SAN DIEGO

SUSTAINABLE LANDSCAPES GUIDELINES

A Watershed Approach To Landscaping

Sustainable Landscapes Program Partners

Development of these guidelines was a collaborative effort by the six Sustainable Landscapes Program partners identified below:

San Diego County Water Authority

The City of SAN DIEGO

County of San Diego Watershed Protection Program

SURFRIDER FOUNDATION SAN DIEGO COUNTY CHAPTER

CALIFORNIA AMERICAN WATER

ASSOCIATION OF COMPOST PRODUCERS "We Build Healthy Soil"

This guide is intended to be used for general informational purposes; the guide does not take the place of professional advice. Please consult with appropriate landscape professionals for site-specific advice prior to making changes to your landscape or irrigation system.

Department of Water Resources State of California

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water smart SAN DIEGO COUNTY WATER AUTHORITY

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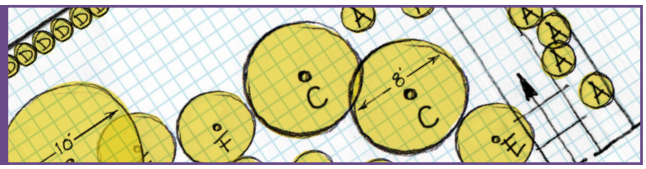

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photo: Amelia B. Lima

What is a **Watershed** approach to landscaping?


photo: Pamela Berstler

This book is intended to help us think more sustainably when we evaluate, plant, build, and maintain our landscapes.

The watershed approach considers every garden as though it were a mini-watershed, holding onto or cleaning all the water that falls on it and nurturing a diverse habitat of plants and insects. Each mini-watershed can be controlled by the people who steward it. The result is that our collective actions restore our greater watersheds and cities.

This book is organized in a way that will help you change your landscape, whether you do it yourself or work with professionals. You may not be able to do everything at once, so planning is essential.

First, learn about your local climate and understand your unique Place in San Diego County.

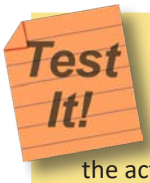
Then turn your attention to building healthy living Soil, selecting climate-appropriate Plants, and learning ways to efficiently Water your landscape with both rainwater and irrigation.

The Project section gives a checklist and examples for getting the job done.

Throughout each chapter, you get to practice some of the ideas outlined in the section. While the book is organized to help you remove lawn and build a more sustainable garden, you may need to move back and forth between chapters, working and referencing different elements of the process and checking out the rules and techniques.

For example, capturing rainwater and irrigating correctly are both covered in the Water chapter, while techniques for removing grass without chemicals can be found in Soil. You'll need to understand both chapters to build a garden that acts like a sponge.

Plan to work



"Test It!"

Look for this icon throughout the book to evaluate your garden and find out more about the specific conditions of your landscape that will determine the actions you need to take.

Clean and Edit

Remove trash, weeds, dead plants, old furniture, etc. Decide which (if any) healthy plants will continue to thrive in your new landscape, and remove everything else. A clean slate will make it easier to see what's going on and help you envision the renovations to come.

Change One Section at a Time

But plan to tackle it all eventually. Home gardeners often haphazardly add a plant here and there, and end up mixing together plants with different needs. Instead pick one section (or more) of your garden that you can completely remodel. After your whole garden is converted and growing, you can fill in a few plants as needed every winter, when it's cooler. Start with your front yard!

Work the plan.

"Do It!"

Look for this icon throughout the book to transform, create and maintain your own sustainable landscape.

Scope Your Project

Nothing like a deadline to get things done! But how much can you realistically do at one time? If your budget is limited, you may want to make small fixes first and then bigger changes in a year or two. Follow the Project Checklist (*see p. 53*) to determine the logical steps for making changes. For example, don't dig up your irrigation and then select new plants; irrigation design always follows planting design.

Remove Your Lawn

We show you how to remove your grass without chemicals and build healthy living soil to create a gorgeous garden.

Contour For Rain

Move your soil around to capture rainfall in your garden. After you've started planting, you don't want to be moving soil.

Select Your Plants

Use this book as a guide for selecting unthirsty plants that will thrive in your San Diego climate zone. Once you've selected your plants, you'll want to group them by their water needs. We show you how in Plants.

Irrigate Intelligently

Much of your irrigation system is below ground, so some planning is required before installing plants and finishing your garden. If you are installing a surface drip system, put plants in the ground before completing the irrigation. If you are adjusting/updating your existing spray system, do any trenching and moving of sprinklers before you plant, and fine tune after.

Compost and Mulch

Don't forget to add these secret ingredients for a healthy garden.

Tend With Care

Water, weed, prune and most importantly, spend some time in the garden observing it. Your new landscape should require less care than a lawn. So, give your garden some love, but don't overwater or reach for the fertilizers and sprays!

Garden like a pro.

"Guidelines"

Look for this icon to find rules and regulations governing landscaping in San Diego. Some apply only to professionals and some apply only to commercial projects. When professionals transform a garden, they can't afford to fail. So, follow their lead for success and read through the details.

"Resources"

Look to the back of the book for additional resources and information.

Moderate **Low** **Very Low**

Wherever we have provided plant selections, we identify them by their water requirement by placing them on a colored background: Blue for MODERATE water use, Yellow for LOW water use, and Red for VERY LOW water use. You can use this color coding to help you group plants by their water requirements in your new landscape, making it easier to irrigate them properly.

The Butterfly icon indicates plants that support the life cycle of butterflies.

Need help getting the job done? *www.WaterSmartSD.org*

The San Diego County Water Authority holds free classes for people wanting to learn more about WaterSmart landscapes. Professionals are standing by, eager to help you. Landscape designers, landscape architects, landscape contractors and irrigation specialists can help redesign your garden, coach you through the process, or actually do the installation. If you work with a gardener, make sure they understand what you're doing and why. Seek certified professionals who are familiar with sustainable landscapes.

San Diego is a **Unique** place


photo: Wikimedia Commons


photo: courtesy California Dept. of Water Resources


photo: courtesy San Diego Fire-Rescue Department

A diverse range of habitats used to cover San Diego County. Streams and lakes conveyed and captured rainwater. Wetlands lined the coast and functioned as natural filtering systems and a buffer from major storms. Since there was no pavement, rainwater sank into the soil, replenishing groundwater and keeping streams flowing.

The most important goal we can set with sustainable landscaping is restoring these natural functions. The more you understand what makes San Diego so special and use this information in your landscape plans, the more successful your garden will be.

Water Resources are limited and rainfall is seasonal, but the native plants, insects, and creatures have evolved to thrive in this arid climate. San Diegans, however, rely on imported potable water and limited groundwater resources for survival. Sustainable landscapes must harvest rainfall and use climate-appropriate plants so they do not rely on precious imported water.

Biodiversity is important. Habitat loss in San Diego County threatens close to 300 native plant and animal species, ranging from native grasslands to the Fairy Shrimp; more species are threatened here than in any county in the nation. Sustainable landscapes nurture local **endemic** species of plants and animals. (**Endemic** means they are native species found nowhere else in the world).

Canyon Ecosystems are natural filters, removing pollutants before they reach rivers, ponds, lakes, beaches and oceans. Healthy canyons protect against land erosion, reduce downstream flooding and provide a home to many of San Diego's native species. If you are landscaping in a canyon, you need to take the canyon's wetland function into consideration in your design.

Wildland Interface and Areas of Special Biological Significance are undeveloped or protected. If you live in a wildland interface area, your landscaping considerations are different than those for more densely populated settings. San Diego County has two Areas of Special Biological Significance (ASBS), that are especially endangered by polluted runoff. These locations (La Jolla ASBS and the San Diego-Scripps ASBS) are adjacent and extend from the northern bluffs of La Jolla through to the UC San Diego campus of the Scripps Institute of Oceanography.

Sensitive Habitat Guidelines

If you live in a Wildland Interface Area or Area of Special Biological Significance, you have a special responsibility to:

- Manage/minimize/protect against erosion (*see p. 28*)
- Minimize pollution (trash/debris, animal waste, chemical runoff)
- Irrigate carefully, do not under or overwater
- Select local native plants whenever possible
- Avoid planting invasive species
- Maintain your property with consideration for fire *(see p.26)*

You live within a **Watershed**

Your landscape is part of one of San Diego's sixteen watersheds. All the rain falling on the eastern side of the Tecate Divide ridgeline drains into the desert aquifers and the Salton Sea. Everything west of the Tecate Divide drains into the various canyons, streams, Western aquifers, and to the Pacific Ocean.

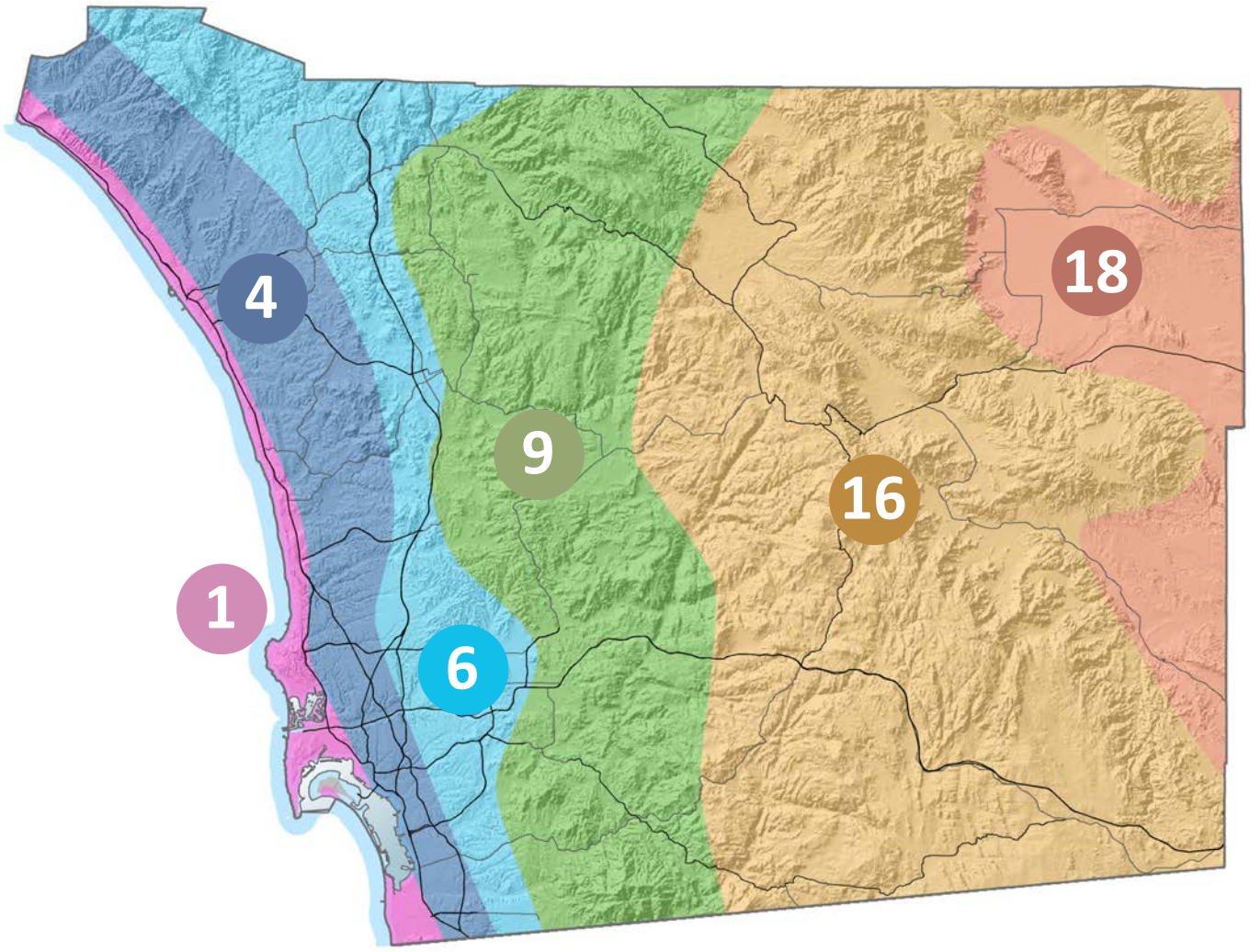
Do It!

Find Your Place in a Watershed

www.ProjectCleanWater.org

Which watershed do you live in? Find out more about the streams, rivers, aquifers, riparian areas and beaches that your landscape impacts. Do your part at home and in your neighborhood to keep the rest of your watershed healthy and flowing clean.

San Diego's **Climate** zones



Garden with your local climate.

San Diego County can be divided into six climactic zones: Coastal, Coastal Inland, Upland Central, Transition, Mountain, and Desert. Each region presents unique challenges for plants and within each zone there can be a great deal of variation (a microclimate) in temperature, sun exposure, soil type, available water and wind exposure, even within one garden.

Evapotranspiration (ET) is the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants. ET is a key descriptive element of climate in a particular area.

Reference Evapotranspiration (ET_o) is a baseline against which all plant water needs are measured. ET_o is the locally calculated amount of water in inches over some period of time required by a reference plot of cool season turfgrass. The California Irrigation Management Information System (CIMIS) maintains a statewide system of weather stations and reference plots, and has identified the six main ET_o zones in San Diego County. In San Diego region's metropolitan areas, annual ET_o will vary from about 33 inches to 56 inches, increasing as you move inland.

Understanding ET_o in your area is the first step toward determining how much water your landscape will require as you make your plant selections *(see pp. 22-23)*.

Need help finding your climate zone?

Sunset Western Garden Book

https://www.sunset.com/garden/new-sunset-western-garden-book

This book provides lots of great information about climate zones throughout San Diego County and plants adapted to these climates, including information about their water use, their form and their estimated size at maturity.

Zone 1: Coastal Prairie

Immediate Coastal areas are strongly influenced by the ocean and cold air that comes down from the mountains to the mouths of canyons. The zone has a mild marine climate resulting from the warm Pacific Ocean. Winters are mild, summers are cool and there is always some moisture in the air, characterized by dense fog and marine layer. Most plants are safe from killing frost in this zone. Winter lows average 48° F and average annual temperatures are in the low 60's (° F). Rainfall averages just 10 inches per year, but both dense morning fog and higher humidity provide moisture to plants, so the ET_o for this area ranges from just 1.0 inch in January to 4.65 inches per month in July, and annually just 33 inches. Coastal Strand plant communities dominate. Plants in this zone face salt exposure, whether from direct ocean spray or airborne salts, and if not adapted to tolerate this excess salt, will struggle.

Zone 4: South Coast Inland

South Coastal Inland areas are just inland from the beach, or on high bluffs above the coastline where you can feel the ocean breeze but can't taste the salt in the air. Considered a thermal belt, this area has less fog and humidity than immediate coastal areas, as well as higher temperatures. The result in an ET_o of 1.86 inches monthly in winter to 6 inches monthly in summer, and annually 47 inches. Coastal Sage Scrub communities predominate, while Coastal Prairies are found where water is more available, in places with heavier clay soils and more groundwater.

Zone 6: Upland Central

This higher elevation coastal area gets influences from both the moist coastal air and the dry interior air. This area has low annual rainfall, averaging 10 inches per year, with moderate humidity, morning fog and wind. ET_o for this zone ranges from 1.86 inches monthly in winter to 6.50 inches monthly in summer, and annually 49 inches. Coastal Sage Scrub is the dominant plant community here, with Chaparral increasing in the foothills and canyons.

Zone 9: Transition

This marine to desert transition area is more inland between the ocean-influenced areas and the dry desert areas. The zone has a combination of thermal belts and cold-air basins and hilltops with occasional marine influence. A wide variety of plants are supported in this area, and the climate influences within a garden can vary from high fog to dry Santa Ana wind conditions. This zone is an excellent citrus growing region. ET_o ranges from 2.17 inches in January to 7.44 inches in July and 55 inches annually.

Zone 16: Mountain

Steep slopes, variations in sun and wind exposure, shallow soils and heavier rainfall affect plants in the mountain regions. Average annual rainfall is 30 inches here, and wet years may bring 45 inches or more. Exposed mountainsides, sheltered canyons, shady stream and riverbanks host plant communities from South Oak Woodland and Coastal Sage Scrub to Chaparral. ET_o ranges from 1.55 inches in January to 9.30 inches in July with 62.50 inches annually.

Zone 18: Desert

Dry and hot conditions, with cold nighttime temperatures, define desert areas and the plant communities that thrive in them. Humidity is very low and water is scarce. Annual rainfall is sometimes as low as 2.5 inches, and averages just 6 inches during a season. ET_o in January is 2.48 inches, rising to 6.90 inches by April and 9.61 inches in July. Annual ET_o is 71.60 inches.

CIMIS

California Irrigation Management Information System

www.cimis.water.ca.gov

Use this website for more detailed information from local weather stations, as well as general information about evapotranspiration zones that may be used to help in water management, water budgeting, designing, planning and scheduling irrigation systems.

Do It! Find Your San Diego Climate Zone!

Coastal Prairie
CIMIS Zone 1
Sunset Climate Zone 24

South Coast Inland
CIMIS Zones 4
Sunset Climate Zone 23

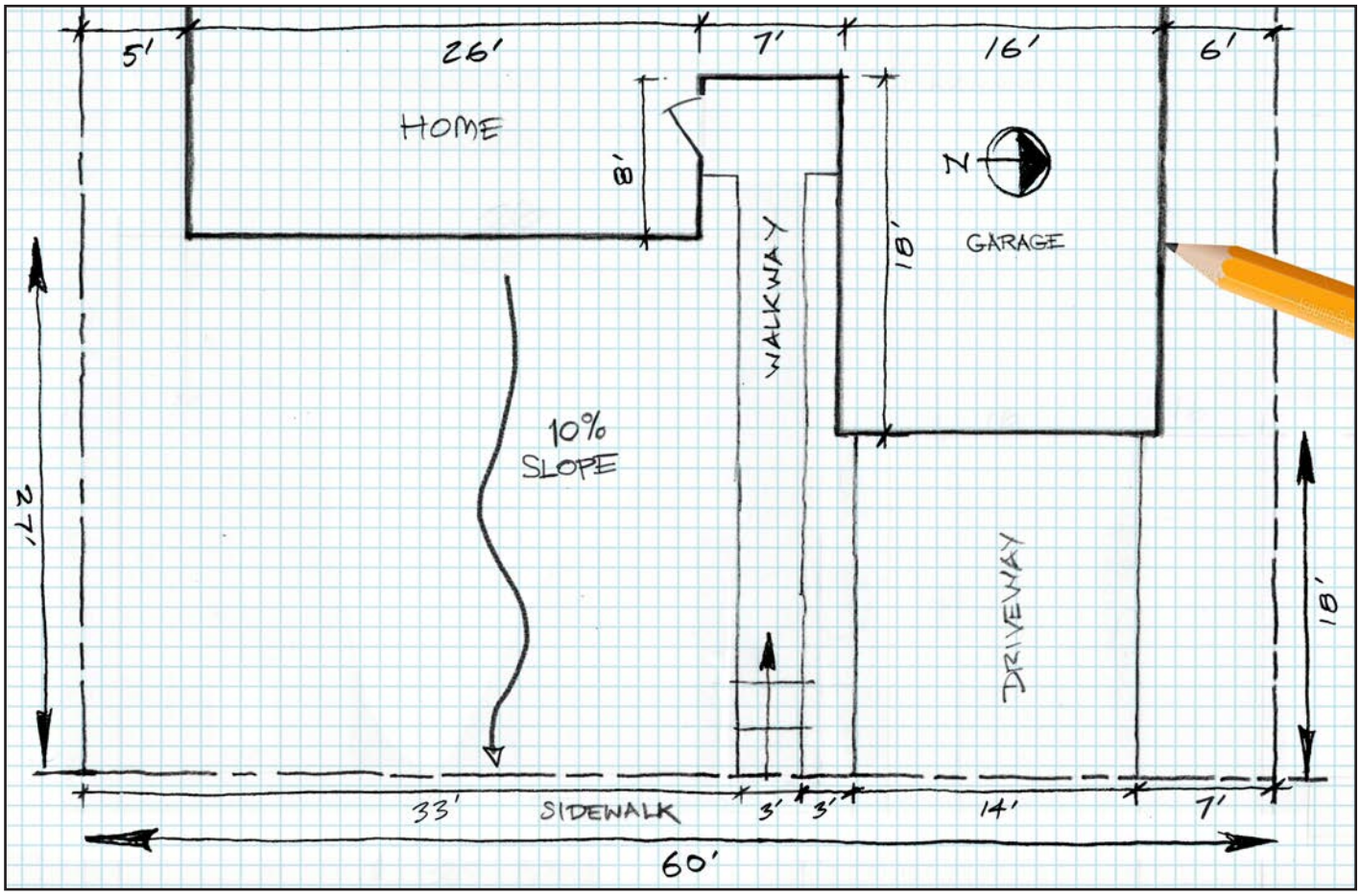
Upland Central
CIMIS Zone 6
Sunset Climate Zones 20, 21

Transition
CIMIS Zone 9
Sunset Climate Zones 20, 21

Mountain
CIMIS Zone 16
Sunset Climate Zones: 7, 18, 19

Desert
CIMIS Zone 18
Sunset Climate Zones: 11, 13

Your yard is a **Mini-Watershed**



Measure to Make Your Site Plan

Measure your site. Once you've got the dimensions, trace the lines cleanly on a sheet of grid paper. Make 10 copies that are dark enough to still see the grid. You will use each of these sheets to evaluate and plan the changes for each aspect of your landscape.

Try using 1 square = 1 foot. Depending upon the size of your property, most projects can use a 1/4 inch = 1 foot scale.

Are there plants in the landscape that you are ready to get rid of?
Are there any hard surfaces you'd like to change?
Take some photos and mark where they are located on your site map.

Use your smartphone or a compass to find North and also mark it on the map.

Need help finding dimensions? *www.WaterSmartSD.org*

San Diego County Water Authority classes show you how to make your own site map.

arcc.sdcounty.ca.gov/Pages/parcelmaps.aspx

Find the dimensions, shape and orientation of your property at the San Diego County Assessor's website There is a $2.00 fee for using this site. Go to Assessors Services and Select "Assessors Parcel Maps." Click on "How do I obtain...?" Click on "Parcel Search." Enter your Street Address or Parcel # and click "Search." Pay as instructed. Download after you pay.

www.google.com/maps/ Look at Google Maps for help placing building and trees on your property. Just type in your address. zoom in. and use the Satellite view.

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Your yard has a **Slope**

Slopes and Hillsides Have Special Rules

Specific landscape design, construction and maintenance practices apply to hillsides. During construction on hillsides steeper than 33% grade, and on partially eroded or eroding slopes, additional measures should be taken to protect both hillsides and waterways (*see p.28*). If in doubt about your skills, consult a professional for specific advice.

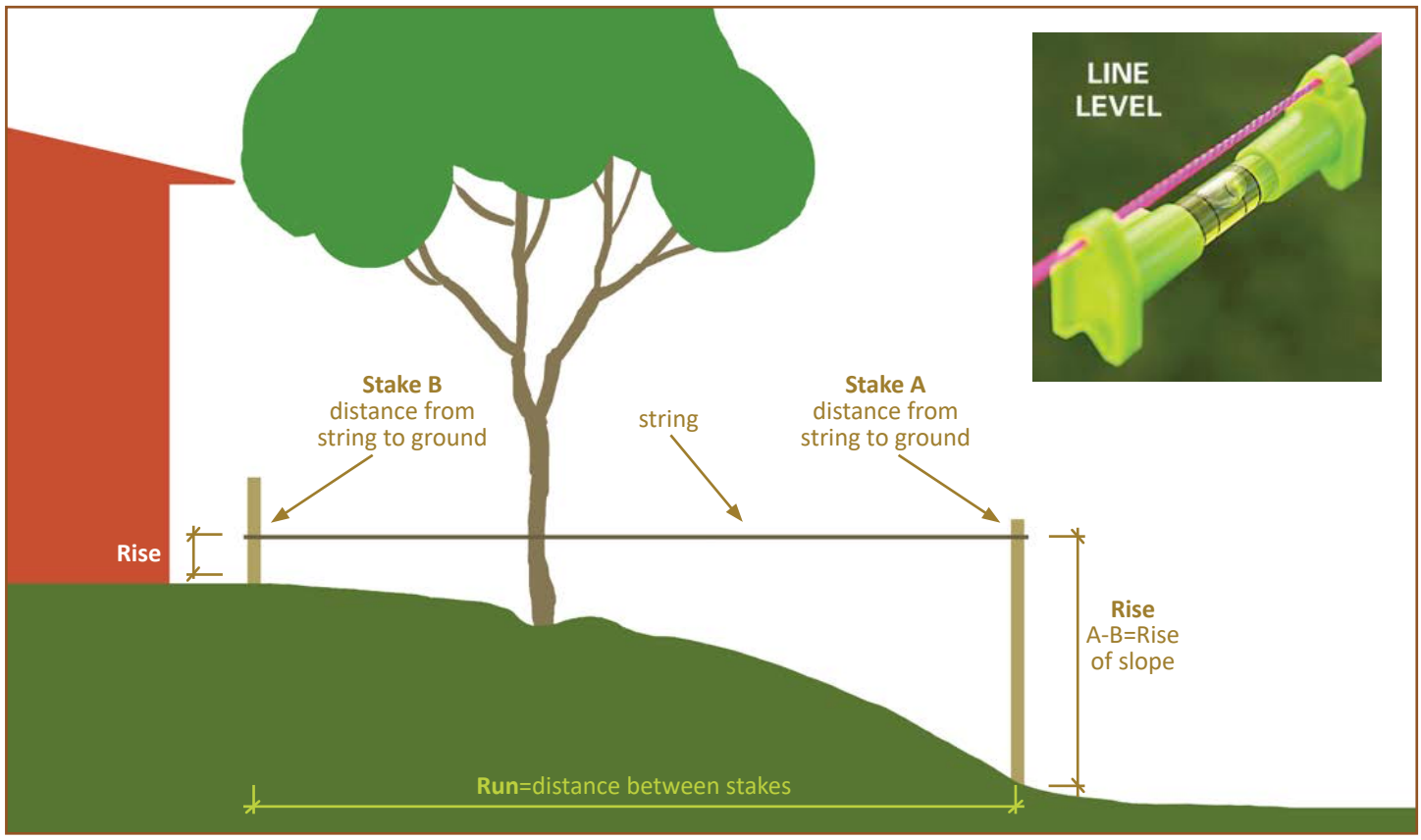


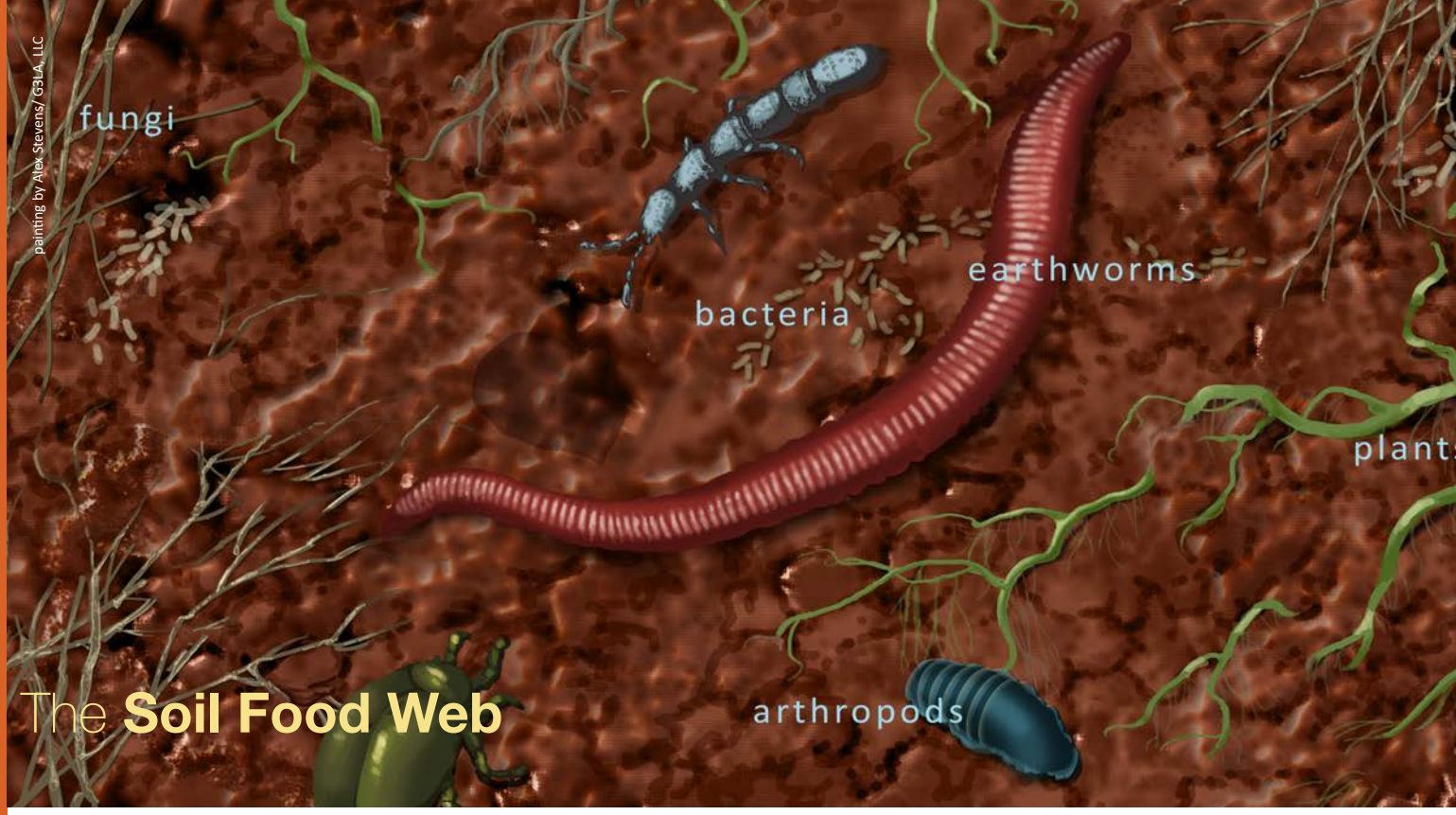
Figure Out How Steep is Your Slope

There are several ways to figure out how steep your slope is, but here is an easy way using stakes, string, and a measuring tape.

