# **Water Rates & Service Charges**

#### Effective July 1, 2014 - Water Rate Schedule

Most customers' meters are read every two months. Meter reading and billing occur once a month for large commercial and industrial accounts.

Bills for all metered services, except for Private Fire Services, consist of four elements: 1) a water service charge; 2) a Seismic Improvement Program (SIP) surcharge for each residential account; 3) a charge for water delivered; and 4) an elevation surcharge.

#### **Bill Element 1 – Service Charge**

A Service Charge based on water meter size to pay for the use of the water meter.

| Meter Size<br>(Inches) | Service<br>Charge<br>Amount | + | Seismic<br>Improvement<br>Surcharge | = | Total<br>Charge |
|------------------------|-----------------------------|---|-------------------------------------|---|-----------------|
| 5/8 or 3/4 (homes)     | \$ 14.69                    | + | \$ 1.37                             | = | \$16.06         |
| 1                      | 23.63                       | + | 3.45                                | = | 27.08           |
| 1-1/2                  | 38.10                       | + | 6.89                                | = | 44.99           |
| 2                      | 55.66                       | + | 11.02                               | = | 66.58           |
| 3                      | 96.61                       | + | 20.65                               | = | 117.26          |
| 4                      | 155.11                      | + | 34.40                               | = | 189.51          |
| 6                      | 301.37                      | + | 68.82                               | = | 370.19          |
| 8                      | 476.88                      | + | 110.10                              | = | 586.98          |
| 10                     | 681.65                      | + | 158.28                              | = | 839.93          |
| 12                     | 944.92                      | + | 220.19                              | = | 1,165.11        |
| 14                     | 1,208.19                    | + | 282.15                              | = | 1,490.34        |
| 16                     | 1,529.96                    | + | 357.84                              | = | 1,887.80        |
| 18                     | 1,851.73                    | + | 433.53                              | = | 2,285.26        |

#### **One-Month Billing**

#### **Two-Month Billing**

| Meter Size (Inches) | Service<br>Charge<br>Amount | + | Seismic<br>Improvement<br>Charge | = | Total<br>Charge |
|---------------------|-----------------------------|---|----------------------------------|---|-----------------|
| 5/8 or 3/4 (homes)  | \$ 29.38                    | + | \$ 2.74                          | = | \$ 32.12        |
| 1                   | 47.26                       | + | 6.90                             | = | 54.16           |
| 1-1/2               | 76.20                       | + | 13.78                            | = | 89.98           |
| 2                   | 111.32                      | + | 22.04                            | = | 133.36          |
| 3                   | 193.22                      | + | 41.30                            | = | 234.52          |
| 4                   | 310.22                      | + | 68.80                            | = | 379.02          |
| 6                   | 602.74                      | + | 137.64                           | = | 740.38          |
| 8                   | 953.76                      | + | 220.20                           | = | 1,173.96        |
| 10                  | 1,363.30                    | + | 316.56                           | = | 1,679.86        |
| 12                  | 1,889.84                    | + | 440.38                           | = | 2,330.22        |
| 14                  | 2,416.38                    | + | 564.30                           | = | 2,980.68        |
| 16                  | 3,059.92                    | + | 715.68                           | = | 3,775.60        |
| 18                  | 3,703.46                    | + | 867.06                           | = | 4,570.52        |

When a meter larger than four inches is required for a single-family residential customer in order to maintain adequate water pressure, the maximum service charge amount and Seismic Improvement Program Surcharge are set at the 4-inch meter level.

The service charge and Seismic Improvement Program surcharge for a special type of meter or for a battery of meters installed on one service in lieu of one meter will be based on the size of a single standard meter of equivalent capacity as determined by the District.

#### **Bill Element 2 – Seismic Improvement**

A flat Seismic Improvement Program Surcharge for each Single Family Residential or Multiple Family Residential account to pay for system-wide seismic improvements being made from 1995-2025. The SIP program costs are being paid over 30 years; the charge is effective on each water bill through February 28, 2025.

| Seismic   | Improvement | Drogram  | Surcharge | (ner himonthly | v hilling) |
|-----------|-------------|----------|-----------|----------------|------------|
| Seisiiiic | Tublovement | FIUgrain | Surcharge | (her nunourun) | y biiiiig) |

| Single Family Residential Accounts | \$2.74 |
|------------------------------------|--------|
|                                    |        |

Multiple Family Residential Accounts\$12.92

Bill Element 3 – Water (Flow Charge)

Charges for units of water delivered for both monthly and bimonthly billing. (One unit is 100 cubic feet, or 748 gallons.)

#### Rates for Single Family Residential Accounts (per 100 cubic feet)

|   |                   | Total Charge                 |                    |  |
|---|-------------------|------------------------------|--------------------|--|
| First                                   | : 172 gallons per | day                          | \$2.91             |  |
| 173                                     | 3 gpd up to 393   | gpd                          | \$3.60             |  |
| All water                               | used in excess o  | f 393 gpd                    | \$4.42             |  |
| Ra                                      | ates for Multifa  | mily Residential Accounts (p | er 100 cubic feet) |  |
|   | All use           |                              | \$3.68             |  |
| All Other Accounts (per 100 cubic feet) |                   |                              |                    |  |
| Cha                                     | arge              | SIP Volume Surcharge         | Total Charge       |  |
| All uses                                | \$3.81            | \$0.15                       | \$3.96             |  |
|   | Nonj              | potable Water (per 100 cubic | feet)              |  |
|   |                   |                              |                    |  |

\$3.17

For all water used

#### Bill Element 4 – Elevation Surcharge

An Elevation Surcharge based on the energy costs of pumping water to higher elevations. Applies to both monthly and bimonthly bills.

#### Elevation Surcharge

| Elevation<br>Band | Elevation  | Amount Per<br>100 Cu. Ft. |
|-------------------|--|---------------------------|
| 1                 | Pressure zones serving elevations 0 through 200 feet (approximate). Pressure zones served by gravity flow and no pumping required. | \$ .00                    |
| 2                 | Pressure zones serving elevations 200 through 600 feet (approximate). Pressure zones requiring pumping.                            | \$.55                     |
|                   |  | \$1.12                    |

Pressure zones serving elevations above 600 feet (approximate). Pressure zones requiring considerable pumping.

The Elevation Surcharge is determined by the pressure zone in which the service connection is located.

#### **Private Fire Service**

Private fire services are charged a monthly or bimonthly service charge based on the meter size. <u>Note</u>: Charges shown for 6- to 18-inch meters are for customers other than single family residences. Even if a meter larger than 4 inches is required for a single-family residential customer in order to maintain adequate water pressure, the maximum service charge amount and Seismic Improvement Program Surcharge is set at the 4-inch meter level.

| Monthly -<br>Meter Size (Inches) | Service<br>Charge<br>Amount | + | Seismic<br>Improvement<br>Charge | = | Total<br>Charge |
|----------------------------------|-----------------------------|---|----------------------------------|---|-----------------|
| 5/8 or 3/4 (homes)               | \$ 12.43                    | + | \$ 1.37                          | = | \$ 13.80        |
| 1                                | 17.84                       | + | 3.45                             | = | 21.29           |
| 1-1/2                            | 26.65                       | + | 6.89                             | = | 33.54           |
| 2                                | 37.34                       | + | 11.02                            | = | 48.36           |
| 3                                | 62.26                       | + | 20.65                            | = | 82.91           |
| 4                                | 97.86                       | + | 34.40                            | = | 132.26          |
| 6                                | 186.84                      | + | 68.82                            | = | 255.66          |
| 8                                | 293.65                      | + | 110.10                           | = | 403.75          |
| 10                               | 418.26                      | + | 158.28                           | = | 576.54          |
| 12                               | 578.46                      | + | 220.19                           | = | 798.65          |
| 14                               | 738.64                      | + | 282.15                           | = | 1,020.79        |
| 16                               | 934.44                      | + | 357.84                           | = | 1,292.28        |
| 18                               | 1,130.26                    | + | 433.53                           | = | 1,563.79        |

#### **Private Fire Service**

There is no charge for water used through fire service in extinguishing accidental fires, but any fire service water lost through leakage or used in violation of EBMUD regulations is charged at double the usual volume charge.

#### **Additional Information**

For low-income customers, EBMUD has a Customer Assistance Program (CAP). For more information about this program, visit the Customer Assistance Program page.

For questions or problems concerning your water bill, water service, water pressure, or water quality, please call Customer Service at 1-866-403-2683 or e-mail custsvc@ebmud.com.

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#### How to Remove Your Lawn

There is a growing trend in California to replace water-thirsty lawns with alternatives that use less water. Listed below are several ways to remove lawn (turfgrass). The method you choose will depend on the size of your lawn, how much manual labor you want to invest, how much you want to spend, and how quickly you want it removed.

#### Sheet Mulching

Sheet mulching is the most natural and beneficial method to remove a lawn. This method maintains the soil structure, adds organic matter, requires a moderate amount of labor, and does not require removal and disposal of turf.

- 1. The soil in the area to be sheet mulched should be wet. If the soil is dry, water sufficiently to get the first 4-6 inches of soil wet. One to two normal irrigations should do it. Water at least 24 hours in advance of mowing.
- 2. Mow the grass as short as possible leaving the clippings on the lawn.
- 3. You will need to add compost for lawns that are brown or not so lush. For a completely brown lawn add 2 inches of compost and water until it is moist down to the grass.
- 4. The green lawn blades and compost will provide nutrients to decompose the rest of the lawn.
- 5. Cover the entire area with cardboard (either used boxes or purchased rolls) or newspaper (10-12 layers). Make sure that the edges overlap six to twelve inches and that no sunlight gets through the paper. The cardboard will smother the lawn and any weeds that might be in the lawn.
- 6. Spread 2 inches of mulch on top of the cardboard. This layer along with the cardboard will keep the mowed lawn/compost from drying out so that the lawn can decompose.
- 7. In the dry summer time check under the cardboard once a month and if dry, water to keep the composting process going. Wait about three months before planting to ensure the lawn is both dead and composted before planting.

#### <u>Solarization</u>

Lawns can be removed using large sheets of clear plastic that are 1-4 mils in thickness. This method works best in areas with full sun for most of the day and should be done during the warm months of the year.

- 1. Cut the grass as short as possible and water well.
- 2. Lay soda cans or other objects on the lawn so that the plastic will be held 2-4 inches off the lawn.
- 3. Using clear plastic that is 1-4 mils in thickness, cover all of the lawn to be removed.



- 4. Using soil, cover the edges of the plastic. If you must use two or more pieces of clear plastic make, sure to overlap them by six inches and tape the length of the sheets on both edges with clear wrapping tape. Make sure that all edges and seams are completely sealed. The plastic sheets trap the sun's radiant energy. If all seams and edges are sealed properly the plastic should balloon up during the day. When properly done, the top 3-4 inches of the soil may heat up as high as 140°F.
- 5. Leave in place for 4 to 8 weeks, depending on how hot the weather is, until the grass is dead. The high temperature may also kill some insects, plant diseases, nematodes, and soil pathogens in the top layer of soil.
- 6. Remove the plastic, add compost and/or mulch, and leave the dead grass to compost in place.

