DO YOU KNOW...

Where we get our water?
Where we store our water?
How much water our city uses per year?
What programs we offer?
How much water we have saved over the years?
Colorado is a headwaters state, with the majority of the state’s rivers beginning high in the Rocky Mountains as snowmelt. One of the benefits of living in a state that relies primarily on surface water is that unlike groundwater, surface water is a renewable water source.

One of the drawbacks is that precipitation levels vary greatly from year-to-year making the majority of the state’s water supply relatively unpredictable – and highly prone to drought.
Aurora’s water system starts nearly 180 miles away and includes the use of reservoirs, the natural river system, pipes, tunnels and pumps, all of which help us pull the water we own from our three river basins and deliver it to Aurora.

Aurora receives 25% of its water supply from the Colorado, 25% from the Arkansas and 50% from the South Platte river basins.

Homestake  Rampart
Turquoise  Quincy
Twin  Pueblo
Spinney Mountain  Aurora
Jefferson  Meredith
Strontia Springs  Henry
The average annual distribution for the past three years is 16.6 billion gallons annually. About half of that water is used outdoors. Aurora has a semi-arid climate, and our snow and rain levels are about half of the average annual precipitation for the United States, so it’s important that we all do our part to help conserve water.
...we offer programs to help you save water and money?

INDOOR

- Free indoor water assessment
- Ultra-high-efficiency toilet rebate
- Low-income water efficiency program

OUTDOOR

- Free landscape designs and rebates
- Free automatic sprinkler system assessments and rebates
- Customize your watering schedule
- Water conservation classes
- Gardening and volunteering
...how much water the conservation division has saved?

448 million gallons or 7.2 billion cups of water

Combined water savings for 2016, 2017, 2018
Irrigation Clock and Controller Programming
There are plenty of things that can go wrong with your irrigation system that can cause nightmares:

- Runoff due to excessive watering
- Watering different types of plant material on the same irrigation zone
- Flooded valve box
- Rain sensor not connected properly...or at all
- Wire mess in valve box
Goal for Today

• Understand and confidently use irrigation controllers!
  – Tackle the basics: how they work; how to program them; how to maintain irrigation efficiency using a controller
  – You don’t have to become an irrigation professional to master this skill
Water for the health of your landscape and with a purpose in mind. How much is used vs. how much is needed?

Enacting behavior change and perception in how we see and use water.

No matter how good/expensive a system is, if the homeowner isn’t involved or doesn’t know what they are doing, it will won’t be efficient.

About 40-50% of household water use is outdoor consumption in CO.
Different types of heads distribute water at different rates. Important to know what you have in each of your zones as this will also affect how long to run your zones, in addition to plant material and site conditions.

Aurora City Code:
- At least 4” pop up height minimum, 6” pop up height for curbs but preferred for turf
- Pressure regulating stem (PRS) for spray bodies
- Check valves (SAM) for rotors and spray bodies

6 inch pop ups for turf
Precipitation Rate- rate (how fast) at which water comes out of head

Varies based on sprinkler type, but also on brand, water pressure, and head spacing. Irrigation companies list the precipitation rate for each sprinkler they sell in their manuals, along with the optimal water pressure for the rate. The model numbers are typically listed on top of the head for sprays, some rotors are listed on top or are color coded with information listed on the website-for reference if you need to look up the precipitation rate.

CONTINUED ON NEXT SLIDE NOTES
Sprays- water comes out at much faster rate than rotors and rotary heads. Important to not have mixed heads on the same zone as this will prevent effective and efficient distribution of water to the plant material.

Drip- NOTICE gallons per HOUR not gallons or inches per MINUTE, means a much slower delivery of water therefore longer runtimes; flow rates vs. precipitation rates- differences

Important to know the precipitation rate as it varies pretty significantly across sprinkler head types. If you cannot determine the precipitation from the brand and model information, you can conduct a catch can test for each turf zone in your system. Note that the catch can test is only ideal to perform if your system works properly, i.e. there are no leaks, broken heads, etc.
The Catch Can Test is just one part of the Outdoor Water Assessment program we provide.
To provide adequate water to all plants without over or under-watering some, group plants with similar irrigation needs in one zone. Once your plants are grouped into zero, low, medium and high water groups, you should plan your irrigation schedule to apply the appropriate amount of water to each zone. You can learn a great deal about plant-water requirements simply by observation.