1. Place two stakes in the ground - one at the top of the slope (Stake B) and one at the bottom or toe (Stake A).
2. Take a 5' to 20' long string and wrap it around both stakes, pulling the string taut and relatively level between them.
3. Attach a line level to the middle of the string, and allow it to hang down beneath the string.
4. Slide the string up and down the stakes, keeping it taut, until the level indicates a level line.
5. Determine the Rise of the Slope by measuring the distance between the ground and the string on Stake A on the lower part of the slope, and doing the same on Stake B on the upper part of the slope.
6. Now subtract the Stake B distance from the Stake A distance. This number is the Rise of your slope.
7. Determine the Run of the Slope by measuring the length of the string between the stakes.
8. Divide the Rise by the Run and multiply by 100 to determine the percent of slope.

Here's an Example:
Stake A distance between ground and level line = 28"
Stake B distance between ground and level line = 4"
Distance between stakes = 20' (multiply by 12"/foot to get total inches)
Distance between stakes = 20' x 12"/foot = 240" total

RISE of Slope = Stake A - Stake B = 28" - 4" = 24"
RUN of Slope = 240"
Slope is RISE Divided by RUN Multiplied by 100 or 24" / 240" x 100 = 10% **Our SLOPE = 10%**



The **Soil Food Web**

Living Soil is not dirt!

Soil is specific to its place ("terroir" as the wine makers call it) and it has qualities that can and cannot be changed by gardening practices.

"Dirt" and "Soil" mean different things. "Dirt" describes the physical qualities of the rock particles and cannot be changed by gardeners.

"Soil" describes the complex living collection of dirt, organic matter, billions of microorganisms, plants, bugs and chemistry that hold it all together. Healthy, living soil is a sponge for water, an immune system and restaurant for plants, and a storage box for carbon. Healthy soil is alive, and gardeners can create living soil.

The most important things we can do to improve soil are to mulch, avoid tilling and compaction of existing soil and avoid using chemical fertilizers and herbicides that kill the soil microbes.

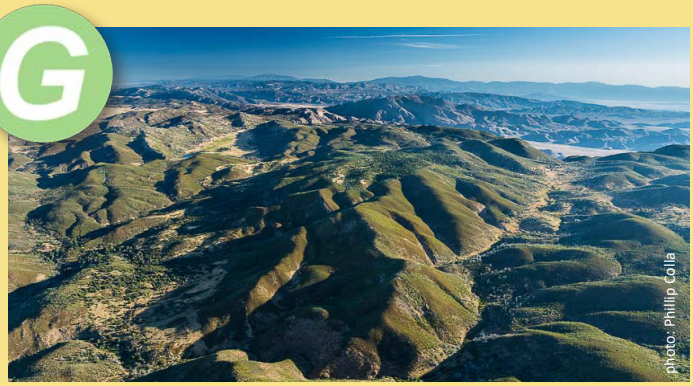
We want to do everything we can to protect and grow the soil microbes that create soil structure, the air holes between bits of rock and organic matter that make the soil behave more like a sponge than a brick. The important thing about a sponge is that it holds water when water is scarce, and gets rid of it when there is too much. Every type of soil can have better structure and be more sponge-like.

Organic Matter is Structural

Organic matter is bits of leaves and twigs that function like rock particles, and feeds microbes living in the soil that make soil fluffy (think about bread rising because of yeast.)

Our job in garden renovation is to continuously feed as much organic matter as possible to the landscape -- first with compost and mulch, and eventually by just letting the plants feed themselves with their own leaf litter.

What **Kind** of soil do you have?



Many San Diego Soils Are Impervious

Throughout San Diego County there are areas that have impermeable soils. These impervious soils are poor infiltration areas because water does not flow through the soil to replenish the groundwater. But, even in impervious areas, we can build new landscapes to prevent erosion and eliminate pollution by cleaning water as it flows through the garden's healthy living soil and plants. No matter where we landscape, we can concentrate on improving soil structure as much as possible.

Before we figure out how to build better soil, we need to figure out what kind of soil we have. Clay, Silt or Sand, are the basic soil types. The smallest particles create clay soil and the largest make sandy soil, with loam (an even blend of sand, silt and clay) considered the "just right" medium.

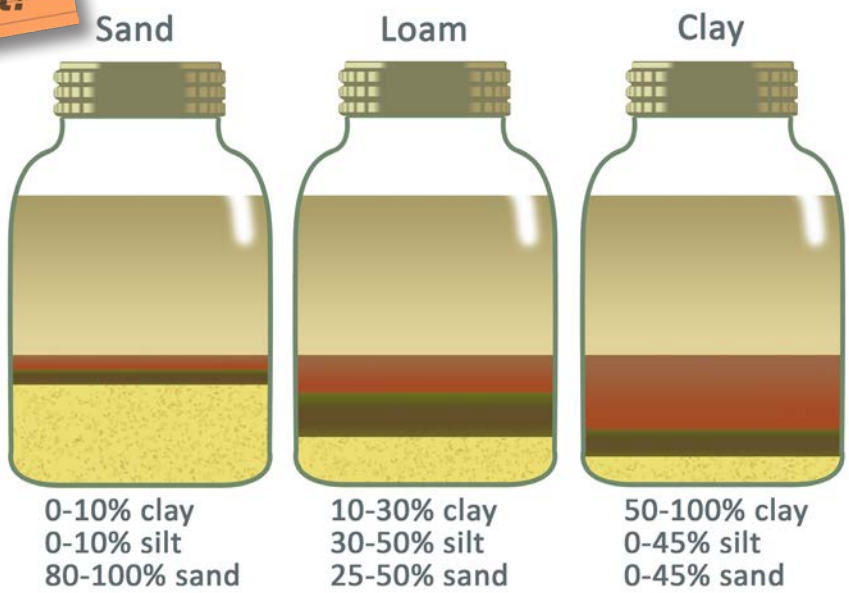
In general, sandy soil drains faster than clay soils. Remember soil structure also is vitally important – lifeless, compacted sandy soil will not absorb water while healthy clay soil can behave more sponge-like, holding and releasing water when appropriate. Some tests can be done on site to figure out what kind of soil you have, while others require laboratory analysis. Soil that will be used for food production should be tested in a lab for heavy metals, so you can figure out how to remediate it. Soil that will be receiving a lot of storm water should be tested on site for compaction using the Percolation Test (*see p. 39*).

NRCS Soil Texture Triangle

The National Resource Conservation Service of the USDA has a Soil Texture Triangle to help you figure out your exact soil type using a Jar Test.

www.nrcs.usda.gov
search"Soil Texture Calculator"

Test It! Determine Soil Type Using A Jar Test



This is fun to do with kids!

1. Use a 1 Qt. size glass container.
2. Add 1 Cup of soil from the garden. Select one area per container, or take samples from several holes and blend them together.
3. Add 3 Cups of distilled water.
4. Shake until all solids are suspended in water.
5. Place container on a shelf and wait 24 hours.
6. If the container is cloudy, then wait another 24 hours.
7. After 48 hours, the layers should be settled: **Sand** on the bottom, **Silt** in the middle, and **Clay** on top
8. Measure the layers in proportion to each other.
9. Use the graphic to determine the Soil Type based on the proportions of Sand, Silt or Clay.

Which jar does your sample most look like?

For Example: If there are equal proportions of Sand and Silt, and very little Clay, then the proportions are something like 40% Sand and 40% Silt and 20% Clay.

Loam best describes the jar with 40% Sand, 40% Silt, and 20% Clay.

Your soil is Loam.


photo: Tom Rau

Every garden needs **OWL**

OWL is Oxygen, Water and Life

These are the three things required by the billions of microbes that bind soil together to transform brickl-ike dirt into healthy, living soil sponges. Organic matter, planning and some labor may be involved, but the payoff in reduced maintenance, reduced inputs, reduced pollution on land and in our waterways, and the increased beauty of thriving, healthy landscapes is invaluable.

Oxygen is needed by healthy plant roots and soil organisms. Healthy soil has lots of tiny little pockets of air. When soils are eroded, graded or disturbed, their structure becomes compacted. Compaction is caused when the tiny air and water bubbles are squeezed out of the soil and microbes are killed. Microbes can be killed by fertilizer and pesticide use or even heavy traffic (foot or vehicular).

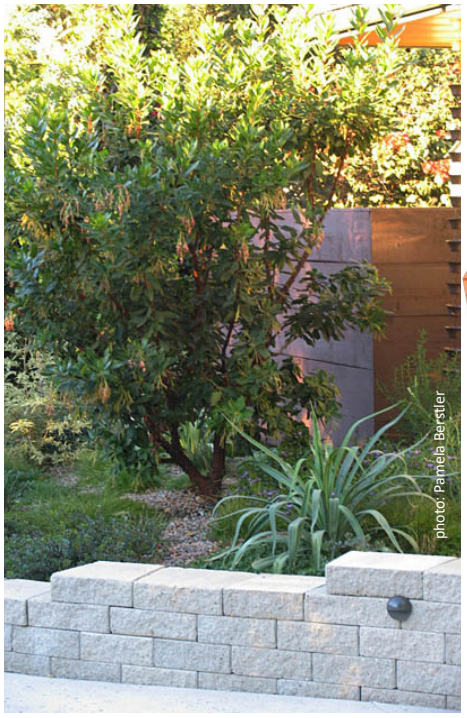


photo: Pamela Berstler

Water is needed by both plants and microbes. But too much water in the soil will displace the oxygen, saturating the soil and creating an anaerobic condition. Pathogenic microbes prefer anaerobic soil, and if this condition persists, diseases may develop, endangering the health of your garden.

Water is constantly moving through the soil. Any water in the soil needs to be replenished as the plants use it, as it evaporates from the soil surface, and as gravity pulls it down past the root zone.

Life in the soil includes all of the bacteria, protozoa, nematodes and fungi, the food they eat, the excretions they make, and the root systems they sustain. Living microbes most quickly can be incorporated into soil by adding really good quality compost.

Plants attract microbes to their roots by feeding them carbon. Bacteria and fungi hold the soil together with microscopic glues and binders. The microbes consume organic matter and are then consumed themselves by larger creatures (worms, ants, slugs, centipedes, insect larvae, etc.) In turn, these creatures are consumed by creatures further up the food chain. Carbon and other nutrients are cycled through these many life forms, creating healthy, living, well-structured soil, no matter what the soil type.

Test It!

Use a Soil Probe

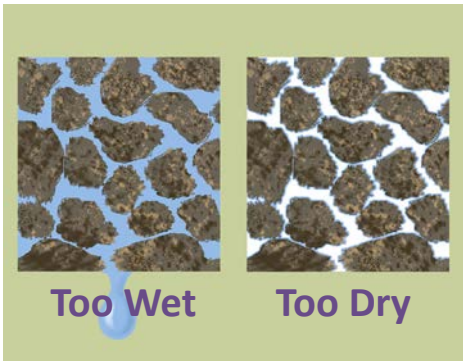
A soil probe allows you to determine a lot of information about your soil. It will come in handy when you are trying to figure out whether water is reaching the plant roots or even goes too deep beyond the roots' reach.

Take multiple samples from around your garden.

How deep are your plants' roots?

Build **Great** soil

Try to avoid excessive disturbance of the soil. But, if it happens, make sure you add Oxygen, Water and Life as soon as possible to begin the restoration of the soil microbes.



Eliminate Compaction by loosening soil.

If you can press a pitchfork into the soil, that is all you need to do to create air holes.

If the soil is heavy Clay, then augering or tilling may be necessary. Immediately after augering heavily compacted areas, fill the holes with good compost or earthworm castings. Then water the whole thing thoroughly to get the biology processes kickstarted. Remember that augering and tilling destroy the delicate Soil Food Web already existing in the soil, so they should be employed only when absolutely necessary. If you have a lawn, aerating twice a year will help eliminate compaction.

After decompacting, two essential practices for getting and maintaining soil oxygen are:

1) Feed the microbes organic matter so they continue making the little air pockets.

2) Manage water so things don't get too saturated or too dry.

Water Wisely, first with rainwater.

Rainwater provides the perfect chemistry for both plants and microbes, and should be provided as much as possible when it is available.

Irrigate Intelligently to maintain the water balance in soil. Too much water saturates soil and results in the anaerobic conditions that promote disease. Too little might result in microbes drying up and going to sleep. When microbes are no longer cycling nutrients for the plants, the roots will die and the plant might too.

Feed your soil.

Organic matter is the only food for the Soil Food Web that improves water holding capacity of soil. You can get organic matter from a wide variety of sources. Dead organisms and plant material are combined with the sugars and other compounds secreted by living plants and creatures.

Mulch, compost and compost tea can be applied to the surface of the soil and used as amendments during planting and soil preparation.

Plants do not need to be fed with fertilizers (even organic ones) if you maintain OWL. Avoid applying any fertilizers, but especially chemical ones, and any other chemical inputs.

Weed Barrier?

It looks like weeds grow right through weed barrier and it keeps OWL from happening.

Leaf It in Place

Leaf litter and grass clippings should be allowed to remain on the soil surface, under the plants from which they fall, instead of being removed during maintenance.

Be careful not to pile up leaves or mulch against the trunk of the plant. Try to keep them a minimum of 5" away from the trunk.

Tea for Two

Compost tea and worm castings offer a microbe jump start, providing many benefits of compost in an easily-digestible aerated liquid (compost tea) or dry form (worm castings), already teeming with life.

Compost vs. Mulch

Compost is a soil amendment.

Compost looks like soil. You cannot tell what it once was. That is because it is food scraps, landscape debris and/or manure from livestock, or biosolids (human manure) and other organic matter that already has been partially consumed and mostly decomposed by microorganisms. Good compost brings oxygen, water and life in one package.

How to Use Compost. Compost can be store-bought or homemade. The compost-making process, or composting, involves creating optimal conditions for the microbes to do their transformative work.

When compost looks like soil, it can be worked directly into the soil. The more coarse or visible the bits of the compost are, the more likely it is to be used as mulch on top of the soil rather than as an incorporated amendment.

Compost works its magic in several ways. First, the compost itself contains particles that improve soil structure. Next, as compost decomposes in soil it encourages the formation of soil macroaggregates. These macroaggregates are composed of existing soil particles and decomposed organic matter, which combine to create a more stable and better functioning soil structure.

Mulch is a soil topping.

Mulch may be organic or inorganic material that covers soil and looks like the recycled debris that it is. Mulch can be made from organic debris (grass clippings, leaf litter, and shredded wood trimmings) or inorganic materials such as gravel or decomposed granite.

The microbes in healthy, biologically diverse mulch structure and "knit" the organic matter together, forming a thick blanket. This cover protects soil and plant roots from temperature change, keeps moisture in by slowing evaporation from the surface of the soil and keeps weeds from sprouting by reducing sunlight penetration to the soil surface.

How to Use Mulch. Mulch always stays on top of the soil, and is never worked in. Recycled organic debris is the most effective type of mulch, because it builds soil structure over time and provides a durable, protective surface barrier. The smaller the debris and the more mixed leaves with wood chips, the faster it decomposes. When building soil, small and mixed is best.

Composted material, especially coarse composts, also can be used as mulch. Artificial and inorganic mulches (decomposed granite, gravel, rubber chips, other rubble) are primarily decorative, since they do not contribute to soil life or plant health. They may be best used in limited applications such as pathways.

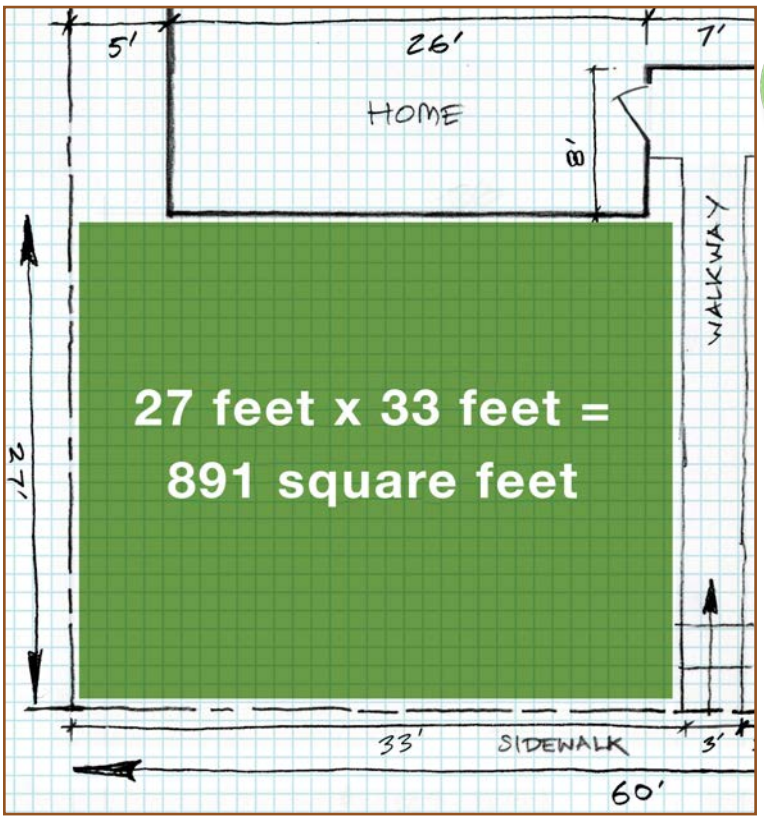
Need help buying amendment? ***www.buy-compost.com***

MAKE IT
Less than 5 Cubic Feet

BUY IT IN BAGS
Between 5 and 25 Cubic Feet

BUY IT BULK
More than 25 Cubic Feet or 1 Cubic Yard

How mulch do you **Need**?



Add Organic Matter

Add 1” to 3” of compost to improve the water holding capacity of soil by 30%.

Place 3” to 6” of mulch on top of the soil to hold in moisture and keep down weeds when planting, and maintain 2" to 4” of mulch on beds at all times.

Keep mulch 1” to 6” away from the stems of plants.

Calculate the material requirement

Start with the **Square Footage (SF)** of space to be covered and figure out how much you will need for 1 inch of material.

SF x 1 inch ÷ 12” (dividing by 12” turns your inch of amendment into feet of amendment) = **Cubic Feet (CF)** of material needed.

If you need less than 20 CF of material, you can probably make it in a compost pile or purchase it in bags.

If you need more than 25 CF of material, you must convert your materials to Cubic Yards, because you are going to have to have it all delivered in bulk.

Cubic Yards (CY) are found by dividing CF by 27.
So, 25 CF ÷ 27 = about 1 CY of material needed.

Applied to Our Site:

891 SF x 1 ÷ 12” = 74.25 CF for 1” of mulch.

If you need 2”, you multiply the amount needed for an inch by 2 and if you need 6”, you multiply this number by 6.

We need 4” of mulch = 74.25 CF x 4 = 297 CF

For our yard, that is 297 CF ÷ 27 = about 11 CY of mulch. That sounds like a lot of material! It looks like we will have to buy it in bulk (*see p. 14*).

More information at: ***SustainableLandscapesSD.org/landscape-materials/***

Avoid These Mulches Around Plants

While these mulches are commercially available, they don’t decompose to feed the soil microbes. Although some are organic materials, they are not recommended. For example, shredded redwood takes a very long time to break down. Dyed mulches are composed primarily of recycled wood materials such as treated or painted furniture or wood palettes, so avoid using these mulches around the plant material.

shredded redwood | dyed wood mulch | decomposed granite | gravel | rubber

Before

Lose your lawn **Without Killing** your soil

Protect Microbes when removing turf.

If you are ready to transform your water-guzzling grass into healthy living soil, just follow along with the recipe for "Soil Lasagna" (a.k.a. Sheet Mulching), and you will have delicious living soil in no time. Here are some things to consider as you plan your grass removal process.

Keep Grass Moist until you remove it. You want to be able to work with the microbes in the soil, and they need water to stay alive. Also, it will be easier to remove grass that is fresh and moist than it will be to try to find the weeds you missed in a clump of dry dead grass.

Avoid Solarizing Your Garden. Solarization is a process of removing grass without chemicals that uses the sun to broil the soil at high temperatures, killing everything beneath. While some people swear by this process, there are two major drawbacks to consider:

The broiling approach kills everything in the soil, including the microbes, so you will definitely have to invest in lots of compost to bring back the good guys after you are finished.

A completely sterilized soil is a perfect place for weeds. As soon as the plastic is off the site, weeds will want to colonize the ground. You may have killed the seed bank in the soil, but new weeds will arrive and have no opposition to a major takeover.

CALL DIG ALERT (811)

Hitting a gas line or water main is no laughing matter! Call at least two days before digging so marks can be made to avoid underground cables, water lines, gas lines and sewer pipes. Be careful digging around irrigation lines; they can be as shallow as 4" below the surface.

www.digalert.org

Avoid Compaction and Don't Till. The bigger the equipment for removing the turf, the more the soil beneath is compacted. Try to only use hand power or walk-behind equipment rather than a bob-cat or other scraper. Tilling soil breaks up and kills soil microbes so you are pretty much guaranteed to have weeds pop up afterward.

Protect Trees in Grass Areas

If you have healthy trees growing out of your grass, then you have to be extra careful with the roots. Don't use any heavy equipment under their branches and be extra gentle when removing the grass, especially near their trunks.

To minimize root shock, be sure to keep the trees well-watered during the grass removal phase and plan for them to be on their own hydrozone in the new garden *(see p. 34)*.

Trees in grass will go into shock when water is reduced, so protect the urban forest by keeping them watered during the first year after turf is removed, even if you remove surrounding irrigation.

Cut it or **Cook** it?

We know we need to build healthy living soil, so what to do with the grass? Grass can be left in place and turned into soil or removed with a sod cutter. But which way is best? It depends upon your grass type (*see p. 24*).

Cut It if you have warm season grass

If you have any combination of the warm season grasses (St. Augustine, Bermuda, etc.). You have a bigger project ahead of you, and you'll need to remove the grass, as much of the roots as you can, and perhaps even the top few inches of soil as you try to get rid of the roots.

The best way to do this is with a sod cutter. A sod cutter, dumpster to remove the cut sod, and other equipment can be rented. Once you've cut it out and disposed of it properly, you can get cooking!

Rent A Sod Cutter

Most large box stores or hardware stores have sod cutters available for rent.

Make Notes on Your Site Plan

Figure out how much area of grass you are removing. Now you will have to do the calculations for compost, paper and mulch (*see p. 15*).

If you are going to do the Sheet Mulching process, you will need the following (*see pp. 18-19*):

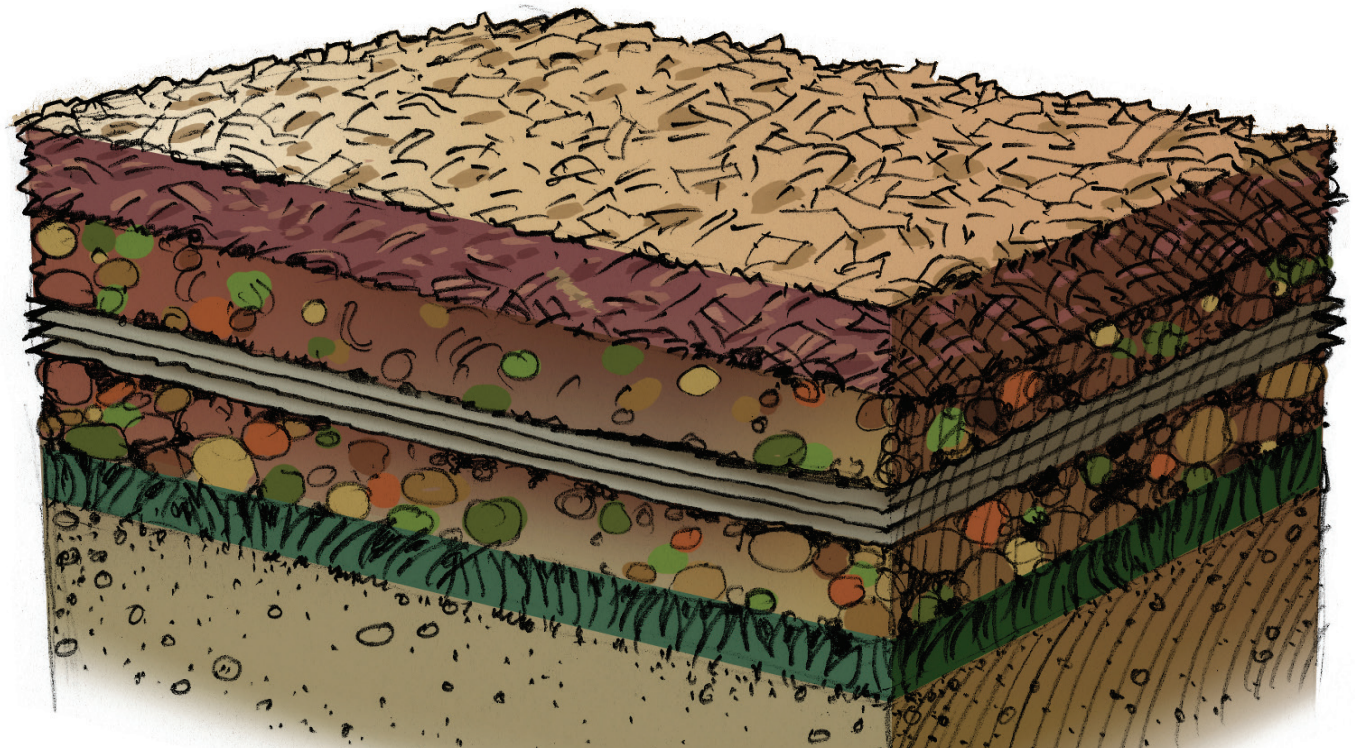
1. 1" of compost OR enough compost tea to cover the area **RULE OF THUMB:** 5 gal. undiluted compost tea covers approximately 1,000 sq. ft. garden.
2. 4" – 6" of mulch over the whole area
3. Rolls of painters' paper or cardboard with 6" overlaps **RULE OF THUMB:** Multiply the Square Footage of the area by 1.25 to determine the total amount of paper you will need, and you will more than cover the overlaps.

Cook It if you have cool season grass

If your lawn is a fescue type (cool season turf), you're good to go from here, and only need to remove the grass if you want to speed things up. Just follow the Soil Lasagna Recipe on the next page, and you'll be cooking your grass away.

Note: There are some especially tough weeds, including Bermuda Grass, Yellow Nutsedge and Oxalis, for which both plants and as much root as possible must be carefully physically removed. If you have these plants in your garden, DO NOT TILL!

These weeds grow from tiny little root fragments, stolons (Bermuda Grass) and bulbettes (Yellow Nutsedge and Oxalis) and tilling just spreads the weeds around. If you have these weeds and you have removed all that you can, plan on doubling the layers of paper and amount of mulch used in the Sheet Mulching process (*see p. 19*).



drawing by Alex Stevens/ G3LA, LLC

Cook up a **Soil Lasagna**

Sheet Mulching creates an instant sponge.

