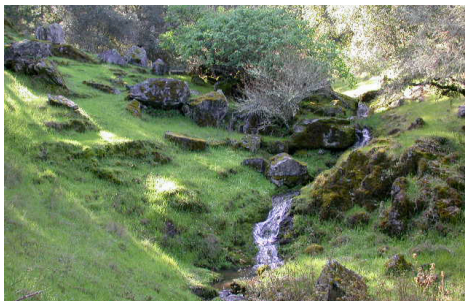
Salmon Creek Water Conservation Program

Conservation Strategy No.2: Residential Self-Survey for Efficient Water Use in Coastal California Communities

Coastal Conservancy



Overview

The residential self-survey is a tool for residents on community water systems or on their own water supply (well, spring, pond) that helps identify opportunities to conserve water through improving efficiency and understanding how water is used within the home and garden. It is a "do-it-yourself" saving water challenge that can result in tremendous savings in household water use.

Residents can complete the self-survey on their own. Water suppliers and community groups can promote use of the survey throughout the towns and rural areas by sponsoring educational self-survey workshops and neighborhood gatherings.

The survey includes a water-audit of all household water uses, indoors and outdoors. The audit identifies opportunities for assessing and then replacing or repairing inefficient fixtures and systems. In particular, the audit provides how-to steps for determining flow rates of faucets and showerheads, as well as the flush volumes of toilets; techniques for detecting leaks in the home and garden and information on leak repair; and data on irrigation needs based on climate conditions of the coastal region you live in. The survey also includes a Residential Water Use Calculator for determining the amount of water used at the residence, both indoors and outdoors. The Calculator is tailored to coastal California climates by geographic region.

Target community

This self-survey is designed for single-family residences with any water supply source. Metered water users can apply the specific information about using the water meter to help understand water use and detect leaks. The survey can also be used for multi-family residences by using the indoor portion for each unit of an apartment complex or condominium development, and using the outdoor portion of the survey for the common landscaped areas.

Potential effect

The 2003 study by the Pacific Institute *Waste Not Want Not: the Potential for Urban Water Conservation in California* reports the potential to save up to 40% of indoor water use in residences in California by installing efficient plumbing hardware and adopting practices to maximize water use efficiency. Pacific Institute further reports savings of 25% - 40% in outdoor water use through garden design and maintenance practices. Performing the self-survey will give a resident the information needed to estimate the savings potential at their home.

Implementation

There are two action steps for a household to take to complete this self-survey:

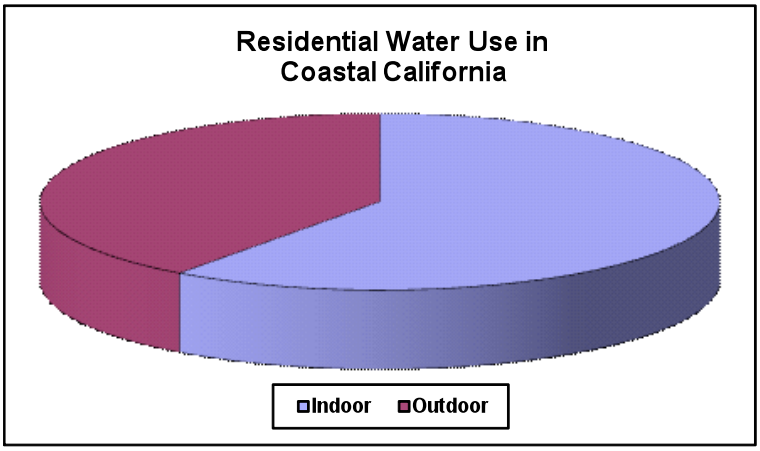
1) complete a water-audit of your home and garden water use, and

2) calculate your household water use according to your family size, the results of the audit and the region of the California coast where you live.

Before taking on these action steps, let's take a big-picture look at where water is used in homes in coastal California.

About residential water use in coastal California

The Pacific Institute estimates that 55-65% of all residential water use serves indoor needs in coastal California communities. Outdoor uses make up 35-45% of overall residential use. The graph below illustrates the breakdown of residential water use.

