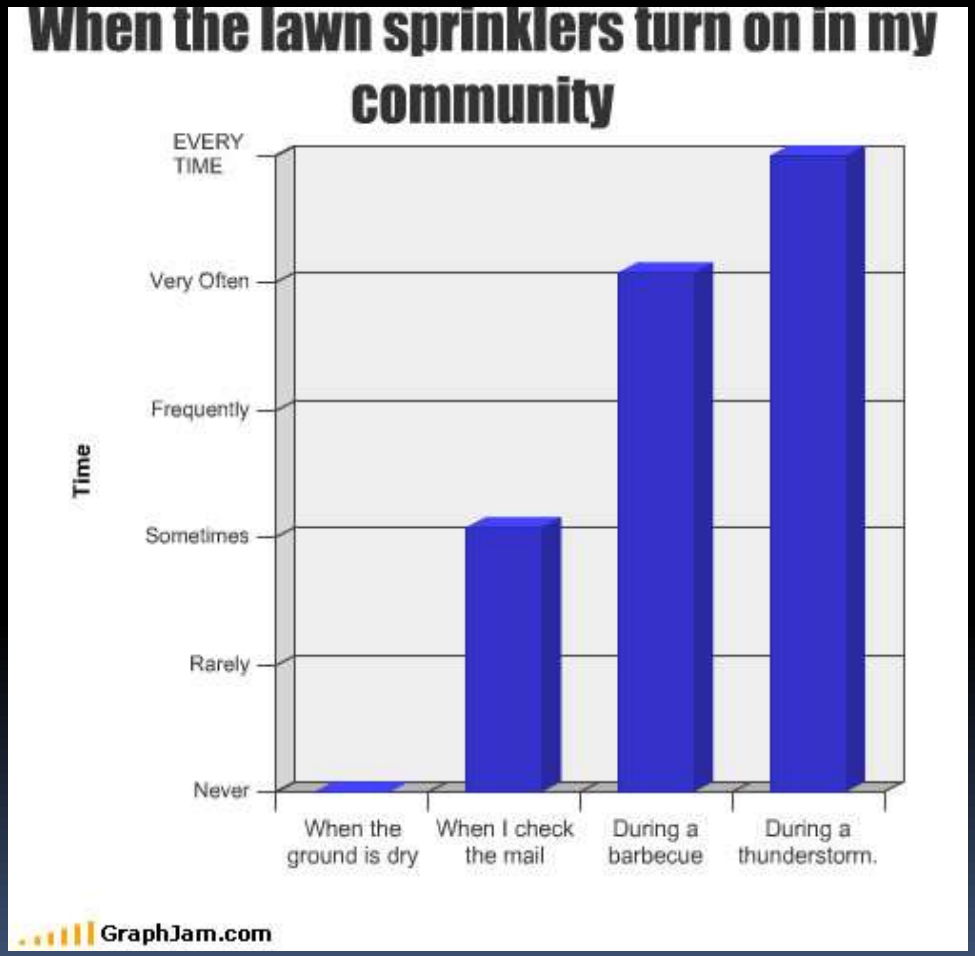
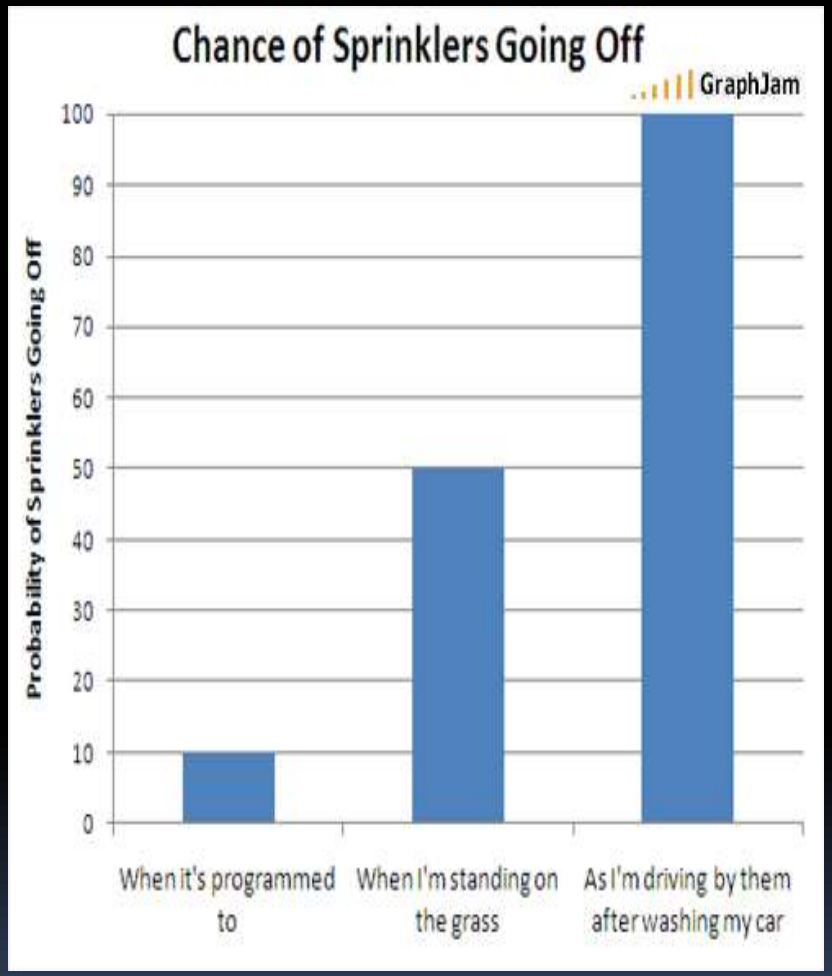
Some Truths About Irrigation





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….More truths

- Better than half of all treated water used in the U.S. during the summer is applied to residential and commercial landscapes.
- More than 50 percent of residential and commercial irrigation water is lost to evaporation, runoff, overwatering, or poor design/maintenance
- Americans typically apply on the average 30% to 60% more water on their landscapes than necessary for the plants to thrive.
- Large contributor to non-point source pollution
- Drip systems can use more water than conventional systems
- There is no such thing as an Automatic Irrigation System

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Irrigation Systems in a nutshell

Basically : Holes in pipes/Managed Leaks

If it's.....