A healthy living soil sponge is full of oxygen, water and life. We call the process of building living soil sheet mulching, or Soil Lasagna because it boosts microbes so much, they actually cook down the organic matter and start eating up the grass as food. Once you've made the Soil Lasagna, all you need to do is keep the system wet so the microbes can stay awake and cooking. How long this will take depends on the kind of grass you have *(see p.24).* When you're ready to plant, just dig a hole right into it, cutting through paper/ cardboard (if it's still there) and plant into the yummy soil beneath.

You Will Need:

Shovels and Rakes
Bins for removed grass and soil
Landscape flags
Compost, Worm Castings, or Compost Tea
Wheelbarrow(s)
Mulch
Painters' Paper or big sheets of Cardboard
Hose with shut off nozzle at end
Water (LOTS!)

Do It!

Secure Your Permits

Call DIG ALERT (8-1-1) two days in advance, and check with your local water agency for any water use restrictions.

www.digalert.org

R

Rent A Dumpster

For every 1,000 sq. ft. of turf removed you will need 1 low-boy (10 yard capacity) dumpster.

1. After you have checked for permits and any local water use restrictions, deal with the lawn you have. If it's cool season, mow it to about 1/2" height, say goodbye and soak it thoroughly with water. Then go to #3.
2. If you don't have cool season grass, rent a sod cutter and remove the grass and 2"to 3" of roots beneath. The result is that you will be removing about 6" of grass and soil. Unfortunately, this must be hauled away, so you will need to rent a dumpster. Now go to #3.

3. Dig a trench 8"to 12" deep (about 1 shovel depth) and at least 12"to 24" wide around all hard surfaces and building foundations (less deep here). Complete contouring for rainwater absorption and retention and any landscape adjustments such as paths, patios, other features (*see pp. 44-45*).
4. Flag your sprinkler heads so you can find and adjust them later.
5. Add a (1/2" to 1" deep) layer of compost on top of the graded soil. Alternatively, use humates, a sort of freeze-dried compost available at some landscape supply stores, or spray with compost or worm tea. You are adding good instant food and some microbes to the soil!

6. Water everything well. Wake up, microbes!
7. Roll out painters' paper, cardboard or other paper. Overlap at the seams by at least 6". No naked soil!
8. On the hardscape edges, make a "burrito" of rolled paper and mulch to keep grass from resprouting immediately.
9. The paper is watered again and add another layer of compost here, if you'd like. Rake a thick blanket 4"to 6" deep of mulch over the paper or compost.
10. Water the mulch thoroughly. This mulch layer will absorb more water than you ever thought possible to become soaked through. Don't despair; just keep watering!
11. Plant right through the layers. The longer you wait to plant, the tastier the lasagna will be for the new plants, but you can plant right away if you removed the grass.
12. Step back and admire your work!

Right **Plant**, Right **Place**

Five Great Mediterraneans

1 Correa 'Dusky Bells'
Red Australian Fuschia (Australia)

2 Dietes bicolor
Fortnight Lily (South Africa)

3 Teucrium chamaedrys
Germander (Mediterranean)

4 Calandrina spectabilis
Rock Purslane (Chile)

5 Leucadendron 'Safari Sunset'
Cone Bush (South Africa)

San Diego County has a Mediterranean climate.

Plants from around the world are adapted to living in San Diego's Mediterranean climate. This is especially true for plants from the Mediterranean basin, South Africa, Australia, and Chile, the four other Mediterranean climate zones of the world, which are characterized by long, hot dry summers and short cooler wet winters.

While Mediterranean plants may be climate adapted for San Diego, every plant grows best in its native place. Local native plants have co-evolved with the specific climate, geology, soils, insects, birds, animals and other members of the plant community of a particular region. When we want to create landscapes that require the least amount of work after establishment and the most value for endangered insects like butterflies and bees, we reach for local native plants first, and Mediterranean or other climate-appropriate plants second.

Selecting low-water-use plants is essential for creating a landscape that works with the climate and for grouping plants with the same water needs in order to more effectively irrigate them. Several water conservation strategies have evolved in these plant communities, and by learning to recognize their adaptation tricks you can identify plants as climate appropriate.

Select **Climate-appropriate** plants

Evapotranspiration (ET) is the key to watering plants.

Evapotranspiration explains how much water plants really need, and when they need it. ET is a quick way for plant people to explain environmental conditions, especially solar radiation (sunshine or cloud cover). The stronger the sunshine, the higher the ET.

Plant leaves are like solar panels, gathering energy to enable the plant to transform water and carbon dioxide from the air into oxygen and sugars for building their bodies and feeding soil microbes. Transpiration is like plant sweat. It cools down the solar panel leaves. Water also evaporates off soil around the plants. This combined water loss from plants and soil is called ET.

It is helpful to understand water loss in terms of ET when selecting plants for the lowest **Landscape Water Requirement** (*see p. 23*), planning irrigation and managing the **Soil Moisture Account** (*see p. 38*). Check out the **Plant List** for a complete listing of the climate-appropriate plants highlighted throughout this book (*see p. 58*).

all photos: Marilee Kuhlmann

Need help identifying climate-appropriate plants?

There are four characteristics shared by many climate-appropriate plants that will allow you to find them in a crowded nursery.

Stiff, Leathery Leaves hold on to water and stay evergreen for most of the year.

Silver or Hairy Leaves reflect sunlight, cooling the plant. Hairy back sides of leaves hold moisture longer, cooling them off.

Tiny Little Leaves are like tiny solar panels that are easier to keep cool than one large hot surface.

Solar Tracking Leaves will appear to be standing at attention, straight up and down in the middle of the day. As the day progresses, or if you see the same plant in the early morning, you will find that the leaves are more horizontally oriented. This plant is moving its solar panels to minimize the hottest sun exposure. Many of the California native manzanitas utilize this adaptation.

Do some water **Homework**

Plant Factors (PF) categorize each plant's water requirement.

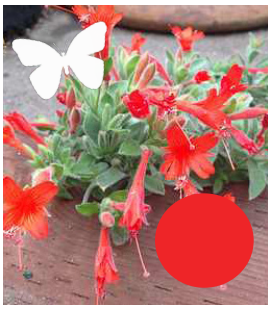
The Water Use Classification of Landscape Species (WUCOLS) is a resource used by professionals to classify plants according to their water requirement. The water requirement of each plant in your landscape can be determined by gathering information about that plant and then comparing it to the amount of water needed by cool season grass growing in your climate zone.

These water requirement categories, or Plant Factors, include **VERY LOW, LOW, MODERATE** and **HIGH**.

Once we select our plants, we can figure out the water use of the entire landscaped area that is irrigated (*see p. 23*).

Cool-season turf is among the thirstiest of all plants. Replacing turf areas with climate- appropriate plants that have lower water requirements and irrigating them with more efficient systems offers potential for great water-savings.

- **HIGH PF:** plants need 60-100% of the water needed for grass lawn (PF of 0.6 - 1.0)
- **MODERATE PF:** plants need 30-60% of the water needed for grass lawn (PF of 0.3 - 0.6)
- **LOW PF:** plants need 10-30% of the water needed for grass lawn (PF of 0.1 - 0.3)
- **VERY LOW PF:** plants need 10% or less of the water needed for grass lawn (PF of less than 0.1)



Moderate Low Very Low

Notice that wherever we have provided plant selections or lists in this book, we have identified the plants by their water needs by placing them on a colored background (*see pp. 58-59*). You can use this color coding to help you group plants by their water requirements in your new landscape, so they may be irrigated more efficiently. The **Butterfly** icon indicates plants that support the life cycle of butterflies.

Determine landscape **Water Savings**

How LOW can you go?

We encourage landscape designs that use the least amount of potable water necessary. Project owners should have in mind the level of efficiency and sustainability they want to achieve in their landscapes. As a general rule, we will want to maximize our capture and use of rainwater and to reduce, if not eliminate, our reliance on potable water for irrigation. When we compare how much water our new landscape design will need with our existing landscape water use, we can determine our total estimated water savings.

The difference in water consumption becomes apparent when we calculate the water use requirements for landscapes filled with plants that require high, moderate, low or very low water. By holding ET, irrigation efficiency and landscape area constant while varying just the plant factor, the examples calculated below illustrate the differences in annual water requirements.

Calculate Landscape Water Use

Refer to the **San Diego Water Efficient Landscape Ordinance** for guidance on determining how much water your landscape design will need. These four key variables help you determine your landscape water use in a formula that is converted to gallons when multiplying by the constant, 0.62.

$$ET_o \times 0.62 \times (PF \div IE) \times LA = \text{Landscape Water Use in Gallons}$$

1. **Landscape Area (LA)** is the Square Feet of area being landscaped with plants requiring irrigation *(see p. 8).*
2. **Evapotranspiration (ET_o)** in inches is the Reference Evapotranspiration from your San Diego Climate Zone *(see p. 6).*
3. **Plant Factor (PF)** is MODERATE, LOW or VERY LOW depending upon your plant selection *(see p. 22).*
4. **Irrigation Efficiency (IE)** There is no such thing as a perfect irrigation system. There are many factors that limit the efficiency of a system that can have a big impact on your water use and the health of your plants. We address irrigation efficiency specifically in the **Water** section of this book (*see pp. 46-47*).

The examples below apply the following assumptions to the water use calculation shown above:
ET = 51" of water annually **IE** = 0.7 **LA** = 1,000 square feet

Example 1:
A garden filled with **high water use plant**s (PF = **0.8**)

51" x 0.62 x (**0.8** ÷ 0.7) x 1000 = 36,137 gallons of water annually.

Example 2:
A garden filled with **moderate water use plants** (PF = **0 .5**)

51" x 0.62 x (**0.5** ÷ 0.7) x 1000 = 22,586 gallons of water annually.

Example 3:
A garden filled with **low water use plants** (PF = **0.2**)

51" x 0.62 x (**0.2** ÷ 0.7) x 1000 = 9,034 gallons of water annually.

Example 4:
A garden filled with **very low water use plants** (PF = **0 .1**)

51" x 0.62 x (**0.1** ÷ 0.7) x 1000 = 4,517 gallons of water annually.

County of San Diego Water Efficient Landscape Ordinance (WELO)

www.sandiegocounty.gov
search"landscape ordinance"

San Diego County's Water Efficient Landscape ordinance requires new commercial and residential projects to create water budgets for their landscaping and reviews design documents to ensure that new landscape designs comply with the budget. It ensures that new construction uses the latest irrigation technology to irrigate without wasting water.

Water Use Classifications of Landscape Species (WUCOLS)

www.ucanr.edu/sites/WUCOLS/

WUCOLS IV provides evaluations of the irrigation water needs for over 3,500 taxonomic plant groups used in California landscapes.

Lawns: **Use** It or **Lose** It!

Cool Season Grass grows best in cooler periods of the year.

This grass will require water in the hot summer if it is not to go dormant (brown).

Typically these grasses grow as bunch grasses and propagate by seed or weak stolons. Cool season grasses are smothered easily by sheet mulching.

Varieties include: Bent Grass (*Agrostis*), Fescue varieties (*Festuca*), Kentucky Bluegrass (*Poa pratensis*), Perennial Ryegrass *(Lolium perenne*).

Cool season grass needs more water than warm season grass and is considered a HIGH water use plant.

Warm Season Grass grows best in warmer periods of the year.

This grass hits its stride when temperatures exceed 80°F, but will go dormant (golden brown) in the wintertime when rainy and cool.

Typically these grasses grow from sturdy rhizomes extending deep underground. Warm season grasses require physical removal and/or intensive sheet mulching using at least 6” to 12” of mulch.

Varieties include Bermuda Grass (*Cynodon dactylan*), Blue Grama *(Bouteloua gracilis*), Buffalo Grass (*Buchloe dactyloides*), St. Augustine Grass (*Stenotaphrum secundatum*), Zoysia, and Seashore Paspalum.

Warm season grass is a MODERATE water use plant.

Maintain Lawn Organically

Lawns that are maintained organically and efficiently can offer a cool surface for both active recreation or just hanging out.

Most lawns are maintained inefficiently, and require too much water and energy or become a major source of pollution from fertilizer and pesticide runoff. For these reasons, lawn areas should be limited to accessible, usable and high-functioning areas like play yards, sports fields and picnic areas.

Many residents are rethinking the use of lawn as an all-purpose, wall-to-wall groundcover. If you decide to keep your grass, follow these guidelines to maintain it organically so that it will play nicely with the rest of your sustainable landscape.

- Top dress with 1/8” to 1/4” compost annually
- Aerate and de-thatch annually
- Manage your irrigation
- Mow less frequently
- Maintain 3” to 4” height on cool season grass and 1-1/2” to 2” height on warm season grass
- Grass-cycle every time you mow
- Do not allow seed heads to form on the grass (remove if they do)
- Consider over-seeding with clover to make it more interesting and drought-tolerant
- Eliminate chemical inputs

Groundcovers as lawn substitute

Great Groundcovers

1 Asteriscus maritimus
Gold Coin Plant

2 Arctostaphylos edmundsii 'Carmel Sur'
Creeping Manzanita

3 Lomandra longifolia 'Breeze'
Dwarf Mat Rush

4 Senecio serpens
Blue Chalksticks

5 Salvia 'Bee's Bliss'
Bee's Bliss Sage

Walkable Turf Alternatives

1 Achillea millefolium rosea 'Island Pink'
Pink Yarrow

2 Fragaria chiloensis
Beach Strawberry

3 Dymondia margaretae
Silver Carpet

4 Thymus pseudolanguinosus
Wooly Thyme

5 Calylophus hartwegii
Sundrops

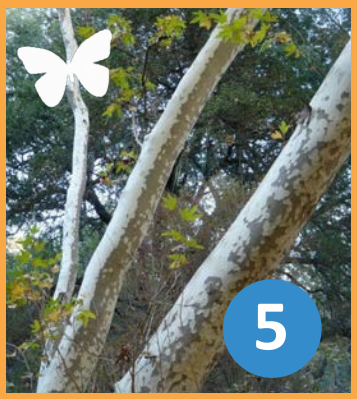
Keep cool in a **Fire** zone

Fire is a real and constant threat.

This is especially true in wildland interface areas. Plant selection, design and consistent maintenance all must be in accordance with fire safe guidelines. Landscapes should resist ignition and provide 35 feet of actively maintained defensible space around structures and access zones (Zone 1), maximizing fire prevention and also allowing for access by fire crews, if necessary. Beyond Zone 1, the landscape should reduce the chance of potential airborne embers through careful thinning of native vegetation for another 65 feet (Zone 2).

Many of San Diego County's native plant communities, like chaparral, are able to survive and recover from infrequent fire. Some plants use fire to signal available space to grow and thus start the germination process. But when fires are too frequent, even the most well-adapted plants' ability to survive is disrupted. Invasive species have made fires more frequent, with longer duration and hotter intensity, so it is even more important to avoid invasive plants in fire-prone zones.

Five Fire Fighters



1 Hemerocallis hybrids
Daylily hybrids

2 Aloe striata
Coral Aloe

3 Abutilon palmeri
Indian Mallow

4 Convolvulus cneorum
Bush Morning Glory

5 Platanus racemosa
CA Sycamore

Use Plants That Resist Ignition and are less likely to produce airborne plant embers. These plants include those with a high salt and/or water and low volatile oil content in their leaves, like succulents. Agaves, aloes, crassulas and other succulents store extra water in their fleshy leaves.

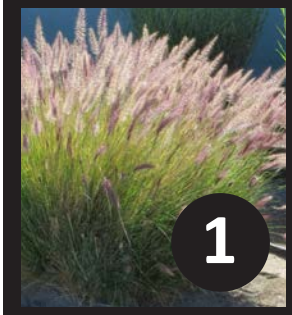
Messy, oily trees and shrubs, like eucalyptus and junipers, do the opposite – igniting quickly, burning hot and long, and releasing copious embers into the air, which may further spread the fire.

Preventative maintenance includes regularly removing dry grass, thatch, brush, weeds, litter, waste, and dead and dying vegetation. Trees should be properly pruned. Shrubs and perennials should be kept thinned, with dead branches and leaves removed. Unwanted vegetation must be regularly mown, cut or grazed, while root structures must be left intact to avoid erosion. Dead leaves and branches are particularly flammable, especially on evergreen shrubs or vines like bougainvillea, and these must not be planted close to structures.


photo: Pamela Berstler

Avoid **Takeover** artists

Pull These Invasive Plant Pests



1 Pennisetum setaceum
African Fountain Grass

2 Vinca major
Periwinkle

3 Schinus terebinthifolius
Brazilian Pepper Tree

4 Cytisus scoparius
Scotch Broom

5 Nassella tenuissima
Mexican Feather Grass

Some non-native plants love everything about San Diego County. They love it so much that they have moved in, stretched out, and are attempting to take over. Some are greedy, jumping up at the first rainfall and sucking water and soil nutrients away from the more relaxed native plants. Others are pushy, taking over habitat and keeping everyone else out.

Few of these species offer any benefits to the local animals and insects. Invasive species and species that act like invasives should be removed from your gardens, removed from nursery stock and should not be planted in the first place.

Plant Right /California Invasive Plant Council *www.plantright.org www.cal-ipc.org*

California Invasive Plant Council maintains a list of invasive plants causing problems throughout the state. However, this list only addresses plants that have been proven to be invasive throughout the entire state.

For a list of potential invasive horticulture plants that are grown in San Diego, also review the Plant Right website.

California Native Plant Society (CNPS) *www.cnps.org*

Go here to find lists of great California native plant alternatives that appreciate being planted in San Diego and behave themselves in our gardens.

Try These Well Behaved Plants

1 Melica californica
CA Melic Grass

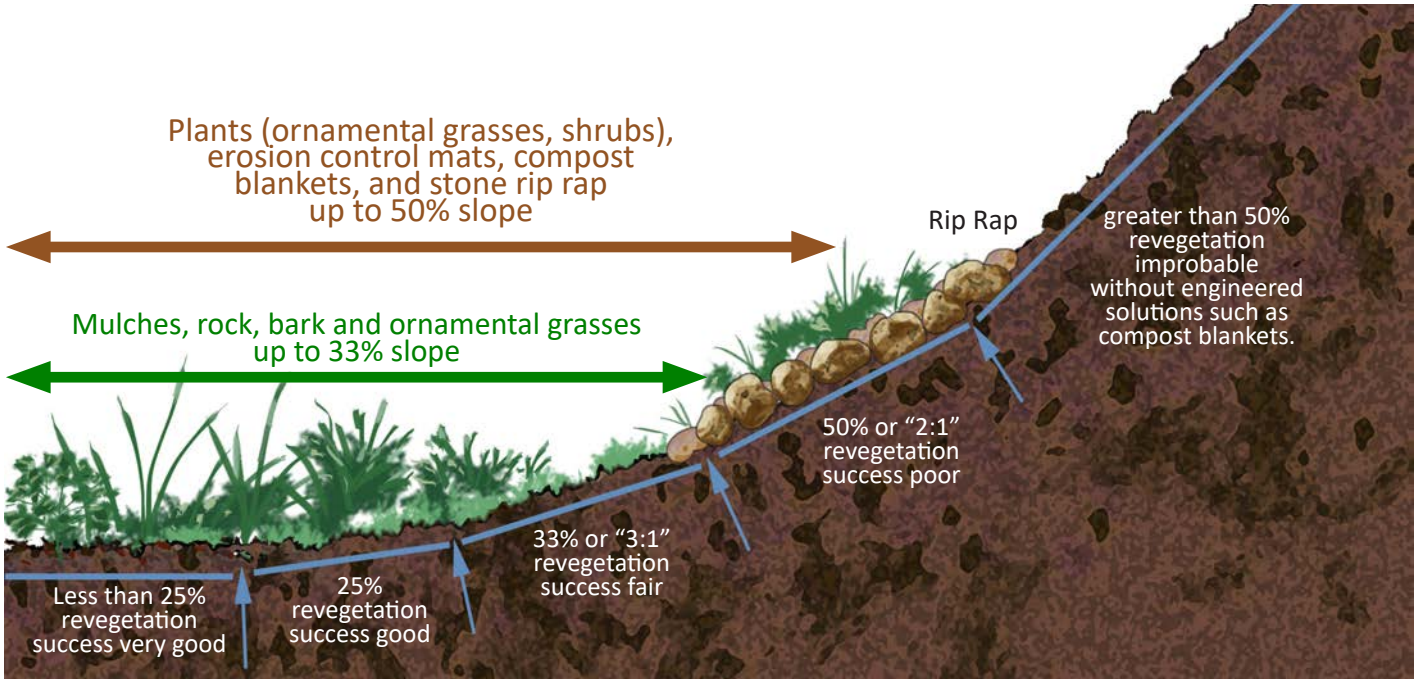
2 Lessingia filaginifolia
Silver Carpet

3 Quercus agrifolia
Coast Live Oak

4 Lotus scoparius
Deerweed

5 Nassella pulchra
Purple Needle Grass

Slopes and **Hillsides** are special



Hardy Hillside Holders

1 Romneya coulteri
Matilija Poppy

2 Ceanothus griseus horizontalis 'Yankee Point'
Yankee Point Ceanothus

3 Isomeris arborea
Bladderpod

4 Rhus integrifolia
Lemonade Berry

5 Heteromeles arbutifolia
Toyon, Christmas Berry

Whenever possible, do not disturb canyon hillsides. Low-water-use plants, trees, deep-rooted native plant species, and climate-appropriate plants with strong root structures, should be selected for disturbed or built slopes and hillsides, as these root systems can help hold soil together.

If your slope is gentle, 3:1 or less (33% grade), coarse compost and mulch can be applied directly to hillside and slope surfaces, providing surface protection from the force of falling rain and shading exposed soils. With occasional and gentle irrigation, mulch will "knit" together.

Compost blankets are a kind of erosion control mat applied to the soil surface to protect and preserve it. They can be used either alone, with coir mats or other organic-engineered material with biodegradable grids for stabilization. Mats allow water to penetrate through to underlying soils while retaining loose soil and debris and preventing erosion. You can plant right through them or use pre-seeded products.

Hillside Irrigation Considerations

When preparing a hillside for planting, determine how you are going to irrigate before doing any work. Low-volume rotating spray heads are ideal for sloped areas, if the space is large and the groundcover is uniform. Inline emitter drip tubing also can be effective, especially for wider-spaced shrubs and trees.

Water can be applied in shorter durations, over the course of a given day, so that it can be fully absorbed between application times. Runoff, erosion and efficient deep watering are important issues to keep in mind always, but especially on hillsides (*see pp. 47-49*).

Please note that emitters on drip systems should be placed above the plant basin, and spray systems should have check valves in all lower heads to avoid low point runoff. Irrigation for the top of the slope and the bottom of the slope should be on separate valves.

More **Trees**, please!

Five Low Water Landscape Trees

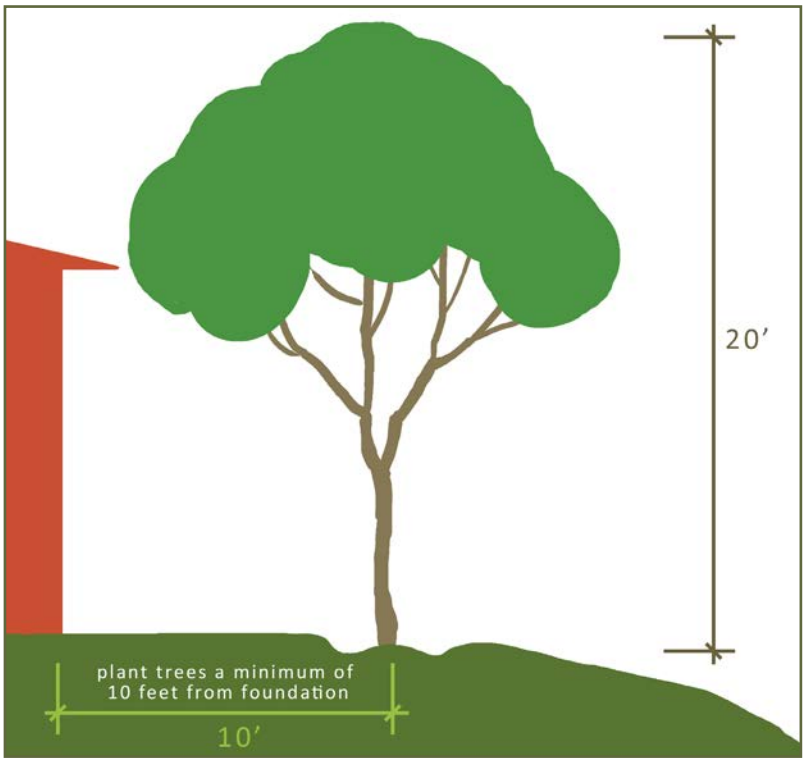
1 Chilopsis linearis
Desert Willow

2 Parkinsonia 'Desert Museum'
Desert Museum Palo Verde

3 Cercis occidentalis
CA Redbud

4 Lyonothamnus floribundus
Catalina Ironwood

5 Arbutus 'Marina'
Hybrid Strawberry Tree



Landscaping with trees improves property values.

While planting trees means improved water quality, resulting in less runoff and erosion, it's also good for the pocketbook. Healthy, mature trees add an average of 10% to a property's value.

Trees properly placed around buildings can reduce air conditioning needs by 30% and can save 20–50% in energy used for heating.

Consider the mature size of the tree when you plant it. Right now, it's in a 15-gallon container, but a small tree will grow into a 30-foot-tall tree with a 30-foot-wide canopy of branches. If you've selected a large tree, it could be 70 feet tall and wide!

Make sure the placement of the tree is sufficiently far away from the house. Small trees (30' wide or less) should be no closer than 10 feet. And large trees (70' wide or more) should be planted no closer than 20 feet from the house.

Below are five large shrubs that are great for screening unwanted views. But, always consider the viewshed of your neighborhood. Are you blocking a special view for someone else?

Five Great Screening Plants

1 Prunus ilicifolia ssp. lyonii
Catalina Cherry

2 Myrica californica
Pacific Wax Myrtle

3 Pinus torreyana
Torrey Pine

4 Cuppressus forbesii
Tecate Cypress

5 Ceanothus 'Ray Hartman'
CA Mountain Lilac

Eat your yard

Group Edibles together for irrigation.

You don't have to become a farmer to enjoy edibles in the landscape because many native plants and herbs have fruit and leaves you can harvest, and they can be mixed into any climate-appropriate planting scheme. Organic methods, including sheet mulching, (*see pp. 18-19*) and Integrated Pest Management (*see p. 31*) ensure the health of the soil, the crops and the people who eat them. Be sure to check local drought ordinances to confirm watering schedules permitted for edibles.

Five Great Fruit Trees

1 Punica granatum
Pomegranate

2 Ziziphus jujuba
Jujube, Chinese Date

3 Prunus salicina
Santa Rosa Plum

4 Acca sellowiana
Pineapple Guava

5 Citrus'Improved Meyer'
Improved Meyer Lemon

Edible Perennials & Fruiting Shrubs

1 Salvia elegans
Pineapple Sage

2 Ribes aureum
Golden Currant

3 Vitis 'Roger's Red'
Roger's Red Grape

4 Sambucus mexicana
Mexican Elderberry

5 Aloysia citriodora
Lemon Verbena

Plant for **Pollinators**

Do It!

Plant a Butterfly Garden

Look for the Butterfly icon on pictures of certain plants throughout this book. These are plants that support the life cycle of butterflies. Try to get several in your garden so you help the larvae and caterpillars as well as the full grown nectar-seeking showstopper.

Gotta Get Bees

Not every bit of ground needs to be covered in mulch. Try designating a 5 to 10 square foot patch of open ground for solitary ground nesting bees and insects, especially if you have planted San Diego native plants.

Plants and Bugs need each other to survive.

Nature provides checks and balances in a garden, and you can attract insects and creatures that will help you maintain your garden without pesticides. Flowering plant species rely on insects for pollination and thus reproduction. In turn, plants feed and house insects. Some bugs eat too much, destroying plants and spreading diseases. Other bugs, beneficial insects, fight off the bad guys, eating them or disrupting their reproductive process. Birds, bats and lizards help out too, consuming pests both big and tiny.

By actively cultivating a diversity of plants in our landscapes that flower at different times of the year to attract good bugs and predators, we are improving the resilience of our gardens and reducing the need for chemical inputs. To attract more garden-helpers, like mason bees and lizards, create habitat specifically for them. Consider getting a man-made nesting box for bees, leave a small rock pile for lizards, or put a large tree branch in the garden and let it decompose naturally.

R

Integrated Pest Management (IPM)

www.ipm.ucdavis.edu/GENERAL/whatisipm.html

IPM is not a single action or method, but rather is a series of information-based steps, approaches and methods, used in combination to prevent diseases and infestations of invasive and pathogenic species, both plant and animal. If a situation is uncontrollable with natural and biological methods, then the particular plants and/or design of the landscape should be reconsidered and altered to promote an environment in which the plants will not be susceptible to infestation or disease.