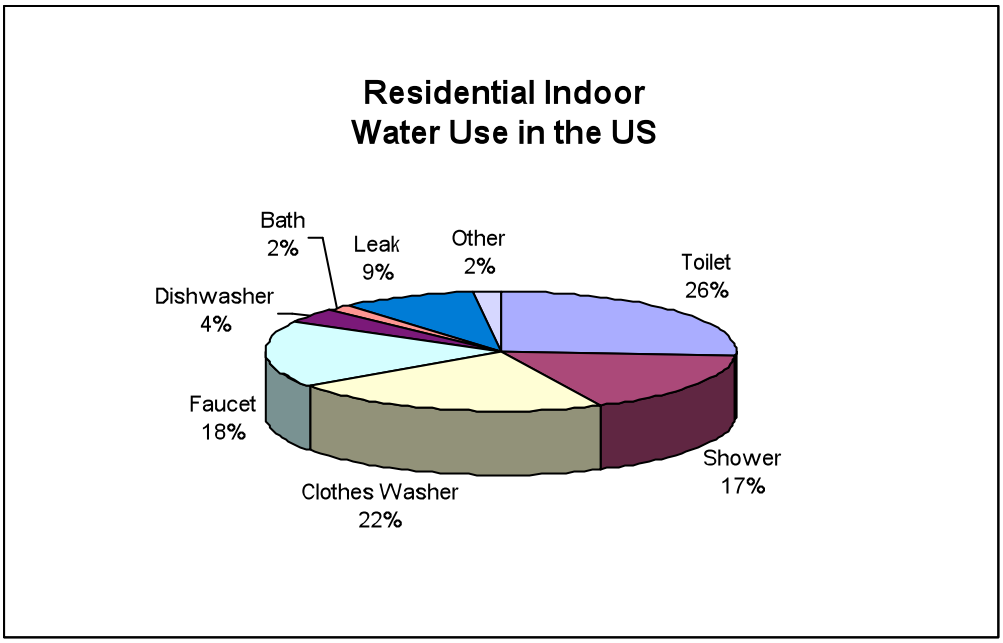


Actual residential use per person (called per capita use) varies according a number of factors:

- the age and efficiency of the plumbing fixtures in the home
- the size of the garden, types of plants, climate and efficiency of irrigation
- the presence of water meters (people use less when water is metered)
- the price of water (people use less when water is costly)

Average per capita residential indoor water use was measured in a 1999 study by the American Water Works Association (AWWA), *The Residential End Uses of Water Study*. Researchers physically measured water use at 100 single-family homes in each of 12 cities in the US (1,188 homes in all) using data-loggers installed on each home. Homes in the study had a mixture of efficient and non-efficient fixtures. The average per capita indoor use was 73 gallons per person per day. Assuming this represents only 60% of the residential per capita water use as illustrated above, adding outdoor water use brings the total estimated per capita residential water use to about 120 gallons per person per day.

A closer look at indoor water use based on the work of AWWA and Amy Vickers, author of the *Handbook of Water Use and Conservation: Home, Landscapes, Businesses, Industries, Farms*, is presented in the chart that follows. Clearly toilets, showers, faucets and clothes washers account for the majority of indoor water use. These fixtures are targeted for efficiency in the "water-audit" section of this self-survey.



Residential Water-Audit

The residential water-audit is a tool to determine the efficiency of the current water using fixtures in the home and garden, and to check for the leaks that most households have. You can save 25% or more on your water use (and your water bill if you are served by a community system) by going through the audit steps and taking the recommended simple actions. The audit tool includes numerous links to other web resources with helpful illustrations, guidance and even films illustrating how to become more water efficient today!

The water-audit consists of three sections:

1) checking for leaks,

2) auditing indoor water uses, and

3) auditing outdoor water uses.

Homes with water meters take different steps in Section 1 of the water-audit than homes without water meters.