- Designed, installed, managed and maintained properly: Fairly efficient, moderate impacting distributor of water –

- Designed, installed, managed and maintained Poorly: Inefficient, potentially high impact, water wasting head ache.

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Assessing the irrigation system

Examine the controller

****** Write down # of programs, current schedule etc on work sheet**

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Assessing the irrigation system (Controller)

Controller interface

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Terms used to Program Controllers

5 **Start Time:** Time at which specific valves/ programs will operate a station or zone.

1 **Off /Stop:** Ends irrigation activities

2 **Program:** Where specific information on irrigation activities are stored.

4 **Run Time /Station Duration:** Time, in minutes, a specific valve will stay on

6 **Cycle/ Run Days:** Days of the week/month scheduled to allow irrigation

3 Current time

8 **Semi-Auto:** Operates (cycles through) entire program regardless of start times.

7 **Manual:** Operation of single selected station

Cycle and soak

Sensor bypass (on/off)

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Assessing the irrigation system (Controller)

Most have a quick programming guide in the door

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Assessing the irrigation system (Controller)

What we are looking for:

- All displays light up correctly
- All buttons and dials work correctly
- Activate semi auto (some models have a test program pre-installed) monitor that all stations connected operate via controller.
- Check rain sensor operation (if accessible)
- Make sure that rain sensor is by-passed. ****

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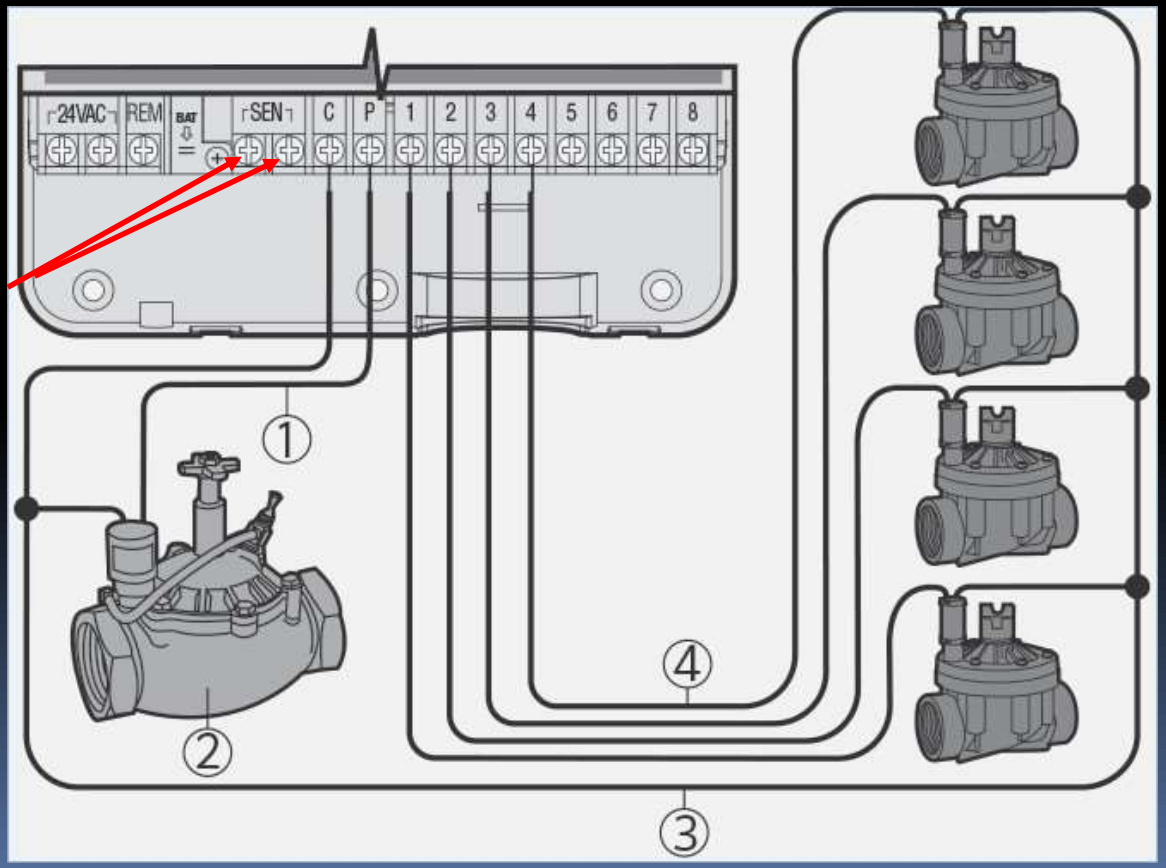
Assessing the irrigation system (Controller)

Wiring

- **Power is on!!!!**
- Connections are clean and tight into the terminals.
- Wired correctly.



Note if rain sensor or other is attached and if appropriately located.

(Sensor should be located where it is not exposed to irrigation. Should not be mounted where access is impeded by branches, eaves, roofs etc.
If you look up and see anything other than blue sky...it is in the wrong place.)

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Assessing the irrigation system

Backflow protection

Backflow preventers: Follow current municipal code as to acceptable types and installation. Note appearance and any discrepancies in installation protocols.