#### <u>Herbicide</u>

There are a number of herbicides that will kill turfgrass. Most are not recommended by horticulture experts, as they leave a residual in the soil. Other choices, such as glyphosate (the active ingredient in Roundup<sup>TM</sup>), do not leave a residual in the soil. The spray is absorbed by the plant and root system. Products like Roundup can be very expensive and are best used in small areas or to spot spray, if needed. Always follow the directions and use appropriate protective gear when using herbicides. Once the turfgrass is dead, you need to add compost/mulch to compost the dead lawn in place.

#### Physical Removal

The fastest way to remove a lawn is to physically remove the sod by cutting it into strips with a sod cutter. Sod cutters can be rented, or you can hire someone to do the work. The sod can then be rolled up and taken away. Note: removing the sod generally removes the top layer of soil, which is the most nutrient-rich soil in the yard, so you will need to build the nutrients back into the soil with compost. Caution: Removing sod doesn't work well if you have Bermuda grass. In this case, the only way to get rid of the lawn is through solarization or herbicides, plus several months of waiting to be sure it's really gone.

An alternative to removing the strips of sod from the site; use the strips in the new garden and "compost" in place. You can lay them upside down in new landscape area to create a mound, as fill in a low spot, or to create a berm. Compost them in place using the sheet mulching method.



# Garden Design and More!

**CCWD's interactive** website has been updated. It is now available to help you create a wonderful, water-wise garden. **Based on the climate in Contra Costa County** along with other factors specific to our region, this site helps you design your landscape by offering vivid color photographs, a searchable plant database, water-saving tips and much, much, more!



Main Menu Garden Tours (

Garden Gallery Plants



To access the website, go to <u>www.ccwater.com/conserve</u>. Scroll down and click on the Gardening in Contra Costa Counnty icon to get started.

# Introduction to the Website

Looking to install a beautiful lowmaintenance landscape that won't bust your water budget? A world of ideas is just a few mouse clicks away.

The Contra Costa County Water Wise Gardening and Landscaping web site is a guide for water conservation in the home landscape. This



site offers many sample water-efficient gardens to view as well as the ability to identify and learn more about the plants within these gardens.

The following is a quick overview of what each of the sections can do. For a more detailed description of any of the sections, see below. For a how to video click on the 'We now have a guide to using the resource' below the link to Gardening in Contra Costa County on the CCWD home page.

- Garden Tours From the main screen you can visit outstanding gardens found here locally. Click on photos to expand them and to reveal clickable hot links to individual plant information windows.
- Garden Gallery Landscape photos grouped into multiple categories, such as Front yards, Backyards, and Native Gardens. Photos expand with individual plant hot links.
- Plants Detailed descriptions (including water needs) for more than 600 plants can be found using Plant Lists (e.g. Lawn Substitutes, Clay Soil Plants), our guided Plant Search, or alphabetically in Plants by Name.
- My List Go plant shopping! Click the Add Plant button on any of the plant information windows to save the plant. On the main screen, click My List to see the contents of your saved plants and to print reports to bring to your local nursery.
- Watering Guide Ever wonder how much to water your plants? Click here to get specific information about watering the plants in your home landscape.





# Lawn & Landscape Watering Schedule

#### Seasonal Changes Affect Water Demand

from June to December, plants will need less and less water. lower angle, which means plants need less water. This means that lower in the sky, like during the winter, the sunlight hits the earth at a causes plants to need more water. When the angle of the sun is during the summer, the sunlight hits the earth more directly, which landscape? Well, when the angle of the sun is high in the sky, like the sun. So how does this affect the water needs of my lawn and This has to do with the earth's axis and how the earth rotates around December, the sun is only one-third as high in the sky as it is in June. in the sky during the winter as it does in the summer? In fact, during heid as of the second states that the sun doesn't go as high hus

require less and less water. It means that as the days get shorter, lawns and landscapes will sadesshaft! What does this mean for our lawns and landscapes? the year with only 9.5 hours of daylight. That's 5.5 hours less of of daylight. December 21, the winter solatice, is the shortest day of summer solstice, is the longest day of the year with nearly 15 hours sun rises later and sets earlier than in the summer. June 21, the winter than in the summer? Well, in fact, it does. In the winter, the Dog 2 Cog 2 Charle it gets darker earlier in the

#### nebreð nuð ni verð Vater in Your Garden

#### **9**terate

them to another part of the garden. leave the soil plugs on the lawn or remove oxygen to get to the roots. You can either Aerate your lawn. This allows water and

or call (925)688-8320. www.ccwater.com Conservation Programs and Tips, For more information on Water

#### wow

water demand. improve the quality of the lawn and reduce lliw sidT .eshoni E ot Z.S ot anwal woM

#### Use a Broom

gallons of water every time. driveway or sidewalk and save up to 80 Use a broom instead of a hose to clean your

evaporation loss, improve soil, and keep soil improve plant health, reduce water ensure there is a 2" to 3" layer. This will Add mulch to all planting areas every year to

#### Reduce Your Lawn

Mulch

temperature cool in the summer.

for plants that thrive in Contra Costa County. with a beautiful garden. Ask your local nursery Consider replacing some of all of your lawn .səqeəsbnel əmot teom ni tnalq pnisu Turf grass or lawn is the single biggest waterLandscape professionals use a variety of techniques to maximize landscape quality and water use efficiency. Below are several watering techniques that professional irrigators use to maximize every drop.



Repeat Cycles Clay soil cannot absorb water as fast as sprinklers apply it. So instead of watering for one long cycle, use 2 or 3 shorter cycles with an hour in between. This will allow the water to soak in much better & encourage deeper roots.

Check Sprinklers Once a month inspect the sprinklers while they are working. Check for broken, bent or misaligned heads. Also trim back grass or other plants that are blocking the sprinkler.



When to Water The optimum time to water your landscape is between 3:00 am and 8:00 am. This is because the sun is down, the temperature is cooler, and the wind is generally calm. Watering during the day can result in as much as 30% of the water being lost to evaporation.





Micro-Climates

Plants growing in shade (north/east side of your house) will generally require up to 50% less water than the same plants in full sun (south/west side of your home). Adjust your watering schedule to account for the different micro-climates in your yard.

Water like the *Pros!* The most efficient way to water lawns and landscapes is to water deeply and infrequently while adjusting the schedule every month to reflect seasonal changes. The following is the recommended watering schedule for lawns and landscapes in Contra Costa County.

| Month       | LAWNS TREES, SHRUBS, GROUND                             |   |   |  |   |  |  |  |
|-------------|---|---|---|--|---|--|--|--|
|             | Pop-up sprinklers:<br>Run 3 cycles of 3 to<br>6 minutes | Impact/Rotor<br>sprinklers:<br>Run 3 cycles of 7 to<br>10 minutes | Multi-stream/ MP<br>rotator:<br>Run 3 cycles of 15 to<br>20 minutes | Pop-ups/ fixed<br>spray sprinklers:<br>Run 3 cycles of<br>3 to 6 minutes | Impact/Rotor<br>sprinklers:<br>Run 3 cycles of<br>9 to 12 minutes | Multi-stream/<br>MP rotators:<br>Run 3 cycles of<br>20 to 24 minutes |  |  |
| Jan and Feb |   | Off   |   |  | Off   |  |  |  |
| Mar         |   | 1 day per week  |   |  | Off   |  |  |  |
| Apr         |   | 1–2 days per week   | 1 day per week  |  |   |  |  |  |
| Мау         |   | 2–3 days per weel   | k   | 1–2 days per week  |   |  |  |  |
| Jun         |   | 3–4 days per weel   | k   | 2 days per week  |   |  |  |  |
| Jul         |   | 3–4 days per week   | :   | 2–3 days per week  |   |  |  |  |
| Aug         |   | 3–4 days per weel   | k   |  | 2 days per week   |  |  |  |
| Sep         |   | 3 days per week   |   |  | 1–2 days per week   |  |  |  |
| Oct         |   | 2 days per week   |   |  | 1 day per week  |  |  |  |
| Nov         |   | 1 day per week  |   |  | Off   |  |  |  |
| Dec         |   | Off   |   |  | Off   |  |  |  |

Use the above schedule as a guide. Monitor your landscape and adjust the schedule for rain or other conditions.



Mulch reduces the amount of water that evaporates from your soil, which means you'll be able to water less. Use our coupons to save money when you buy mulch!





For a list of all our conservation programs, please visit: <u>www.ccwater.com.</u>



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For a list of all our conservation programs, please visit: <u>www.ccwater.com.</u>

# Sheet Mulching 101

Sheet mulching is one of the easiest ways to convert a lawn to a water-wise garden. Compared to physically removing the old lawn, sheet mulching is less work, less expensive and doesn't involve the use of machinery or toxic chemicals. It is a process of composting your lawn in place. Over time, sheet mulching improves the quality of the soil and provides a welcome environment for beneficial insects, worms, and micro-organisms. Getting started is easy. Just follow these steps:

- 1. Measure the lawn area that you want to sheet mulch. You'll need to know how many square feet so you can get the right amount of materials. <sup>(1)</sup>
- 2. Water the lawn sufficiently to get the first 4-6 inches of soil wet. One or two normal irrigation days should do it. Water at least 24 hours in advance of mowing.
- 3. Mow the lawn as short as possible and leave the clippings where they fall. This may be the last time you will need your lawn mower. ©
- 4. If your lawn is adjacent to pavement, you may want to remove a 12" wide strip of the lawn along the pavement. This will keep the sheet-mulching layers from overflowing onto the pavement. Do this with a shovel getting down approximately two to three inches (2"-3").
- 5. If the lawn is brown or not so lush you will want to add up to a two-inch (2") layer of compost (soil amendment), directly on top of the old lawn and rake it in. The green lawn blades and compost will provide nutrients to help decompose the lawn. Water the entire area until the water soaks down to the lawn. This will get the composting process going.
- 6. Install a layer of cardboard over the entire area. Overlap each row by 6 inches. Rolls of corrugated cardboard can be purchased for this purpose. Other options include: using large flattened cardboard boxes (remove all wrapping tape) or ten (10) layers of newspaper. The cardboard will smother the lawn and any weeds. Do NOT use any type of permanent barrier such as plastic or weed fabric.
- 7. Add a two inch (2") layer of mulch (wood chips) on top of the cardboard, as the final layer. This layer along with the cardboard will keep the mowed lawn/compost from drying out so that the lawn can decompose.
- 8. In the dry summer time check under the cardboard once a month and if dry, water to keep the composting process going. Wait about three months before planting to ensure the lawn is both dead and composted before planting.

#### (1) How Much Will You Need?

For every inch of depth to cover a 10' x 10' area (100 square feet), you will need 0.3 cubic yards (8 cubic feet). It takes 27 cubic feet to make one cubic yard. You may want a landscape supply center to deliver bulk quantities to save time and effort. Visit <u>www.ccwater.com/conserve</u> for discount mulch coupons you can use.