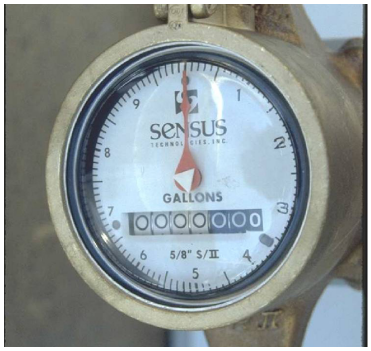
1) Checking for Leaks

Checking for leaks with a water meter

- Turn off all water using fixtures in the home and garden (including the ice maker).
- Locate the water meter – usually in the ground in a concrete box in the public right-of-way in front of the house.
- Check the meter to see if the "low flow indicator" (a small red or blue triangle or dial on the face of the meter) is moving, or if the sweep-hand going around the dial is moving. Meters vary in how the dials are configured. The picture on the left below is a fairly common type of water meter that reads in cubic feet (one cubic foot = 7.48 gallons). The picture on the right is a meter that reads in gallons.

Cubic Feet Meter

Gallon Meter



- Read the meter and record the meter reading similar to reading the odometer on a car. Most meters have a six- or seven-digit number on the face that shows the total number of gallons used since the meter was installed. On most meters the last digit of this number does not move. The large sweep hand registers for this last digit, revolving one time for every ten gallons or for every cubic foot (depending on the type of meter) of water use.
- Wait for one hour and read the meter again.
- If no water flowed through the meter during the hour, there are no leaks in the garden or house. You can go on to Section 2 of the audit – evaluating indoor water use.
- If the low-flow indicator is moving or if the meter reading shows that water flowed through the meter during the hour, there are one or more leaks. You now need to figure out whether the leaks are in the house, in the garden, or both.
- Locate and turn off the master house valve and master irrigation valve if you have them. The master house valve is usually located on a mainline serving the house, in line with a hose bib. The irrigation master valve is probably located on the irrigation system. With both valves off, check the meter again. If there is no longer any use through the meter, the leak is either in the house or on the irrigation system. If there is still use on the meter, there is a leak on the mainline and you will likely need a plumber to locate and fix the leak. After the mainline leak is fixed, go on to the next step to test if there are also leaks in the house or garden.
- To determine if there is a leak in the house, open the master house valve and check the meter again. If water is moving through the meter, there is a leak in the house. Testing for leaks in the house is covered in Section 2 of this audit.
- To determine if the leak is on the irrigation system, close the house valve and open the irrigation valve. If water is moving through the meter there is a leak on the irrigation system. Evaluating the irrigation system for leaks is covered in Section 3 of this audit.

Checking for leaks without a water meter

- Locate the point of connection of your house plumbing and the source water (well, spring, tank, etc).
- Visually inspect the piping from the point of connection to the point of entry to the house and to the connection to the garden watering system. Look for excessive plant growth, soggy soil, the presence of moss and water-loving weed plants along the entire path of the pipelines outdoors. If you find leaks, repair them immediately.
- In the house, check around all water using fixtures for signs of leakage – around toilet seals, under sinks, around the dish washer and at the inlet for the clothes washer. If you find leaks, repair them immediately. Checking for toilet leaks is covered in Section 2 of this audit.
- In the garden, inspect all piping from the point of connection to the main water system to the valves – the section of the irrigation system that is under constant pressure. If you find leaks, repair them immediately. Evaluating the irrigation system for leaks while in operation is covered in Section 3 of this audit.

2) Indoor Water Use

Toilets – To make sure your toilets are as efficient as possible, there are two important areas to test for each toilet in the home: 1) whether the toilet is leaking, and 2) the toilet flush volume. Check for toilet leaks even if your meter leak check in Section 1 resulted in no leaks.