Atmospheric Vacuum Breaker:

Pressure Vacuum Breaker:

Double Check:

Reduced Pressure Principle:

Hose Bibs:

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Leaks: Y/N _____GPM Description _____

Controller info:

Type/model/make: _____ No. stations: _____ No. operating: _____

Current Program:

Start Time(s): 1 _____am/pm 2 _____am/pm 3 _____am/pm 4 _____am/pm
Start Time(s): 1 _____am/pm 2 _____am/pm 3 _____am/pm 4 _____am/pm
Start Time(s): 1 _____am/pm 2 _____am/pm 3 _____am/pm 4 _____am/pm
Start Time(s): 1 _____am/pm 2 _____am/pm 3 _____am/pm 4 _____am/pm

Run Times (zones/valves): (In Minutes) 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ 16 _____

Days per week: M __ T __ W __ Th __ F __ S __ Su __ 1 every – 1 2 3 4 5 6 7 days
Cycles per day: 1 2 3 4 Notes:
_____
_____
_
Backflow Prevention: AVB, PVB, DBL CHK, RPP Status: ____ Notes: _____
_____

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Assessing the Landscape

The Walk Through

- Note any particular difficulties/ issues the resident may be having
- Note any topographical issues (slopes, declivities)
- Note the maturity and density of the overall plantings (shrubs, flowers, trees (This will factor in later)
- Note the general health of the turf. Any areas not getting enough water? Getting too much?
- Soils: compacted? Clay sand mix etc
- Use this time to measure approximate area.
- Assess (note) micro climate

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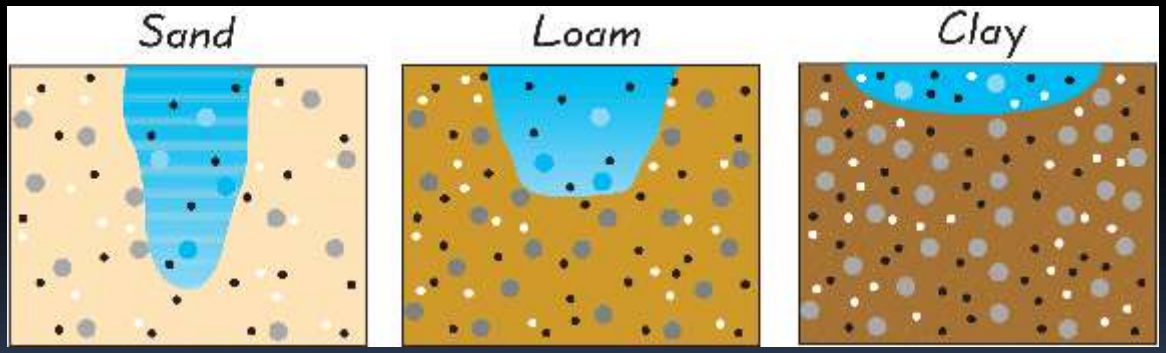
A quick word about Soils

- Soils are the gas tank : Too much - the plants suffer and may die!
  Too little - the plants suffer and may die!

Over watering can cause run off /waste. Leaches nutrients from the areas around the roots where the plants get their vitamins. Starves the plant for oxygen.
Under watering limits the amount of nutrients a plant gets. (harder for them to take in) Starves the plant for oxygen.

The rate at which soil soaks up water (infiltrates) is the limit on how fast water can be applied at any one cycle



Textural class	*Water holding capacity, inches/foot of soil*
Coarse sand	0.25 - 0.75
Fine sand	0.75 - 1.00
Loamy sand	1.10 - 1.20
Sandy loam	1.25 - 1.40
Fine sandy loam	1.50 - 2.00
Silt loam	2.00 - 2.50
Silty clay loam	1.80 - 2.00
Silty clay	1.50- 1.70
Clay	1.20 - 1.50

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A quick word about Micro climate

- Micro climate relates to how or if outside factors will contribute/affect watering

If a turf area is surrounded by asphalt and has no trees or buildings shading it we would classify that micro climate as high
If a building shades it most of the day and it iis bordered by planting beds the micro climate would be low.
It works the same way for shrubs and even trees.
We make a judgment call based upon how much, how long and how relevant.

Area assessed	High	Mid range	low
Turf/landscape etc	1.2 to 1.4	.9 to 1	.5 to .8

These numbers will factor in with the scheduling

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The Walk Through continued

Use the time to talk with the customer(s) about:

Planting plants in groups with similar water needs

Talk Possibilities/options

Reducing turf size

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The Walk Through continued

SHRUBS/TREES

- Note type and density
- Water need is based upon health of canopy and density more than total area
- Deeper watering-less frequently

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The Walk Through continued

SHRUBS/TREES

- The more dense and lush, the higher the water usage.
- Deeper the root level, the less frequent the cycle. Depth and breadth of roots means greater access to moisture
- Native plants (region adapted) will thrive with less supplemental water

Plant type	lush	average	lean	stressed
Shrubs	.60 to .65	.40 to .50	.30 to.35	< .30
Natives(adapted)	.40 -.45	.30 -.35	.20 -.25	< .20
Ground Cover	.70 - .80	.50 - .60	.30 - .40	< .30
mixed	.90 -.95	.75 -.80	.50 - .55	< .50
Turf	.80 -.85	.75 - .80	.60 -.65	< . 60

These numbers will help to schedule

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The Walk Through continued

Talk about possible alternatives to turf in difficult areas:

Under Trees

- Steep slopes

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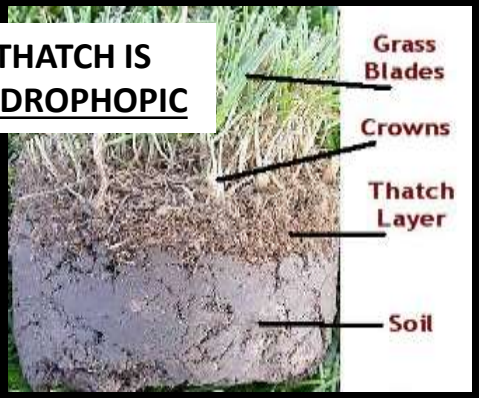
The Walk Through continued

THATCH IS HYDROPHOPIC



Thatch

- Hydrophobic
- Not grass clippings
- Inhibits nutrients from reaching the root system
- Rake and dispose of residue

Aeration

- De - compacts soils
- Facilitates broader / deeper root growth
- Allows better penetration of water and nutrients
- Rake up plugs and remove from lawn

Soil amendments:

- Organic mulches. incorporating pumice, ¼-10 minus gravel, bio char, turf alternatives