2. Water and mow the lawn

### Sheet Mulching 101



3. Remove a 12" wide strip of the lawn down 3" below the adjacent pavement.



4. Add a 2" layer of compost on top of a dry lawn.



4. Rake the compost evenly over the lawn.



5. Install a layer of cardboard on top of the compost



6. Add a 2" layer of mulch on top of the cardboard.



Sheet Mulching Completed

# **15%** VOLUNTARY **DROUGHT** PROGRAM

# California is facing a significant water shortfall.

It's time to renew your conservation efforts and ensure you're using water wisely.

# Please Do...

- Continue your conservation-minded indoor water use
  - Reduce your outdoor discretionary water use
    - Sign up for the WATERSAVER
    - e-Newsletter at

www.ccwater.com

# **Program Details**

- Voluntary 15% reduction in historical water use
- Historical use is an average of 2005-07 water use at your residence
- Focus reductions on outdoor water use
- Recent conservation efforts
   do not count against you

#### HOW TO REDUCE WATER USE BY 15%

The average household uses 340 gallons of water per day. Here are some simple ways to save 50 gallons per day.

#### **READ YOUR METER**

By reading your water meter, you can determine your daily use and check for leaks. A leaky toilet can lose up to 40 gallons per day.

#### WASH FULL LOADS

Running the dishwasher only when it is full saves 4 to 6 gallons per load.

#### **REDUCE SPRINKLER USE**

Reducing your automatic sprinkler schedule by one watering day saves up to 400 gallons per week.

#### **SHORTEN YOUR SHOWER**

Taking shorter showers saves 2 to 6 gallons per minute.

CCWD has numerous conservation programs, including water-use evaluations and rebates, to help you conserve water and meet the voluntary drought program goal. More conservation tips and information are available at www.ccwater.com/conserve or 925-688-8320.

# **15%** PROGRAMA **VOLUNTARIO** DE SEQUÍA



# California enfrenta un déficit de agua importante.

Es hora de renovar sus esfuerzos de conservación y asegurarse de que está utilizando el agua con prudencia.

# Por favor, Sí ...

- Continúe con el uso del agua interior con mentalidad de conservación
  - Reduzca el uso discrecional de agua al aire libre
    - Inscríbase para
    - WATERSAVER
    - e-Newsletter en

www.ccwater.com

# Detalles del programa

- Reducción voluntaria del 15% en el uso histórico del agua
- El uso histórico es un promedio del uso del agua en su residencia del '05-'07
- Enfóquese en reducciones del uso del agua al aire libre
- Los recientes esfuerzos de conservación no cuentan en contra de usted

#### CÓMO REDUCIR EL USO DE AGUA UN 15%

El hogar promedio utiliza 340 galones de agua por día. Aquí están algunas maneras sencillas de ahorrar 50 galones por día.

#### **LEA SU MEDIDOR**

Mediante la lectura de su medidor de agua, usted puede determinar su uso diario y revisar si hay fugas. Un inodoro que gotea puede perder hasta 40 galones por día.

#### LAVE CARGAS COMPLETAS

El funcionar el lavaplatos sólo cuando esté lleno ahorra 4 a 6 galones por carga.

#### REDUZCA EL USO DE ESPARCIDORES

La reducción de su horario de esparcidores automáticos por un día de riego ahorra hasta 400 galones por semana.

#### **ACORTE SU DUCHA**

Tomar duchas más cortas ahorra 2 a 6 galones por minuto.

CCWD cuenta con numerosos programas de conservación, incluyendo evaluaciones y reembolsos de uso del agua, para ayudarle a conservar el agua y lograr el objetivo voluntario del programa de sequía. Más consejos para la conservación e información están disponibles en www.ccwater.com/conserve ó 925-688-8320.

#### Sprinkler precipitation rates - the key to controlling irrigation runoff

Spray nozzles have a high precipitation rate that frequently results in irrigation runoff. The precipitation rate will vary with pressure and spacing. At 30 psi and spaced in a square pattern the precipitation rate is 1.58" per hour. The triangular pattern has slightly higher precipitation rates due to the tighter row spacing of 13 ft. at 1.83"

| 30° Traje | ctory           | •             |             |                |                |
|-----------|-----------------|---------------|-------------|----------------|----------------|
| Nozzle    | Pressure<br>psi | Radius<br>ft. | Flow<br>GPM | Precip<br>In/h | Precip<br>In/h |
| 15F       | 15              | 11            | 2.60        | 2.07           | 2.39           |
|           | 20              | 12            | 3.00        | 2.01           | 2.32           |
|           | 25              | 14            | 3.30        | 1.62           | 1.87           |
|           | 30              | 15            | 3.70        | 1.58           | 1.83           |
| 15H       | 15              | 11            | 1.30        | 2.07           | 2.39           |
|           | 20              | 12            | 1.50        | 2.01           | 2.32           |
|           | 25              | 14            | 1.65        | 1.62           | 1.87           |
|           | 30              | 15            | 1.85        | 1.58           | 1.83           |



Verify the working water pressure at the spray nozzle to be a minimum of 30 psi. In the case of the 15 Series nozzle, any pressure less than 30 psi requires a closer spacing than 15 ft. If the sprinklers are operating at 20 - 25 psi and spaced at 15 ft there will be serious coverage (uniformity) problems. Measure water pressure as the circuit operates at the first and last sprinkler on the circuit. Verify spacing to be no greater than the radius. Sprinklers should be spaced in a square or triangular pattern with consistent spacing between heads.



Test working water pressure at the first and last sprinkler with a pressure tee and gauge.



Verify spacing between heads with a tape measure. At 30 psi spray heads should be spaced at no greater than their series, i.e 15 series at 15 ft, 12 series at 12 ft, etc.

Rotor sprinklers rotate a single or multiple streams to achieve coverage. In general, the end of the stream from one sprinkler should hit right at the base of the adjacent sprinkler. The pressure requirement at the nozzle is dependent on the spacing and the nozzle installed in the sprinkler. Performance charts indicate a radius(spacing interval) that can be achieved with a particular nozzle at varying pressures. Generally, these sprinklers have a higher pressure requirement than spray nozzles. As a consequence low nozzle pressure is a common problem. Pressure, along with spacing must be verified in the field. Precipitation rate data may only be relied upon when pressure, nozzle, and spacing agree with nozzle performance data. These sprinklers have lower precipitation rates than sprays and therefore can be run for longer periods before runoff occurs.

| PGP    | PGP Red Standard Nozzle |               |             |             |              |  |  |  |  |  |  |  |  |
|--------|-------------------------|---------------|-------------|-------------|--------------|--|--|--|--|--|--|--|--|
| Perfo  | Performance Data        |               |             |             |              |  |  |  |  |  |  |  |  |
| Nozzle | Pressure<br>PSI         | Radius<br>ft. | Flow<br>GPM | Precip      | o in/hr<br>▲ |  |  |  |  |  |  |  |  |
| 1      | 30                      | 28'           | 0.5         | 0.12        | 0.14         |  |  |  |  |  |  |  |  |
|        | 40                      | 29'           | 0.6         | 0.14        | 0.16         |  |  |  |  |  |  |  |  |
|        | <b>50</b>               | <b>29'</b>    | <b>0.7</b>  | <b>0.16</b> | <b>0.19</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 30'           | 0.8         | 0.17        | 0.20         |  |  |  |  |  |  |  |  |
| 2      | 30                      | 29'           | 0.7         | 0.16        | 0.19         |  |  |  |  |  |  |  |  |
|        | 40                      | 30'           | 0.8         | 0.17        | 0.20         |  |  |  |  |  |  |  |  |
|        | <b>50</b>               | <b>30'</b>    | <b>0.9</b>  | <b>0.19</b> | <b>0.22</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 31'           | 1.0         | 0.20        | 0.23         |  |  |  |  |  |  |  |  |
| 3      | 30                      | 30'           | 0.9         | 0.19        | 0.22         |  |  |  |  |  |  |  |  |
|        | 40                      | 31'           | 1.0         | 0.20        | 0.23         |  |  |  |  |  |  |  |  |
|        | <b>50</b>               | <b>31'</b>    | <b>1.2</b>  | <b>0.24</b> | <b>0.28</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 32'           | 1.3         | 0.24        | 0.28         |  |  |  |  |  |  |  |  |
| 4      | 30                      | 32'           | 1.2         | 0.23        | 0.26         |  |  |  |  |  |  |  |  |
|        | 40                      | 33'           | 1.4         | 0.25        | 0.29         |  |  |  |  |  |  |  |  |
|        | <b>50</b>               | <b>34'</b>    | <b>1.6</b>  | <b>0.27</b> | <b>0.31</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 34'           | 1.8         | 0.30        | 0.35         |  |  |  |  |  |  |  |  |
| 5      | 30                      | 34'           | 1.6         | 0.27        | 0.31         |  |  |  |  |  |  |  |  |
|        | 40                      | 36'           | 1.8         | 0.27        | 0.31         |  |  |  |  |  |  |  |  |
|        | 50                      | <b>38'</b>    | <b>2.0</b>  | <b>0.27</b> | <b>0.31</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 38'           | 2.2         | 0.29        | 0.34         |  |  |  |  |  |  |  |  |
| 6      | 30                      | 34            | 2.0         | 0.33        | 0.38         |  |  |  |  |  |  |  |  |
|        | 40                      | 36'           | 2.4         | 0.36        | 0.41         |  |  |  |  |  |  |  |  |
|        | <b>50</b>               | <b>38'</b>    | <b>2.7</b>  | <b>0.36</b> | <b>0.42</b>  |  |  |  |  |  |  |  |  |
|        | 60                      | 38'           | 2.9         | 0.39        | 0.45         |  |  |  |  |  |  |  |  |

These charts represent precipitation rates at half circle or 180 degree setting. For full circle operation divide the chart values by 2!





#5 noz. - 2.0 gpm @ 50 psi at 360 deg precipitation rate = 0.135" / hr



#5 noz - 2.0 gpm @50 psi at 180 deg (half circle) precipitation rate = 0.27" / hr.