Main take-away is that turf should be on a separate zone from perennials, shrubs, trees, etc., especially if the turf is KY bluegrass as the water needs vary drastically.
Evapotranspiration (ET)

• Evaporation + Transpiration = Evapotranspiration

• Measured in inches
  – 1” of water over 1 square foot = 0.623 gallons

• Efficiency is simply replacing the majority of water lost to ET

Evaporation
  • Combination of climate conditions that influence the rate water turns into gas (water lost to the atmosphere)
  • Solar intensity, wind, humidity, temp etc

Transpiration
  • Water used by the plant, food creation, structure AND TEMP REGULATION (majority of water used by plants for temp regulation, releasing moisture out of stoma into a ‘bubble’ to create a microclimate)

Evapotranspiration is the combination of these processes of the water that is used by plants per day, per week. ET is affected by weather and the stage of plant growth.

Efficiency
  • Irrigation to replace as much as was actually used (i.e. maintain weight by eating same calories as you burn)
  • System efficiency means delivering the right amount uniformly across the landscape without waste

THIS IS THE DEMAND SIDE OF IRRIGATION
Define what we mean by a program - the information that you enter into the controller to turn the irrigation on and off for the days and times you select. Multiple programs on a controller let you run different stations on different schedules. It’s like having several controllers in one box. If you have shrubs that need to be watered every seven to ten days and trees on another station that need watering every ten to fourteen days, you’ll need a controller with two programs. If you also have a lawn that needs to be watered every three days, you’ll need another program and so on.

Residential controllers will run sequentially.

Start times signal all zones in a program to run in succession.
Irrigation Controllers- Programming

Program Example:

- Zones 1-3 are grass, you want to water them 2 days a week at 3, 4, and 5 am, they would all go on program A.
- Zone 4 is a shrub bed, you want to water 3 days a week at 10pm, it would go on program B.

Zones 1-3 on program A do no each have their own start time, zone 1 will run as long as it is programmed to, then 2, then 3.
Watering days are the days in which your controller will run your irrigation system. Per Aurora City Code, watering is never permitted more than three days a week. Watering between 10 AM and 6 PM is not permitted between May 1 and Sept. 30.

A start time is simply the time of day you want the irrigation to start. From May 1- Oct 1, can never water between 10am-6pm (good rule to maintain all year). A start time means, any zones on that program will run in succession, ex if zone 1 and 2 same program, zone 1 = 15 mins zone 2 = 10 mins, start time for both is 1am, not 1am and 1:15am

A run time is amount of time that you set your controller to run for each zone.
When sprinklers run for a long time at once, the soil is often unable to absorb water at the same rate, which will cause runoff that flows onto streets/sidewalks or pools in certain areas of the yard. This will also saturate the top layer of soil without allowing much moisture to penetrate further underground, causing shallow root growth and a build-up of organic matter called thatch that can restrict movement of air, water, and nutrients. The “cycle and soak” scheduling method helps avoid runoff and shallow watering by breaking the total daily runtime into 3 shorter cycles spaced about an hour apart.

CONTINUED ON NEXT SLIDE NOTES
Once you determine the total daily runtime needed in a given zone, divide that by 3 to determine the runtime. In order to get multiple cycles, simply program 3 different start times for that zone (each program on your clock should be able to accommodate multiple start times). Space the start times about an hour apart to help achieve deep watering for healthier and more drought-hardy root growth (do not space cycles so to have some in the morning and others at night). Adjust the number of days you water each week as the weather changes throughout the year. Begin and end the season watering 1 day a week, move to 2 days per week for the majority of the season and add a 3rd day if we experience prolonged periods of hot and dry weather.
• Cycle and Soak
  – Find the total runtime needed to replace ET, break into shorter cycles that accommodate infiltration rate of soil

• Space cycles within an hour (soak)

• Ideal for CO soils

• Cycle and soak will prevent runoff, achieve deep watering and, paired with longer spacing between watering days, will encourage deeper/more expansive root growth.
• Soak - idea is not just to avoid runoff, achieve DEEP watering (down to right below the root zone)
  • the hour break allows the soil to soak up as much as it can (accommodating infiltration rate)
  • the next layer of water will push the first bit further down into soil > deeper into ground
• Within an hour (opposed to 2 cycles in morning, 2 at night) prevents ET from using surface moisture
• Will help roots grow deeper to look for more water, esp in clay soil, soil can hold water longer period of time below the top 2-3 inches of soil (combined with deeper roots, grass has a reservoir of water that it can use when it’s hot and dry)
• Spacing between watering days (adhering to MAD) will let the top bit of soil dry out, grass will begin digging for water, down and around, extensive roots

CONTINUED ON NEXT SLIDE NOTES
In our example from earlier, we needed to replace 0.5” of ET loss with a PR of 1.5”/hr zone > 20 min runtime > usually we would say break that up into 3 even cycles of 6-7 mins

• Using the equation, with a PR of 1.5 in/hr and an IR of .1 in/hr the max cycle time would be 4 minutes.
Typically, sprinkler systems have a much higher precipitation rate than the soils infiltration rate.