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The Walk Through continued

Talk about Fertilization : Knowing what is needed

- Soil tests
- 0-Low phosphate fertilizers
- no broadcast spreading

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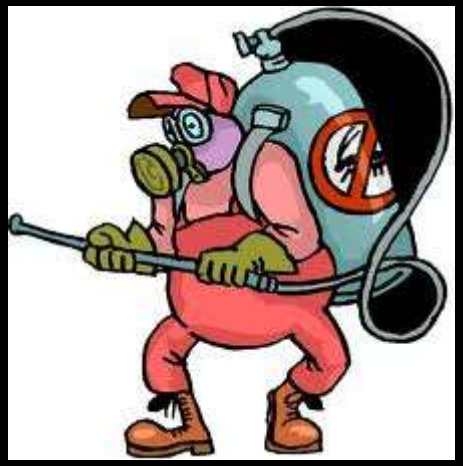
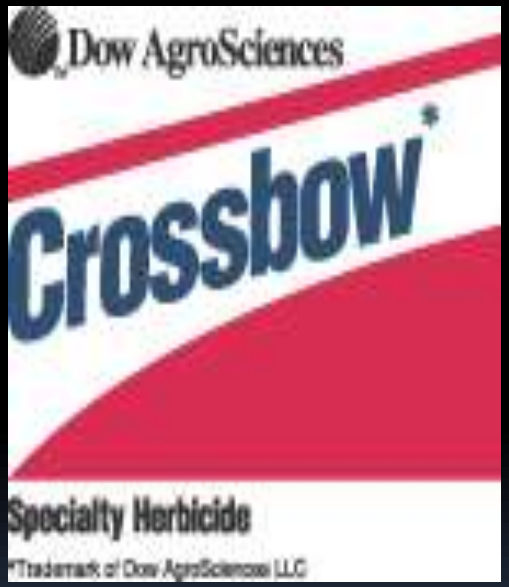
The Walk Through continued

Talk about chemical Usage: Responsible applications

- Follow the directions carefully
- Don’t add to it or over do it
- Pesticides are indiscriminant





Site Assessment (Walk through)

Notes: _____

_____

_____

_____

1) Turf SQFT_____ Shrubs SQFT _____ Density___ Micro H__ L __ Mid: __
2) Turf SQFT_____ Shrubs SQFT _____ Density___ Micro H__ L __ Mid: __
3) Turf SQFT_____ Shrubs SQFT _____ Density___ Micro H__ L __ Mid: __
4) Turf SQFT_____ Shrubs SQFT _____ Density___ Micro H__ L __ Mid: __

Practice problem Sheet # 1

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A little bit about sprinklers

Sprinklers (The Distribution System)

Most common types:



- Pop up Sprays:

Virtually every manufacturer makes them. Very poor uniformity (uneven, unbalanced patterns)
Do not do well with high pressure. (misting)



- Rotators:

Multiple manufacturers. Good uniformity. Operates well at higher pressures. Very low precipitation rate (less run off)



- Rotors:

Multiple manufacturers. Variety of nozzles. Adjustable.
Works with a variety of pressures

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A little bit about sprinklers

Other commonly used types

Impact rotors:

Bubblers:

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A little bit about sprinklers

- Drip Systems:

Potentially the best delivery system.

Higher level of maintenance. Can use as much or more water than conventional.

Very low rate of application.

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A little bit about sprinklers

Uniformity

- Defined as how evenly water is distributed over the area covered
- Rated as Good-better-best and normal or typical
- Based upon how evenly spaced (consistency in distance between heads) Operating pressure and maintenance (adjustment, free flow of water from nozzles and disrepair)
- Always recorded as a decimal (1-would be perfect...and that never happens)

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A little bit about sprinklers

Uniformity standards for various sprinklers

Sprinkler type	Best	better	Good	Typical
Pop up Spray	.65 -.75	.55 -.65	.45 - .55	< .45
Multi Stream Rotators	.75 -.85	.65 -.75	.55 - .65	< .60 - .70
Rotors	.70 -.80	.60 -.70	.50 -.60	< .55 - .65
Drip	.85 -.95	.75 -.85	.70 - .80	< .60 - .75

- Farther removed from 1 the more water that needs to be added

Example: A zone of pop up sprays flowing 15 GPM for 10 min at a uniformity rate of .75 would apply about 188 gallons to insure adequate water.
Same zone at .45 would apply about 232 gallons or about 20% more

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A little bit about sprinklers

Precipitation Rate

Defined as the amount of water being distributed over the area being watered for a set period of time. Usually recorded as inches per hour.

- Relates to individual sprinklers
- Groups, lines or zones of sprinklers
- An area being watered by multiple zones
- Used to calculate schedules (run times vs need)

Turf typically needs 1” of water per week + or – based upon time of year and maturity

Shrub needs different amounts based upon season, density of plantings and type.

Schedules will reflect these differences with frequency of applications and volume per.

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HOW MUCH IS 1 INCH?

Simple equations to calculate water needs of turf grass

- Turf: 1” per week (Higher during peak) 1” of water = .62 gallons per SqFt

- (1) Precipitation rate: $\frac{96.3 \times GPM}{Area\ (SqFt)}$ = inches per Hour
- (2) Run time per week: $\frac{Area\ (SqFt) \times .62}{GPM}$ = minutes weekly to apply 1” of water.

Example 1: $\frac{96.3 \times 22\ GPM}{2500\ SqFt} = \frac{2118.6}{2500} = .84$ inches per hour or $\frac{1}{.84}$ = 1.19 hrs per week

Example 2: $\frac{2500 \times .62}{22\ GPM} = \frac{1550}{22} = \frac{70.45}{60}$ minutes = 1.17 hours or $\frac{60}{70.45}$ = .85 inches per hour

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A little bit more about sprinklers

Things that affect sprinkler performance:

Pressure:

- Too low: drop dispersal reduced (large drops; large streams)

- Too High: misting 10% to 20 % losses

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A little bit more about sprinklers

Things that affect sprinkler performance:

Wind: Winds over 5mph can distort patterns

Misalignment: (adjustments)

Blockage:

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A little bit more about sprinklers

Things that affect sprinkler performance:

Mismatched heads:

- Rotors and sprays on the same valve
- Drip and conventional on the same valve
- Nozzle sizes inconsistent

} All create differences in volume and precipitation rates for various sprinklers

Line Breaks and missing or broken heads

More than 1 valve connected on same station

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Assessing the irrigation system

- Operate one station at a time on manual
- Does the valve operate correctly? Open and close completely and upon command
- Observe the sprinkler operation: Note Adjustments, broken risers/heads, broken lines, leaks and blockages. Note pressure: too much (misting) Too little (thick streams w/ no diffusion)
- Note coverage: Turf , shrubs, planters etc. Is there good overlap w/other zone(s)? Does it cover turf as well as shrubs?