Pollinator Attractors

1 Asclepias fasicularis
Narrow Leaf Milkweed

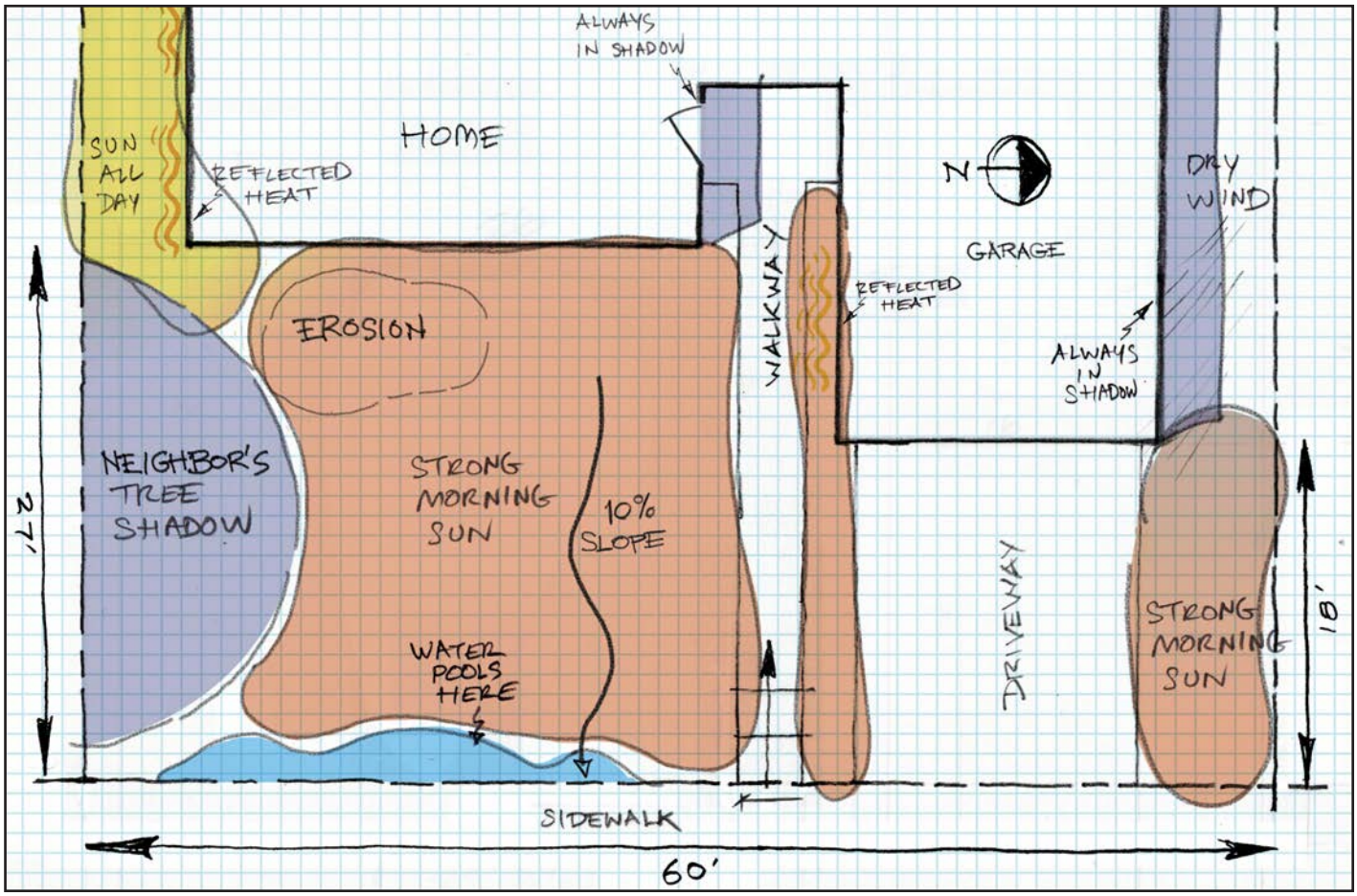
2 Heuchera maxima
Island Alum Root

3 Eriogonum grande var. rubescens
San Miguel Island Buckwheat

4 Verbena lilacina 'De la Mina'
Cedros Island Verbena

5 Galvezia speciosa 'Firecracker'
Island Bush Snapdragon

Map your **Microclimates**



Microclimates are climate factors particular to your garden.

Every garden has areas where plants will flourish and other areas where plants will struggle. Structures, walls, fences, and other plants can affect the amount of sun and shade in a garden. And every garden is completely different, even if it is located in the same general climate zone. There will be hills and hollows in your front yard that may collect cold air or, because your property is sloped, you don't get frost when neighbors do.

Microclimates may differ significantly from the general climate of an area. We need to map these microclimates, and the first step is walking around your property during the day and observing it more closely.

Do It! Note Sun and Shade.

Mark the areas that receive sun all day and areas that are shaded all or part of the day. Also note which areas receive only partial sun, maybe just a few hours of direct morning sun, midday or in late afternoon.

When you start choosing your plants make sure to select those that are appropriate to the sunlight patterns of your garden. Plants marked as "full sun" will not be happy in full shade.

Are there other things you observe in your garden? Mark it on your map!

Which Plants Will You Keep? Now is the time to decide which plants will work well in your new garden and which you should plan to remove. Outline the canopy area of each plant you are keeping and note with the name, general size and health of the plant.

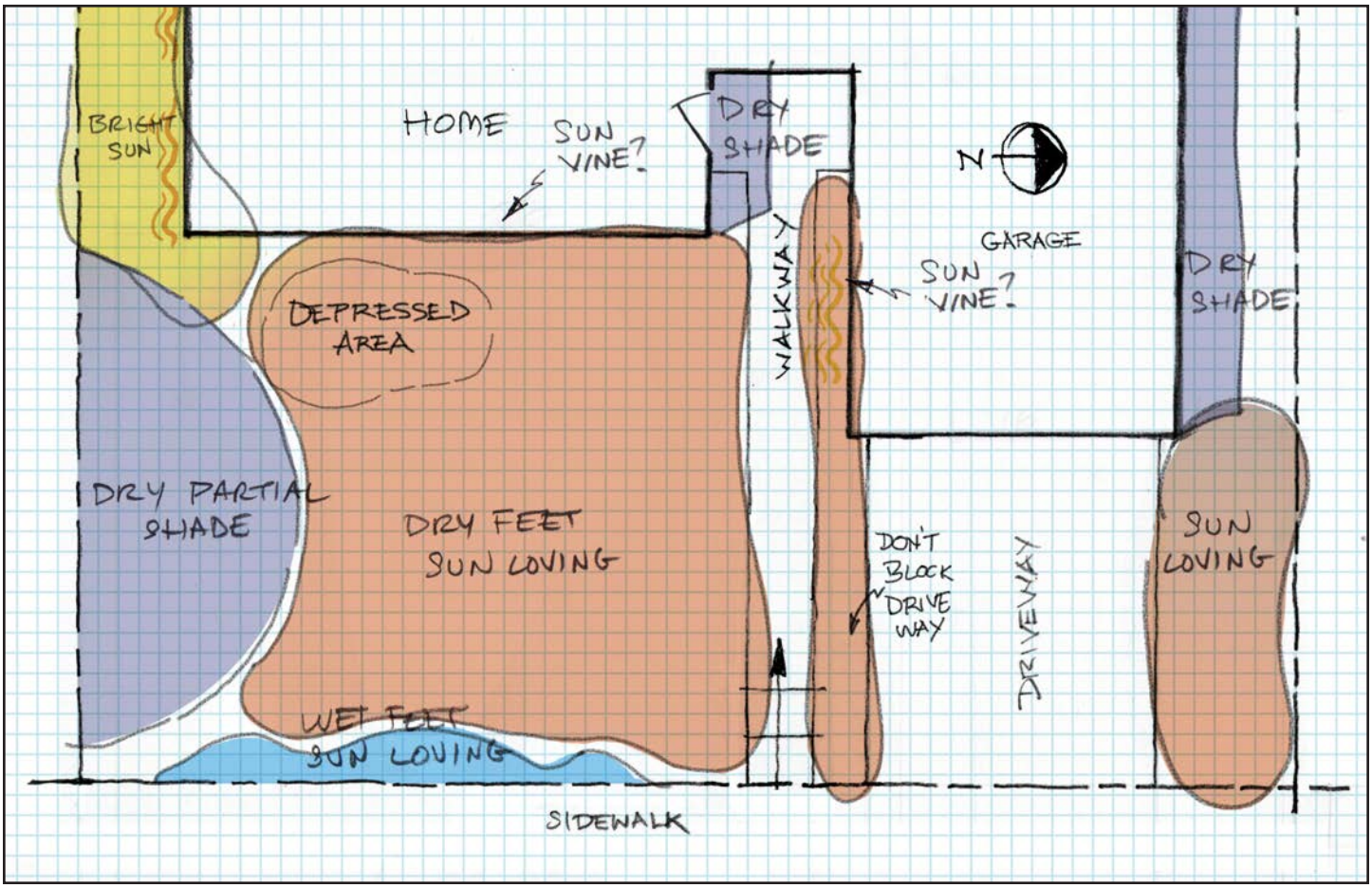
Which of these plants seem unthirsty and which are not? Many plants can be unthirsty if they are well established, with deep healthy roots (old rose bushes or very large shade trees, for example).

Do It! Group Your Plants for Similar Needs: Sun/Shade and Water Use.

When selecting and grouping plants, note the water requirements of each plant and make sure plants with different water needs are not placed together. For example, Some Sun-Loving plants have MODERATE water needs and some have VERY LOW water needs. If we mixed these two types of plants together, one would always suffer if the watering regime worked for the other.

Start making lists of plants with similar water needs that tolerate wet feet, and that require dry feet. Which wet feet plants have MODERATE Plant Factors? Do dry feet plants have MODERATE Plant Factors?

Match plants to your microclimates



Arrange Plants based on their favorite microclimates.

Plants that need more water will be found grouped together at the base of a depression or near the banks of a stream. Plants that need fast draining soils will be found on slopes. Plants that love sun will not be growing in the shade of the oak tree, and plants that require deep shade will not be growing in the open field.

Our Site Has Three Microclimates. What types of plants will work in the main part of the front yard considering the Microclimate Map?

(1) The front yard is in full sun for most of the day, so most of the plants need to be sun lovers.

(2) There is a moist depressed area in full sun. We may want to emphasize that moist area for rain catchment. The hillside areas surrounding the depression are raised slightly and drain freely.

(3) There is a slightly shady area under the canopy of the neighbor's tree and at the front entry.

We Have Three Plant Communities. When we select plants for this garden, we will need to find at least three different kinds:

(1) Sun-loving plants that prefer to have their feet dry and thrive in faster-draining soil,

(2) Sun-loving plants that can tolerate wet feet in winter and thrive in heavier soil, and

(3) Plants that tolerate dry shade.

Are we finished grouping our plants? Not yet. We need to consider how we are going to irrigate the plants. So, now we need to assign Plant Factors to each of the plants to make sure our plant water needs are all the same in each area (*see pp. 22-23*) or go to: ucanr.edu/sites/WUCOLS/

Deciduous or Evergreen?

You will see the note D/E/S on the plant lists in this book. D is Deciduous, (or a plant that loses all of its leaves). E is Evergreen, (or a plant that does not lose its leaves). S is Semi-Deciduous, (or a plant that loses some leaves in certain conditions).

Plants speak Latin

Did you know that many plants have similar common names? Ask for plants by their common name, and you might end up with something completely different than what you want. The best way to order plants is to use the Latin name; that way there is no miscommunication.

Group plants by **Hydrozones**

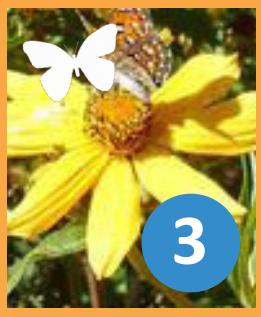
Hydrozone Rules

- Plants with similar needs are planted together so water can be applied as efficiently as possible through rainwater catchment and irrigation.
- Sun exposure, slope, and plant root depth should be considered so that full sun areas are one hydrozone, shade areas are another, and mixed exposure areas are yet another.
- Each irrigation valve should irrigate a separate hydrozone containing plants with similar water needs, living conditions, and root depths.
- Plants with high water needs (vegetables, lawn) must be on their own hydrozone and the sprinklers/emitters on that zone must not water anything else.
- Each hydrozone must be able to handle enough water volume for every emitter to work properly.
- Each hydrozone should have sprinklers or emitters that emit the same amount of water and they should be spaced so that every plant in the zone gets the same amount of water (pros call this matched precipitation).

Five Plants OK With Wet Feet

1 Mondarella villosa
Coyote Mint

2 Juncus patens
CA Gray Rush



3 Bidens laevis
Joaquin Sunflower

4 Muhlenbergia rigens
Deer Grass

5 Iris douglasiana
CA Native Iris

Five Plants That Prefer Dry Feet

1 Ceanothus maritimus
Bluff CA Lilac

2 Epilobium canum 'Everett's Choice'
Everett's CA Fuschia

3 Arctostaphylos 'Sunset'
Sunset Manzanita

4 Muhlenbergia capillaris 'White Cloud'
Hairy Awn Muhly

5 Bouteloua gracilis 'Blonde Ambition'
Blonde Ambition Blue Grama

Keep **Friends** in community

CA Coastal Prairie Community

1 Eschscholzia
CA Poppy

2 Sisyrinchium bellum
Blue-eyed Grass

3 Achillea 'Moonshine'
Fern Leaf Yarrow

4 Erigeron glaucus
Seaside Daisy

5 Eriogonum parvifolium
Cliff Buckwheat

CA Coastal Sage Scrub Community

1 Salvia 'Pozo Blue'
Grey Musk Sage

2 Diplacus aurantiacus
Sticky Monkeyflower

3 Salvia munzii
San Diego Sage

4 Ribes speciosum
Fuschia Gooseberry

5 Trichostema lenatum
Wooly Blue Curls

CA Chaparral Community

1 Sphaeralcea ambigua
Desert Mallow

2 Agrostis pallens
Bent Grass

3 Cercocarpus minutifolius
San Diego Mountain Mahogany

4 Dendromecon rigida
Bush Poppy

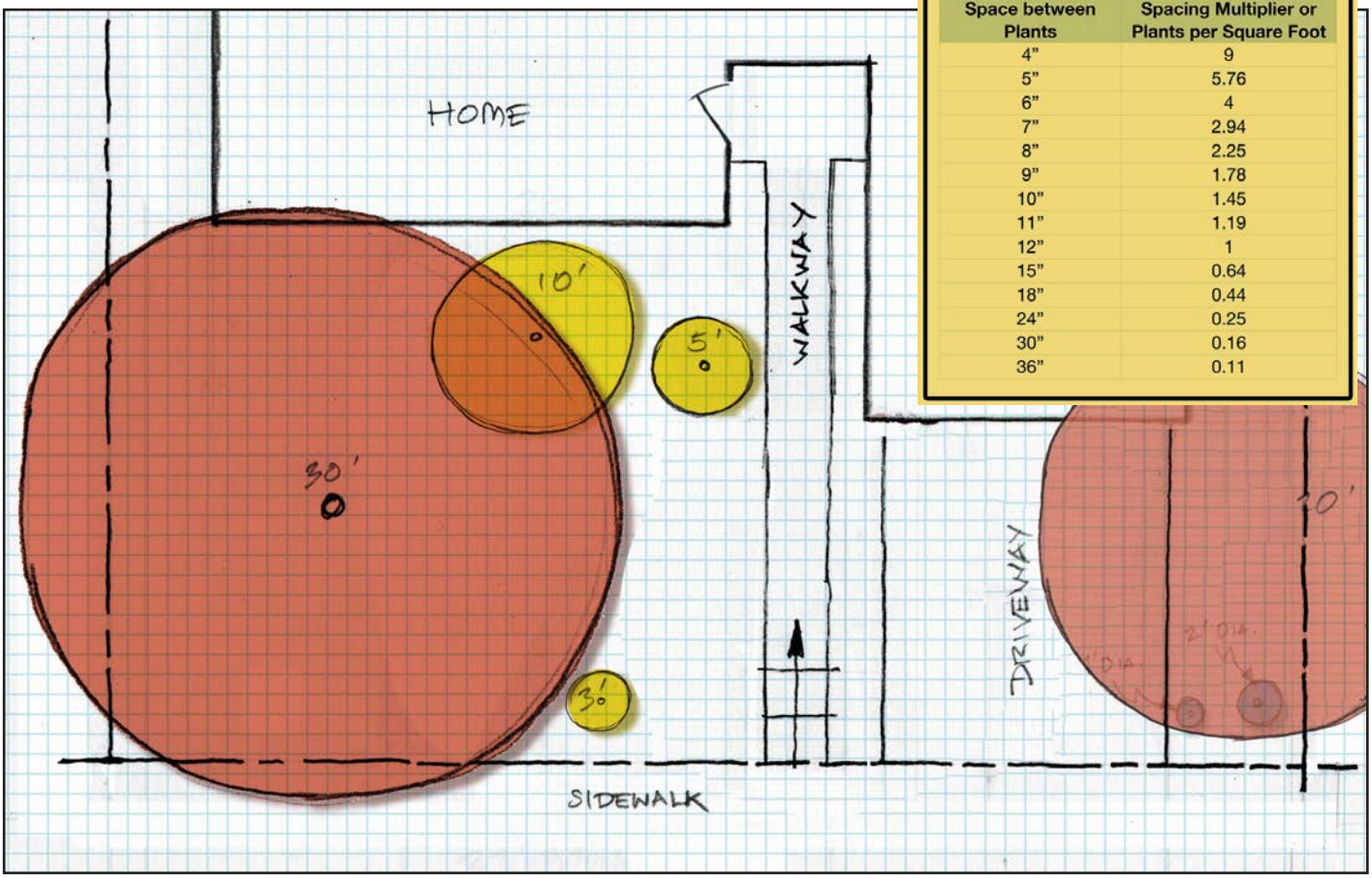
5 Leymus condensatus 'Canyon Prince'
Clumping Wild Rye

Plants live in communities.

Left on their own, plants arrange themselves into communities of their friends based on common microclimates, and interactions with each other, with insects, birds, and other animals, and with the physical environment. Most communities tend to occur repeatedly in the landscape under similar environmental conditions.

While non-native plants may be equally adapted as native plants to the climate conditions of a particular area, local native plant communities have evolved together and will grow so well together that they will reject "outsiders" and work together to out compete them. So, we recommend learning something about the San Diego plant communities and selecting plants that like to live together from those lists.

Give plants **Space** to grow



Space between Plants	Spacing Multiplier or Plants per Square Foot
4”	9
5”	5.76
6”	4
7”	2.94
8”	2.25
9”	1.78
10”	1.45
11”	1.19
12”	1
15”	0.64
18”	0.44
24”	0.25
30”	0.16
36”	0.11

Note Height and Width of each plant at maturity.

This allows you to correctly space the plant in the landscape. Proper plant placement, taking into account mature plant size, should limit the need for future pruning and reduce the amount of maintenance required in the long run.

Natural forms are encouraged for habitat value, but fire prevention does require regular pruning and removal of dead plant material.

Use the inset spacing chart to help figure out how many plants you need per Square Foot based on the mature size of the plant.

Scale Your Plants for Maturity by making Plant Circles the size of the plant at maturity using a 1” = 4’ scale.

Practice using colored pencils to indicate the water needs of the plants; it will make it easier to lay out the planting plan in irrigation zones.

Look how big the (LOW water use) 20’ and 30’ wide canopy trees will be. Will this change the microclimates in the future? Think ahead if your tree will cover a whole yard that’s now sunny.

Small plants are mighty

Select the smallest healthiest plants you can find, especially when choosing natives. Once planted in a properly prepared bed, and watered wisely, the small plants establish themselves more vigorously than plants raised in larger containers. But just because you’ve selected small plants, doesn’t mean you need to buy more than the space allows!

Root depth matters

Make notes about the root depth of the plants when you are placing them on your plan. Trees, with their deep roots, will be irrigated less frequently, but for a longer time. While groundcovers with shallower roots will require more frequent water. Keep trees and groundcovers on separate hydrozones.

Make your **Planting Plan**

Do It!

Plan for Planting. Start with a copy of your Microclimates Maps (*see p. 32-33*). Begin the plant design process by selecting the right plant for the right place in your garden. Use the Plant List below to match plants with the conditions, and represent the plants with circles the appropriate size and color reflecting Plant Factors. This is the foundation of your Plant Shopping List. It's just a paper plan, so move things around! Experiment!

1. Take into consideration microclimates and select plants that need Full Sun, Part Shade or Shade as appropriate.
2. Consider Plant Factors - Low or Very Low Plants on berms and Moderate Plants in the swales.
3. Consider the height, width and root depth of each plant.
4. What form of plant do you desire - Grass or Groundcover, Vine, Shrub or Perennial or Tree?
5. Once you've drawn your plan, count up the number of plants you will need to order and mark them in the Quantity box.

QTY	Symbol	Form	Botanical (Latin) Name	Common Name	Plant Factor	Sun	Dimension H' x W'	Flower Color	Notes
14	A	Grass	Bouteloua gracilis 'Blonde Amibition'	Blonde Ambition blue grama	L/VL	F	2' x 2'	wheat	Dry Feet
4	B	Perennial	Lavandula	Lavender varieties	L	F	3' x 3'	purple	Mediterranean
4	C	Perennial	Salvia 'Bee's Bliss'	Bee's Bliss sage	L	F	2' x 8'	blue/purple	Groundcover
22	D	Perennial	Teucrium chamaedrys	Germander	L	F	3' x 1'	pink/purple	Mediterranean
3	E	Perennial	Verbena lilacina 'De la Mina'	Cedros Island verbena	L	F/PS	2' x 4'	purple	Mediterranean
2	F	Shrub	Abutilon palmeri	Indian mallow	L	F	5' x 5'	gold	Borders
1	G	Shrub	Galvezia speciosa 'Firecracker'	Island bush snapdragon	L	F	4' x 5'	red	Pollinator
1	H	Tree/Shrub	Punica granatum	Pomegranate	L	F	10' x 10'	orange/red	Mediterranean
2	I	Vine	Vitis 'Rogers Red'	Roger's Red grape	L	PS/S	30'	white	Mediterranean
27	J	Perennial	Heuchera maxima	Island alum root	M/L	PS/S	3' x 1'	white/pink	Pollinator
3	K	Perennial	Juncus patens	CA gray rush	M	F/S	2' x 2'	brown	Wet Feet
2	L	Shrub	Dendromecon rigida	Bush poppy	VL	F	9' x 6'	yellow	CA Chaparral

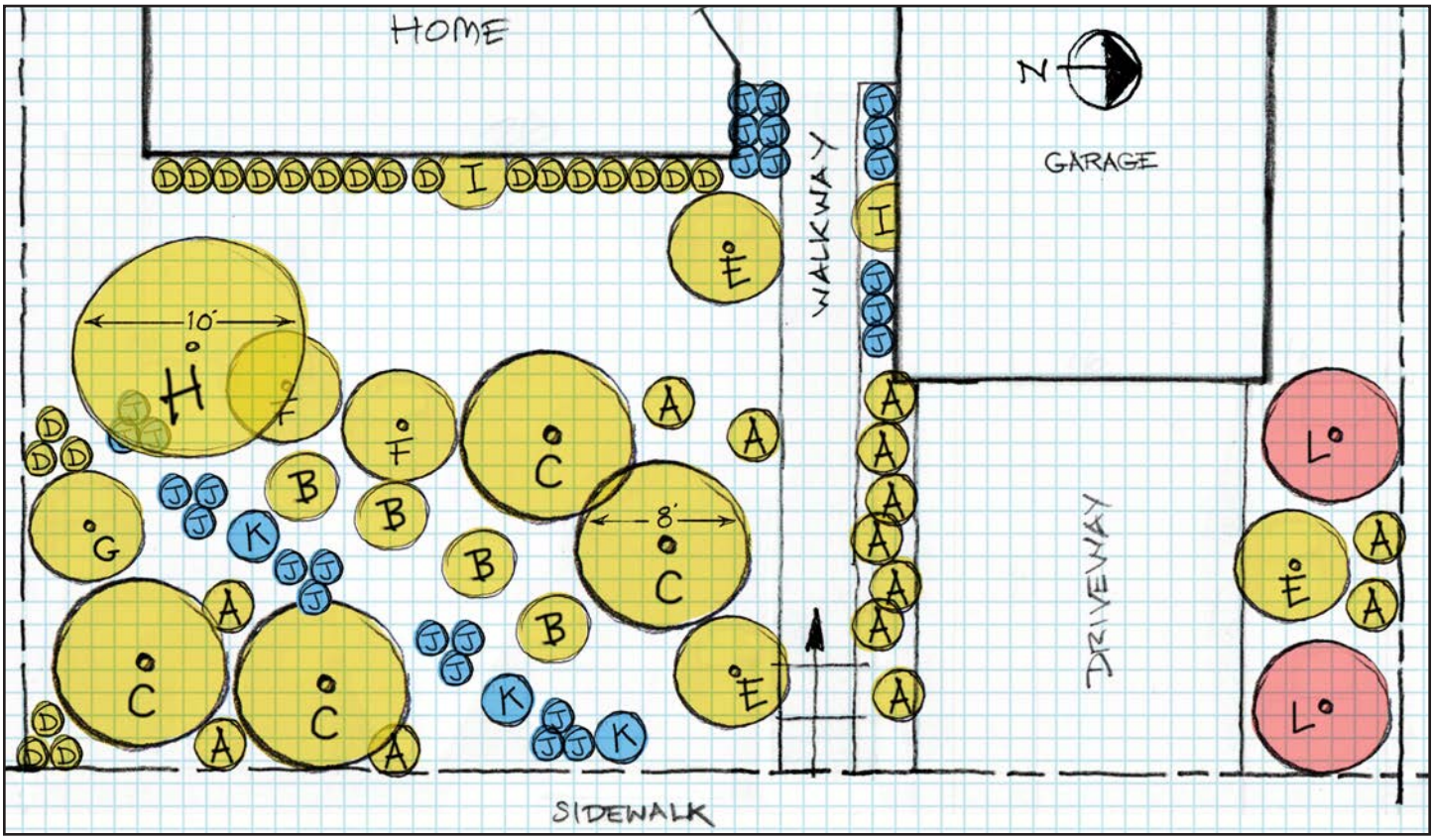


photo: Sam Wells

Water **Wisely**

Manage Water to keep OWL alive.

Managing water wisely in the landscape to keep oxygen, water and life in balance means knowing something about both rainwater capture and irrigation. Approximately half of the water coming into an average San Diego household is used outdoors, the majority of which is irrigation. Additionally, according to USEPA experts, up to 50% of commercial and residential irrigation water used is lost due to evaporation, wind, improper system design, or overwatering. So, we always want to be sure to use water as efficiently as possible for our gardens.

Healthy soil, full of life, absorbs water like a sponge and shares it with plants as needed. It also releases any excess water once the sponge is saturated. During the traditionally wet San Diego winters, the healthy soil sponge can absorb water, in surprisingly large quantities, to be released slowly to plants as they need it in the drier months. Shading the soil surface, with plant material and mulch, protects soil water by slowing evaporation.

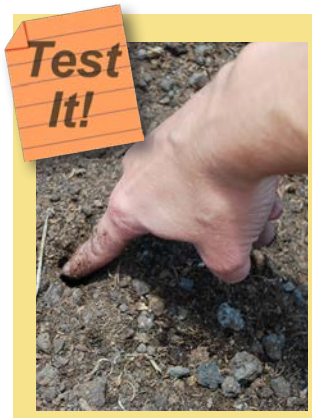
The objective of managing water in the landscape is to keep just the right balance of oxygen and water so that plants look great and stay healthy.

Balance Your Soil Moisture Account. When oxygen and water are in balance within the soil, the amount of water that is lost through evapotranspiration (ET) is just like writing a check for water out of the soil bank account.

The water that enters the soil reservoir as rain or irrigation is just like making a deposit into a soil checking account. By keeping records of these transactions (water in and water out), it is possible to know how much water in the soil reservoir is available in the landscape at any given time for the plants to spend.

The initial soil bank balance is determined by direct observation or is assessed after a thorough wetting of the soil by irrigation or winter rains. Every day, plants take small amounts of water out of the soil through ET and then when it rains or an irrigation event occurs, the soil bank is filled up again. The trick is to make sure that you don't overdraft your account.

How do we tell when our account is depleted? Smart irrigation controllers and landscape professionals are able to calculate this OR you can rely on probing with your fingers or a soil probe.



Wet or Dry?