The pitot tube and pressure gauge are used to measure nozzle pressure which is evaluated against nozzle performance charts

| Suggested maximum run times on clay soil before runoff occurs<br>(on flat surfaces)<br>infiltration rate - 0.10" / hr |  |         |          |            |          |          |          |  |  |  |  |  |
|---|--|---------|----------|------------|----------|----------|----------|--|--|--|--|--|
| spray   | spray  | spray   | rotors   | rotors     | rotors   | rotors   | rotor    |  |  |  |  |  |
| 1.6" / hr   | 1.8" / hr  | 2" / hr | 0.25"/hr | 0.35" / hr | 0.45"/hr | 0.55"/hr | 0.65"/hr |  |  |  |  |  |
| 4 min   | 4 min  | 4 min   | 24 min   | 17 min     | 13 min   | 11 min   | 9 min    |  |  |  |  |  |
| Suggested   | Suggested maximum run times on clay loam soil before runoff occurs |         |          |            |          |          |          |  |  |  |  |  |
| (on flat su   | (on flat surfaces)   |         |          |            |          |          |          |  |  |  |  |  |
| infiltratio   | infiltration rate - 0.16" / hr                                     |         |          |            |          |          |          |  |  |  |  |  |
| spray   | spray  | spray   | rotors   | rotors     | rotors   | rotors   | rotor    |  |  |  |  |  |
| 1.6" / hr   | 1.8" / hr  | 2" / hr | 0.25"/hr | 0.35" / hr | 0.45"/hr | 0.55"/hr | 0.65"/hr |  |  |  |  |  |
| 6 min   | 5 min  | 4 min   | 38 min   | 27 min     | 21 min   | 17 min   | 14 min   |  |  |  |  |  |

Low head drainage occurs in lateral sprinkler piping after the irrigation valve has shut down. When heavy clay soils are being irrigated, multiple cycles (usually 6-8) must occur every day that irrigation takes place. This necessary cycling process introduces the problem of low head drainage. This problem may be resolved with addition of check valves which may be retrofitted into the base of spray head bodies.



It is not unusual to find irrigation valves with spray and rotor type sprinklers plumbed together. This is never acceptable and should be corrected because of the different precipitation rates of the two types!





While low pressure at spray nozzles is frequently encountered, it is not unusual to find spray systems with excessive pressure. When pressure exceeds 45 psi, the sprinkler body should have a pressure regulating feature. This feature, like the anti-drain check valve, may be retrofitted into an existing spray body without digging up the sprinkler When sprinkler inlet pressures exceed 75 psi a regulator must be installed at the valve or backflow prevention device location.







Spray heads operating at 90 psi. This problem was corrected with the addition of a regulator feature on the valve.





Internal pressure regulating device is designed for inlet pressures between 45 and 75 psi

Same circuit operating at 30 psi!

#### Managing the Controller in a Drought

The amount of irrigation water applied to the landscape varies with the type of plant material and the precipitation rate of the sprinklers. The environmental factors that drive plant water use are temperature, wind, solar radiation, humidity, and ground temperature and collectively they generate a number known as Evapotranspiration (ET). These factors are nearly impossible for the landscape manager to evaluate in the field. The State of California manages a network of computerized weather stations linked to a free website in a program known as CIMIS (California Irrigation Management Information System). There are nearly 200 of these stations throughout the state. They provide the landscape manager with a number that represents the inches of water plants generally need in a month, week or day. The number available from the local weather station. In these instances tables are available providing monthly averages in the Water Efficient Landscape Ordinance (WELO) which is also available on line.

#### Average ETo Values by Station

| Stn Id | Stn Name | CIMIS<br>Region | Jan<br>(in) | Feb<br>(in) | Mar<br>(in) | Apr<br>(in) | May<br>(in) | Jun<br>(in) | Jul<br>(in) | Aug<br>(in) | Sep<br>(in) | Oct<br>(in) | Nov<br>(in) | Dec<br>(in) |
|--------|----------|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 170    | Concord  | SFB             | 1.28        | 1.93        | 3.40        | 4.63        | 6.34        | 7.14        | 7.46        | 6.65        | 4.98        | 3.26        | 1.73        | 1.09        |



#### http://wwwcimis.water.ca.gov/



#### http://ucanr.edu/sites/WUCOLS/



Every plant has a different water requirement relative to  $ET_0$  based upon the landscape coefficient or  $K_L$ . The primary factor that drives that landscape coefficient is the species factor. Our biggest concern in the drought is the water requirement for turfgrass as it consumes the bulk of the landscape water. The plant water requirement  $ET_L$  is obtained for any period by multiplying the  $ET_0 \times K_L$ . In a traditional year cool season turfgrass such as fescue, Kentucky Bluegrass, or rye have a species factor of 70 percent or 0.70. In a drought we reduce this species factor and in turn the landscape coefficient ( $K_L$ ) to 60 percent or 0.60. This follows guidelines developed by turfgrass experts at the University of California at Davis and Riverside.

July  $ET_L$  in a traditional year –  $ET_O$  (7.46") x K<sub>L</sub> (0.70 for cs turf) = 5.22" / month

July  $ET_L$  in a drought year –  $ET_O$  (7.46") x K<sub>L</sub> (0.60 for cs turf) = 4.48" / month

# The water savings associated with this recommendation will save 0.74" in the peak month of July which is a 14% reduction in water use!

The development of an irrigation schedule is based on the average daily  $ET_L$ . In the month of July we have a  $ET_L$  of 4.48". The objective is to establish an average daily  $ET_L$  which in this case is 0.144" per day (4.48" / 31 = 0.144"). The replacement for every 3rd day watering for turf in a typical July is 0.432 inches (3 x 0.144). If we were watering on a flat clay surface the infiltration rate or maximum intake rate of the soil is 0.08 inches per hour. It would be necessary to have 5 cycles or start times (5 x 0.08 = 0.40). Since most programs have only 4 start times, it will be necessary to utilize two programs to have an adequate number of start times on clay soils.



On Tuesday the turf water requirement is 0.432''. Regardless of the type of sprinkler, the soil infiltration or intake rate of 0.08'' for clay (in this case) dictates the maximum amount of water applied to be 0.08'' before runoff. Some sprinklers such as rotors and drip apply water more slowly and can have longer run times. Spray type sprinklers have a much higher precipitation rate so their run times to reach runoff are shorter. The sprinkler does not dictate the number of repeats rather it is the soil type! So the number of cycles required is 5 (0.432 / 0.08 = 5.4) We may have to use 2 programs here because of the limitations of start times available per program on most controllers.

|                    |     | PROGRAM A        | PROGRAM B        | PROGRAM C        |  |  |  |  |  |
|--------------------|-----|------------------|------------------|------------------|--|--|--|--|--|
| DAY OF THE WEEK    |     | MTWTFSS          | MTWTFSS          | M T W T F S S    |  |  |  |  |  |
| ODD/ EVEN or INTER | VAL |                  | Ŭ                |                  |  |  |  |  |  |
|                    | 1   | 12:30 a.m.       | 11:00 p.m.       |                  |  |  |  |  |  |
| PROGRAM            | 2   | 2:00 a.m.        |                  |                  |  |  |  |  |  |
| START TIMES        | 3   | 3:30 a.m.        |                  |                  |  |  |  |  |  |
|                    | 4   | 5:00 a.m.        |                  |                  |  |  |  |  |  |
| STATION LOCATIO    | N   | STATION RUN TIME | STATION RUN TIME | STATION RUN TIME |  |  |  |  |  |
| 1                  |     |                  |                  |                  |  |  |  |  |  |
|                    |     | 1                | 1                |                  |  |  |  |  |  |

#### WATERING SCHEDULE FORM EXAMPLE .....

The next step in scheduling is to determine the run time in minutes required for Tuesday. We use a simple run time formula  $RT = ET_L$  (turf water requirement) / PR (precipitation rate) x 60 (constant). In this example the sprinkler is a 15 ft spray spaced square at 30 psi with a precipitation rate of 1.58" / hr. Recall the Tuesday  $ET_L$  so the run time is as follows  $ET_L$  (0.432) / PR (1.58) x 60 = 16 minutes. The problem is that the number is not divisible by 5, but we can have different run times to make this work. On Program A we'll water 3 minutes per cycle x 4 starts = 12 minutes. If we water 4 minutes on program B as well we would be watering 16 minutes.



#### (plant water requirement)





#### WATERING SCHEDULE FORM EXAMPLE.

|                       |                                   |      |               |        |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  | _ |
|-----------------------|-----------------------------------|------|---------------|--------|---------------------|----|---------------|------------|-------|------|---|---|---|-------|------|-------|-----|--|--|--|--|--|---|
| PROGRAM A             |                                   |      |               |        | PROGRAM B PROGRAM C |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
| DAY OF THE WEEK       |                                   |      | M T W T F S S |        |                     | М  | M T W T F S S |            |       |      | М | Т | W | Т     | F    | S     | S   |  |  |  |  |  |   |
| ODD/ EVEN or INTERVAL |                                   |      |               | -      |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
| 1                     |                                   |      | 12:30 a.m.    |        |                     |    |               | 11:00 p.m. |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
|                       | PROGRAM 2                         |      | 2:00 a.m.     |        |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
| s                     | TART TIMES                        | 3    | 3:30 a.m.     |        |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
|                       |                                   | 4    | 5:00 a.m.     |        |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |
| STATION               | STATION LOCATION STATION RUN TIME |      |               |        |                     | SI | 'ATIO         | N RU       | N TII | ΛE   |   |   | S | ratio | N RU | N TIN | /IE |  |  |  |  |  |   |
| 1                     | sprays front                      | lawn |               | 3 min. |                     |    |               |            | 4 m   | ۱in. |   |   |   |       |      |       |     |  |  |  |  |  |   |
| 2                     |                                   |      |               |        |                     |    |               |            |       |      |   |   |   |       |      |       |     |  |  |  |  |  |   |

(3 min. x 4 starts = 12 min.) (4 min. x 1 start = 4 min.) 12 min. + 4 min. = 16 min

We've completed the schedule for station 1 for the spray heads on the turf for Tuesday. The irrigation water that we had to apply (0.432") requires 5 repeats and utilized the capabilities of both the A and B programs. The water requirement for Tuesday morning replaces 3 days of turf water use or 0.432 inches of water). On the majority of controllers in the field there are only three programs. We'll use the final program, program C, for station 1 on Thursday and Saturday. The amount of water required on Thursday and Saturday replaces two days of turf water use or 0.29. The run time for program C (Thursday and Saturday) is  $RT = ET_L / PR \times 60 (0.29 / 1.58 \times 60) = 11 min$ . It is not possible to divide this into even cycles as 11 is not divisible into equal parts. We will increase time to 12 minutes and have four 3 minute cycles. The alternative is three 3 minute cycles which might not be enough.

#### WATERING SCHEDULE FORM EXAMPLE

|                       |            |      | PROGRAM A        | PROGRAM B       |    | PROGBAM C        |
|-----------------------|------------|------|------------------|-----------------|----|------------------|
| DAY OF THE WEEK       |            |      | MTWTFSS          | MTWTF           | SS | MTWTFSS          |
| ODD/ EVEN or INTERVAL |            | AL   | •                |                 |    |                  |
| 1                     |            |      | 12:30 a.m.       | 11:00 p.m.      |    | 12:30 a.m.       |
| PROGRAM 2             |            |      | 2:00 a.m.        |                 |    | 2:00 a.m.        |
| S                     | TART TIMES | 3    | 3:30 a.m.        |                 |    | 3:30 a.m.        |
|                       |            | 4    | 5:00 a.m.        |                 |    | 5:00 a.m.        |
| STATION LOCATION      |            | N    | STATION RUN TIME | STATION RUN TIM |    | STATION RUN TIME |
| 1 sprays front lawn   |            | lawn | 3 min.           | 4 min.          |    | 3 min.           |
| 2                     |            |      |                  |                 |    |                  |
|                       |            |      |                  |                 |    |                  |

(3 min. x 4 starts = 12 min.) (4 min. x 1 start = 4 min.)