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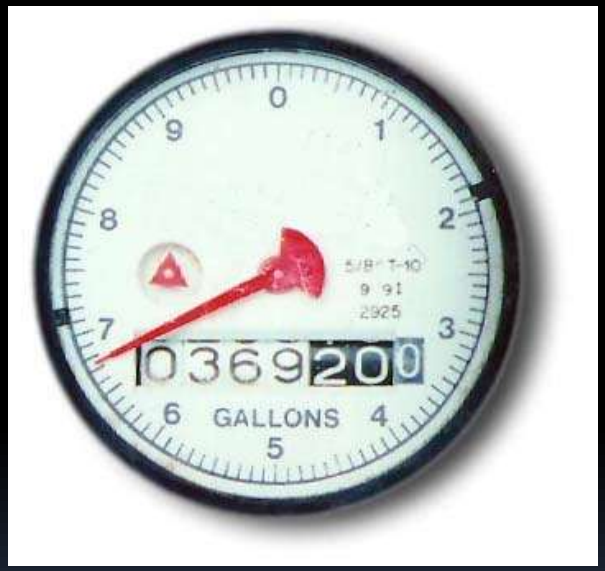
Assessing the irrigation system

Calculate precipitation rate for each zone by observing and measuring how far the sweep hand on the meter moves in 1 minute while zone is operating.
And multiply: by .75 for CCF and 1 for gallons. Wait until system is operating fully before measuring



Repeat process for all stations

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Irrigation System

Zone: 1 (Heads) _____ Flow: ____ GPM
Planting: Turf ___ Shrubs ___ Grnd Cover___ Mixed___ Notes: _____
_____

Zone: 2 (Heads) _____ Flow: ____ GPM
Planting: Turf ___ Shrubs ___ Grnd Cover___ Mixed___ Notes: _____
_____

Zone: 3 (Heads) _____ Flow: ____ GPM
Planting: Turf ___ Shrubs ___ Grnd Cover___ Mixed___ Notes: _____
_____

Zone: 4 (Heads) _____ Flow: ____ GPM
Planting: Turf ___ Shrubs ___ Grnd Cover___ Mixed___ Notes: _____
_____

Practice Sheet #2

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Assessing the irrigation system

Lets do one together

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Creating a Schedule

EVERYTHING YOU NEED TO GET A CUSTOMER'S OUTDOOR WATERING BACK IN THE IN THE BALL PARK

HOW MUCH IS 1 INCH?

Simple equations to calculate water needs of turf grass

- Turf: 1” per week (Higher during peak) 1” of water = .62 gallons per SqFt

- (1) Precipitation rate: $\frac{96.3 \times GPM}{Area\ (SqFt)}$ = inches per Hour
- (2) Run time per week: $\frac{Area\ (SqFt) \times .62}{GPM}$ = minutes weekly to apply 1” of water.

Example 1: $\frac{96.3 \times 22\ GPM}{2500\ SqFt} = \frac{2118.6}{2500} = .84$ inches per hour or $\frac{1}{.84}$ = 1.19 hrs per week

Example 2: $\frac{2500 \times .62}{22\ GPM} = \frac{1550}{22} = \frac{70.45}{60}$ minutes = 1.17 hours or $\frac{60}{70.45}$ = .85 inches per hour

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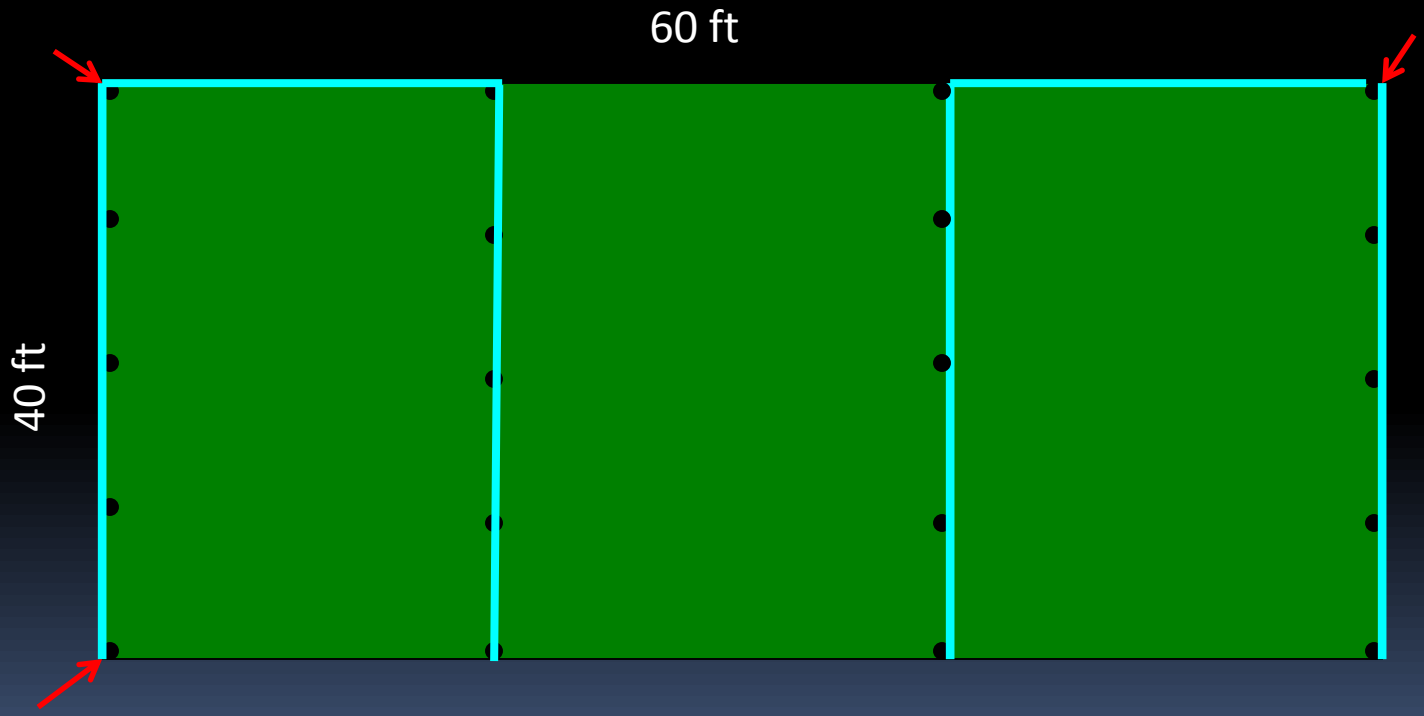
Calculating a Schedule