Only sandy soil has an infiltration rate that exceeds some available sprinkler components.

Very few people actually take into account the IR of their soil when planning their runtimes. The structure of clay soils is like plates being stacked on stop of and next to each other. It holds water so well, that it doesn’t take much before the soil has reached its water holding capacity. Once this has occurred, water being to run off, essentially being wasted.

**CONTINUED ON NEXT SLIDE NOTES**
To troubleshoot what the useful IR of a soil is, can run the system with a stopwatch until you notice runoff, that is the upper limit of your runtime.

Avg. infiltration rate in aurora is 2/10 inch/hr.

Aurora soils more clayey, pockets of sand.

What type of soil do you have?
• The purpose of the function is to use July/August as 100% of the water needs of the plant (highest level of ET), in April ET may be 20% of August so this function will only water 20% of the scheduled run time
  • Ex: zone 1 is programmed for 10 min at 100%, seasonal adjust to 20% will make that run 2 mins

• This function has the right intention of reducing water based on the needs of plants in cooler weather
  • HOWEVER, it only adjusts the runtimes, not the days per week
  • In example 20% in April means 2 min runtime, that is VERY shallow watering that will likely get evaporated without any effect
  • More effective method of going to 1 day a week from 2 for example, still achieves a ‘soak’ watering, the spacing

CONTINUED ON NEXT SLIDE NOTES
You will see an overall reduction in the amount of water used... but most of that water is being wasted > not efficient

- Does not set up grass to be more drought tolerant, spacing days will, drought tolerant plants need less water regularly and do not need to increase as quickly as ‘dependent’ grass
Irrigation Controllers- Scheduling

• Cycle and Soak Example
  - ET last week was 1 in., your PR is 1.8 in./hr. (sprays)
  - Need to run 34 minutes (for the week) to replace ET
  - Scheduling: Break into 2 watering days; 17 minutes per water day
    - Field test shows 7 minutes until runoff occurs (Soil IR)
    - Break watering in to 6 min. cycles
  *Final schedule – 2 days/week, 3 cycles of 6 min. per watering day

• Calculate how long it takes to run each zone to replace the ET from the previous week (usually a weekly posting of ET)
  • x inches of water loss to ET divided by inches per hour precip rate (1 in)/(1.8 in/hr) = .55hrs
• Divide that total runtime into 2 days (grass can usually survive on 2 days per week, esp with healthy root systems, 3 days a week is fine when exceptionally hot)
  • .55 hours X 60 = 34 mins. Divide 34 mins by 2 days = 17 minutes per day

CONTINUED ON NEXT SLIDE NOTES
• Divide the total run time so as not to exceed the IR.
  • If IR is unknown, field test of running zone until you see runoff (mark how long that takes, do not exceed this amount of time)
  • Can explain to homeowners how to do a field test, otherwise use general precipitation rates of heads
  • divide by number of cycles (usually 3) or reverse direction and divide total runtime by max runtime to get the number of cycles needed
  • 18 mins total runtime: mins/3cycles=6mins/cycle
  • Space cycles about 1 hour apart to allow water to soak into the soil.
  • If wanted to start at 1am, programmed start times are: 1am, 2am, 3am

*Final schedule – 2 days/week, 3 cycles of 6 min. per watering day*
**City Provided Irrigation Scheduling Info**

Please visit our website for the latest watering schedule.

https://www.auroragov.org/residents/water/watering_times
Irrigation Controllers - Going Smart

- Smart Technology
  - Water savings potential but DO NOT increase the system’s EFFICIENCY
  - Only made to mimic an engaged homeowner aimed at convenience
  - Efficient, well-maintained system is needed before going smart
Weather-based controllers use weather data to calculate evapotranspiration, the amount of water that evaporates from the soil surface or is used by the plant. Based on local weather conditions, these smart controllers automatically adjust the irrigation schedule to deliver only enough water to meet the plant needs. Different controllers use different sources of weather data. These include on-site weather sensors, data from a local weather station or data from the internet. Weather-based controllers can be retrofitted on new or existing irrigation systems.