12 min. + 4 min. = 16 min

(3 min. x 4 starts = 12 min.)

8

One important feature of more modern controllers is the percentage or seasonal adjust key or +/- key. It allows adjustment of an entire program by percentages. Heavy clay soils and spray heads render this a meaningless feature. Imagine that there is a 3 minute run time that needs a 10% reduction. The controller times in 1 minute increments so the % key only works for 33% changes (3 minutes reduces to 2 minutes is a 33% change). Then only options we have with these short run times is to eliminate a start time or decrease a run time. This is exactly why rotors, with their lower precipitation rates, and longer run times are a better option than sprays. If the rotor station was set for four 10 minute cycles a 90% adjust would reduce the run time to 9 minutes!



Ultimately we need to be very creative in dealing with drought conditions where reduced watering days may be imposed by cities or water agencies. There are many limitations to controller programming when this occurs and they are acutely felt during a drought. Another serious limitation in the more arid regions of the state is the limitation of the water meter to apply water in two days that would normally be applied in 3 to 7 days per week!





#### **Irrigation Schedule**

#### Concord, CA

Every other day

watering

#### Pop Up Spray Heads / Cool Season Turf

Cool Season Turf with a KT species factor (maximum stress) 0.60

| DULQ    | 0.56 |              |
|---------|------|--------------|
| PR Rate | 1.58 | inches / hr. |
| RTM     | 1.36 |              |

|    |     | Concord         | Concord         | Concord | Lower    | Upper    | Lower   |
|----|-----|-----------------|-----------------|---------|----------|----------|---------|
|    |     | ET <sub>0</sub> | ET <sub>0</sub> | CS Turf | Bndry.   | Bndry.   | Bndry.  |
|    |     | Avg             | Avg.            | Req't   | Run Time | Run Time | Run Tim |
|    |     | Monthly         | daily           | daily   | min.     | min.     | min.    |
| 31 | Mar | 3.4             | 0.1097          | 0.0658  | 5        | 7        | 7       |
| 30 | Apr | 4.63            | 0.1543          | 0.0926  | 7        | 10       | 11      |
| 31 | May | 6.34            | 0.2045          | 0.1227  | 9        | 13       | 14      |
| 30 | Jun | 7.14            | 0.2380          | 0.1428  | 11       | 15       | 16      |
| 31 | Jul | 7.46            | 0.2406          | 0.1444  | 11       | 15       | 16      |
| 31 | Aug | 6.65            | 0.2145          | 0.1287  | 10       | 13       | 15      |
| 30 | Sep | 4.98            | 0.1660          | 0.0996  | 8        | 10       | 11      |
| 31 | Oct | 3.26            | 0.1052          | 0.0631  | 5        | 7        | 7       |
|    |     | 43.86           |                 |         |          |          |         |



20 15 10

Every 3rd day

watering



#### MP Rotators / Cool Season Turf

Cool Season Turf with a Kr species factor (maximum stress) 0.60

|    | DU <sub>LQ</sub> | 0.72            | inchor ( hr     |           | Every oth  | er day   | Every 3rd       | day        |                           |        |
|----|------------------|-----------------|-----------------|-----------|------------|----------|-----------------|------------|---------------------------|--------|
|    | RTM              | 1.2             | incres / in.    |           | watering   |          | watering        |            |                           |        |
|    |                  | Concord         | Concord         | Concord   | Lower      | Upper    | Lower           | Upper      |                           |        |
|    |                  | ET <sub>0</sub> | ET <sub>0</sub> | CS Turf   | Bndry.     | Bndry.   | Bndry.          | Bndry.     |                           |        |
|    |                  | Avg             | Avg.            | Req't     | Run Time   | Run Time | Run Time        | Run Time   |                           |        |
|    |                  | Monthly         | daily           | daily     | min.       | min.     | min.            | min.       |                           |        |
| 31 | Mar              | 3.4             | 0.1097          | 0.0658    | 18         | 22       | 28              | 33         | -                         | 100 m  |
| 30 | Apr              | 4.63            | 0.1543          | 0.0926    | 26         | 31       | 39              | 47         |                           |        |
| 31 | May              | 6.34            | 0.2045          | 0.1227    | 34         | 41       | 51              | 62         | Contraction of the second |        |
| 30 | Jun              | 7.14            | 0.2380          | 0.1428    | 40         | 48       | 60              | 72         | A Salary                  | NV/    |
| 31 | Jul              | 7.46            | 0.2406          | 0.1444    | 40         | 48       | 60              | 73         | Section 201               | ALC: N |
| 31 | Aug              | 6.65            | 0.2145          | 0.1287    | 36         | 43       | 54              | 65         |                           |        |
| 30 | Sep              | 4.98            | 0.1660          | 0.0996    | 28         | 33       | 42              | 50         |                           |        |
| 31 | Oct              | 3.26            | 0.1052          | 0.0631    | 18         | 21       | 26              | 32         |                           |        |
|    |                  | MAXIMU          | M CYCLE LEN     | GTH (IN M | INUTES) TO | AVOID R  | UNOFF ON CLAY   | SOILS      |                           |        |
|    |                  |                 | SPRAYS          |           | 4 MINUTE   | S        | (15 FT SQUARE   | SPACING)   |                           |        |
|    |                  |                 | ROTORS          |           | 14 MINUT   | ES       | (0.43" / HR PRE | CIP RATE)  |                           |        |
|    |                  |                 | LINE SOURC      | E DRIP    | 4 MINUTE   | s        | (0.9 GPH - 12") | K 12" SPAC | ING)                      | 10     |



Every 3rd day

#### Drip / Line Source - 0.9 GPH - 12" x 12" spacing

Every other day

| Ornamental Shrubs with a species factor Kp (max stress) | 0.40 |
|---|------|
|   |      |

DULQ

0.9

|    | PR Rate | 1.42            | inches / hr.    |            | watering |          | watering |          |
|----|---------|-----------------|-----------------|------------|----------|----------|----------|----------|
|    | RTM     | 1.06            |                 |            |          |          |          |          |
|    |         | Concord         | Concord         | Concord    | Lower    | Upper    | Lower    | Upper    |
|    |         | ET <sub>0</sub> | ET <sub>0</sub> | Orn. Shrub | Bndry.   | Bndry.   | Bndry.   | Bndry.   |
|    |         | Avg             | Avg.            | Req't      | Run Time | Run Time | Run Time | Run Time |
|    |         | Monthly         | daily           | daily      | min.     | min.     | min.     | min.     |
| 31 | Mar     | 3.4             | 0.1097          | 0.0439     | NA       | NA       | 6        | 6        |
| 30 | Apr     | 4.63            | 0.1543          | 0.0617     | NA       | NA       | 8        | 8        |
| 31 | May     | 6.34            | 0.2045          | 0.0818     | NA       | NA       | 10       | 11       |
| 30 | Jun     | 7.14            | 0.2380          | 0.0952     | NA       | NA       | 12       | 13       |
| 31 | Jul     | 7.46            | 0.2406          | 0.0963     | NA       | NA       | 12       | 13       |
| 31 | Aug     | 6.65            | 0.2145          | 0.0858     | NA       | NA       | 11       | 12       |
| 30 | Sep     | 4.98            | 0.1660          | 0.0664     | NA       | NA       | 8        | 9        |
| 31 | Oct     | 3.26            | 0.1052          | 0.0421     | NA       | NA       | 5        | 6        |
|    |         |                 |                 |            |          |          |          |          |



#### Drip / Point Source - random spacing - 0.25" / hr. PR

Ornamental Shrubs with a species factor Kp (max stress) 0.40

|    | DU <sub>LQ</sub><br>PR Rate<br>RTM | 0.9<br>0.25<br>1.06 | inches / hr.    |            | Every oth<br>watering | ner day  | Every 3rd<br>watering | day      |
|----|------------------------------------|---------------------|-----------------|------------|-----------------------|----------|-----------------------|----------|
|    |                                    | Concord             | Concord         | Concord    | Lower                 | Upper    | Lower                 | Upper    |
|    |                                    | ET <sub>0</sub>     | ET <sub>0</sub> | Orn. Shrub | Bndry.                | Bndry.   | Bndry.                | Bndry.   |
|    |                                    | Avg                 | Avg.            | Req't      | Run Time              | Run Time | Run Time              | Run Time |
|    |                                    | Monthly             | daily           | daily      | min.                  | min.     | min.                  | min.     |
| 31 | Mar                                | 3.4                 | 0.1097          | 0.0439     | NA                    | NA       | 32                    | 33       |
| 30 | Apr                                | 4.63                | 0.1543          | 0.0617     | NA                    | NA       | 44                    | 47       |
| 31 | May                                | 6.34                | 0.2045          | 0.0818     | NA                    | NA       | 59                    | 62       |
| 30 | Jun                                | 7.14                | 0.2380          | 0.0952     | NA                    | NA       | 69                    | 73       |
| 31 | Jul                                | 7.46                | 0.2406          | 0.0963     | NA                    | NA       | 69                    | 73       |
| 31 | Aug                                | 6.65                | 0.2145          | 0.0858     | NA                    | NA       | 62                    | 65       |
| 30 | Sep                                | 4.98                | 0.1660          | 0.0664     | NA                    | NA       | 48                    | 51       |
| 31 | Oct                                | 3.26                | 0.1052          | 0.0421     | NA                    | NA       | 30                    | 32       |

# EUUING 5399 Pacheco Blvd

Concord, CA

(925) 687.3220

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\* lower boundary represents a water time that assumes a high uniformity of application DULO

\* upper boundary increases run time to account for normal sprinkler uniformity deficiencies

Precipitation Rate Tables - Low Volume/Drip-Micro Irrigation Point Source Emiiters or Micro Spray

(METER FLOW)