 # 1

Measure square footage of each area of grass to be watered. Multiply that number by .62 to get the amount of water needed weekly to equal 1". In this example: 2400 X .62 = 1,488 gallons to equal 1"



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Scheduling

Need per week: 1” = Area X .62 X type X density X Micro +/- based upon season

Pecipitation rate (PR) $\frac{96.3 \text{ X gpm}}{\text{Area}}$ = inches per hour

Area: 1 – PR _____ Need: _____ Current: _____ based on controller

Area: 2 – PR _____ Need: _____ Current: _____ based on controller

Area: 3 – PR _____ Need: _____ Current: _____ based on controller

Area: 4 – PR _____ Need: _____ Current: _____ based on controller

Divide by days per week for water

Recommendations:

Head/replacements/repairs/ retro-fit:

_____

_____

Maintenance: _____

_____

_____

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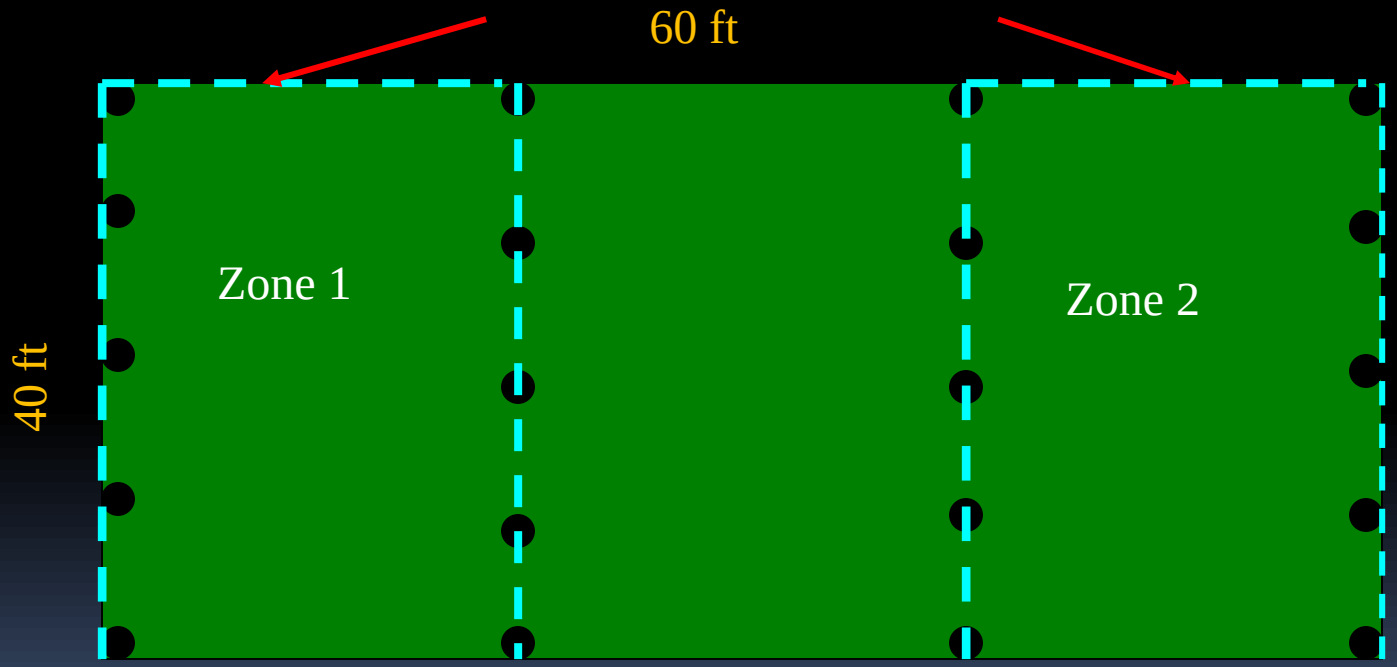
Calculating a Schedule (CCF)

 # 2

Run each zone for 1 minute. Write down the number of times the sweep hand goes around for each.

Example: Zone 1- 1.5 times or 11.25 gallons Zone 2- 1.2 times or 9.75 gallons

Add both zones to get total applied. In this case: 11.25 + 9.75 = 21 (round down) 21 gallons per minute