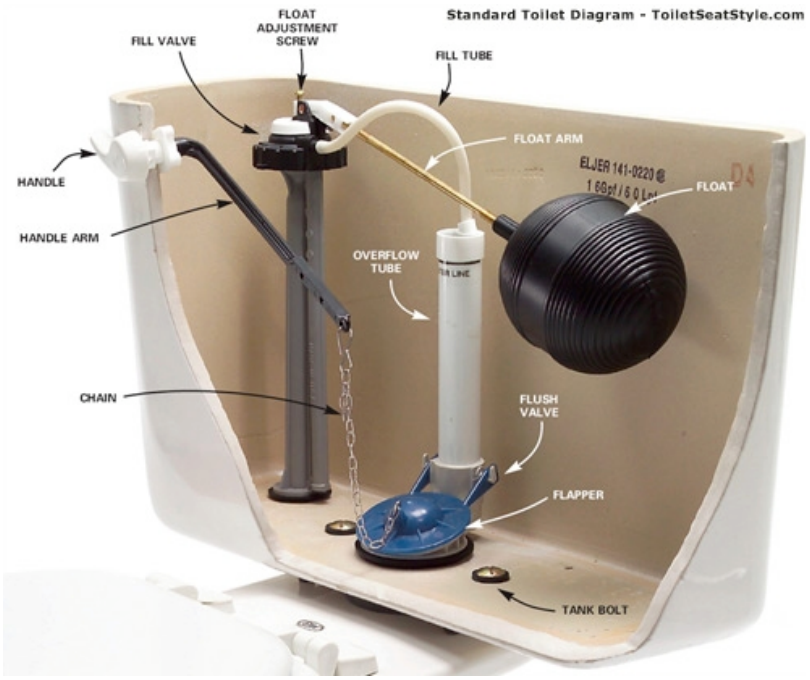
Toilet leaks

In addition to the instructions that follow, you can find illustrated information on testing for toilet leaks, and repairing leaks at: http://www.h2ouse.org/action/index.cfm and at the "Toiletology" web site at: http://www.toiletology.com/intro.shtml.

- Put several drops of food coloring in the tank of the toilet (if you have a coloring toilet sanitizer, remove it and flush the color away before this step).
- Wait 15 minutes and do not flush the toilet during this time.
- If colored water appears in the bowl you have a toilet leak from the tank to the bowl. Most often this is the flapper or an overflow leak. Use the illustration that follows to help problem solve a toilet leak with the steps that follow.
- Check the flapper to see if it is worn, if it fits into the flush valve snugly and if it is catching on anything. Replace the flapper if needed. When you shop for a replacement flapper, take the make and model of the toilet with you - make sure that the replacement flapper is the correct replacement for your toilet.
- To test for an overflow leak, sprinkle a small amount of talcum powder on top of the water in the tank. If the water moves toward the overflow tube, there is an overflow leak. Adjust the float arm to shut off the valve before water spills into the overflow tube.

Toilet flush volume

- Most toilets have the flush volume on the bowl rim between the seat and the tank, or the date of manufacture stamped on the inside of the tank. To determine flush volume based on manufacture date use the chart below. Note that since 1992, all toilets sold in the US must be 1.6 gallons per flush (gpf) or less. High Efficiency Toilets (HET) with an average flush volume of 1.28 gpf or less are now considered the wisest choice if purchasing a new toilet.



Toilet Flush Volume by Manufacture Date

Manufacture Date	Gallons per Flush
1980 and earlier	5-7 gpf
1980 – 1992	3.5 gpf
After 1992	1.6 gpf or 1.28 gpf (HET)

- If there is no flush volume or date on the toilet, you can calculate the volume of the flush by measuring the inside of the tank and level to which the water falls during a flush as follows:
  - Using a tape measurer, measure and record the length and width of the toilet tank.
  - Place the tape measurer straight down into the tank and make a note of the water level in inches.
  - Leave the tape in place and flush the toilet, making a note of the lowest water level before the tank begins to refill.
  - Subtract the second water level reading from the first to get the height reading.
  - Multiply height x length x width to get the flush volume in cubic inches.
  - Divide the cubic inches by 231 to convert to gallons.
  - Plan to replace older, high water using toilets with new water efficient models. The latest and most efficient HET toilets use an average of 20% less than the current standard of 1.6gpf. Some HETs use as little as 1.0 gpf.

Showerheads

Determine the flow rate of the showerheads in the home by going through the steps below for each showerhead. If the flow rate is greater than 2 gallons per minute (gpm), plan to replace with new showerheads. Check with your water utility to see if they provide water efficient showerheads to their customers. If they don't, ask that they start a showerhead and aerator distribution program!

- To calculate the flow of a showerhead, turn it on to the normal flow rate that you use.
- Using a large water pitcher, a bucket, or jar with a handle, hold the container under the showerhead and capture all flow for 10 seconds.
- Measure the quantity of water collected (using a measuring cup or known volume container) and multiply the volume by 6 to calculate the gpm. One gallon holds 4 quarts, or 16 cups.