Use "digital" technology! Because it may appear dry on the surface, stick your finger into the soil and make sure it's wet below. If it's wet up to your second knuckle, it doesn't need any more water, so wait another day or two. Alternatively, if you use a soil probe, you can feel the moisture in the soil and make a determination yourself (*see p. 12*). You can look at plant health to determine water need, but sometimes overwatering and underwatering will produce similar results in plants.

Underwatering Symptoms

- Soil is bone dry
- Older leaves turn yellow or brown or drop off
- Leaves are wilted
- Leaves curl and become brittle
- Stunted growth
- Plant is dead!

Overwatering Symptoms

- Soil is constantly saturated
- Leaves turn a lighter shade of green or turn yellow
- Young shoots are wilted
- Leaves are green yet brittle
- Algae and mushrooms are present
- Growth is excessive
- Plant is dead!

Rainwater as a **Resource**

Water From Rain can be captured.

During the rainy season, run off from hard surfaces (roofs and patios) can be directed to the permeable landscape. By capturing rainwater in soil we may be able to build an ecosystem that can go through the dry summer months with minimal or no additional water. Our whole built environment can be transformed into a living sponge and a giant rain barrel. If there's more rainwater than can be absorbed, or the soil is particularly impermeable, then we can allow it to flow through our gardens, removing pollution before sending it along its way.

In order to capture rainwater we will have to take a serious look at our roof, do some basic math, make choices about when and where to hold the water, and contour the garden so the garden makes the grade. We also need to figure out whether or not our soil needs help to become a better sponge.

Water From Irrigation is needed when rainwater is insufficient.

In our San Diego region, rainfall can be insufficient and unreliable. An alternate water source, such as irrigation, may be required. If you already have an irrigation system, you may cap the heads or convert to a more efficient drip or low application rate spray head.

In order to make choices about our irrigation system, we will have to learn to identify various irrigation components as well as any problems with existing systems. We also will need to learn a little about how irrigation is applied properly to a landscape and ways we can best control the amount of water applied.

Do You Have A Brick or A Sponge?

If you have a brick you will need to take this into consideration when planning your contours. You will need to spend some time to turn the soil back into a sponge. Also, if the soil does not drain well, you will need to take special care when you plant that you do not drown your new plants.

When you select plants, remember your soil type and choose plants that prefer it – if you have sandy soil, look for plants that require free draining soil, and if you have clay, look for plants that can withstand heavy soil (*see p. 11*).

We want to have soil in our landscape that can capture water and allow it to soak completely into the soil within 24 to 48 hours. Building Living Soil therefore becomes important in our plan to capture rainwater and save it for a dry day.

Test It! Percolation Test (Drainage Test)

You Will Need:

- Dig a hole the size of a 1-gallon plant (that's about 12" deep and 12" wide).
- Fill the hole with water and wait. Note how long it takes to drain completely. This is necessary to completely saturate the soil.
- When all the water has drained out, fill the hole up again all the way and see how long it takes to drain out.
- Lay a stick or the shovel handle across the hole and measure the distance from the top of the water to the stick each hour until it has drained completely.

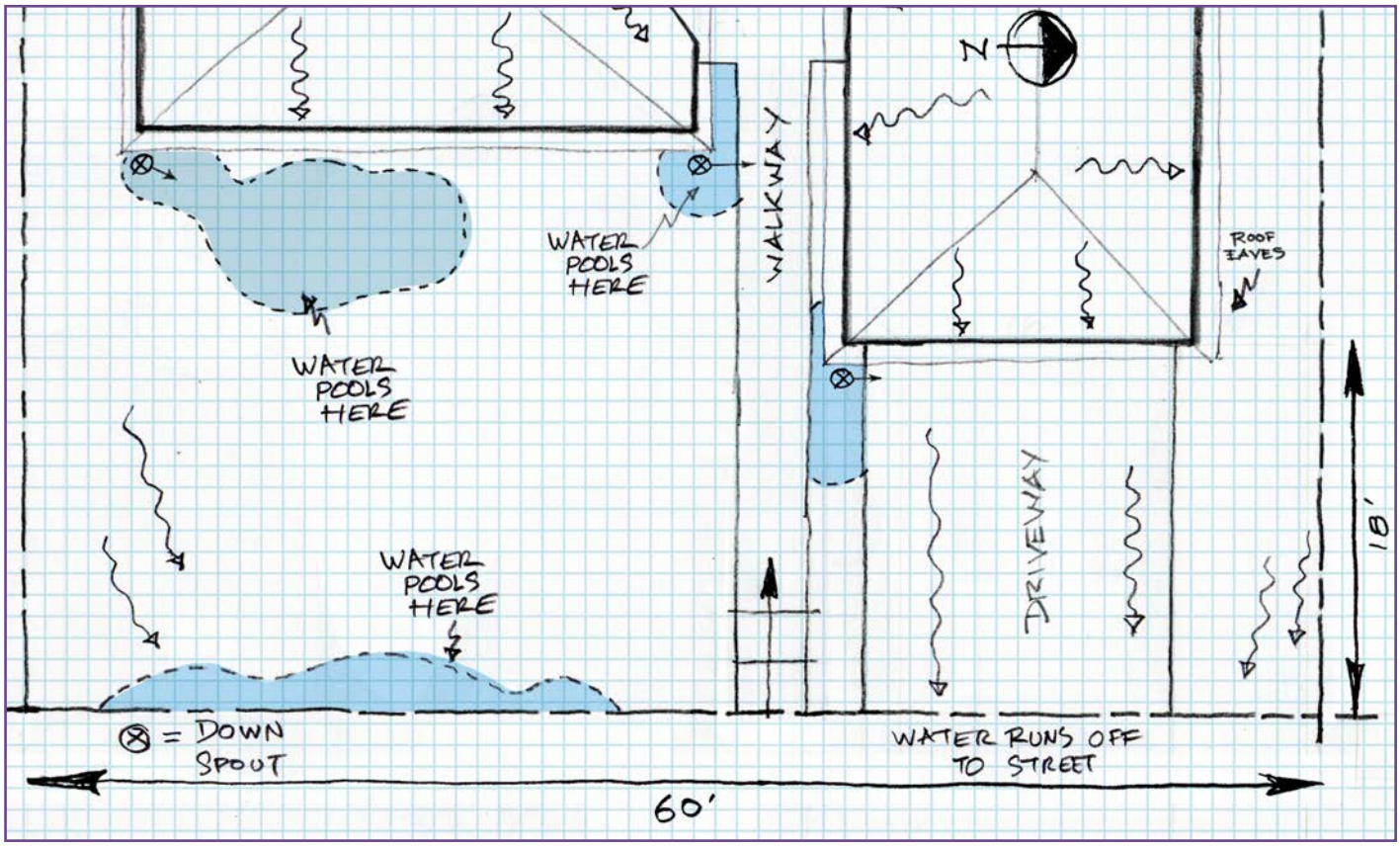
Verdict:

>4" per hour - You have sand and need to add organic matter to improve the soil *(see p. 13)*.

<1" per hour - YOU HAVE A BRICK. Your soil needs some extra help so try sheet mulching (*see p. 19*).

1" - 4" per hour - Congratulations! Your soil drains well! YOU HAVE A SPONGE!

Where is the water **Moving** in your garden?



Do It!

Where Does Water Go In Your Yard?

Make a copy of your Site Plan and label it Water Plan.

Watch what happens to water as it comes off the roof of your home and moves across your property.

- Do you have low spots in which water pools?
- Does water run off the property anywhere?
- Does water run onto the property from a neighbor or street?
- Do any buildings or any hard surfaces appear to be water damaged? If so, does it appear to be a result of rain, of irrigation or both?
- Note the direction of water as it moves around the property.
- Turn on the irrigation for no more than 3 minutes and note whether there is pooling or runoff.

How Much Water from each downspout?

Imagine the water from your garage roof splits into two downspouts and Your Total Roof Area is 20' x 20' = 400 SF

If half of the water goes into each downspout, then the roof size for one downspout is: 400 SF ÷ 2 = 200 SF

0.62 is a constant that converts square foot inches into gallons. Now calculate how much water in gallons is coming from one downspout: 1" x 200 SF x 0.62 = 124 gallons of water per inch of rain per downspout.

You can use these calculations to determine how much water comes off any hard surface (patio, driveway, sidewalk, etc.).


photo: Pamela Berstler

Capture **First Flush**

First Flush is the first inch of rain after a dry spell.

This is the most important water to capture in your landscape. The first rainfall washes away pollution that has gathered on hard surfaces during the dry spell, and it needs to be filtered by the landscape before it goes anywhere else.

Do It! Calculate How Much Water Comes Off Your Roof

The shape of your roof doesn't matter. A pitched roof and a flat roof have the same footprint and the same amount of rain falls on the roof whether sloped or flat. You can measure a sloped roof from an arial view or from the ground without worrying about the slope. Just measure the outside edges and calculate the square footage as you would any landscape area.

Area of a Rectangle = length of side A x length of side B

Some roofs are flat, and therefore easy to calculate. For complicated roofs, divide the area into squares or triangles and add up the area of each square or triangle.

Once you know the total area of the roof, you can figure out the amount of rainfall that it generates in gallons. 0.62 is a constant that converts square foot inches into gallons.

Rainfall (in inches) x Roof Square Feet x 0.62 = Gallons of Rain Water From Your Roof

If your roof is 1,000 square feet (SF), here's how much water runs off it:

- 1"(rainfall) x 1,000 SF x 0.62 = 620 gallons
- 10" (typical coastal rainy season total rainfall) x 1,000 SF x 0.62 = 6,200 gallons

It adds up quickly, even in dry areas. Try to save as much as you can in your landscape sponge!

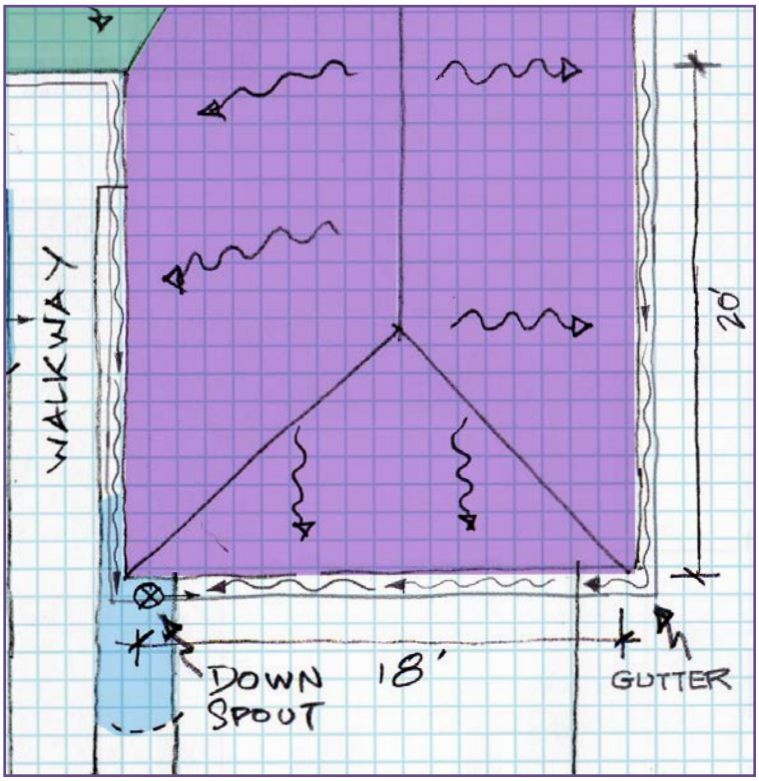
Your Roof is a Mini-Watershed. Track where water falls on the roof - this is the **Top** of your watershed. Then mark where it flows off the roof - this is the **Bottom** of your watershed.

Take another look at your roof and begin to separate out each area that deposits water into a downspout. Mark the location of each of your roof gutters and downspouts.

Once you know the total area of the roof, you can figure out the amount of rainfall that it generates.

The new way of thinking about landscapes has completely turned around the old idea of putting water on to hard surfaces and into the storm drain in order to get it off the property as quickly as possible.

By contouring our landscapes and **Slowing**, **Storing**, **Spreading**, and **Sinking** rainwater, we reduce the negative effects of hard surfaces and help give our watersheds a chance to manage the stormwater. Plus, sinking water in our yards helps combat drought, so there are multiple benefits from considering a watershed approach (*see pp. 42-43*).



Catch the rain: **Slow** and **Store**

Slow It!

If gutters are installed on your house, water will be directed into downspouts, where it can move with great force and speed, especially in a large storm. Instead of allowing downspouts to discharge directly on hard surfaces like the driveway or pathway, think about ways to redirect the downspouts into vegetated areas. Replace downspouts with rainchains to slow down the water, so it is more easily absorbed when it reaches landscaped areas. Add a rain barrel or cistern at the bottom of the downspout or rainchain and allow it to overflow into the garden.

If gutters are not installed, water sheets off roof surfaces and can cause erosion. Areas under eaves may be covered in permeable groundcover such as pea gravel, mulch, or rock to reduce the compacting force of water falling on bare soil. Spreading fresh leaf and wood chip mulch throughout the garden will slow down water. Healthy soil, bound together by the structures its life creates, can withstand even the strongest rains.

Store It!

Rainwater also can be directly harvested and stored. Storage vessels include rain barrels and cisterns directly connected to downspouts.

Stored water gradually can be released into the landscape between winter rains, building up the soil sponge and ensuring that native plants get adequate water during the winter when they need it most. If you need water in the summer and capture enough of it, you may be able to use your cistern water for irrigation.

Both rain barrels and above ground cisterns are inexpensive to purchase and easy to install. Mosquitoes are kept out by screens, and with a little maintenance and common sense, the water can be kept safe. If you intend to store rainwater, make sure that you divert the First Flush into the landscape before capturing that which follows.

Properly sited trees are an excellent landscape feature for grabbing rain and allowing it to be released slowly over time.

Catch the rain: **Spread** and **Sink**

Five Great Permeable Surfaces

1 sand set pavers

2 porous concrete paving

3 interlocking pavers

4 gravel

5 sand set flagstones

Some Rainwater Capture Rules

- Always check with local building regulations before altering your drainage.
- Redirect downspouts from hard surfaces into landscaped areas or other permeable surfaces.
- Use rain barrels or cisterns and direct the overflow into landscaped or permeable areas.
- Choose permeable hardscape for new patios, walkways and driveways.
- Break up impermeable surfaces like walkways and patios or cut 4” gaps in driveways.
- Keep all soil on the property and use it for creating contours throughout the landscape.
- Make sure you have turned your soil into a sponge.

Spread It!

Water needs to be spread around to spend some time in your landscape. You may have an existing impervious walkway. If so, make sure it drains to the landscape and you are good to go.

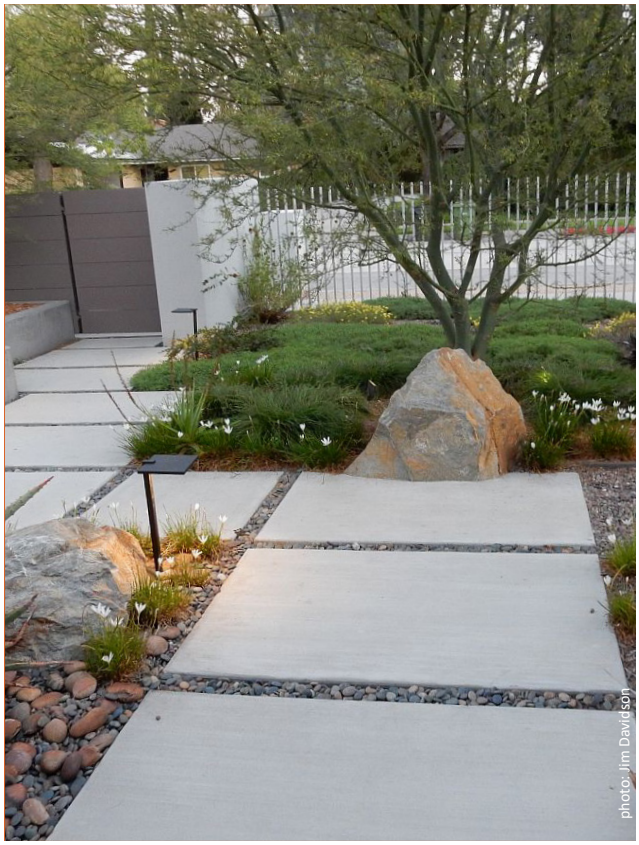
If you choose to replace your hardscape, consider a permeable surface such as permeable pavement, permeable asphalt and permeable pavers.

If you cannot use permeable pavers or permeable poured concrete to build your patios and walkways, then consider breaking up or cutting the pavement and rearranging it with gaps between the pieces or puncturing it to create planting areas. Paved area that have drains can be redirected from storm drains into the garden.

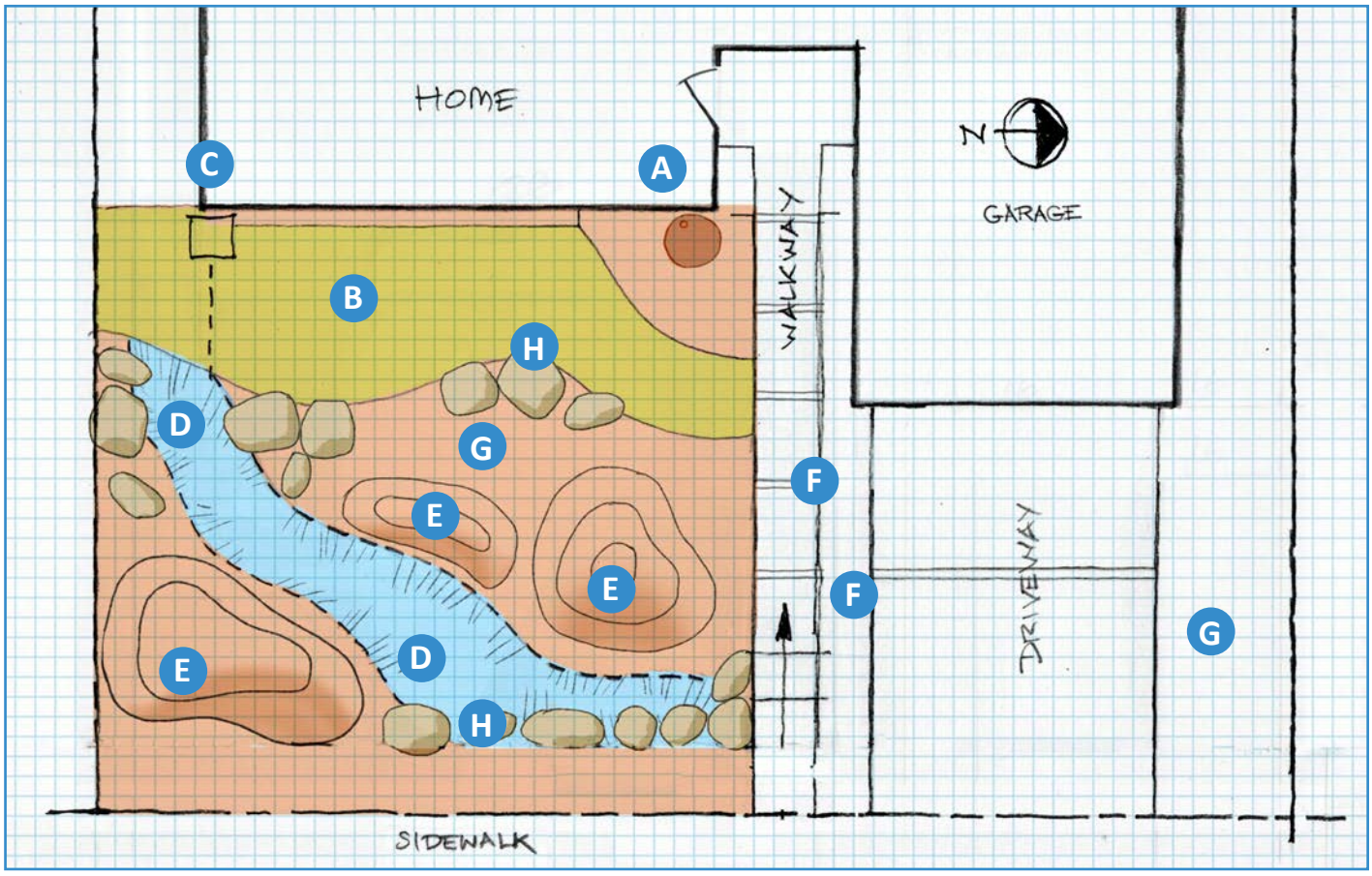
Sink It!

Trust the soil sponge to do its job. Existing impermeable surfaces that cannot be transformed should be treated as water capture areas, where water is collected before it is guided to the garden. If you are not able to capture and hold the water on site, then concentrate on making sure that it passes through as much of the natural landscape as possible before it moves off your yard and becomes runoff.

Consider making small depressions, or creating a dry creek, also called a swale, to spread the water. Remember to keep all of your soil on site, and use whatever you dig out to create interesting high points, or berms, next to the low point.



Detain the rain



Use Multiple Strategies to hold on to First Flush.

A **Downspout Redirected** off walkway and into rain barrel. Overflow from rain barrel goes into landscaped area.

B **Permeable Patio** of gravel is installed.

C **Downspout Diverted** into a catch basin which is connected by perforated pipe into the swale area of the landscape. This should eliminate the pooling and erosion caused by the downspout.

D **A Slight Depression**, or swale, has been dug out in the dry shade area on the South side of the property and across the front yard into the low spot at the sidewalk that always is wet. This swale is only 12" deep in the middle.

E **Relocate Soil As Berms** when digging out the swale and the patio area. Relocated soil becomes raised areas (berms) on either side of the depressed area. The berms become places for plants that like fast drainage.

F **Horizontal 4" Cuts** have been made in the walkway and driveway and filled with 1/4" to 1/2" crushed gravel.

G **Living Soil** is being created with Sheet Mulching using 4" - 6" of mixed leaf and bark tree trimmings covering the whole yard.

H **Boulders**, typically no more than 12" to 18" in diameter, are used to retain both the slight slope, flattening the permeable patio area, and the edge of the swale next to the sidewalk and walkway where the overflow will occur.

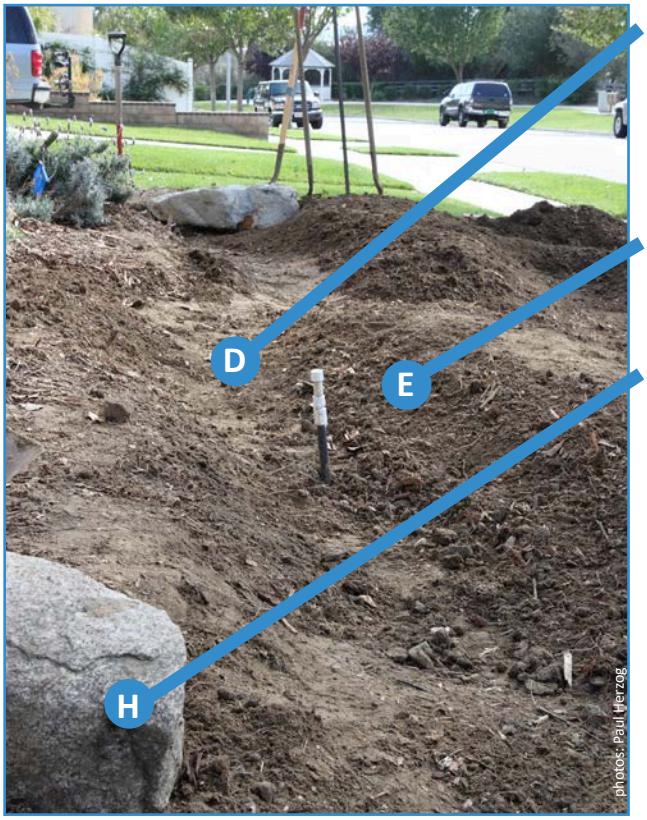
G Mind the Foundation

Be sure to locate your berms and swales away from the foundation of the buildings and edges of the sidewalks. Always grade away from foundations.

A good rule is 5' to 9' from buildings and 3' from sidewalk edges. Where space is limited, make sure the low point of the basin fits these parameters. Overflow of excess water can go to the sidewalk or the street so long as you protect against erosion.

Keep yards **Contoured**

photo: John Huber



photos: Paul Herzog

Basins and Swales are shallow depressions, or channels no more than 12" to 24" deep, on gently sloped or nearly flat landscapes that move water around over short distances. The plants in and around the depressions capture and sink small volumes of surface water. Small, shallow depressions are best used in clay soil areas, while sandy soils may accommodate the deeper (up to 24" deep) depressions. Channels can be planted (vegetated swales) and/or lined with rocks and small boulders to resemble natural creek beds.

Berms are mounds of raised soil, usually planted, that can border basins and swales or be used alone. Berms help contain and move water around, increasing the holding capacity of basins and swales.

Boulders may be used to retain small berms or edges of swales and to create interest in the landscape.

Do It!

Make Your Grades!

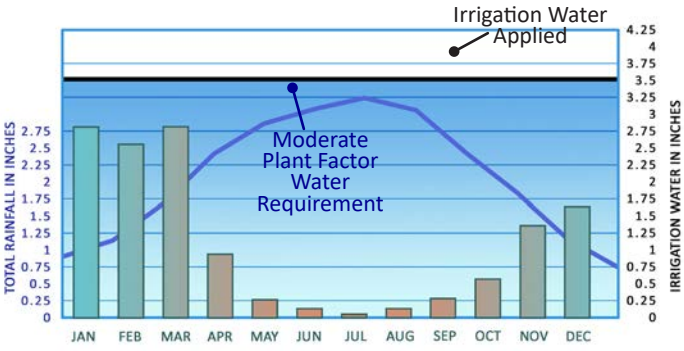
Use existing depressions, slopes and contours for guidance when planning landscape grading. If your yard is flat, move soil around to create more rain-holding contours. Do the Percolation Test (*see p. 39*) and remediate your soil as necessary to make it more of a sponge before you complete your rainwater capture plans. Remember to seek professional advice for grading and capturing water on existing hillsides.

As always, before digging, **CALL DIG ALERT 8-1-1** or visit: ***www.digalert.org***

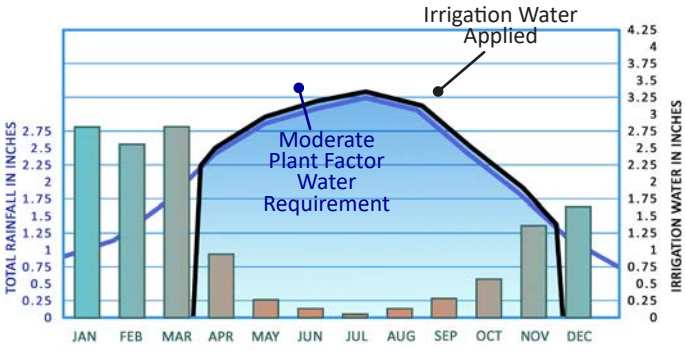
Irrigate **Intelligently**

Irrigation Efficiency has a big impact on plant health and water use.

Irrigation systems have a lot of inter-connected mechanical elements that must be designed, installed, programmed and maintained properly for optimal performance. Irrigation Efficiency is a way of describing how well your irrigation system is delivering water for the beneficial use of the plants in your landscape. Issues that adversely affect the performance of your irrigation system reduce its efficiency. Broadly grouped, these issues relate to site conditions, irrigation control and the distribution uniformity of the system.



Unmanaged Inefficient Irrigation



Managed Efficient Irrigation

Lower Landscape Water Requirement With More Efficient Irrigation, and therefore, save more water in your new landscape *(see p. 23).* In this section we will look at three ways to improve your irrigation system efficiency by upgrading and continuously maintaining it for maximum performance.

(1) Smart Irrigation Management
(2) State-of-the-art System Upgrades
(3) Match Irrigation to Hydrozones

San Diego Landscape Watering Calculator can help you produce a watering schedule for your landscape. The calculator is based on historical climate data for your zip code, and inputs you enter about the plants, irrigation type and microclimates for each hydrozone.

From June to October you can use this calculator to set your controller programs each month. While nature provides the rain from November to June, use your irrigation sparingly or turn it off all together.

In a particularly dry winter, adjust the program monthly to be sure you are irrigating to make up for the lack of rainfall. The sustainable landscape that gets winter water will require less in the summer.

Intelligent irrigation begins with the simple understanding that "setting and forgetting" irrigation controllers is a thing of the past. Even if you do not yet have a "smart" irrigation controller that adjusts the program for weather conditions, you can be more proactive in managing your landscape water and more closely matching your watering schedule with the actual water needs of the landscape.

Upgrading your system with state-of-the-art components is the most significant thing you can do to save water.