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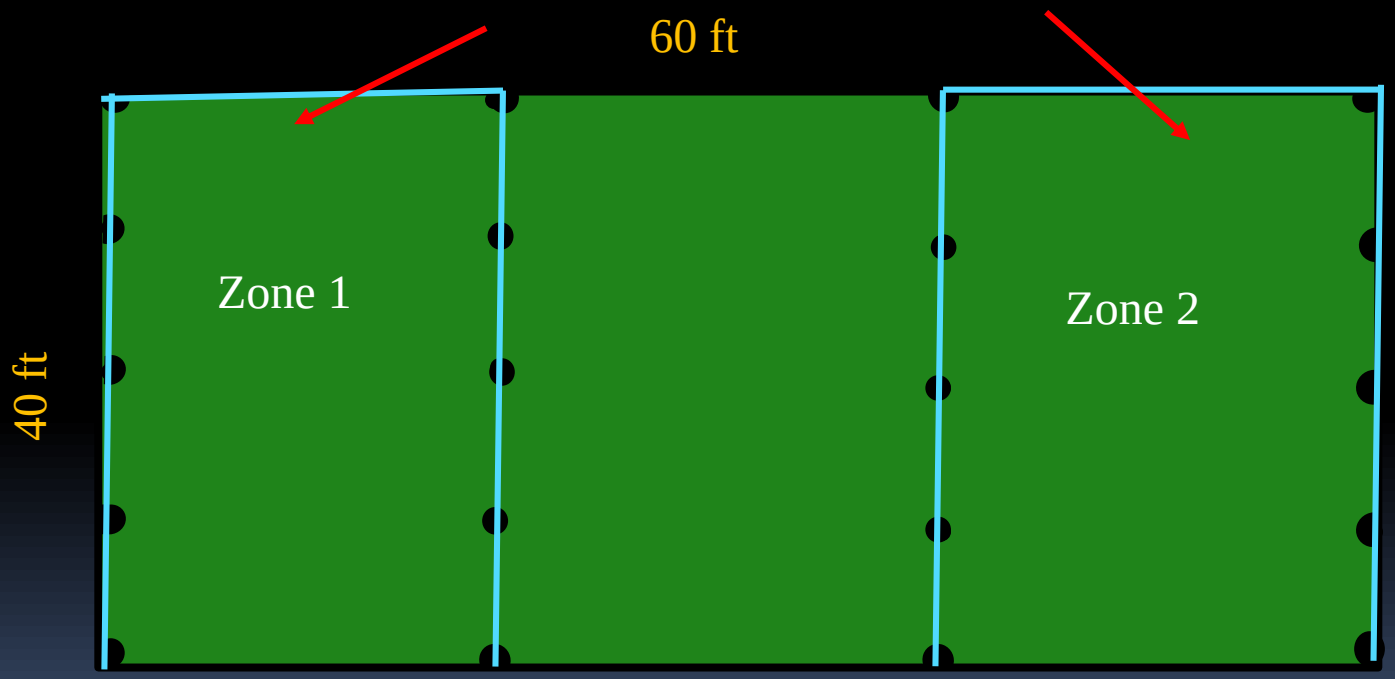
Calculating a Schedule

Divide the gallons per minute into the total gallons needed weekly to get a schedule of how long each zone must run to provide 1” of water.

Example: 1488 ÷ 21 = 70.85 or 71 minutes weekly per zone



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Calculating a schedule

 # 5 **What we know so far:**

a) 2400 SqFt of grass needs 1488 gallons per week to receive 1” of water

b) Precipitation Rate for both zones is 21 gallons per minute.

c) 1488 gallons ÷ 21 gallons per minute = 70 minutes run time per zone per week

d) Divide time by number of days to water (how many days a week) judgment call.

Are we done?

Lets go a little deeper

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Calculating a schedule

We know how much water is being applied.

We know “generally” how much we need.

We Know how much the customer has been using.

Lets now factor in the density, plant type and micro climate

Practice Sheet # 3

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Schedule:

(Spring) From _____ to _____

Turf: _____ Min per day No. of cycles_____ Days per week_____

Shrubs: _____ Min per day No. of cycles___ Days per week_____

Mixed _____ Min per day No. of cycles___ Days per week_____

(Summer) From _____ to _____

Turf: _____ Min per day No. of cycles_____ Days per week_____

Shrubs: _____ Min per day No. of cycles___ Days per week_____

Mixed _____ Min per day No. of cycles___ Days per week_____

(Fall) From _____ to _____

Turf: _____ Min per day No. of cycles_____ Days per week_____

Shrubs: _____ Min per day No. of cycles___ Days per week_____

Mixed _____ Min per day No. of cycles___ Days per week_____

Comments: _____

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Calculating a schedule

 # 5 **What we know so far:**

a) 2400 SqFt of grass needs 1488 gallons per week to receive 1” of water

b) Precipitation Rate for both zones is 21 gallons per minute.

c) 1488 gallons ÷ 21 gallons per minute = 70 minutes run time per zone per week

d) Divide time by number of days to water (how many days a week) judgment call.

e) Add time for Months in the season:

EX.

April: Manually and only if needed

May: 1st half (manually) 2nd half 2 per week 25 minutes

June: Same as May add third day @ 25 minutes Add 5 minutes per cycle if needed.

July/August: Days remain. Add additional time (10 to 15 min per cycle) if needed

September: 1st half Same as June, 2nd half same as May

October: Same as April

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Writing down what you've Observed

Recommendations

Landscaping

1) Quick Fixes: Water reduction on turf (Stress management, dormancy). Adding mulches and soil amendments thatching, mowing height.
2) Significant fixes: Aeration, remove and replace non-native plants with native and regionally adapted species.
3) Major Fixes: Replacing or removing turf, lawn alternatives, landscape re-design

Equipment

1) Quick fixes: Sprinkler adjustments (raising, lowering, etc.), pruning or trimming away blockages, changing nozzles, installing rain sensors
2) Significant fixes: Repairing, replacing broken risers/heads, sprinklers & valves. Repairing leaks, adding sprinklers, replacing controllers
3) Major fixes: Adding zones. Replacing/installing control wires. Replacing/installing backflow prevention assemblies. Re-designing and installation

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Writing down what you've Observed

Recommendations

Scheduling

1) Break it down into seasonal periods: spring/summer/fall
2) Give them a rough estimate of when they should change their programming and how they should change it. (days per week, minutes per station etc)
3) Point out trouble areas and offer advice about how to mitigate problems. (cycle and soak, separate programs, etc.)
4) Demonstrate operating the controller
5) Show them how to make programming changes