Faucets

Check all faucets for leaks and to determine flow rate.

- Check for leaks by turning the faucets off and visually inspecting for leaks. Even a slow leak is a big water waster – a drip a second wastes almost 200 gallons a month. For information on repairing faucet leaks visit: http://www.h2ouse.org/action/index.cfm
- Determine the flow rate of all faucets in the home by going through the steps outlined above in the showerhead section. If the flow rate of the bathroom faucet is greater than 1.5 gpm or the kitchen faucets is greater than 2.2 gallons per minute, plan to change the faucet aerators (the small fitting that threads into most faucets) to lower flow. Utility sink faucets and bathtub spouts typically have higher flow rates because they are designed to fill a volume fast. Check with your water utility to see if they supply low flow faucet aerators to their customers. If they don't, ask that they start a showerhead and aerator program.

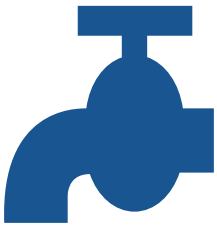
Bathtub

Turn on the water to the bathtub and divert water to the showerhead to check for leaks. When the water is diverted to the showerhead, the water flow should stop from the tub faucet. If flow continues, the shower diverter needs replacement or repair.

Clothes washer

Check the supply lines when the machine is in operation for leaks. If you have a front-loading clothes washer, consider replacing with a water and energy efficient EPA rated EnergyStar rated model which may reduce water use by 50%. Find out more at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CW

Dishwasher



The supply line is not visible in most dishwasher installations, so check the flooring around the dishwasher periodically for signs of water leaks or seepage. Consider replacing any pre-1994 machines with a water and energy efficient EPA rated EnergyStar rated model. Find out more at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DW

Pressure regulation

Some homes may have too much water pressure, which can cause household appliances to malfunction and wear out. Most household appliances are designed to operate best with no more than 50 psi (pounds per square inch) of water pressure. If water flows from faucets and showers with excessive force, or pipes vibrate or make noise when water is flowing, or fixtures such as your dishwasher make excessive noise in operation, your water pressure may be high. Have a plumber check the pressure inside the home and outside the home. If pressure exceeds 60 psi, install a pressure regulator at the main supply source (after the water meter if you have one). This will save the life of appliances and reduce water use. A pressure regulator also provides protection to your house from unexpected water pressure surges.

Other

If you have other water uses in the home such as an ice maker, check the supply lines to those uses for proper operation.

3) Outdoor Water Use

This section of the water-audit is designed to check the repair and efficiency of your current gardening watering system. Outdoor watering is often the most inefficient water use in the household, and most studies show savings potential of 25 - 50% through good garden watering practices. For more information on a comprehensive approach to designing and caring for your garden in rural coastal California communities, visit the Low Water Gardening Conservation Strategy at salmoncreekwater.org