CFM GPM

# AREA IN SQUARE FEET(CANOPY AREA)

# 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500 525 550 575 600 625 650 675 700 8

| 0.03 | 0.25 | 0.48 | 0.32 | 0.24 | 0.19 | 0.16 | 0.14 | 0.12 | 0.11 | 0.10 | 600  | 0.08 |      |      |      |      |      |      |      |        |       |        |       |       |       |     |              |  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|-------|--------|-------|-------|-------|-----|--------------|--|
| 0.07 | 0.50 | 0.96 | 0.64 | 0.48 | 65.0 | 0.32 | 0.28 | 0.24 | 0.21 | 0.19 | 0.18 | 0.16 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.10 | 0.10   | 60.0  | 0 60'0 | 80.   |       |       |     |              |  |
| 0.10 | 0.75 | 1.44 | 0.96 | 0.72 | 0.58 | 0.48 | 0.41 | 0.36 | 0.32 | 0.29 | 0.26 | 0.24 | 0.22 | 0.21 | 0.19 | 0.18 | 0.17 | 0.16 | 0.15 | 0.14 0 | .14   | 0.13 0 | 13    | 12 0  | 12 0  | H   | Ξ            |  |
| 0.13 | 1.00 | 1.93 | 1.28 | 0.96 | 0.77 | 0.64 | 0.55 | 0.48 | 0.43 | 0.39 | 0.35 | 0.32 | 0.30 | 0.28 | 0.26 | 0.24 | 0.23 | 0.21 | 0.20 | 0.19 0 | 0.18  | 0.18 0 | 117 0 | .16 0 | 15 0  | 15  | -            |  |
| 0.17 | 1.25 | 2.41 | 1.61 | 1.20 | 0.96 | 0.80 | 0.69 | 0.60 | 0.5  | 0.48 | 4.0  | 0.40 | 0.37 | 0.34 | 0.32 | 0:30 | 0.28 | 0.27 | 0.25 | 0.24 0 | 12    | 0.22 0 | 21 0  | 20 0  | 19 0  | 61. | 8            |  |
| 0.20 | 1.50 | 2.89 | 1.93 | 1.44 | 1.16 | 0.96 | 0.83 | 0.72 | 0.64 | 0.58 | 6.53 | 0.48 | 44.0 | 0.41 | 620  | 0.36 | 0.34 | 0.32 | 020  | 0.29   | .28   | 0.26 0 | 22    | .24 0 | 3     | 2   | 21           |  |
| 0.23 | 1.75 | 3.37 | 2.25 | 1.69 | 1.35 | 1.12 | 0.96 | 0.84 | 0.75 | 0.67 | 0.61 | 0.56 | 0.52 | 0.48 | 0.45 | 0.42 | 0.40 | 0.37 | 0.35 | 0.34 0 | 32    | 0.31 0 | 29    | .28 0 | 27 0  | .26 | 5            |  |
| 0.27 | 2.00 | 3.85 | 2.57 | 1.93 | 1.54 | 1.28 | 1.10 | 0.96 | 0.86 | 0.77 | 0.70 | 0.64 | 0.59 | 0.55 | 0.51 | 0.48 | 0.45 | 0.43 | 0.41 | 0.39 0 | 37    | 0.35 0 | 33 0  | 32 0  | 310   | 30  | 2            |  |
| 0.30 | 2.25 | 4.33 | 2.89 | 2.17 | 1.73 | 1.44 | 1.24 | 1.08 | 0.96 | 0.87 | 0.79 | 0.72 | 0.67 | 0.62 | 0.58 | 0.54 | 0.51 | 0.48 | 0.46 | 0.43 0 | .41 0 | 0 950  | 38 0  | 36 0  | 35 0  | 8   | 8            |  |
| 0.33 | 2.50 | 4.82 | 3.21 | 2.41 | 1.93 | 1.61 | 1.38 | 1.20 | 1.07 | 0.96 | 0.88 | 0.80 | 0.74 | 0.69 | 0.64 | 0.60 | 0.57 | 0.54 | 0.51 | 0.48 0 | .46   | 0.44 0 | .42 0 | 40 0  | 65    | 37  | 8            |  |
| 0.37 | 2.75 | 5.30 | 3.53 | 2.65 | 2.12 | 1.77 | 1.51 | 1.32 | 1.18 | 1.06 | 0.96 | 0.88 | 0.81 | 0.76 | 0.71 | 0.66 | 0.62 | 0.59 | 0.56 | 0.53   | 50    | 0.48   | .46 0 | 4     | 42 0  | 41  | ñ            |  |
| 0.40 | 3.00 | 5.78 | 3.85 | 2.89 | 231  | 1.93 | 1.65 | 1.44 | 1.28 | 1.16 | 1.05 | 0.96 | 0.89 | 0.83 | 0.77 | 0.72 | 0.68 | 0.64 | 0.61 | 0.58 0 | 55    | 0.53   | 50    | .48   | 46 0  | 4   | <del>2</del> |  |
| 0.43 | 3.25 | 6.26 | 4.17 | 3.13 | 2.50 | 2.09 | 1.79 | 1.56 | 1.39 | 1.25 | 1.14 | 1.04 | 0.96 | 0.89 | 0.83 | 0.78 | 0.74 | 0.70 | 0.66 | 0.63   | 09.0  | 0.57   | 5     | 52 0  | 50    | .48 | 46           |  |
| 0.47 | 3.50 | 6.74 | 4.49 | 3.37 | 2.70 | 2.25 | 1.93 | 1.69 | 1.50 | 1.35 | 13   | 1.12 | 5    | 0.96 | 0:90 | 0.84 | 0.79 | 0.75 | 12.0 | 0.67 0 | 25    | 0.61 0 | 59 0  | .56 0 | 5     | 3   | ŝ            |  |
| 0.50 | 3.75 | 7.22 | 4.82 | 3.61 | 2.89 | 2.41 | 2.06 | 1.81 | 1.61 | 1.44 | 1.31 | 1.20 | 111  | 1.03 | 96.0 | 0.00 | 0.85 | 0.80 | 0.76 | 0.72 0 | 69.0  | 0.66 0 | .63   | 60 09 | 58 0  | 28  | 5            |  |
| 0.53 | 4.00 | 7.70 | 5.14 | 3.85 | 3.08 | 2.57 | 2.20 | 1.93 | 171  | 1.54 | 1.40 | 1.28 | 1.19 | 1.10 | 1.03 | 0.96 | 0.91 | 0.86 | 0.81 | 0.77 0 | 13    | 0.70   | . 67  | 64 0  | 62 0  | 65  | 5            |  |
| 0.57 | 4.25 | 8.19 | 5.46 | 4.09 | 3.27 | 2.73 | 2.34 | 2.05 | 1.82 | 1.64 | 1.49 | 1.36 | 1.26 | 1.17 | 1.09 | 1.02 | 0.96 | 0.91 | 0.86 | 0.82 0 | .78   | 0.74 0 | 121   | .68   | .65 0 | 8   | 19           |  |
| 0.60 | 4.50 | 8.67 | 5.78 | 4.33 | 3.47 | 2.89 | 2.48 | 2.17 | 1.93 | 1.73 | 1.58 | 1.44 | 1.33 | 1.24 | 1.16 | 1.08 | 1.02 | 0.96 | 0.91 | 0.87 0 | .83   | 0.79   | .75 0 | 72 0  | 0 69  | 19  | Q.           |  |
| 0.64 | 4.75 | 9.15 | 6.10 | 4.57 | 3.66 | 3.05 | 2.61 | 2.29 | 203  | 1.83 | 1.66 | 1.52 | 1.41 | 1.31 | 1.22 | 1.14 | 1.08 | 1.02 | 96.0 | 0.91 0 | .87   | 0.83   | 08.0  | 76 0  | 33 0  | 8   | 89           |  |
| 0.67 | 5.00 | 9.63 | 6.42 | 4.82 | 3.85 | 3.21 | 2.75 | 2.41 | 2.14 | 1.93 | 1.75 | 1.61 | 1.48 | 1.38 | 1.28 | 1.20 | 113  | 1.07 | 1.01 | 0.96   | .92   | 0.88 0 | .84   | .80   | 77 0  | 74  | 5            |  |

\* Obtain flow to the area by reading water meter. Calculate canopy area using Ewing's "16 point" measuring system for irregularly shaped areas.



# In-Line Drip Tubing Flow Precipitation Rates (Netafim)

|                                      |       |        |        |        |        | Ē      | #       |         |        |         |        | -               |         |         | ŝ      | RUB             | & GR   | NNO   | DCO    | VER   |      |      |      |
|--------------------------------------|-------|--------|--------|--------|--------|--------|---------|---------|--------|---------|--------|-----------------|---------|---------|--------|-----------------|--------|-------|--------|-------|------|------|------|
| <b>GENERAL GUIDELINES</b>            | 5     | AVS    | OIL    | LOA    | M SI   | J      | SAN     | DV SC   | DIL C  | OARS    | ESO    | 1               | CLAY    | SOIL    | 3      | MM              | SOIL   | SAI   | VDV    | SOIL  | COAS | SES  | SOIL |
| EMITTER FLOW                         | 0     | 26 GF  | H      | 0      | 4 GPI  | -      | 0.6     | GPH     |        | 0.9 (   | HdS    |                 | 0.26 (  | HdS     | 1      | 0.4 G           | H      | 0     | 6 GP   | H     | 0    | GPI  | +    |
| EMITTERSPACING                       |       | 18~    |        |        | 12"    |        | _       | .2.     |        | 1       | h      | -               | 18      |         | _      | 18-             |        |       | 12-    |       |      | 12-  |      |
| LATERAL (ROW) SPACING                | 18    | 20-    | 22     | 18"    | -20-   | 22"    | 12-     | 14" 1   |        | 2 1     | 1 -1   | 2- 18           | 5 21    | - 24    | - 18   | - 21            | 24"    | 16    | 18"    | 20-   | 19   | 18"  | 20-  |
| BURIAL DEPTH                         |       | 1.071  | Bury   | werd,  | throu  | ghout  | the z   | one fre | t-t-uc | -90     |        |                 |         | -       | Dn-su  | ríace<br>se zon | or bur | y eve | My the | augho | ti   |      |      |
| APPLICATION RATE (INCHES/HOUR)       | 0.15  | 3 0.17 | 0.15   | 0.45   | 0.41   | 0.37   | 960     | 0.83 0  | 12 1   | 44 1.   | 24 1.  | 08 0.           | 19 0.1  | 6 0.1   | 4 0.2  | 9 0.2           | 1 0.21 | 0.72  | 0.64   | 0.58  | 1.08 | 0.96 | 0.87 |
| TIME TO APPLY 34" OF WATER (MINUTES) | 81    | 8      | 8      | 8      | 3      | 41     | 16      | 18      | 21     | 1       | 2 1    | 4 8             | 9       | 100     | 8      | 61              | 20     | 21    | 8      | 36    | 2    | 16   | 17   |
| Following thes<br>0.9 GPH            | e max | mum :  | spacit | ng gui | deline | s, emi | ther fi | ow sel  | ection | o can t | be inc | rease<br>ach at | d if de | sired t | by the | r desig         | ner.   |       |        |       |      |      |      |

Note: 0.4, 0.6 and 0.9 GPH are nominal flow rates. Actual flow rates used in the calculations are 0.42, 0.61 and 0.92 GPH.

#### Measuring irregularly shaped drip zone canopy

When the geometry of an area is complex, the area can be measured by treating it as a circle. The formula for the area of a circle is Pi (3.14) x radius (squared) = A. We can determine the average radius of any shape by measuring the distance from near the center to the perimeter 16 times using a 100 foot tape. We then total these measurements and divide by 16 to obtain the average.

In the field use a fabricated  $2 \times 2$  plywood sheet with a hole in the center for a screwdriver and place this sheet near the approximate center of the area to be measured. Create 16 permanent radii from the center at 22.5 degree increments on the plywood sheet. Use these as a guide and measure to the perimeter.





For simplicity of calculation inches are converted to a decimal equivalent. A conversion chart for inches to decimal equivalent may be found on the right side of the table on the reverse side of this page.