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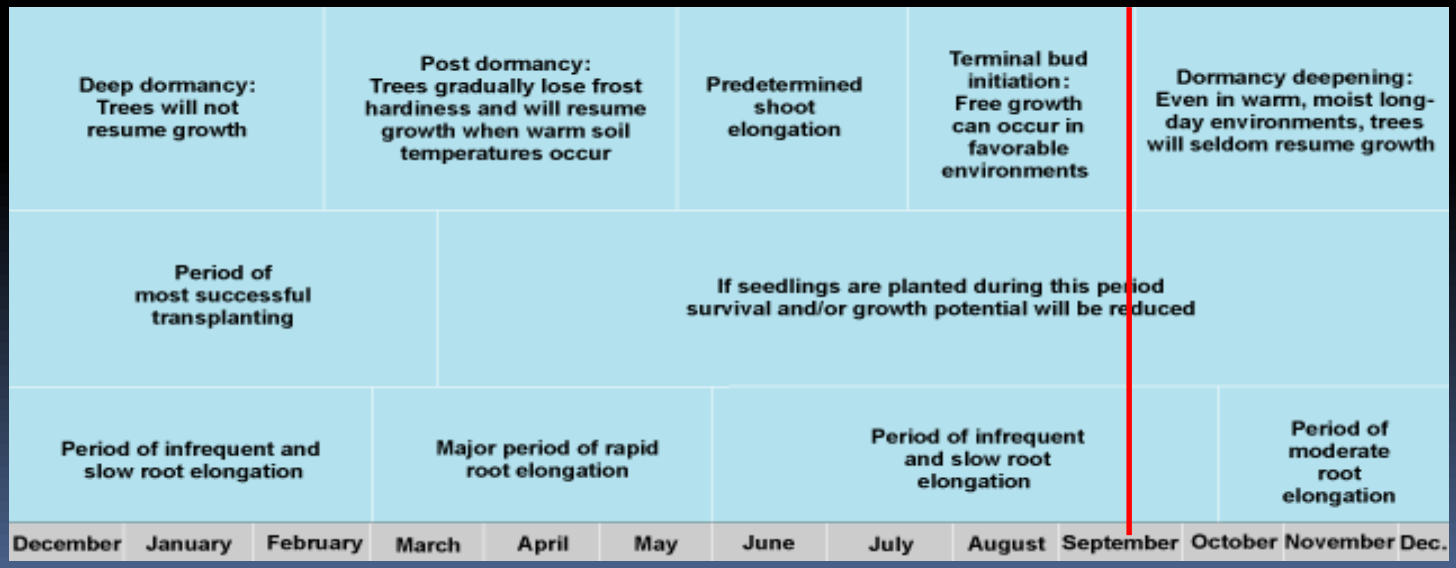
LUNCH

A little bit about seasonal dormancy

- Dormancy is triggered by length of day and intensity of sunlight more so than temperature
- As days get significantly shorter, the sun's position makes the intensity less direct, less energy for the plant
- By mid September, plants are already moving towards winter dormancy and require mostly infrequent watering's
- All irrigation should cease by mid October at the latest



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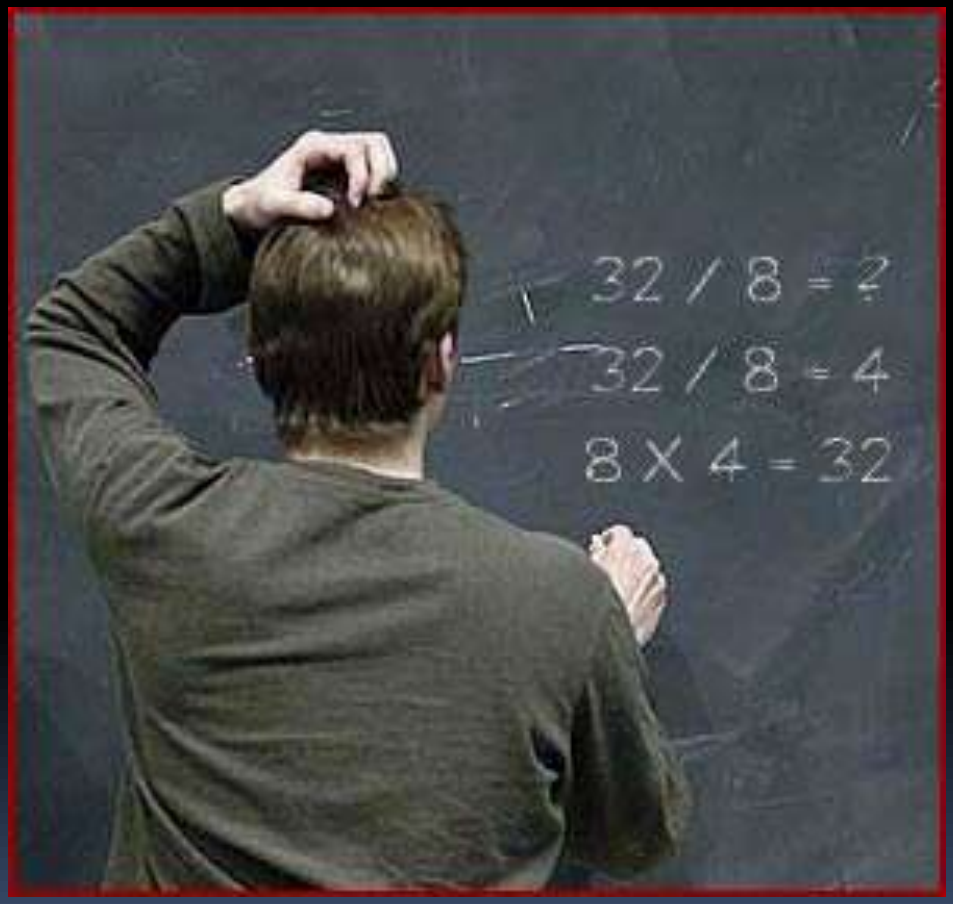
Let’s go do one in the field



Field work: Practice Audit

Determining your pace:

Need 100’ tape and some uneven ground

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Results

What did we see?

- Leaks:
- Faucets:
- Toilets:
- Showers:
- Other:

Outside:

- Landscape
- Plants
- Grass
- Controller
- Back flow
- Valves
- Sprinklers

Recommendations:

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Pools and ponds

- A 25’X 20’ pool can easily lose 1” to 2” of water to evaporation in a week. (300 - 600 gals)

- Cover the pool

- Reduce temperature

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Pools and ponds

- Back flushing: **(Use the water on your plants)**

- Check for Leaks

Malfunctioning fill valves #1 swimming pool/pond water waster

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Thank you

Questions?

Flow Down….





…….. LEAVE A LITTLE FOR THE REST OF US





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Contact Information

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City of Lake Oswego

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