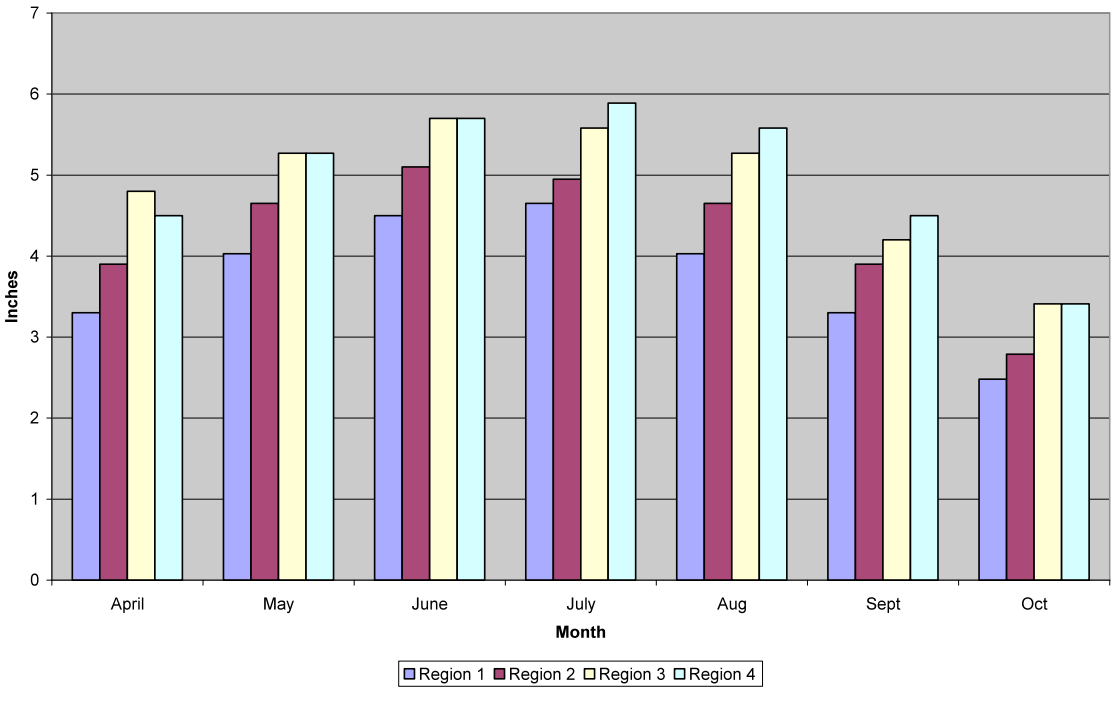
- Checking the mainline of the irrigation system for leaks was covered in Section 1 of this water audit.
- If you have an in-ground watering system (automated or not), run each valve on the system and observe the system in operation. This is something you should do every spring and at least once during the summer. Look for the following and adjust or repair as recommended below:
  - Visually inspect the valves, pipelines, irrigation heads and drip emitters for leaks or malfunction. Look for excessively wet areas, soil mounding, or water seeping from planted area/sidewalk edges. Drip irrigation lines are low-pressure so leaks are not as evident as they are on high-pressure overhead sprinkler lines. Walk each drip line and observe whether the line is intact, the emitters are working (not clogged) and if the fittings are intact. Fix any leaks or broken equipment.

- For overhead sprinklers, observe each head in operation to make sure that the full spray pattern is operating (if not, unclog the nozzle), the heads are upright (if tilted, straighten), rotors are rotating (if not, clean the gears in the head or replace), coverage is even (if not, adjust nozzles), the spray is not obstructed by plants (if so, trim plants or adjust spray), and if the spray is hitting the target plants (if not, adjust the spray).

- For drip irrigation, make sure the emitters are placed at the appropriate distance from the plants and that all emitters are dripping at approximately the same rate (if all emitters on the line are the same flow rate emitter).

- If you have an automatic irrigation controller check the schedule for each valve. The schedule includes the days of the week or month the valve runs (which is scheduled in the "program"), the length of time it runs each time it turns on (the "run-time") and the time or times of day that it waters ("start-time/s"). Irrigation controllers have the capability to water with "multiple start times" which is especially valuable with heavy soils (clay-type soils) or on slopes. Using repeat start times allows you to apply the water slowly – at a rate the soil can absorb. For example – watering for 15 minutes by applying three 5-minute applications separated by an hour each will allow more water to soak in than watering 15 minutes at one time. This is called "cycle irrigation" and it is a no-cost way to save water today!
- If you hand water, check all hose fixtures for leaks and install new washers as needed. If you use a hose-end sprinkler to water the garden, install a mechanical water timer between the hose bib and the hose that can be set for a certain amount of time or flow, and will shut off automatically when the watering is done.
- Inspect all planted areas to make sure that mulch covers all non-planted areas and the soil under all plantings.
- Know your climate and water according to the plants' water needs. The California Irrigation Management Information Systems (CIMIS) network of weather stations provides historical and current data about plant water needs throughout our state. Coastal California has four regions, each with different irrigation needs. A map illustrating these regions is at: http://www.cimis.water.ca.gov/cimis/pdf/eto-map1.pdf. The four regions are described in the table below.

Reference ET of Four Coastal Califonial Regions–Inches/Month



- Identify your region by the description or the map. The graph that follows shows the reference evapo-transpiration (ET) by region during the typical months when irrigation might be needed. Reference ET is an estimate of water needed by very high water use plants like turf-grass. Most garden plants need only 1/3 to 1/2 of reference ET, and most drought resistant plants will need no supplemental irrigation once established. More information on plant water use is in the next part of the survey – the Water Use Calculator.