Hire Certified Professionals

When selecting a professional designer or contractor to help you with your project, seek providers who are qualified to provide irrigation design services. Credentials like the Irrigation Association's Certified Irrigation Designer can help assure your project's success. You may also ask if your contractor is a Qualified Water Efficient Landscaper. (QWEL) www.qwel.net

San Diego Landscape Water Calculator

apps.sandiego.gov/landcalc/

Use this calculator to create a watering schedule that more closely matches the actual water requirements of the hydrozones in your landscape.

Install a "Smart" Irrigation Controller

Switch out your old irrigation controller for a "smart" controller. *www.WaterSmartSD.org*

Smart irrigation **Management**

Keep Water on the landscape.

Observe the irrigation while running and check to make sure that sprinkler heads are not spraying water onto sidewalks, patios or structures. If the water is being applied too fast for the soil to absorb it, runoff will occur. Puddling and pooling also may be an indication that water is applied too fast or too often. Repairs to broken pipes and heads should be made immediately, or the system should be turned off until repairs can be made.

Cycle and Soak Programming eliminates dry weather runoff. Observe how quickly runoff occurs when you are running your irrigation. This is the MAXIMUM run time for your irrigation controller in this hydrozone. So, to cycle and soak your irrigation, you divide up the total minutes required by the hydrozone into blocks of time NO LONGER than the observed runoff time and allow a 30 minute rest period in between the irrigation cycles.

For example, if we need 12 minutes of water in a certain hydrozone, but we observe runoff after 3 minutes, we break down the 12 minute total into four 3 minute cycles with 30 minutes between each cycle.

Hand Watering is especially good for getting a garden established, when you are going to want to spend more time looking at the plants to make sure nothing is amiss. During establishment you may need to water every week or two weeks because roots are only 4" to 10" deep on a newly-planted one gallon plant. (That's why it's great to try to plant during the rainy season!)

Really look at your plants. Are they appearing droopy or sad? Is the soil very dry? If so, then give the plants a good drink and watch. Don't water more than two days in a row, and let the soil dry out completely before watering again. Remember the symptoms of overwatering and underwatering are very similar *(see p. 38).*

After the first year or two, once your plants are settled, your sustainable garden will not need water more than once or twice a month, if at all. Stop watering after the first seasonal rains begin, and let nature do its thing.

Test It!

Observe Your Irrigation System

Turn on each valve of your irrigation system and observe how quickly water begins to run off the landscape. Note the time when the runoff occurs. For some systems this could be immediately, and others it may take as long as 5 minutes.

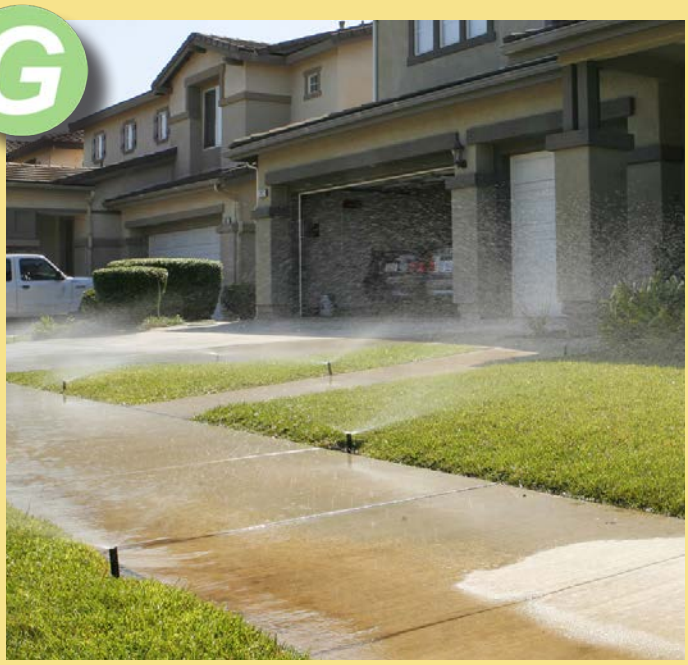
Make sure that the spray irrigation is never running for longer than 8 minutes at one time.

Make notes on your irrigation plan and turn off your irrigation until you are able to fix these issues:

- Do you have broken sprinkler heads?
- Are there heads that are blocked by plants or objects (planters or lights)?
- When the system turns off, does water come out of the lowest heads in the landscape?
- Are heads in need of adjustment so they do not directly spray on to the hardscape?

The image below is an example of the overspray and runoff of an inefficient irrigation system.

G



Adjust Sprinklers to Eliminate Runoff

Several things can be done to minimize runoff due to irrigation. These include:

1. Tune up spray irrigation systems so there is no overspray on to hard surfaces.
2. Do not install spray irrigation in areas that are too narrow for spray (8' wide or narrower).
3. Move spray heads 24 inches from any buildings or hard and impermeable surfaces.
4. Cycle and Soak irrigation run times.
5. Convert spray systems to micro or drip irrigation with the lower precipitation rates, pressure regulation and a filter.
6. In lawn areas, be sure to follow the organic maintenance practices to keep your soil spongy (*see p. 24*).
7. Replace standard overhead sprayers with high-efficiency rotator nozzles or other types of low precipitation rate nozzles.

Showers or Drips?


Rotary Nozzle

Spray Irrigation emits water in an overlapping (head-to-head) pattern.

This can be an efficient way to irrigate large landscapes with groundcover or uniform plant material like lawns or meadows.

Gallons Per Minute (GPM) Spray systems apply water in GPM, so if you know the application rate of each spray head, the distance between heads, and the pressure of your system, it is relatively easy to figure out how much water is applied every time you run your irrigation.

Challenges include irrigating very narrow areas surrounded by hardscape, or irregular patterns. Irregular patterns are particularly challenging because spray irrigation requires head-to-head coverage to be efficient and odd-shaped areas may be under or over watered. High-volume spray heads that emit water at a much higher rate than the soil can absorb should be replaced.

Positives include low volume spray heads that, when properly installed, apply water at about 1/3 the rate of conventional spray heads. The newer spray irrigation heads also have improved the spray itself, with heaver droplets that are more resistant to wind. Landscapes with grade changes using spray heads should have check valves installed to prevent water from flowing out of the low point heads.

Drip Irrigation delivers water directly to roots.

Since drip irrigation is covered with soil or mulch, this water does not evaporate as quickly as it might if it were applied at the surface by spray.

Gallons Per Hour (GPH) Drip systems apply water in GPH, so they often are required to run for longer periods of time than spray systems. However, the actual run time must always account for precipitation rate and runoff.

Challenges include the possibility that drip systems could apply water too quickly for the soil to absorb, so careful consideration is required especially when dripline grids are installed. Drip irrigation operates most efficiently at low pressure (between 15 and 30 psi). To achieve optimal performance and avoid breakage, pressure regulation either at the valve or at the point of connection of the dripline to the buried lateral lines must be used. Also, it is essential to install some kind of filtering system to keep the emitters from becoming clogged.

Positives include the fact that installations of subsurface (or under at least 2 inches of mulch) systems may be the most efficient way to irrigate nearly every type of garden area. Since the tubing is flexible, it can be made to accommodate a wide variety of irregular shaped areas or rectangular areas when laid in a grid pattern, and in rings that are easily expanded as trees or large shrubs grow.

What is a Tattle-Tale?

Screw a white cap (replacing the nozzle) on to the pop-up riser of one sprinkler head on each line when converting to drip.

When the drip irrigation is running below the mulch, the tattle-tale will pop up and let you know that the irrigation is on.

What is a Low-Flow Valve?

Irrigation valves are designed to work within a certain pressure range (pounds per square inch or psi) and flow range (gallons per minute or GPM). If you redesign your system and use low-flow irrigation, the flow through the valve may be so low that your existing valve will not operate effectively and may get stuck in the "open" position, wasting water.

If you have flow lower than 5 GPM per valve, check your valve specifications for flow range. Replace all valves that are not specified for low flow systems.

Irrigation **System** overview

Basic Components of Most Irrigation Systems

1 shutoff valve (ball valve)

2 anti-siphon valve

3 PVC pipe

4 sprinkler head

5 irrigation controller

images courtesy Hunter Industries Inc.

Conventional Irrigation Systems are notoriously inefficient.

This is due to a variety of factors, including poor design, inadequate maintenance, and improper management. Well-designed and operated systems can reliably deliver the necessary water to sustain our landscapes without waste or excess.

A **Shutoff Valve (Ball Valve)** can be manually operated to cut off the water supply in the event of a leak, malfunction, or major repair.

The **Anti-siphon Valve**, when activated by an **Irrigation Controller**, delivers water through a **PVC Pipe** lateral irrigation line, ultimately reaching the **Sprinkler Head**, which applies water to the landscape.

Key Components of An Intelligent Irrigation System

1 in-line pressure regulator

2 submeter or flow sensor

3 rotary nozzle

4 pressure regulator and filter for drip irrigation

5 smart controller

image 1 and 3 courtesy of Rain Bird Corporation, and image 5 courtesy of Hunter Industries Inc.

An Intelligent Irrigation System operates efficiently.

These irrigation components are designed to operate at lower pressure levels, as specified by the product manufacturer. When devices operate with excess pressure, damage, and even failure can occur, not to mention water waste.

A **Pressure Regulator** will eliminate excess pressure.

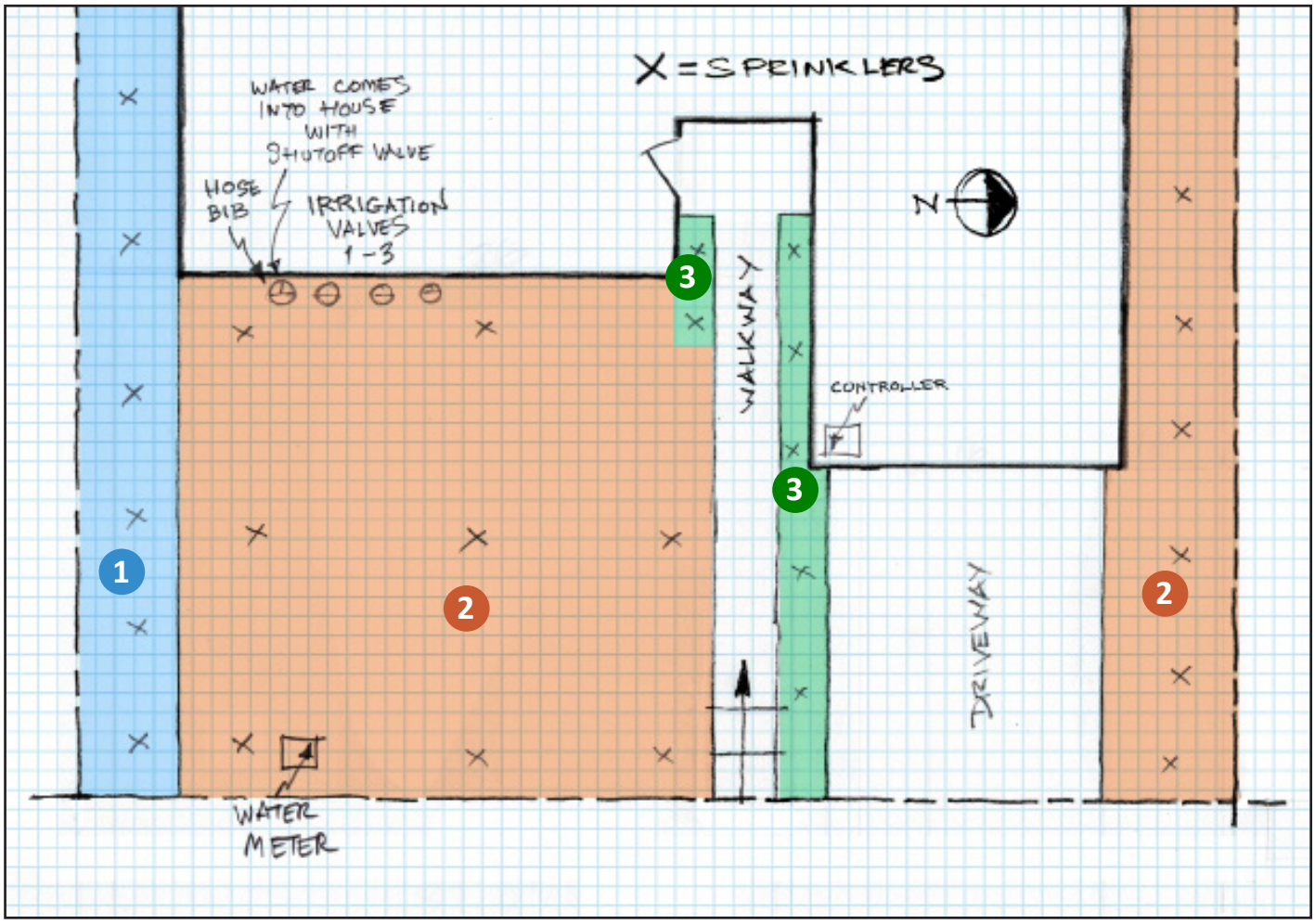
A **Submeter** can be installed where the irrigation system tees off of the mainline to the house. It is a recommended option for large properties to keep track of the actual volume of water being applied to the landscape. Single family homes typically have a single mixed-use meter that does not distringuish between indoor and outdoor water use. Another alternative is to install a **Flow Sensor** that works in tandem with a smart controller.

Low-volume irrigation devices, like **Rotary Nozzles** and **Micro or Drip Irrigation** are designed to deliver water to the landscape at a slower rate that better approximates the infiltration rate of the soil. This reduces the likelihood of runoff.

Smart Controllers will automatically adjust irrigation schedules in response to changing site and/or weather conditions. These come in two varieties. ET controllers monitor weather conditions, while soil moisture-based controllers directly sample moisture in the ground. These devices also have features like “cycle-and-soak” functions that can help eliminate runoff. When selecting a controller, look for brands with the EPA WaterSense® label.

look for WaterSense Meets EPA Criteria

Map your **Existing** irrigation



Our Sample Project has three existing irrigation zones indicated by different colors.

1. South side of the property - 6 Side-strip Conventional spray heads

2. Front yard and North side of the property - 14 Conventional spray heads (3 Quarters, 4 Halves, 1 Full in the front yard and 6 sde-strips on the North side) *Note that a pipe under the walkway and driveway connects the two areas.

3. Along walkway and front entry - 7 Side-strip Conventional spray heads

The challenge is to use the parts of the existing irrigation system that can work with the new system, without abandoning everything and starting from scratch. Be aware, however, that if you are renovating most of your landscape, you may need to significantly alter the irrigation. If this is the case, starting from scratch may be the most cost and time-effective alternative.

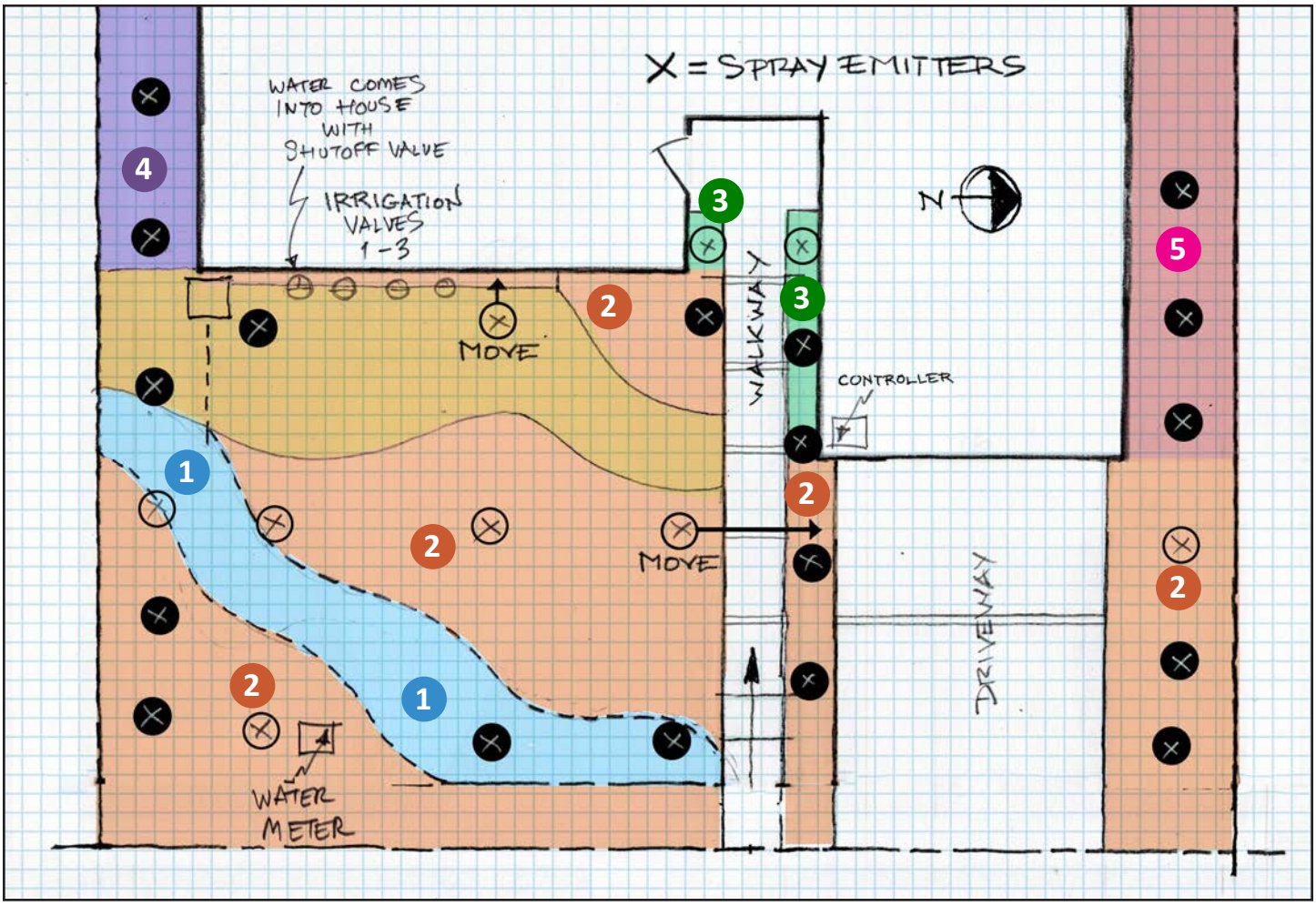
Do It! Make A Map of Your Irrigation System

Locate all of the sprinkler heads on your property and mark their location on a copy of your Site Plan.

Also mark the location of the following elements:

- Water Meter or Irrigation Submeter and where the water comes from the street on to the property (the Main Line)
- Irrigation Controller
- Shut Off Valve for turning off the irrigation system
- Pressure Regulator – this may be for the irrigation system separate from the house or, if your irrigation comes from a pipe that first serves the house, it may be located before it enters the house
- Irrigation Valves
- Hose Bibs
- Backflow Preventer (If you don't have one, your sprinkler valves probably do, so don't worry)
- Color code which sprinklers go on at the same time when a valve is turned on.

Match **Irrigation** to new **Hydrozones**



Compare Valve Zones to hydrozones.

Which sprinkler heads go on at the same time and what kind of plant material are they irrigating? Get ready to make changes to your irrigation system in order to accommodate both the new grading and the new plants you are introducing into your garden. You will have to match each valve zone with the new hydrozones you created.

1. MODERATE water-use plants in the low wet spots and swale - Cap all but 1 head and convert to drip.
2. LOW water-use plants in front yard dry berm areas and VERY LOW water-use plants on North side of driveway - Move 1 head against house; Cap 2 heads in Front yard; Cap all but 1 head on North side; Run drip tubing through cut in walkway to access the planter between walkway and driveway; Convert all uncapped heads to drip.
3. MODERATE water-use plants in dry shade of front entry - Cap 5 heads and convert 2 to drip (one on either side of walkway).
4. Make a new zone from backyard valve for South facing wall of house.
5. Make new zone from backyard valve for North facing wall of garage.

- capped spray emitters
- spray emitters converted to drip

Need help with irrigation? (www.clca.org)

If your irrigation system was installed by a licensed landscape contractor within the past 5 years, you may be able to call on them to walk you through the system before you attempt any renovations. If your system is older than 5 years, it may be very difficult to renovate. Also, check your valves and make sure they are not leaking. If valves are leaking, or if there are any elements about which you are unsure, make the investment in having a licensed landscape contractor renovate your system in accordance with your new sustainable landscape plan.

Before

photo: Pamela Bannister

Every project starts with an **Idea**

Envision your new garden.

Now that you've learned the concepts behind the watershed approach to creating a healthy and sustainable landscape, ask yourself what you want to do in your garden.

Our Homeowner wants to remove the lawn and replace it with a sustainable landscape that prevents pollution from going to the storm drains. But how to get there when faced with an ocean of grass? Here are his Project Objectives:

1. Remove the grass without using chemicals (see p. 18-19)
2. Capture all the rainwater from his roof, even though one downspout puts the water right on the driveway (see p. 38-45)
3. Reduce water use by 70% or more
4. Consider a dog or child-friendly garden -- No thorns or sticky grass seed heads!
5. Build healthy Living Soil that will act like a sponge, even if it rains a lot (p. 38-45)
6. Plant some fruit trees or edible vines and shrubs
7. Plant mostly local California native plants that will attract birds, butterflies and bees for pollination
8. Make pathways and driveway more permeable
9. Keep all dry-weather runoff on the property
10. Convert the existing spray irrigation to micro or drip irrigation with the intention of eventually removing it or not turning it on after establishment. In some areas rotating nozzles may be the best
11. Create a small permeable patio near the house so there is room for a bench or outdoor table
12. Integrate a beautiful object like an art piece or an interesting pot
13. Hire a professional to help design the project, but try to complete most of the construction with friends and family helping out

photo: www.petnet.io

photo: Jeremy Sison

photo: Paul Herzog

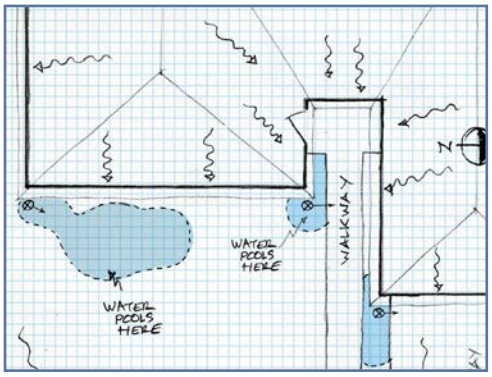
Use this **Project Checklist**


photo: Pamela Berstler

Prepare to work.

☐ Clean up Your Property
Remove trash and debris, weeds, dead plants

☐ Orient Yourself
- ☐ Check local water agency for watering restrictions
- ☐ Are permits required?
- ☐ Check local water agency for incentives before you remove your grass and start your project. (Projects that have started before getting an official approval do not usually qualify for incentives.)
- ☐ Find Your Watershed – make notes about viewsheds, ASBS, wildland interface
- ☐ Find Your San Diego Climate Region (Note CIMIS and Sunset Zones)
- ☐ Confirm fire regulations in your area



☐ Make a List of Things You Want In Your New Landscape
- ☐ Think about how much maintenance you want to do
- ☐ How much rainwater do you want to catch in barrels or cisterns?
- ☐ Determine how much of your property you want to change – and how much lawn to remove

Plan before digging.

- ☐ Do you need design help?
- ☐ Walk around and take photos (for BEFORE)

☐ Make a Site Map
- ☐ Take measurements
- ☐ Microclimate Map

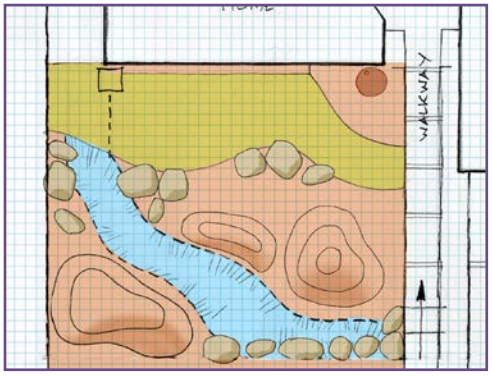
☐ Water Plan
- ☐ Calculate roof area and measure non-permeable surfaces
- ☐ Note location of downspouts
- ☐ Calculate water available from each downspout


photo: Paul Herrog

☐ Grading Plan For Capturing Rainwater
- ☐ Slope of site
- ☐ Plan for where to stockpile topsoil if project is large
- ☐ Identify trees to be protected during construction

☐ Test Soil Type
- ☐ Percolation Test – Brick or Sponge?
- ☐ Jar Test - Sand, Silt, or Clay?

☐ Make an Existing Irrigation System Plan
- ☐ Run irrigation and make immediate adjustments
- ☐ Fix broken heads or lines, move blocked heads
- ☐ Adjust controller program time to eliminate runoff (cycle and soak)



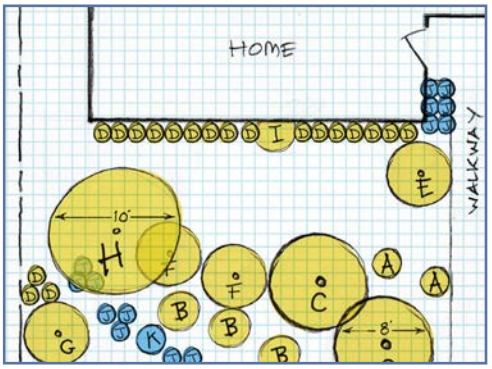
☐ Draft a Hardscape Plan
- ☐ Existing hardscape that needs to become more permeable
- ☐ New hardscape

☐ Do Some Shopping and Research
- ☐ Rain chains (non-copper), rain barrels and cisterns
- ☐ Mulch and compost
- ☐ Permeable hardscape options
- ☐ Nurseries for plants
- ☐ Make Appointments
- ☐ Install gutters, if you want to harvest more water

☐ Secure Permits

Use this **Project Checklist**

www.digalert.org



Design for plants.

- ☐ What do you want in your yard?
- ☐ Follow guidelines for hillside planting
- ☐ Ask for help at a nursery

☐ Make A Planting Plan

- ☐ Assign Plant Factors to existing material
- ☐ Research native plant communities for your area
- ☐ Butterflies and pollinators
- ☐ Swales and berms (wet and dry feet!)
- ☐ Edibles and fruit trees
- ☐ Select one or two trees
- ☐ Check *www.plantright.org* for the BAD GUYS
- ☐ Scale plants for maturity
- ☐ Hydrozone
- ☐ Make sure contractor understand sustainable landscapes concepts

Begin your project installation.

Do you need construction/installation help?

CALL DIG ALERT 8-1-1

☐ Make Calls to Order Equipment, Material, Deliveries

- ☐ Rent a sod cutter and dumpster, if necessary
- ☐ Organic matter for the soil
- ☐ Boulders and gravel for creek beds or bio-swales
- ☐ Catch basins or piping for irrigation and drainage
- ☐ Rain barrels, cisterns, gutters, down spouts, etc.

☐ Stockpile Soil and Protect Trees

- ☐ Protect trees (limbs and roots) from construction damage (***Note:** Tree roots typically extend well beyond the tree canopy)
- ☐ Remove plants that are not wanted

☐ Change Existing Hardscape to Make It More Permeable

☐ Remove Grass and Build Soil (Soil Lasagna)

- ☐ Continue to water your lawn up to two days before removal
- ☐ Make lunch for some young people to help you remove turf
- ☐ Remove your turf without chemicals through Sheet Mulching

☐ Contour Site For Rain

- ☐ Contour soil to hold on to First Flush
- ☐ Remember not to remove soil; use it to create your contours
- ☐ Add organic matter to the soil (compost, compost tea from worm castings, etc.)
- ☐ Install catch basins, drainage pipe and sleeves under hardscape

☐ Repair Irrigation

- ☐ Set back spray irrigation 24” from hard surfaces
- ☐ Identify or move future drip irrigation points of connection
- ☐ Replace valves for low pressure valves
- ☐ Install pressure regulator
- ☐ Install flow meter or landscape sub meter
- ☐ Install low-head check valves on slopes and grade changes

☐ Capture Rainwater

- ☐ Lay out plan using flour, chalk or spray paint
- ☐ Install any new hardscape surfaces, draining to the landscape
- ☐ Install boulders and materials for creek beds or swales
- ☐ Install rain barrel or cisterns

Use this **Project Checklist**


photo: Paul Herzog

Install new plants.