Today’s irrigation controllers include advanced technology to help systems use water more efficiently. Many new controllers are compatible with mobile devices, such as tablets or smartphones, allowing the user to interact with their irrigation system wherever they have a signal.

CONTINUED ON NEXT SLIDE NOTES
User Inputs: similar to inputs we discussed earlier
- zip code/location: relevant for weather station information, dependent upon which controller you have and the weather service that controller uses
- plant material: cool/warm season grass, shrubs, trees. Are they established or new?
- sun exposure: full/partial/shade?
- slope
- sprinkler head type: spray/rotor/rotary/drip. Important (as we have discussed!) in relation to precipitation rate and amount of water distributed per zone
- watering restriction information: City of Aurora has watering restrictions, or more affectionately called, conservation measures. This needs to be factored in when setting up the schedule
Irrigation Controllers - Program Inputs

- **Soil Type**
  - What type(s) of soil do you have?

- **Sun Exposure**
  - Which areas receive full sun?

- **Wind Exposure**
  - Is wind persistent in certain areas?

- **Slope**

- **Plant Type**
  - Turf? Shrubs? Trees?

- **Precipitation Rates**
  - What types of sprinklers do you have?

- **ET**

Additional: slope
• Control from phone
• Track water use/schedule
• Can set and in theory forget, but reality it will keep irrigation in people’s minds throughout season
• Tech is cool but driven by “app money” not necessarily by sound irrigation principles….some of them need work
Irrigation Controllers - Going Smart

Orbit B-Hyve Controller Interface
Irrigation Controllers- Going Smart

Rachio Controller Interface
Rain Sensors- switching device activated by rainfall, aka on/off switch. Port in irrigation controller to connect sensor. As moisture-absorbing disks expand, they activate a switch that interrupts the circuit from the controller to the solenoid valves. Once the rain sensor has dried out, the switch deactivates - this allows for normal operation. Reactive to rain events. Not the best tech - explain thresholds

SMS- Sensor connected to an irrigation system controller that measures soil moisture content in the active root zone before each scheduled irrigation event and bypasses the cycle if soil moisture is above a user-defined set point. SMS, like rain sensors, are considered rain shut off devices, but while rain sensors measure evapotranspiration rates, soil moisture sensors measure real time soil moisture.

CONTINUED ON NEXT SLIDE NOTES
Flow meter - monitors flow rates in systems - detecting, monitoring and reporting critical flow zone data and total system flows. When paired with specific smart controllers, these devices can send instant alerts to homeowners or property owners when a leak is detected, and can shut down the affected zone.
Irrigation Controllers-
Check it or Wreck it

- Fancy gadgets are great! But what if your system is a mess?! 
- Regular checks are a must!
Aurora Water Rebates-Smart Controllers

- Non-Weather Based
  - No Rebate, but must meet city code (multi start times, water budgeting/cycle and soak, memory retention, battery backup, flexible water day programming)

- Smart Controllers
  - If system is working efficiently, these controllers allow greater convenience for ET/site specific watering
  - These only save water if programmed correctly and system is already efficient
  - Rebate covers material cost up to $300
    - 50% after installation
    - 25% after 1st full growing season
    - 25% after 2nd full growing season
Aurora Water Rebates - Rain Sensors

Rain Sensors
• Required by city code
• Required to install a rain sensor to be eligible for any other rebate if not currently installed
• Wired and wireless are rebated (different amounts)
• Can get without assessment
Aurora Water Rebates-Irrigation Equipment

Equipment

- Requires an Outdoor Water Assessment
- Options:
  - High-efficiency nozzles
  - Gear driven rotor sprinklers (check valves required)
  - Pop-up sprinkler bodies (pressure-reg. stems + check valves required)
  - Soil moisture sensors
  - Drip conversion
Water Efficiency Programs-
EPA WaterSense

- Voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA), is both a label for water-efficient products and a resource for helping you save water.

- Rebates require EPA WaterSense logo, but our standards are more specific
Aurora Water Programs and Classes

- Outdoor Water Assessments
- Landscaping and Irrigation Classes
- Indoor Water Assessments
- Rebates
  - Toilets
  - Water-wise Landscape
Aurora Water Programs - Know Your Flow

- Educates homeowners on their water usage + efficiency
- Monthly email communications about actual vs. recommended usage
- Available to single-family homeowners; required for rebates
Thank You

Water Conservation Office
Hotline 303-739-7195
conservation@auroragov.org