Residential Water Use Calculator

Calculate your individual household water use by answering the questions in the Residential Water Use Calculator, using the results from the water-audit wherever they can be applied. If you are not sure about the answer, fill in your most reasonable estimate for an answer. This tool can be used to test out some "what if's" about your water use, such as:

- What if we change the lawn to drought-resistant shrubs?
- What if we get a front-loading EnergyStar clothes washer?
- What if our young adult son/daughter moves out?
- What if there is a drought and we have to cut our water use in half – how will we do it?

Residential Water Use Calculator

To download the interactive spreadsheet version of this calculator, go to: http://www.salmoncreekwater.org/water-use-calculator

Coastal Regions of California – from CIMIS (Calif. Irrigation Management Information Systems)

Region 1	Coastal plains and heavy fog belt - Most of the immediate coast North of Santa Barbara, except the Monterey Bay and San Francisco Bay
Region 2	Coastal mixed fog areas - Monterey Bay, East side of San Francisco Bay and portions of the immediate coast south of Santa Barbara
Region 3	Coastal valleys and plains and North coast mountains - just East of Region 1 in Del Norte, Humboldt, San Mateo, Santa Cruz and Santa Barbara Counties
Region 4	South coast inland plains and mountains North of San Francisco - just East of Region 1 in Mendocino, Sonoma, Marin, Ventura, Los Angeles, Orange and San Diego Counties

RESIDENTIAL WATER USE CALCULATOR – for Coastal California

Instructions: Fill in the lightly shaded areas with input and calculated water use in the darker shaded areas

Calculating Residential Water Use in Coastal California				
A - Household Information		**Input**	**Units**	**Calculated Water Use**
1-HI	How many people are in your household?		People	
2-HI	In which Region of the coast is your residence? (see Coastal Regions Table on previous page)		Region	
B - Indoor Water Use				
	SHOWERS/BATHS			
1-S	How many showers are taken each day in your household?		Showers	
2-S	What is the average length of each shower?		Minutes	
	Enter 6.3 if unsure			
3-S	What is the flow rate of your showerhead (from the audit- average if more than one shower)?		Gallons/ minute	
	Shower water use – Calculate: Number of showers X length of shower X showerhead flow rate			Gallons per day
4-S	How many baths are taken each week in your household?		Baths	
4-S	What is the volume of your bathtub?		Gallons	
	Enter 35 if unsure			
	Bath water use – Calculate: Number of baths X volume of bath / 7days per week			Gallons per day
	TOILETS			
1-T	How many times a day on average does each person flush the toilet in your house?		Flushes	
	Enter 5.1 if unsure			
2-T	How many gallons does your toilet flush (from the audit - average if more than one toilet)?		Gallons/ flush	
	Toilet water use – Calculate: Number of flushes X number of people X volume of toilet flush			Gallons per day
	FAUCETS			
1-F	How many times a day on average does each person use the faucet to brush teeth, wash hands, etc.?		Times	
2-F	What is the average flow rate of your faucets (from audit – kitchen and bath faucets only)?		Gallons/ minute	
3-F	How many minutes on average does the water run with each use?		Minutes	
	Faucet water use – Calculate: Number of uses X number of people X number of minutes X faucet flow rate			Gallons per day

	WASHING DISHES			
1-DW	How many times a day are dishes washed by hand?		Times	
2-DW	How many minutes does the water run during each washing?		Minutes	
	Hand washing use – Calculate: Number of times X minutes X faucet flow rate X faucet flow rate (from 4-F)			Gallons per day
3-DW	How many times a week is the dish washer run?		Times/ week	
4-DW	How many gallons per load is your dish washer?		Gallons/ load	
	Average for pre-1994 machines is 10 gallons; average for EnergyStar is 6 gallons			
	Dish washer use – Calculate: Number of times X gallons per load / 7 days per week			Gallons per day
	LAUNDRY			
1-L	How many loads of laundry are done each week in your household?		Loads/ week	
2-L	How many gallons per load are used by our washing machine?		Gallon/ load	
	Average machine uses 42 gallons; average for EnergyStar is 24 gallons			
	Laundry water use – Calculate: Number of loads X gallons per load / 7 days per week			Gallons per day
Total Indoor Daily Water Use – Add all uses				Gallons per day
Per person indoor water use – divide Total Indoor Daily Water Use by number of people in the home				Gallons per person per day
Annual indoor water use – multiply Total Indoor Daily Water Use by 365				Gallons per year