- ☐ Compare Planting Plan with Existing Irrigation Plan
- ☐ Fall is the best time to get free rain irrigation!
- ☐ Order plants and gather materials necessary for planting

☐ Lay Out Planting Plan

- ☐ Lay out your Planting Plan using flour, chalk or spray paint
- ☐ Make your "in field" adjustments
- ☐ Install your plants into the soil lasagna
- ☐ Be sure to consider plants' size at full maturity when placing in the landscape.
- ☐ If drainage is poor, auger holes and wait to complete
- ☐ Thoroughly and completely water holes, plants, and surrounding soil


photo: Pamela Berstler

Upgrade and adjust new irrigation.

- ☐ Consider hand watering until landscape is established (1-2 dry seasons)
- ☐ Adjust irrigation schedule using the Landscape Watering Calculator

☐ Accommodate the Planting Plan

- ☐ Where spray is used, convert to low flow, high-efficiency rotary nozzles
- ☐ Convert spray emitters to micro-or drip or install new drip lines
- ☐ Cap all unused spray emitters
- ☐ Install tattle-tale flush assemblies
- ☐ Install end caps on the drip zones
- ☐ Create an "as built" drawing of the new irrigation layout
- ☐ Install a smart irrigation controller

Establish and steward new landscape.


photo: Pamela Berstler

☐ Complete Irrigation Installation

- ☐ Irrigation for establishment is best used during fall, winter and spring months if rainfall is limited
- ☐ Adjust irrigation to eliminate runoff
- ☐ Regularly flush drip irrigation lines, especially during the first year
- ☐ Seasonally adjust automatic irrigation schedule. Reduce in fall; turn it off in winter!
- ☐ Move drip irrigation and add emitters as the tree grows in order to maintain the wetting zone at the outside edge of the tree's canopy (dripline)

☐ Maintain Living Soil and Plants

- ☐ Maintain 3" to 4" of organic (plant-based) mulch and add more annually
- ☐ Prune trees only with Certified Arborists
- ☐ Practice Integrated Pest Management


photo: Pamela Berstler

☐ Maintain Rainwater Capture Systems

- ☐ Make sure gutters are not clogged
- ☐ Clean rain barrels/cisterns
- ☐ Make sure mosquito screen is not ripped
- ☐ Flush pipes
- ☐ Clean out catch basins
- ☐ Remove debris from swales, especially at inlets/outlets

Enjoy your yard!

A word about **Budgets**

Sustainable Landscape Retrofits
are a serious investment.

When you invest in sustainable landscaping, you are investing in the long-term value of your property. However, there is no such thing as a typical budget for landscape design and installation.

While a good **RULE OF THUMB** is to budget 5% - 10% of your home's current market value in a landscape renovation, every site is different, and the situations encountered on that site will dramatically influence the overall budget for the project. Location, expectations of the neighborhood and aesthetics must be combined with all of the functional requirements discussed in this book to inform the final budget for your landscape. When you include outdoor rooms or other built amenities, the prices rise exponentially.

Consider that the landscape is raw ground to be prepared, graded, etc. In addition to landscape contractors, all of the typical building trades work on a landscape: plumbing, electrical, and if you are making outdoor rooms, expect to include stone masons, carpenters, fixtures and appliances.

A hard-working, Do-It-Yourselfer (DIY) can remove turf, make grade changes and build soil through sheet mulching. Planting and converting an existing irrigation system to drip also can be accomplished, using the techniques outlined in this book. The more you do yourself, work with what you have, or select low cost materials, the more affordable you will make your landscape changes.

A basic landscape renovation of a turf-covered front yard covering 1,000 square feet, adjusting an existing working spray irrigation system and not including an outdoor room, should cost approximately $5 - $10/square foot for a DIY renovation or $12 - $20/square foot for a professionally designed and installed landscape.

Property Assessed Clean Energy (PACE) program financing allows property owners to fund qualified water-efficiency projects with little or no up-front cost. Properties located within participating cities or unincorporated areas of San Diego County may be able to finance up to 100% of their project and pay it back over time through their property tax bill. For more information, visit your city's website, or if you live in an unincorporated area go to the county's website.

All-in Planting costs = Plants + Installation Labor

An all-in price for planting that includes the labor costs for a professionally installed plant may be 2x - 3x the purchase price of the plant because the installer should provide a 30 - 90 day plant replacement guarantee.

Upgrade Your Irrigation or Remove It Entirely!

Avoid the cost of installing new irrigation pipe by keeping your existing working irrigation zones and upgrading the spray heads to low-flow nozzles or replacing them with a drip system. If you're ready to go native, consider eliminating your irrigation entirely and just water by hand. There is no better way to get in touch with the natural cycles of your landscape.

Invest in soil

photo: Paul Herzog

Soil preparation is the single greatest investment you can make in the long-term health and beauty of your garden. Buy your compost in bulk, and expect to spend at least 10% of your budget on building healthy Living Soil.

Invest in design

photo: Steve Williams

The more time you spend researching your options and planning your garden, the better prepared you will be during construction. Measure twice, dig once! Spend the time yourself, or expect to pay 10% - 20% of your budget on professional design assistance.

Invest in rain

Capturing and holding on to rainfall from adjacent hard surfaces, helps prepare your garden for the long, dry summer and reduces irrigation demand. Expect to spend up to 20% of your budget on labor for grading for rain and materials for drainage.

Projects need **People**

Assessment Organizations including site assessment and testing, various measuring services, surveyors, soil testing services and even Google Maps are available to help. Property measuring and surveying companies can develop more detailed plans with elevations, siting of trees and landscape amenities, irrigation, etc. If you get out into the yard with a measuring tape and the list of Do IT! projects we've put into this book, you should be able to make a serviceable site map to scale.

Planning and Design professionals can help you develop a working plan and budget for your landscape. The plan should include drawings, a list of resources, and an outline of the techniques to be used to implement the plan. Landscape architects and landscape contractors can assist you in developing a plan and budget. Landscape designers also can help you create a conceptual design. Working with a licensed professional is always recommended, especially if you have hillsides and slopes or complicated structures.

Landscape Installation and Construction professionals are licensed landscape contractors who specialize in building landscapes, and are able to work on all aspects of the sustainable landscape plan. If you feel comfortable with the techniques outlined in this book, you can install your own garden, especially knowing that if you get stuck you can call upon the expertise of licensed landscape professionals, who carry all of the necessary insurance and are knowledgeable about permits.

Rainwater Catchment specialists include people certified by the American Rainwater Catchment Systems Association (ARCSA) to design and install rainwater capture systems. These professionals can bring a lot of specific expertise to your project, particularly if it involves the installation of an active capture system such as a cistern.

Green Plumbers can assist you on an as-needed basis if you are attempting a DIY renovation. Their expertise is usually limited to the point of connection of the irrigation system with the municipal or home supply, backflow prevention, pressure regulation, or graywater installation.

Irrigation Systems Consultants include people who have been certified by an EPA WaterSense® labeled certifying organization to provide irrigation system auditing, design, and maintenance. These professionals can bring specific expertise on improving the efficiency of irrigation systems. The Irrigation Association, California Landscape Contractors Association Water Managers, Qualified Water Efficient Landscapers, and G3 Watershed Wise Landscape Professionals all provide searchable lists of certified professionals.

Plant Selection specialists include your local retail nursery and garden center, native plant societies, Master Gardeners, and professional gardeners. The best plant selector, however, is you! Do the homework to select plants that are both climate appropriate and locally native to your place, and you will be rewarded with a better understanding and appreciation of your garden as it evolves over time. Plus, you can advise your friends on their plant selections!

Maintenance of sustainable landscapes requires an understanding of the watershed approach to landscaping and water management. While there will be less mowing of lawns and blowing of leaves, there will be more fine pruning, irrigation flushing and tuning, cleaning and checking rain barrels and other water retention devices and soil building. Maintenance people should demonstrate an ability to think critically, be open to the techniques and ideas outlined in this book and understand how to implement IPM, mulching, basic irrigation tune-ups, and native plant husbandry.

Certified Arborists are specialists trained in the art and science of planting, caring for, and maintaining individual trees. Find qualified tree professionals at the International Society of Arboriculture (ISA) and the American Society of Consulting Arborists (ASCA).

Water Managers are a big part of ongoing sustainable landscape maintenance. If you are still using an irrigation system for your landscape, you may consider hiring a professional certified by the California Landscape Contractors' Association (CLCA) who has demonstrated expertise in water management. But, learning how to manage your own water is best.

Public Education on a watershed approach to landscaping is provided by your local water districts and various non-profit organizations throughout San Diego County. These classes are generally free of charge.

Find Qualified Professionals and Take Free Classes

For the website addresses of professional organizations listing qualified professionals check out the Resources section of this book.

The San Diego County Water Authority holds free classes for people wanting to learn more about WaterSmart landscapes. For information and registration go to:

www.watersmartsd.org

Use this **Project Plant List**

Plant List Key

Form:	Natural shape taken by the plant	**B:**	Plant supports life cycle of butterflies
Plant Factor:	**M**=Moderate, L=Low, VL = Very Low	**D/E/S:**	**D**=Deciduous, **E**=Evergreen, **S**=Semi-Deciduous
Sun:	**F**=Full, **PS**=Part Shade, S=Shade	**Notes:**	Section of the book where you can read more about this plant

Form	B	Botanical (Latin) Name	Common Name	Plant Factor	Sun	Dimension H' x W'	D/E/S	Flower Color	Notes
Annual	x	Eschscholzia californica	CA poppy	L	F	1.5' x 1'	D	orange	Coastal Prairie
Grass		Bouteloua gracilis 'Blonde Amibition'	Blonde Ambition blue grama	L/VL	F	2' x 2'	D	wheat	Dry Feet
Grass		Leymus condensatus 'Canyon Prince'	Clumping wild rye	L	F	4' x 3'	E	wheat	Chaparral
Grass		Muhlenbergia capillaris 'White Cloud'	Hairy awn muhly	L	F	4' x 4'	E	white	Dry Feet
Grass		Nassella (stipa) pulchra	Purple needle grass	L	F	3' x 1.5'	D	wheat	Invasive Alternative
Grass	x	Sisyrinchium bellum	Blue-eyed grass	L	F	2' x 1.5'	E	blue	Coastal Prairie
Grass		Agrostis pallens	Bent grass	M/L	F/S	2' x 1.5'	S	wheat	Chaparral
Grass		Juncus patens	CA gray rush	M	F/S	2' x 2'	E	brown	Wet Feet Ok
Grass		Melica californica	CA melic grass	M	PS	3' x 0.50'	S	wheat	Invasive Alternative
Grass		Muhlenbergia rigens	Deer grass	M/L	F/PS	5' x 5'	D	wheat	Wet Feet Ok
Groundcover	x	Achillea millefolium rosea 'Island Pink'	Pink yarrow	L	F	3' x 3'	D	pink	Turf Alternative
Groundcover		Asteriscus maritimus	Gold coin plant	L	F/PS	1' x 4'	E	yellow	Groundcover
Groundcover		Calylophus hartwegii	Sundrops	L	F	1' x 2'	E	yellow	Turf Alternative
Groundcover	x	Ceanothus griseus horizontalis 'Yankee Point'	Carmel Mountain ceanothus	L	F	3' x 12'	E	blue	Hillside
Groundcover	x	Convolvulus cneorum	Bush morning glory	L	F/S	4' x 4'	E	white	Fire Zone
Groundcover		Lomandra longifolia 'Breeze'	Dwarf mat rush	L	F/S	3' x 4'	E	yellow	Groundcover
Groundcover	x	Salvia 'Bee's Bliss'	Bee's Bliss sage	L	F	2' x 8'	E	blue/purple	Groundcover
Groundcover		Thymus pseudolanuginosus	Wooly thyme	L	F	0.25' x 1'	D	pink	Turf Alternative
Groundcover	x	Arctostaphylos edmunsii 'Carmel Sur'	Carmel Sur prostrate manzanita	M/L	F/PS	0.5' x 15'	E	pink/white	Groundcover
Groundcover		Fragaria chiloensis	Beach strawberry	M/L	F/PS	0.25' x 1'	E	white	Turf Alternative
Groundcover	x	Ceanothus maritimus	Bluff CA lilac	VL	F/PS	2.5' x 9'	E	blue	Dry Feet
Groundcover		Dymondia margaretae	Silver carpet	VL	F/PS	0.25' x 2'	E	yellow	Turf Alternative
Perrenial	x	Achillea 'Moonshine'	Fern leaf yarrow	L	F	2' x 3'	D	yellow	Coastal Prairie
Perennial	x	Asclepias fascicularis	Narrow leaf milkweed	L	F	3' x 0.50'	D	white	Pollinators
Perennial		Dietes bicolor	Fornight lily	L	F/S	3' x 3'	E	white/yellow	Mediterranean
Perennial	x	Diplacus aurantiacus	Sticky monkeyflower	L	F/S	3' x 3'	S	yellow	Coastal Sage
Perennial	x	Erioginum parvifolium	Cliff buckwheat	L	F	1.5' x 3'	E	white	Coastal Prairie
Perennial	x	Teucrium chamaedrys	Germander	L	F	3' x 1'	E	pink/purple	Mediterranean
Perennial	x	Verbena lilacina 'De la Mina'	Cedros Island verbena	L	F/PS	2' x 4'	E	purple	Pollinators
Perennial	x	Erigeron glaucus	Seaside daisy	M/L	F	1.5' x 3'	E	pink/blue	Coastal Prairie
Perennial		Hemerocallis hybrid	Daylily	M	F/PS	2' x 2'	S	various	Fire Zone
Perennial	x	Heuchera maxima	Island alum root	M/L	PS/S	3' x 1'	E	white/pink	Pollinators
Perennial		Iris douglasiana	CA native iris	M	F/PS	3' x 3'	E	various	Wet Feet Ok
Perennial	x	Mondarella villosa	Coyote mint	M/L	F	1.5' x 3'	S	lavender	Wet Feet Ok
Perennial	x	Epilobium canum var. latifolium 'Everett's Choice'	Everett's CA fuchsia	VL	F	0.5' x 5'	S	orange red	Dry Feet
Succulent		Aloe striata	Coral aloe	L	F	3' x 2'	E	red	Fire Zone
Succulent		Senecio serpens	Blue chalksticks	L	F	1' x 3'	E	white	Groundcover
Succulent		Calandrina spectabilis	Rock purslane	M/L	F/PS	2' x 4'	E	purple	Mediterranean

Use this **Project Plant List**

Form	B	Botanical (Latin) Name	Common Name	Plant Factor	Sun	Dimension H' x W'	D/E/S	Flower Color	Notes
Shrub	x	Abutilon palmeri	Indian mallow	L	F	5' x 5'	E	gold	Fire Zone
Shrub	x	Aloysia citriodora	Lemon verbena	L	F	10' x 15'	E	white	Edible
Shrub	x	Arctostaphylos 'Sunset'	Sunset manzanita	L/VL	F	5' x 5'	E	pink/white	Dry Feet
Shrub		Correa 'Dusky Bells'	Red Australian fuchsia	L	F/PS	2' x 3'	E	red	Mediterranean
Shrub	x	Eriogonium grande var reubescens	San Miguel Island buckwheat	L/VL	F	2' x 3'	E	pink	Pollinators
Shrub	x	Galvezia speciosa 'Firecracker'	Island bush snapdragon	L	F	4' x 5'	E	red	Pollinators
Shrub	x	Isomeris arborea	Bladderpod	L	F	5' x 6'	E	yellow	Hillside
Shrub		Leucadendron 'Safari Sunset'	Cone bush	L	F	10' x 8'	E	yellow/red	Mediterranean
Shrub	x	Salvia clevelandii 'Pozo Blue'	Grey musk sage	L	S	4' x 6'	S	violet	Coastal Sage
Shrub	x	Salvia munzii	San Diego sage	L/VL	F	3' x 3'	E	blue	Coastal Sage
Shrub	x	Sambucus mexicana	Mexican elderberry	L/VL	F/PS	12' x 12'	D	white	Edible
Shrub	x	Sphaeralcea ambigua	Desert mallow	L/VL	F	3' x 2'	E	apricot	Chaparral
Shrub	x	Bidens laevis	Joaquin sunflower	M	F	3' x 2'	E	yellow	Wet Feet OK
Shrub		Myrica californica	Pacific wax myrtle	M	F/PS	18' x 9'	E	white	Screen
Shrub	x	Ribes aureum	Golden currant	M	F/PS	6' x 3'	D	golden	Edible
Shrub	x	Salvia elegans	Pineapple sage	M/L	F/PS	5' x 3'	E	red	Edible
Shrub	x	Cuppressus forbesii	Tecate cypress	VL	F	30' x 15'	E	n/a	Screen
Shrub	x	Dendromecon rigida	Bush poppy	VL	F	9' x 6'	E	yellow	Chaparral
Shrub	x	Lessingia filaginifolia	Silver carpet	VL	F/S	0.50' x 8'	S	violet	Invasive Alternative
Shrub	x	Lotus scoparius	Deerweed	VL	F/PS	3' x 3'	E	yellow	Invasive Alternative
Shrub		Rhus integrifolia	Lemonade berry	VL	F/PS	6' x 20'	E	white/pink	Hillside
Shrub	x	Ribes speciosum	Fuchsia flowering gooseberry	VL	F/S	6' x 3'	S	red	Coastal Sage
Shrub		Romneya coulteri	Matilija poppy	VL	F	9' x 9'	D	yellow/white	Hillside
Shrub	x	Trichostema lanatum	Wooly blue curls	VL	F	5' x 3'	E	purple	Coastal Sage
Tree/Shrub		Acca sellowiana	Feijoa, Pineapple guava	L	F	20' x 15'	E	pink	Fruit Tree
Tree	x	Arbutus 'Marina'	Hybrid strawberry tree	L	F	50' x 40'	E	pink	Tree
Tree/Shrub	x	Ceanothus 'Ray Hartman'	CA mountain lilac	L	F	15' x 9'	E	blue	Screen
Tree/Shrub	x	Cercis occidentalis	Western redbud	L	F/PS	15' x 15'	D	violet	Tree
Tree	x	Chilopsis linearis	Desert willow	L	F	30' x 25'	D	purple	Tree
Tree/Shrub	x	Heteromeles arbutifolia	Toyon, Christmas berry	L	F	10' x 6'	E	white/red	Hillside
Tree		Lyonothamnus floribundus	Catalina ironwood	L/VL	F/PS	55' x 20'	E	white	Tree
Tree		Pinus torreyana	Torrey pine	L/VL	F/PS	50' x 30'	E	none	Screen
Tree/Shrub		Punica granatum	Pomegranate	L	F	10' x 10'	D	orange/red	Fruit Tree
Tree/Shrub		Ziziphus jujuba	Jujube, Chinese date	L	F	40' x 10'	D	yellow/white	Fruit Tree
Tree/Shrub		Citrus 'Improved Meyer'	Improved Meyer lemon	M	F	10' x 12'	E	white	Fruit Tree
Tree	x	Platanus racemosa	CA sycamore	M	F/PS	75' x 50'	D	white	Fire Zone
Tree/Shrub	x	Prunus ilicifolia ssp. lyonii	Catalina cherry	M/L	F/S	25 'x 15'	E	white	Screen
Tree		Prunus salicina 'Santa Rosa'	Santa Rosa plum	M	F	30' x 20'	D	pink/purple	Fruit Tree
Tree/Shrub	x	Cercocarpus minutiflorus	San Diego mountain mahogany	VL	F	9' x 9'	E	yellow	Chaparral
Tree		Parkinsonia 'Desert Museum'	Desert Museum palo verde	VL	F	20' x 20'	D	yellow	Tree
Tree	x	Quercus agrifolia	Coast live oak	VL	F/PS	70' x 30'	E	yellow	Invasive Alternative
Vine		Vitis 'Rogers Red'	Roger's Red grape	L	PS/S	30'	D	white	Edible

You're ready to **Shop!**

My Shopping List

My Climate Zone

My Supply Stores & Nurseries

quantity

compost

mulch

irrigation equipment

rainwater capture materials

boulders and gravel

other materials for sheet mulching (paper, worm castings, hose, etc.)

Notes:

You're ready to **Shop!**

My Shopping List

My Climate Zone

My Supply Stores & Nurseries

	name	size	quantity
trees			
shrubs			
groundcover			
hedge			
ground cover			
other plants			

Use these Resources for **Success**

Botanical Gardens
San Diego Botanic Garden, Encinitas ***www.sdbgarden.org***
The Water Conservation Garden, El Cajon: ***www.thegarden.org***

Equipment Rental
BJ's Rentals - ***www.bjsrentals.com***
Home Depot - ***www.homedepot.com***
Lowe's - ***www.lowes.com***
Pauley Equipment Rental - ***www.pauleyequipment.net***
Sunbelt Rentals - ***www.sunbeltrentals.com***

Fire Protection Landscaping
Fire Resistive Plant List
www.WaterSmartSD.org/sites/default/files/fireresistiveplants.pdf
Fire-Safe Landscaping Can Save your Home (2010)
www.sandiegocounty.gov/dplu/docs/Fire-Guidelines.pdf
Will you be prepared for the next wildfire?
readysandiego.org/get-fired-up/
Native Plant Landscaping to Reduce Wildfire Risk
www.cnpssd.org/fire/ReduceFireRisk.pdf
Ready for Wildfire ***www.readyforwildfire.org/***
Sustainable and Fire Safe Landscapes
ucanr.org/sites/SAFELandscapes/
Fire, Plants, Defensible Space and You
www.sandiegocounty.gov/pds/docs/DPLU199.pdf

Garden Magazines, Tours, Shows and Classes
San Diego Native Garden Tour - ***www.cnpssd.org/tour***
San Diego Horticultural Society Spring Garden Tour
SDHort.org/GardenTour
Encinitas Garden Festival and Tour ***Encinitasgardenfestival.org***
Coronado Flower Show - ***Coronadoflowershow.com***
California Native Plant Society - ***www.cnpssd.org***
Mediterranean Garden Society
www.mediterraneangardensociety.org
Pacific Horticulture ***www.pacifichorticulture.org***
Sunset Magazine ***www.sunset.com/garden***

Irrigation
How to Install Efficient Irrigation. *A Homeowner's Guide to a WaterSmart Landscape*, San Diego County Water Authority - ***www.WaterSmartSD.org***
Irrigation Tutorials - ***www.irrigationtutorials.com***
Irrigation Essentials tutorial - ***www.irrigationessentials.com***
Landscape watering calculator: ***apps.sandiego.gov/landcalc***
WUCOLS: ***www.water.ca.gov/pubs/conservation/a_guide_to_estimating_irrigation_water_needs_of_landscape_plantings_in_california__wucols/wucols00.pdf***
The California Department of Water Resources California Irrigation Management Information System (CIMIS) - ***www.cimis.water.ca.gov***

Landscape Design
A Homeowner's Guide to a WaterSmart Landscape (San Diego County Water Authority) - ***www.watersmartsd.org***
OCEAN FRIENDLY GARDENS Resources to create drought tolerant gardens and apply C.P.R. - Conservation, Permeability, Retention © ***www.surfrider.org/ofg***

Planning
DIG Alert Dial 811 - ***www.digalert.org***

Professional Help
Association of Professional Landscape Designers
www.apldca.org
American Rainwater Catchment Systems Association
www.arcsa.org
American Society of Landscape Architects
www.socal-asla.org
California Landscape Contractors Association - ***www.clca.org***
Irrigation Association - ***www.irrigation.org***
Certified Watershed Wise Landscape Professionals - ***www.greengardensgroup.com***
Qualified Water Efficient Landscaper - ***www.qwel.net***

Water Conservation
San Diego County Water Authority
www.sdcwa.org
Sustainable Landscapes Program
SustainableLandscapesSD.org
WaterSmart San Diego - ***www.WaterSmartSD.org***
Be Water Wise (MWD) - Find link to rebates, watering calculators, watering restrictions and more garden tips - ***www.bewaterwise.com***
SoCal Water Smart apply for rebates - ***socalwatersmart.com***
Water Use it Wisely - ***www.wateruseitwisely.com***

Water Quality
Integrated Pest Management - ***ipm.ucdavis.edu***
Project Clean Water - ***ProjectCleanWater.org***
Think Blue San Diego - ***www.sandiego.gov/thinkblue***

Carbon Storage in Soil
www.ars.usda.gov/is/ar/archive/sep02/soil0902.htm

Turf Maintenance and Removal Advice
Solarization Techniques
www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74145.html

Bermuda grass eradication
www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7453.html

University of CA Riverside Sheet mulching instructions
ucanr.edu/sites/sacmg/files/163135.pdf

Organic lawn care
www.ipm.ucdavis.edu/TOOLS/TURF/MAINTAIN/index.html

Integrated Pest Management
www.ipm.ucdavis.edu/GENERAL/whatisipm.html

Mulch and Compost

El Corazon Oceanside Resident Program-
www.agriserviceinc.com/pdfs/OceansideResidentProgram-web.pdf
Miramar-*www.sandiego.gov/environmental-services/miramar/greenery/index.shtml*
Mountain Meadow Mushroom Farm - *mmmushroom.com*
San Diego Tree Care - *www.sandiegotreecare.com/freemulch.htm*
The Forestry Group - *theforestrygroup.com/?page_id=54*
Atlas Tree Service - *www.atlastree.com/mulch.php*

Plant Choices

Arboretum All-Stars
www.arboretum.ucdavis.edu/arboretum_all_stars.aspx
California Native Plant Library
www.theodorepayne.org/mediawiki
California plants database - *www.calflora.org/*
Gardening With California Native Plants
www.cnpssd.org/horticulture/index.html
Monrovia Nursery Plantfinder - *Monrovia.com*
Nifty Fifty List of Plants for California-Friendly Landscapes *www.watersmartsd.org*
Searchable Water Use Classification (WUCOLS)
www.waterwonk.us/

Invasive Plants

California Invasive Plants Council: *www.cal-ipc.org*
Don't Plant A Pest:*www.cal-ipc.org/landscaping/dpp/brochures.php*
Plant Right! Avoid Invasive Plants: *www.plantright.org*

Trees

Select the Right Tree - *www.selectree.calpoly.edu*
Tree of Life Plant Re-specifier
www.cnpssd.org/TOLN-Rescpecifier.pdf
USDA plants database - *plants.usda.gov/java*

Nurseries and Garden Centers

*To The Trade Nurseries available through landscape professionals
Armstrong Garden Centers - *www.armstronggarden.com*
Evergreen Nursery - *www.evergreennursery.com*
Grangettos Farm and Garden Supply - *www.grangettos.com*
Home Depot - *www.homedepot.com*
Lowe's - *www.lowes.com*
Moosa Creek Nursery - *www.moosacreeknursery.com*
Village Nurseries *www.villagenurseries.com**

North County Coastal (Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar)
Anderson's La Costa Nursery
www.andersonslacostanursery.com
Sunshine Gardens - *www.sunshinegardensinc.com*
Barrels And Branches - *www.barrelsandbranches.com*
Gardens By The Sea - *gardensbytheseanursery.com/index.html*
Glorious Gardens - *www.agloriousgarden.com*

North County Inland - Fallbrook, Bonsall, Vista, San Marcos, Escondido, San Dieguito, Poway, Ramona
Las Pilitas - *www.laspilitas.com*
Briggs Tree Nursery - *www.briggstree.com*
Green Meadow Growers - *greenmeadowgrowers.com **
Waterwise Botanicals - *waterwisebotanicals.com*
Walter Andersen- *www.walterandersen.com*
Oasis Water Efficient Gardens - *www.oasis-plants.com*

Central Region - La Jolla, Mission Beach, Pacific Beach, Old Town, Mission Valley, Clairemont, Kearny Mesa, Miramar, Balboa Park, Hillcrest, North Park, Downtown
Walter Andersen - *www.walterandersen.com*
City Farmers - *www.cityfarmersnursery.com*
Mission Hills Nursery - *www.missionhillsnursery.com*
Green Gardens - *www.sdgreengardens.com*
Recon Native Plants - *www.reconnativeplants.com**

East County - Lakeside, Santee, El Cajon, La Mesa, Lemon Grove, Spring Valley, Alpine, Jamul
Bonita Creek Nursery - *www.bonitafruittrees.com*
Mission Hills Nursery - *www.missionhillsnursery.com*
Summers Past Farms - *www.summerspastfarms.com/nursery.htm*

South Bay - Coronado, National City, Sweetwater, Chula Vista, Otay, Imperial Beach, Point Loma, Harbor Island, Shelter Island
Mission Hills Nursery - *www.missionhillsnursery.com*
Terra Bella Nursery - *www.terrabellanursery.com*

Guidelines keep your project **On Track**

Guidelines throughout this book were derived from the following technical sources.