This shape has a total of 524.55 feet. The average radius is therefore 32.78 (524.5/16). Find the average radius on the reverse table. We have to interpolate to determine that the area is 3,346 sq. ft

| Conversio | on Chart | - Average Ra | adius to S | quare Feet | (16 radii | minimum)          |               |
|-----------|----------|--------------|------------|------------|-----------|-------------------|---------------|
| Avergage  | Area     | Avergage     | Area       | Avergage   | Area      | Avergage          | Area          |
| Radius    | (square  | Radius       | (square    | Radius     | (square   | Radius            | (square       |
| (feet)    | feet)    | (feet)       | feet)      | (feet)     | feet)     | (feet)            | feet)         |
| (1000)    | ,        | (1000)       |            | (1000)     | 5.000     | (1000)            | 12.000        |
| 10.00     | 314      | 22.00        | 1,521      | 43.00      | 5,809     | 66.50             | 13,893        |
| 10.25     | 330      | 22.50        | 1,590      | 43.50      | 5,945     | 66.00             | 13,685        |
| 10.50     | 340      | 22.75        | 1,020      | 44.00      | 6,082     | 66.50             | 13,893        |
| 10.75     | 303      | 23.00        | 1,002      | 44.50      | 0,221     | 67.00             | 14,103        |
| 11.00     | 380      | 23.25        | 1,098      | 45.00      | 0,302     | 67.50             | 14,314        |
| 11.25     | 398      | 23.50        | 1,735      | 45.50      | 6,504     | 68.00             | 14,527        |
| 11.50     | 415      | 25.75        | 1,772      | 46.00      | 6 702     | 69.00             | 14,741        |
| 12.00     | 454      | 24.00        | 1,010      | 40.50      | 6 940     | 69.00             | 15 175        |
| 12.00     | 432      | 24.25        | 1,047      | 47.00      | 7 099     | 70.00             | 15 20/        |
| 12.25     | 471      | 24.30        | 1 02/      | 47.30      | 7,000     | 70.00             | 15 615        |
| 12.50     | 511      | 25.00        | 1 963      | 48.50      | 7 300     | 70.50             | 15,015        |
| 13.00     | 531      | 25.50        | 2 043      | 49.00      | 7 5/3     | 71.00             | 16.061        |
| 12.00     | 552      | 25.50        | 2,045      | 49.00      | 7,545     | 72.00             | 16 296        |
| 12.20     | 572      | 26.00        | 2,124      | 49.00      | 7,050     | 72.00             | 16 512        |
| 13.50     | 59/      | 20.30        | 2,200      | 50.50      | 8 012     | 72.50             | 16 7/2        |
| 14.00     | 616      | 27.00        | 2,250      | 51.00      | 8 171     | 73.50             | 16 972        |
| 14.00     | 638      | 27.50        | 2,370      | 51.50      | 8 332     | 73.50             | 17 203        |
| 14.20     | 661      | 28.50        | 2,403      | 52.00      | 8 495     | 74.50             | 17 437        |
| 14.50     | 683      | 29.00        | 2,552      | 52.50      | 8 659     | 75.00             | 17 671        |
| 15.00     | 707      | 29.50        | 2,042      | 53.00      | 8 825     | 75.50             | 17 908        |
| 15.00     | 731      | 30.00        | 2,731      | 53.50      | 8 992     | 76.00             | 18 146        |
| 15.50     | 755      | 30.50        | 2,027      | 54.00      | 9 161     | 76.50             | 18 385        |
| 15.55     | 779      | 31.00        | 3 019      | 54 50      | 9 331     | 77.00             | 18 627        |
| 16.00     | 804      | 31.50        | 3,117      | 55.00      | 9,503     | 77.50             | 18,869        |
| 16.25     | 830      | 32.00        | 3.217      | 55.50      | 9.677     | 78.00             | 19.113        |
| 16.50     | 855      | 32.50        | 3.318      | 56.00      | 9.852     | 78.50             | 19.359        |
| 16.75     | 881      | 33.00        | 3,421      | 56.50      | 10,029    | 79.00             | 19,607        |
| 17.00     | 908      | 33.50        | 3,526      | 57.00      | 10,207    | 79.50             | 19,856        |
| 17.25     | 935      | 34.00        | 3,632      | 57.50      | 10,387    | 80.00             | 20,106        |
| 17.50     | 962      | 34.50        | 3,739      | 58.00      | 10,568    |                   |               |
| 18.00     | 1,018    | 35.00        | 3,848      | 58.50      | 10,751    | Decimal E         | quival.       |
| 18.25     | 1,046    | 35.50        | 3,959      | 59.00      | 10,936    | inches            | decimal       |
| 18.50     | 1,075    | 36.00        | 4,072      | 59.50      | 11, 122   |                   |               |
| 18.75     | 1,104    | 36.50        | 4,185      | 60.00      | 11,310    | 1                 | 0.08          |
| 19.00     | 1,134    | 37.00        | 4,301      | 60.50      | 11,499    | 2                 | 0.17          |
| 19.25     | 1,164    | 37.50        | 4,418      | 61.00      | 11,690    | 3                 | 0.25          |
| 19.50     | 1,195    | 38.00        | 4,536      | 61.50      | 11,882    | 4                 | 0.33          |
| 19.75     | 1,225    | 38.50        | 4,657      | 62.00      | 12,076    | 5                 | 0.42          |
| 20.00     | 1,257    | 39.00        | 4,778      | 62.50      | 12,272    | 6                 | 0.50          |
| 20.25     | 1,288    | 39.50        | 4,902      | 63.00      | 12,469    | 7                 | 0.58          |
| 20.50     | 1,320    | 40.00        | 5,027      | 63.50      | 12,668    | 8                 | 0.67          |
| 20.75     | 1,353    | 40.50        | 5,153      | 64.00      | 12,868    | 9                 | 0.75          |
| 21.00     | 1,385    | 41.00        | 5,281      | 64.50      | 13,070    | 10                | 0.83          |
| 21.25     | 1,419    | 41.50        | 5,411      | 65.00      | 13,273    | 11                | 0.92          |
| 21.50     | 1,452    | 42.00        | 5,542      | 65.50      | 13,478    | _                 |               |
| 21.75     | 1.486    | 42.50        | 5.675      | 66.00      | 13.685    | c. 2009 Ewing Irr | igation Produ |

Once the canopy area of a specific drip irrigation zone has been measured, the flow to the zone must be obtained by operating the zone from the irrigation controller. Proceed to the water meter and observe the flow to the zone as the station is running. Allow a couple of minutes for the tubing to fill and come to full pressure before reading flow at the meter. Proceed to the precipitation rate chart and derive the precipitation rate by matching area in square feet to meter flow in cubic feet per minute (CFM)

Also insure that there is adequate pressure to the last (and or highest) elevation emitter in the zone. Minimum psi for pressure compensating emitters is 10 psi and for drip line 15 psi.



| Estimating Irregula | rly shaped Areas |                |                     |                           |
|---------------------|------------------|----------------|---------------------|---------------------------|
| /leasurement        |                  |                |                     |                           |
| А                   |                  |                |                     |                           |
| В                   |                  |                |                     |                           |
| С                   |                  |                |                     |                           |
| D                   |                  |                | 19-2-15             |                           |
| E                   |                  | Sales with     | and the             | A Marche                  |
| F                   |                  | A STATEMENT    |                     | Contraction of the second |
| G                   |                  |                | E.                  |                           |
| Н                   |                  |                |                     |                           |
| I                   |                  | 2- 7- 65       |                     |                           |
| J                   |                  | K              | and an and a second |                           |
| К                   |                  | 1              |                     |                           |
| L                   |                  |                | 02.20.0             |                           |
| м                   |                  | 1.             | 17 200              |                           |
| N                   |                  |                |                     |                           |
| 0                   |                  |                |                     |                           |
| Р                   |                  |                |                     |                           |
|                     |                  | EMITTER FLOW ( | TIME TO FI          | LL 2" CAP)                |
| TOTAL               |                  |                |                     |                           |
| AVG/16              |                  | EMITTER TYPE   | GPH                 | FILL TIME                 |
| SQ. FT              |                  |                |                     |                           |
|                     |                  | POINT SOURCE   | 2.00                | 56 SECONDS                |
| METER               |                  | POINT SOURCE   | 1.00                | 1 MIN 52 SECONDS          |
| FLOW                |                  | LINE SOURCE    | 0.92                | 2 MIN 2 SECONDS           |
| CFM                 |                  | LINE SOURCE    | 0.61                | 3 MIN 4 SECONDS           |
|                     |                  | POINT SOURCE   | 0.50                | 3 MIN 45 SECONDS          |
| PR Rate             |                  | LINE SOURCE    | 0.42                | 4 MIN 26 SECONDS          |
|                     |                  |                |                     |                           |
|                     |                  |                |                     |                           |
|                     |                  |                |                     |                           |
|                     |                  |                |                     | 17                        |

The water meter is an important management tool during the drought. As a landscape professional you can provide a very important service for your customers by monitoring their water use. If you are performing landscape maintenance at a site, then you are visiting it on a weekly basis and it will take just a few minutes to provide this service. Your primary objective in this regard is to look for leaks. Open the valve meter box when you arrive for maintenance and watch the meter for a few moments. There is a low flow indicator on the meter. If the meter is not dedicated to the landscape there may be a flow of potable to the residence or building. Try to check for leaks when no one is present in the building. If the irrigation system is off and no one is home the low flow indicator should not be moving. Observe it for a few seconds to see if it is turning. It may not be turning, but there still may be a leak. Note the position of the needle and the reading on the total flow which looks like a car's odometer. Check this before you leave the site to see if there has been any flow during your maintenance period. <u>Calculate the flow of the leak per hour and multiply by 8,760 (hours per year to determine the amount of water loss per year.</u>



At each maintenance visit check the low flow indicator and the position of the needle and total flow to determine if there is a slow leak. Take a digital image with your phone camera to document any leaks as well as the meter number. This is a great low cost service that you can provide to your customers during the drought!

The water meter is usually located between the curb and the backflow prevention device. Most commercial sites have dedicated landscape meters but this is not always the case. Meters record water volume in gallons or cubic feet, but most water agencies provide meters that record in cubic feet. A cubic foot of water is 7.48 gallons and is a 12"x12"x12" cube. Customers are billed in what is known as ccf's or hundred cubic foot units of 748 gallons.



Each full revolution of the dial on commercial meters (1  $\frac{1}{2}$ " and larger) represents a flow of ten cubic feet or 74.8 gallons



Each full revolution of the dial on a residential meter (5/8", 3,4" and 1") represents a flow of one cubic foot or 7.48 gallons

The water meter limits the amount of water that can be delivered to the site. Most irrigation systems were designed with the expectation that they would apply water anywhere from three to seven days per week. Take the system that in non-drought years was able to water six days per week and nine hours per day in the month of July. This is a total watering time of 3,240 minutes ( $6 \times 9 \times 60$ ). Let's assume this is a 2" meter providing 50 gallons per minute. Under these conditions the meter could provide up to 162,000 gallons per week. (This 50 gpm flow is an average as some stations such as drip have far less flow and others such as large turf rotors have more)

Now, transition to a drought where watering is allowed two days per week for a maximum of thirty hours per week. The amount of water that could be delivered to the site would be 90,000 gallons (1,800 minutes x 50 = 90,000. Given this shortfall it is likely the site manager will have to set priorities on landscape watering and it is possible that some areas of the landscape may not survive. Invest the landscape water in large trees and shrubs which have the greatest value in the landscape!