Annual Irrigation Demand by Coastal Region

Irrigation Demand - Gallons per Square Foot Total for Irrigation Season (Apr – Oct)				
Plant Types	**Region 1**	**Region 2**	**Region 3**	**Region 4**
High water use (e.g., turf, annuals, planters, some vegetables)	16.38	18.65	21.33	21.71
Moderate water use (e.g., many ornamentals, citrus, some vegetables, cut flowers)	10.81	12.31	14.07	14.33
Low water use (e.g., most CA native and Mediterranean ornamental trees and shrubs, grapes, pears, figs, many perennials)	5.40	6.16	7.04	7.16
Drought resistant (e.g., some CA native and Mediterranean ornamentals, many conifers and endemic species)	0	0	0	0

C - Outdoor Water Use				
	GARDEN - Refer to your Coastal Region	**Input**	**Units**	**Calculated Water Use**
	Region ____ high water use factor (from Irrigation Demand by Region Table)		Gallons per SF per year	
	Region ____ moderate water use factor (from Irrigation Demand by Region Table)		Gallons per SF per year	
	Region ____ low water use factor (from Irrigation Demand by Region Table)		Gallons per SF per year	
1-G	If you have a lawn, what is the area covered?		Square feet	
	Lawn water use – Calculate: Square feet X gallons per SF for high water use (from above) / 365			Gallons per day
2-G	If you have a vegetable garden, what is the area covered?		Square feet	
	Vegetable garden water use – Calculate: Square feet X gallons per SF for moderate water use / 365			Gallons per day
3-G	If you have containers, what is the surface area of all containers?		Square feet	
	Container water use – Calculate: Square feet X gallons per SF for high water use / 365			Gallons per day
4-G	If you have flower beds, what is the area covered?		Square feet	
	Flower beds water use – Calculate: Square feet X gallons per SF for moderate water use / 365			Gallons per day
5-G	If you have ornamental plantings, what is the area covered?		Square feet	
	Ornamental plantings water use – Calculate: Square feet X gallons per SF for high water use (from Table) / 365			Gallons per day
6-G	If you have drought resistant plantings, what is area covered?		Square feet	
	Drought resistant water use – ZERO water use once established			ZERO
	OTHER			
1-O	How long do you use the hose for other than garden watering each week?		Minutes	
	Other water uses – Calculate: Minutes X 7 gallons per minute / 7 days per week			Gallons per day
Total Outdoor Daily Water Use – Add all outdoor uses				Gallons per day
Per person outdoor water use – divide Total Outdoor Water Use by number of people in the home				Gallons per person per day

Annual outdoor water use – multiply Total Outdoor Water Use by 365				Gallons per year
D - Total Household Water Use				
	Gallons per household per day - Add Total Indoor Daily Water Use and Total Outdoor Daily Water Use			Gallons per household per day
	Gallons per person per day – Add Per person indoor water use and Per person outdoor water use			Gallons per person per day
	Gallons per household per year - Add Annual Indoor Water Use and Annual Outdoor Water Use			Gallons per household per year
	Acre feet per year – Divide Gallons per household per year by 325,851 (gallons in an acre-foot)			Acre Feet per household per year

Tools

Web resources:

H2Ouse at http://www.h2ouse.org/action/index.cfm

US Environmental Protection Agency web page Indoor Water Use in the United States:
http://www.epa.gov/WaterSense/pubs/indoor.html

Information about fixing toilets and more is at the Toiletology web site:
http://www.toiletology.com/intro.shtml

The EnergyStar Program lists water efficient appliances for the home at:
http://www.energystar.gov/index.cfm?c=products.pr_find_es_products

The coastal area map from CIMIS (California Irrigation Management Information Systems) that is used on the water use calculator is at: http://www.cimis.water.ca.gov/cimis/pdf/etomap1.pdf

Additional References Used:

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Coastal Conservancy

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