WSLG - ***www.watersmartsd.org***
A Homeowner's Guide to a WaterSmart Landscape, San Diego County Water Authority (SDCWA)

WaterSmart Landscape Makeover Program Curriculum, San Diego County Water Authority (SDCWA)

WELDM - ***www.sdcounty.ca.gov/pds/Landscape-Ordinance_Design_Review_Manual.html***
County of San Diego Water Conservation in Landscaping Ordinance / County of San Diego Water Conservation in Landscaping Design Manual

CUWCC-***cuwcc.org/Portals/0/Document%20Library/Workshops/Landscape/Landscape%20Symposia/CUWCC%20Landscape%20Symposia%20Report.pdf?timestamp=1430324782441***
The "New Norm" for California Landscapes (California Urban Water Conservation Council Board Memo)

OFG - ***www.surfrider.org/programs/entry/ocean-friendly-gardens***
Ocean Friendly Gardens How To Gardening Guide / Ocean Friendly Gardens Criteria

CSD LID / CSD LID Appendices - ***www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/susmppdf/lid_handbook_2014sm.pdf***
County of San Diego Low Impact Development Strategies Handbook

CSD SUSMP - ***www.sdcounty.ca.gov/dpw/watersheds/susmp/susmp.html***
County of San Diego Standard Urban Stormwater Mitigation Plan (SUSMP)

IPM - ***www.ipm.ucdavis.edu/***
University of California Cooperative Extension (UCCE) Integrated Pest Management

CULEE - ***www.calrecycle.ca.gov/Publications/Documents/Organics%5C44207002.pdf***
Compost Use for Landscape and Environmental Enhancement (CULEE)

PLACE

Landscapes in Wildland Interface Areas
(WELDM D.6) Transitional landscapes, areas between created and wildland areas, should be planted with predominantly locally native plants. Invasive non-native species are specifically prohibited, and sprouts from existing or previously planted invasive species shall be promptly removed. Irrigation in transitional areas shall not influence adjacent vegetation (*see p. 4*).

Preserve Native Vegetation
(SD City Stormwater Standards 3-5) (SD County LID 2.3.1.4)
Preserve existing native trees, shrubs and indigenous vegetation. Preserve riparian vegetation in drainage areas with native plants/soils. Identify locations for planting additional native or drought tolerant trees and large shrubs (*see p. 4*).

Wetland Development
Areas of occupied habitat of sensitive species and wetlands areas are typically unsuitable for development (*see p. 4*).

Project Clean Water Map of San Diego County Watersheds, Dividing Lines, and Major Aquifers
(***www.projectcleanwater.org***)

The western side of the divide is designated as Region 9 by the Regional Water Quality Control Board and is regulated by the Municipal Stormwater Permit (Order No. R9-2007-0001) (*see p. 5*).

(San Diego Bay Watershed - ***www.sdbay.sdsu.edu***) (San Diego Coastkeeper - ***www.sdcoastkeeper.org***)
Find out more about the streams, rivers, aquifers, riparian areas and beaches that your landscape impacts. Do your part at home and in your neighborhood to keep the rest of your watershed healthy and flowing clean.

Pollutants of Concern in San Diego County
Several of San Diego County's receiving waters are identified as impaired, due to a development of total maximum daily loads (TMDLs). There are approximately 190 pending TMDLs in the county, with adopted TMDLs in the San Diego area including:

a. Diazinon for Chollas Creek;
b. Nitrogen and phosphorous for Rainbow Creek;
c. Dissolved copper for Shelter Island Yacht Basin, and
d. Indicator bacteria for beaches and creeks in the San Diego Region.

Once a TMDL is established it may impose conditions on development either through an implementation plan and schedule for the listed water, or through special conditions required of the municipality affected by the numeric criteria of the TMDL.

In addition to TMDLs there are Pollutants of Concern, including:

1. Sediments are soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

2. Nutrients are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

3. Metals are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources and bioaccumulation of metals in fish and shellfish.

4. Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. Organic compounds can constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.

5. Trash both human-made (paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste). This trash & debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. Also, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

6. Oxygen-Demanding Substances includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

7. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

8. Bacteria and Viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

9. Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

10. Hillside Areas - Work With Professionals-in developed hillside areas it is essential to work closely with a qualified, licensed professional on the design of Infiltration BMPs to evaluate the site constraints as well as the potential impacts to downstream property owners *(see p. 9).*

SOIL

SOIL Key Sources:

a. SD LID Handbook; pp. 24, 68, 95-96 Appendices
b. SD County Landscape Ordinance; pp. 9, 18, 20
c. SD Storm Water Standards; 4.15
d. CSD SUMP; pp. 56
e. CULEE; pp. 4, 6, 7-23, 25-39, 45-46
f. OFG; pp. 3, 5
g. WaterSmart; pp. 12, 21, 23, 25
h. SD LID Appendices; Appendix 4: pp. 91-92, 96
i. WaterSmart Workshop Slides; Module 2: pp. 2, 9-10
j. UCCE Integrated Pest Management Cards; all cards, Aphid Pestcard 1

Carbon Sequestration in Soil
(***www.theatlantic.com/health/archive/2013/06/healthy-soil-microbes-healthy-people/276710/***)
Carbon sequestration has become an issue of great importance, and our landscapes can offer significant carbon storage. Carbon is the structural building block of most life on earth, including plants. As they grow, plants retain, or sequester, carbon. Soil, too, is carbon based, and the world's soil contains more carbon than all the plants and the atmosphere combined. Healthy living soil, full of organic matter and life, stores significantly more carbon in its molecular structures than does lifeless soil (*see p. 10*).

San Diego Soil Survey Information:
The United Sates Department of Agriculture National Resources Conservation Services (NRCS), formerly the Soil Conservation Services, has classified San Diego Area soils with respect to: (1) Their ability to accept and absorb water, (2) their tendency to produce runoff, and (3) their erodibility. Their results are presented in Soil Survey, San Diego Area, California (1973). For more information on infiltration site selection please see the CALTRANs Infiltration Study (2003) (*see p. 11*).

Soil – Minimize Compaction (County of SD LID Handbook, 24)
Protect native soils and vegetation, especially during clearing and grading and from construction vehicles and heavy equipment.
Minimize soil compaction in all planned pervious areas (infiltration areas, landscaping, lawns, green space etc.).

Areas adjacent to and under building foundations, roads and manufactured slopes must be compacted with minimum soil density requirements in compliance with the Grading Ordinance, to retain their beneficial hydrological functions.

Soil stability, density requirements, and other geotechnical considerations associated with soil compaction must be reviewed by a qualified, licensed geotechnical, civil or other professional engineer (*see pp. 11-13*).

Apply Mulch (OFG)
Mulch evenly with organic material, with a minimum depth of 4", up to 6". Leave mulch-free space around plant stems and several inches from tree trunks to reduce chance of disease.

To maintain mulch thickness and it's many benefits, add additional mulch as it decomposes, especially if it is not replenished naturally through leaf and other garden litter. Depending on exposure to sun and water, type and depth of mulch, this may be every six months to a year.

Special Mulch Rules
Turf Areas - Limited or no mulch should be used in turf areas, or where creeping or rooting ground covers or direct seeding applications are planned. Apply a ¼" layer of fine compost instead of mulch.

Slope Stabilization - Only stabilizing, coarse textured shredded organic mulch shall be applied on slopes.

Fire Zones - Highly flammable mulch material, such as straw or small mini size wood chips, shall not be used in hazardous fire areas.

Insect Habitat - Small open mulch-free areas are permitted if they are designated for native bee or insect habitat.

Recycle Plant Debris on Site
Leaf litter and other landscape debris should be left alone or used on-site as mulch. Grass clippings should be grass-cycled back to lawn areas. Weeds and unwanted organic matter should be composted on site whenever possible. Only diseased plant material and noxious weeds should be removed from the landscape and disposed of or professionally composted (*see p. 13*).

Compost Guidelines
(CULEE, 8-11) Make compost on site. Your compost is ready to use when it has an earthy smell, it cools off and doesn't reheat when stirred, the color is uniformly dark brown or black and you can't identify the original particles (*see p. 14*).

Compost As Mulch
Compost can be used as mulch, applied directly to the soil surface. As such, it can prevent erosion and help plants and soil filter pollution, especially hydrocarbons and metals from road surfaces. Most greenwaste-based composts can be applied to a depth of 3", while composted biosolids no deeper than 2" (*see p. 14*).

Use Only Good Compost
If compost is not produced on site, then it should be obtained from a reputable source that guarantees high quality. Commercially produced quality can vary significantly due to the diverse nature of feedstock, composting processes, and maturation standards (*see p. 14*).

Use Compost As a Soil Amendment
For native plants, use roughly 15% compost by volume to repair disturbed or damaged soils.

Clay-based soil amended with compost will lead to more productive and healthy plant growth for less cost than amending the same soil with the necessary 45% sand.

In general, poor soils (compacted, lifeless and /or subsoils) should be amended with 3 to 6 cubic yards of high quality compost per 1,000 square feet to improve soil structure.

Biosolids-based composts should be used sparingly if they are high in ammonium nitrogen (*see p. 14*).

No Chemical Applications
No Chemical Fertilizer or herbicides should be used. Pesticides must be used in their least-toxic formulation and as sparingly as possible.

PLANTS

PLANTS Key Sources:
a. SD LID Handbook; p. 69
b. SD County Landscape Ord; pp. 9, 20-21, 23-24, 26-27
c. SD Storm Water Standards; 3.2, 3.3. E.2 3.3
d. CSD SUSMP
e. CULEE; pp. 44-45, 46, 49
f. OFG; pp. 2-4
g. WaterSmart; pp. 8, 13, 15, 16, 17, 21, 23, 25, 35-43
h. CSD Fire Protection; pp. 3-4
I. SD LID Appendices; Appendix x3: 18, Appendix 4: x91, x95
i. WaterSmart Workshop Slides; Module 1: 3-5, Module 2: 6, 10-11, Module 3: 13
k. UCCE Integrated Pest Management Cards; Good Bugs Pestcard

Select Climate-appropriate Plants
(WELDM D.3.b) Plants should be selected and planted based upon their adaptability to the climatic, geologic and topographical conditions of the project site. Low water, deep-rooted plants, that are well-suited for the soil type that exists on site are highly recommended, especially locally native species (*see pp. 20-21*).

Calculate Appropriate Evapotranspiration Rates
ET calculations for specific planting areas start with plant needs, ET requirements. Grading zones should then be noted, showing areas that receive only the water that falls on them, areas where water is concentrated for storage (receiving additional water), and areas in between. Finally, high water-need plant budgets for added water can be calculated (*see pp. 22-23*).

The California Department of Water Resources operates a series of over 100 weather stations strategically placed in various climatic zones throughout California. This network is called the **California Irrigation Management Information System (CIMIS),** and the data it produces is available on its website - ***wwwcimis.water.ca.gov*** (*see pp. 22-23*).

Water Use Classifications of Landscape Species (WUCOLS) A complete list of plants and their water need category can be found at ***ucanr.edu/sites/wucols/****see pp. 22-23*).

Water Feature Rules
Water is recycled by the water feature.
Open water features are covered at least 50% by vegetation,
All water features are maintained without chemicals or additives that are toxic to fish.

Overflow from the water features drains into a vegetated area.
Swimming pools and chemically treated water bodies are drained to sewer systems.

Swimming pools must be covered to minimize evaporation when not in use. (OFG, 4).

Water feature surfaces must be less than 15% of the total landscaped area, and must not exceed 10% of the total lot square footage. " (SDC Landscape Ordinance, 26)

Maintain Lawns Organically
(***ipm.ucanr.edu/PMG/menu.turf.html***)
Grass-cycling, proper mowing height and frequency, eliminating chemical use, proper watering frequency and duration and the use of organic amendments, particularly compost, ensure that lawns are healthy, permeable and green.

Turf should be top-dressed with 1/8" to ¼" of compost once or twice yearly. This minimizes the need for resource inputs, the ability of lawn areas to act as infiltration and filter areas, and reduces polluted runoff (*see pp. 24-25*).

Restriction of Turf Areas
(OFG & WELDM D.4.b-h) Turf areas must be limited. In commercial landscapes, turf areas may not exceed 25% of the total square footage of the landscaped area. It must only be used in areas where it serves a specific purpose (ball-fields, play-yards, parks, cemeteries).

Turf should not be used in inaccessible or decorative areas (parkways, median strips or islands, parking lots or front yards). Cool-season turf may not be used in front yards and warm-season turf may not be over-seeded with cool season turf in winter.

Turf Rules for Non-Residential Projects
Turf is not allowed in an area that is less than eight feet wide in any direction, unless low volume or subsurface irrigation is utilized. Turf shall not be allowed within 24 inches of impermeable surfaces unless it is irrigated with low volume or subsurface irrigation or unless the adjacent impermeable surfaces are designed and constructed to cause water to drain entirely into a landscaped area.

Turf – No Hillside Turf to Prevent Runoff (WELDM D.4.b-h)
Turf shall not be allowed on slopes where the grade is greater than 25 percent (4:1) and where the toe of the slope is adjacent to an impermeable hardscape unless the turf is irrigated with low volume or subsurface irrigation.

Fire Defense Zones
(San Diego Municipal Code (8-2014) Chap 14: General Regulations) Brush management Zone One, the area adjacent to the structure, shall be least flammable and shall typically consist of pavement and permanently irrigated ornamental planting.

Brush management Zone One shall not be allowed on slopes with gradient greater than 4:1 (4 horizontal feet to 1 vertical foot) unless the property received tentative map approval before November 15 1989. However within the Coastal Overlay Zone coastal development hall be subject to the encroachment limitations set forth in Section 143.0142(a)(4) of the Environmentally Sensitive Lands Regulations (San Diego Municipal Code (8-2014) Chap 14: General Regulations)

Brush management Zone Two is the area between Zone One and any area of native or naturalized vegetation and typically consists of thinned, native or naturalized non-irrigated vegetation (*see p. 26*).

Avoid Flammable Plants
(WELDM D.3.d) Within hazardous fire areas, highly flammable plants should be avoided. Refer to the plant list in Appendix G for plants that are both ignition resistive and low water use. Also see Section 2.D.7.

Tree and Shrub Maintenance in Fire Zones
Trees that overhang or touch your structures must be trimmed back away from the structure.

Remove any tree limbs within 10 feet of your chimney. For fire truck access, remove trees and shrubs within 10 feet of each side of your driveway.

Avoid planting trees under or near electrical lines. If the trees grow into overhead lines or make contact with overhead lines under windy conditions, they could cause a fire.

Existing trees should be pruned by cutting off any branches up to 6 feet above the ground and the vegetation beneath the canopy of the tree should be trimmed to prevent ground fires from spreading upward into trees.

Vary the height of plants and adequately space them. Taller plants need to be spaced wider apart.

If you have a heavily wooded area on your property, removing dead, weak or diseased trees may improve growing conditions. This will leave you with a healthy mixture of both new and older trees.

Brush Clearance to Prevent Fire Damage
(WELDM D.7) Work with your neighbors to clear common areas between houses, and prune areas of heavy vegetation that are a fire threat to both properties. Properly maintained defensible space saves property and lives.

Except in hazardous fire areas, any removed trees may be chipped and used as mulch provided the depth of the mulch does not exceed six inches. In hazardous fire areas, highly flammable mulch such as straw or small size wood chips must not be used.

Don't forget to legally dispose of all your cut vegetation. You may contact your local landfill to inquire about green waste recycling. Open burning may not be allowed. Contact your fire agency for more information.

Stack firewood and scrap wood piles at least 30 feet from any structure and clear away any combustible vegetation within 10 feet of the piles. Many homes have survived as a fire moved past it, only to burn later from a wood pile that caught fire after the firefighters had moved on to protect other homes.

Check and clean your roofs and gutters on all structures several times during the spring, summer and fall to remove debris that can easily ignite from a spark.

Check with your local fire district for additional requirements.

Fire – Other Landscaping Rules
Vegetation can only be removed or thinned by mowing, cutting or grazing. The root structure must be left intact to prevent erosion. Do not completely remove or disturb the existing plant root system.

To conserve water, plant low water use trees and shrubs that can be maintained by deep watering as infrequently as once or twice a month.

No irrigated or non-native landscaping is allowed within an open space easement.

Fire Protection Plans (FPP)
(SD County Fire p. 10-11) The FPP must include measures to address the specific location, topography, geology, level of flammable vegetation and climate of the proposed project site. -Defensible Space, Ornamental Landscaping and Vegetation Management

Invasive Plants Don't Plant a Pest!
(OFG 4) No invasive species may be planted, and existing identified invasives should be removed. Invasive species are defined as those listed on the local Invasive Plant Council website as invasive or on the "watch list" (*see p. 27*). ***- www.cal-ipc.org***

Slopes and Hillsides
(SDC LID Appendices, Appendix 4, 92) On steep slopes, increasing soil moisture can potentially cause soil instability, therefore soil amendments may not be suitable for certain slopes. Care must be taken in the timing of the amending, planting and adding water. Areas with grades steeper than 33% are not effective locations for soil amendments (*see p. 28*).

Hillsides – Disturbed Hillside Rules
(WELDM D.9) At a minimum, all manufactured slope areas shall be covered within 10 days of completion of grading with hydroseed/mulch, punched straw mulch, jute netting or other approved geotextile material capable of controlling surface soil erosion.

Except where approved otherwise, all slopes and any other areas disturbed in conjunction with grading activities shall be maintained until vegetation is established, with coverage equal to at least 70 percent of the coverage achieved by native background plants. This threshold must be met before occupancy of the site will be permitted.

A minimum of 50 percent of the total slope area of manufactured slopes shall be planted with deep rooting plantings (i.e., those with a typical root depth of approximately 5 feet or greater). For seeded plantings, at least 50 percent of the viable seed count shall be deep rooting species.

All plant materials on manufactured slopes shall be appropriate to the site conditions, shall be water efficient when established and shall be adequately spaced to control soil erosion.

All slopes in excess of 15 feet shall be planted with rooted container stock at an average rate of one per 100 square feet unless approved otherwise by the Director of Planning and Land Use. Containers shall be a minimum of one gallon for shrubs and five gallons for trees. All container stock shall be provided with a temporary irrigation system.

Herbaceous groundcovers shall be planted at a distance that will typically ensure 100 percent coverage within one year of installation.

Planting Trees in Public Streets or Rights-of-Way
(SD County LID Handbook) Local community planning areas often have specific guidelines for the type and location of trees planted along public streets or rights-of-way. The extent and growth pattern of the root structure must be considered when trees are planted in bioretention areas or other stormwater facilities with under-drain structures or near paved areas such as driveways, sidewalks, utilities or streets. For more information on Street Trees please see Fact Sheet 31 in Appendix 4 (*see p. 29*).

Tree Pruning Guidelines
Pruning should only be done for corrective or preventive measures: to remove dead, crowded, or poorly angled limbs; reduce potential hazards; and, to increase light and air penetration.

Routine thinning does not always improve the health of a tree. Removing large amounts of foliage can reduce growth and stored energy reserves, resulting in stressed trees.
Pruning should be performed in the best season for the tree to avoid potential disease and to avoid pruning just after the spring growth flush.

There should be a purpose for each cut, as each cut has the potential to change the growth of the tree.

Proper technique is essential. Improper or careless pruning can cause damage that extends over the life of the tree. It is important to know where and how to make cuts before beginning the process.

Trees do not 'heal' the way people do. When a tree is wounded, it must compartmentalize the wound. Therefore, a small cut does less damage than a large cut. Waiting to prune a tree until it is mature can create the need for large cuts that cannot be easily compartmentalized.

Utilize Integrated Pest Management (IPM)
(***www.ipm.ucdavis.edu/GENERAL/whatisipm.html***)
Encourage beneficial insects and wildlife in the landscape to eliminate the need for pesticides. If infestations do need to be managed, use the least toxic option available, and in the least amount (*see p. 31*).

Hydrozones
Group plants with like water needs together, according to irrigation zone. Do not put water needy plants next to low-water plants (*see p. 34*).

Plant Selection for Bioswales
Plants should be selected carefully for bioswale and other infiltration areas, with attention to the following factors:

Micro-climate (sun exposure, temperature range, wind, soil type and permeability),

Tolerance of (and ability to remove) potential pollutants, including salt,

Ability to withstand both flooding/inundation and drought,

Disease resistance, mature plant size, aesthetic character should also be taken into consideration,

Native and climate adapted plants are preferred while invasive species are to be avoided completely.

Foundation Planting
For buildings without gutters, plant below the eaves at the drip line. Selected plants should have high capacity for vertical water storage; have leaf architecture that intercepts rainwater and traps it for eventual evaporation; and be sturdy enough to tolerate heavy runoff and periodic soil saturation. Areas should be also mulched to protect uncovered soil between plants from impact of falling rainwater and to increase soil water-holding potential (*see p. 36*).

WATER

WATER Key Sources:
a. SD LID Handbook; p. 40
b. SD County Landscape Ord; pp. 9, 11, 21-22, 24-27, 29-30
c. SD Storm Water Standards; 3.2, 3.5-3.7, 4.15-4.18, I.4-I.30, I.32-I.47, I. 53-I.56, E.1-E.3
d. CSD SUMP; pp. 44-46, 49-50, 55-56, 65, 67-74, 106-107, 111-116, 118-119, 121-123, 125-127, 129-131
e. CULEE; pp. 46-48
f. OFG; pp. 2-7
g. WaterSmart; pp. 15, 18-19, 23-24
h. SD LID Appendices; Appendix 4: pp. 28-59, 66-67, 82-88
i. WaterSmart Workshop Slides; Module 2: 2, 8, Module 3: 2-7

Capture First Flush
(OFG) The first 1" of rainwater, at least, from roof and impermeable surfaces should be captured in landscaped areas, including dry creek beds, vegetated swales or other landscape infiltration areas. None of this water may runoff into the larger watershed (*see pp. 40-41*).

Divert First Flush From Active Capture Devices
If rainwater is being stored in rain barrels or cisterns, a First Flush Diverter must be installed to divert the first flush into the landscape and avoid contaminating stored water.

Rain Barrel and Cistern Guidelines
Secure rain barrels and cisterns to keep them from toppling when full.

Provide First-Flush diversion and overflow into vegetated infiltration areas.

Screen water at intake point to prevent clogging from leaves and other debris.

Cover cisterns securely to prevent accidental drowning and mosquitoes.

Monitor and clean barrels and cisterns regularly (*see p. 42*).

Cisterns For Water Treatment
Water should empty within 24 hours to allow for capture from subsequent storms.

Mosquito prevention is required if water is stored for more than 96 hours.

Cistern should be sized for water quality volume, with overflow for storms (*see p. 42*).

Do not use rain chains made from copper.

Permeable Paving
(LID GUIDEBOOK) Permeable pavers, concrete and asphalts are now available and present a great option for many low-medium traffic areas, including patios, walkways, alleys and parking lot spaces. They do require special maintenance, and there are some limiting factors to their use.

Maintenance Rules:
Permeable pavements and materials should be cleaned with a vacuum-type street cleaner a minimum of twice a year.

Hand held pressure washers can be effective for cleaning the void spaces of small areas.

Permeable Paver Installation & Limitations:
For flat areas only: Installation costs up to 50% greater than conventional concrete but costs can be offset by savings from not installing curb and gutter drainage system.

Not applicable where the seasonal high groundwater table is closer than 10 feet below the bottom of the gravel sub-base unless designed with an under-drain.

Avoid using permeable pavements in close proximity to underground utilities. If it is necessary to use permeable pavements in these areas, care must be taken to keep infiltrated water from migrating into utility trench bedding.

Permeable AC may become clogged if not protected from sediment, or when not maintained.

Applications with under-drain systems are typically more expensive than conventional asphalt

Permeable AC should be avoided in drainage areas with activities that generate highly contaminated runoff (*see pp. 42-43*).

Unit Pavers
(LID GUIDEBOOK) Impermeable pavers, brick and stone can be installed to create permeable surfaces. Areas between units should be filled with gravel, pebbles, sand or un-thirsty ground covers. Installing pavers so that the surfaces they create is permeable is not generally more expensive but it does require special preparation and it may require special maintenance.

Maintenance Rules:

Weeding, sweeping/resetting loose material and eventually replacing gravel, pebbles or ground cover between units.

Unit Paver Installation and Limitations:
For flat areas only: An open-graded crushed rock base (not rounded pea gravels or fines) should be installed under pavers

Pavers must be enclosed by a rigid frame. Concrete, mortared brick on a concrete grade beam, redwood header, and metal edging are commonly used.

Provide under drain system where there are no deep permeable soils.

Curbs and gutters are generally not necessary to control low flow.

Areas with high water tables, impermeable soil layers, or shallow depth to bedrock may not be suitable as infiltration areas with an open-graded base (*see pp. 42-43*).

LID – Design for Storms
The design of LID features used in San Diego must account for the high intensity storms in order to provide for conveyance or bypass, and appropriate erosion prevention (*see p. 45*).

Calculate Rainfall Storage Needs
(SDC SUSMP; pp. 47-48) Assume rain falls at 0.2 inches per hour, and healthy living soil absorbs up to 5 inches of water per hour. Multiply the square footage of the total area draining into an infiltration area by 0.2 to calculate how much water this area receives in one hour. Now multiply the square footage of the infiltration area by 5 (absorbed inches per hour) to see how much water can be absorbed in that hour. The absorption amount must be greater than the received amount. Also, perform a percolation test in the infiltration area to confirm your specific soil is capable of this absorption rate.

Vegetated Filter Swales
Vegetated swales or filter strips should be installed along impervious edges (patios, paths, roads, parking lots, etc.) and bordering watershed intakes (streams, ponds, lakes, etc.) and agricultural fields wherever possible.

Maintenance Rules:
Periodically remove sediment accumulation at top of bank, in swale bed, or behind check dams. LIMITATIONS: Only suitable for grades between 1% and 6%; when greater than 2.5% should be paired with weir or check dam.

Minimize the development of erosion channels within the filter. Even small channels may allow much of the runoff from the field to bypass the filter. These areas should be repaired and replanted immediately to help ensure proper flow of runoff through the filter.

Weeding may be necessary to reduce or eliminate weeds that could compromise the filter strip's effectiveness.

Dry Retention Ponds and Basins
Should be constructed as part of a stormwater "treatment train," with upstream pre-treatment of litter and coarse sediments
Basin sized so that the entire water quality volume is infiltrated within 48 hours.

Drain time and vegetation must be monitored to prevent mosquito and vector habitat.

Semiannual inspections are required to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.

Extensive geotechnical site evaluation must occur before construction to ensure that the infiltration basin will function properly without compromising groundwater, etc.

Infiltration Trenches
Typically constructed as a shallow trench filled with reservoir storage aggregate of gravel or cobbles, but can also comprise of modular plastic cells.

Regular maintenance, including the replacement of clogged aggregate, will also increase the effectiveness and life of the trench.

Not suitable on sites with steep slopes.

Sand Filters
Small scale sand filter units are usually located in below ground concrete pits (as residential/lot level) comprising of a preliminary sediment trap chamber with a secondary filtration chamber.

Larger scale sand filters may comprise of a preliminary sedimentation basin with a downstream sand filter basin-type arrangement.

Most effective in removing pollutants (such as nutrients, frees/ grease and metals) when the sand is mixed with organic mulch
Sand filters require frequent inspection and maintenance
Annual removal and replacement of surface filter sand makes these a more expensive filtration option

Subsurface Reservoir Beds
Provides for storage of large volumes of runoff, which is directed underground by means of permeable pavements or perforated distribution pipes.

Underneath parking lots generally in areas where land values are high and the need to control runoff is great.
Filter fabric placed on floor and sides of recharge bed following excavation allows water to pass readily, but prevents soil fines from migrating up into rock basin, reducing effective storage area of recharge bed. (Filter fabric is not recommended per OFG).

Water can be directed to recharge beds via permeable pavement and/or a storm drain system discharging through perforated pipes.

Direct all sediment-laden runoff from impervious surfaces (e.g., roof tops, roads, parking areas, walkways, etc.) away from permeable pavement/recharge bed or pretreat to eliminate sedimentation.

Subsurface Reservoir Beds Maintenance
Vacuum sweeping or pressure hosing recommended.

Installation and Limitations
Avoid using permeable pavements in close proximity to underground utilities. If it is necessary to use permeable pavements in these areas, care must be taken to keep infiltrated water form migrating into utility trench bedding.

Not applicable where the seasonal high groundwater table is closer than 10 feet below the bottom of the gravel sub-base unless designed with an under-drain.

Mind the Water Table
In the County of San Diego, a ten foot separation is recommended between infiltration practices and the top of the groundwater table in order to allow sufficient biological activity and filtration to occur. CONFLICT: Bioretention (a BMP with incidental infiltration) is not an appropriate BMP when the seasonal high groundwater table is within 6 feet of the ground surface (US EPA/1999).

Minimize Runoff From All Surfaces
Roofs and paved surfaces should be drained into healthy planter areas, whenever possible. Lawns and planter areas must be maintained organically to promote healthy soil structure and to maximize overall soil health (*see p. 47*).

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