# **IRRIGATION ASSISTANCE**

#### **Irrigation Controllers**

#### The following manufacturers offer assistance with irrigation controllers

| MANUFACTURER        | TECH HELP NUMBER | WEBSITE                  |
|---------------------|------------------|--------------------------|
| Hunter              | 1-800-733-2823   | www.HunterIndustries.com |
| Irritrol            | 1-800-899-2058   | www.irritrolsystems.com  |
| Lawn Genie/Rain Jet | 1-800-231-5117   | www.lawngenie.com        |
| Orbit               | 1-800-488-6156   | www.orbitonline.com      |
| Rainbird            | 1-800-247-3782   | www.rainbird.com         |
| Toro                | 1-800-664-4740   | www.toro.com             |
| Weathermatic        | 1-972-278-6131   | www.weathermatic.com     |

#### **Local Irrigation Equipment Suppliers**

The following is a list of local irrigation equipment suppliers For irrigation contractor referrals, contact one of these suppliers

| COMPANY NAME               | ADDRESS                               | <u>PHONE</u> |
|----------------------------|---------------------------------------|--------------|
| Ewing Irrigation           | 5399 Pacheco Blvd, Pacheco            | 687-3220     |
| Horizon                    | 1880 Arnold Industrial Place, Concord | 825-3344     |
| John Deere Landscapes      | 130-A South Buchanan Circle, Pacheco  | 680-7620     |
| Watersavers Irrigation Inc | 4025-A Nelson Avenue, Concord         | 691-9115     |
| The Urban Farmer           | 2121 San Joaquin St., Richmond        | 510-524-1604 |

#### **Irrigation Design Assistance**

The following offer design assistance with do-it-yourself irrigation design projects.

| Rain Bird               | www.rainbird.com                    |
|-------------------------|-------------------------------------|
| Toro                    | www.toro.com/sprinklers/guides.html |
| Hunter                  | www.hunterindustries.com/homeowners |
| Orbit                   | www.orbitonline.com                 |
| Irrigation<br>Tutorials | www.irrigationtutorials.com         |
| Netafim                 | www.netafimusa.com/landscape        |
| Urban Farmer            | www.urbanfarmerstore.com            |

# **Concord Area Irrigation Supply Stores**



# Irrigation Upgrade Program Contra Costa Water District

Commercial properties typically use *double* the amount of water needed to maintain a healthy landscape! To help reduce landscape water use, improve water efficiency, and save money, Contra Costa Water District (CCWD) is offering to pay a portion of the costs for improving the irrigation equipment in existing systems. This program only covers material costs for equipment.

#### Qualifications:

Qualifying property must be a commercial or multi-family site in: the CCWD Treated Water Service Area, Martinez, Bay Point, Pittsburg, Antioch or Oakley.

#### Program Description:

The Irrigation Equipment Upgrade Program assists landscape irrigation customers in upgrading specific irrigation equipment to improve water-use efficiency. Financial incentives are offered toward the purchase of irrigation equipment (as listed on the back of this letter). Installation company invoices or receipts from the irrigation equipment supply store are required to receive rebate. *Rebates do not cover labor*. This program is *Not Retroactive*. All upgrades must have *Contra Costa Water District approval before beginning upgrade work*.

*Funds Are Limited* Call the CCWD Water Conservation office for an Application

(925) 688-8321



#### Equipment Included:

#### • Rain Sensors

Customers may purchase their own sensors and receive a rebate of **50% of the list cost up to \$15.00 per sensor or** receive a **free** Rain Sensor from CCWD. Limit is one sensor per irrigation controller.

#### • Drip Retrofit

The program offers a rebate on a drip system that *replaces* an existing spray system. High pressure, and multi-outlet devices are not qualified. The rebate is *\$0.10 per square foot* of converted landscape area determined during post inspection.

#### Smart' Irrigation Controllers

The program offers a rebate of *50% of the list cost* of 'Smart' irrigation controllers, *not to exceed \$20.00 per active irrigation station*, number of active stations to be determined during post-inspection. Site is required to have a well-maintained irrigation system in good working order.

#### <u>Meters</u>

Flow Meter - The program offers a rebate of 25% of the list cost of a flow meter.
Sub-Meter - The program offers a rebate of 25% of the list cost of a sub-meter.
Check Valves - The program offers a rebate of 25% of the list cost of a check valve.

#### Valves

Master Valves - The program offers a rebate of 25% of the list cost of a master valve. Pressure Regulating Valve-Rebate is 25% of the list cost of a pressure regulating valve.

#### High Efficiency Nozzles

The program offers a rebate of *\$2.00 per nozzle, not to exceed 50% of list cost of nozzles*, for replacing fixed spray nozzles with one of the following **high efficiency nozzles**: Hunter MP Rotator, Rain Bird Rotary, Toro Precision Series Spray, or Toro Precision Series Rotating. *Entire sprinkler zones must be replaced to qualify*.

#### • Sprinkler Head Retrofit

The program offers a rebate of *\$ 1.50 per new qualified spray head and \$3.50 per new qualified matched precipitation rate rotor head, not to exceed 25% of the heads list cost*, when *replacing* existing, inefficient sprinklers.

#### New sprinklers must meet the following requirements:

- 1. Matched precipitation rate for each station
- 2. Minimum 6" pop-up height for lawn sprinklers
- 3. Shrub heads must spray unobstructed when installed
- 4. Pressure at head must be within manufacturer specifications. (Pressure regulating valves can be installed when needed and will be rebated at 25% of list cost.)
- 5. Head spacing for spray heads and rotors must be a minimum of 90% overlap (100% overlap is recommended).

Funds Are Limited

Call the CCWD Water Conservation office for an Application

### (925) 688-8321

# **Line Source Drip Irrigation Layout**



# Note: All drip irrigation systems should have the following components to ensure a long lasting properly functioning system.

- 1. Automatic or manual valve to activate the system
- 2. Filter to keep particles from getting in the system and clogging emitters
- 3. Pressure regulator to keep the system within the operating range of the emitters
- 4. Loop system to prevent clogging of system when tubing is cut or pulled apart
- 5. Air/Vacuum relief valve (one at each high point)
- 6. Automatic or manual flush valve to flush any debris out of system (low point and furthest point away from valve in each system)



| Today's | Today's Meter |       | Previous Meter |        | Cubic Feet | m.     |        | Gallons | Divided By<br># of Days |        | Average Gallons | Average Gallons    | Allocation for |
|---------|---------------|-------|----------------|--------|------------|--------|--------|---------|-------------------------|--------|-----------------|--------------------|----------------|
| Date    | Reading       | Minus | Reading        | Equals | Used       | 7.48   | Equals | Used    | Readings                | Equals | Used per Day    | per Period to Date | bining period  |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |
|         |               | -     |                | =      |            | x 7.48 | =      |         | ÷                       | =      |                 |                    |                |

| Today's<br>Date | Today's Meter<br>Reading | Minus | Previous Meter<br>Reading | Equals | Cubic Feet<br>Used | Times<br>7.48 | Equals | Gallons<br>Used | Divided By<br># of Days<br>Between<br>Readings | Equals | Average Gallons<br>Used per Day | Average Gallons<br>per Period to Date | Allocation for billing period |
|-----------------|--------------------------|-------|---------------------------|--------|--------------------|---------------|--------|-----------------|--|--------|---------------------------------|---------------------------------------|-------------------------------|
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | Ш      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | Ш      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |
|                 |                          | -     |                           | =      |                    | x 7.48        | =      |                 | ÷  | =      |                                 |                                       |                               |

# **Point Source Drip Irrigation Layout**



# Note: All drip irrigation systems should have the following components to ensure a long lasting properly functioning system.

- 1. Automatic or manual valve to activate the system
- 2. Filter to keep particles from getting in the system and clogging emitters
- 3. Pressure regulator to keep the system within the operating range of the emitters
- 4. Loop system to prevent clogging of system when tubing is cut or pulled apart
- 5. Air/Vacuum relief valve (one at each high point)
- 6. Automatic or manual flush valve to flush any debris out of system (low point and furthest point away from valve in each system)

#### HOW TO READ YOUR WATER METER



For a standard residential connection

CCWD reads your water meter every other month to determine your water use and water bill. You can also use the meter to:

- Monitor you water use
  - Watch for water leaks



#### **Locate Your Water Meter**

Locate the water meter on your property, usually located in a concrete box near the street labeled CCWD.

Note: Be very careful when removing your meter box lid. Use two large screwdrivers – one to stick in the hole and one to pry up the outer edge. Lift the lid just enough to slide it over to the side with your foot. Replace the lid by sliding it back into place. Be careful not to drop the lid on the meter!

#### Anatomy of the Water Meter

Most meters look like the one pictured to the right.

**Dial**: the dial will rotate when water passes through the meter. One full rotation of the dial equals 1 cubic foot of water or 7.48 gallons.

**Low Flow Indicator**: the Low Flow Indicator will rotate with very little water movement. Any water moving through the meter is detected so even small leaks will register.

**Odometer**: the odometer records total water use in a similar way as the odometer in your car records miles driven. The water meter odometer records water use in cubic feet and displays as follows: The digits from right to left represent 1 cubic foot, 10 cubic feet, 100 cubic feet and so on. Like a car odometer, the water meter odometer cannot be altered.

#### How to Monitor Your Water Use\*

*The following steps will show you how to determine how much water you use over a period of time.* Or use our online calculator at www.ccwater.com/conserve/water\_calculator.asp

- 1. Read the odometer and write it down completely. Then write down the date you read it. After a period of days (we suggest 7 days) read the odometer again and write it down and write down the date.
- 2. Subtract the first reading from the second reading. This is your water use in cubic feet during the period.
- 3. Multiply the water use by 7.48. This is your water use in gallons during the period.
- 4. Divide the water use in gallons by the number of days between readings. This is your average gallons per day during the period.

\* The worksheet provided on the reverse side will help to calculate your household water use using the steps above.

#### How to Watch for Leaks

Turn off all water indoors and outdoors including sprinklers, ice maker, etc... If the low flow indicator moves, this may indicate a leak in an appliance or pipe. If the meter shows no obvious movement, note the reading on the meter and return in 4 hours to see if there is any change. Note: if you use water during that time, the meter reading will change. If you do notice movement, check all appliances, faucets, toilets and other water sources for drips or leaks. *CCWD can provide information on companies providing leak detection services – contact Water Conservation at 925-688-8320*.



- Water meters measure cubic feet of water used. To convert cubic feet to gallons, multiply the number of cubic feet by 7.48.
- CCWD measures water use by units for billing purposes: 1 unit of water billed = 100 cubic feet = 748 gallons.

