UCCE
El Dorado County
Master Gardeners
Present

Water-resilient Landscapes
Part 2

Water-resilient Landscapes

Agenda:

- Overview
- California Water Story
- It Starts with the Soil
- Hydrozoning & Plant Selection
- Irrigation
- Capturing & Utilizing Rainwater
- Q & A Class Wrap-Up

Resources

- CNPS – What Grows Here? https://www.calflora.org/entry/wgh.html
- Calscape Advanced Search: https://calscape.org/login.php
- River Friendly Inspiration Gardens: g http://www.ecolandscape.org/riverfriendly/topics/inspiration-garden.html
- The Regional Water Authority's Water-Wise Gardening software: s http://www.rwa.watersavingplants.com/
- The UC Davis Arboretum All-Stars: http://arboretum.ucdavis.edu/arboretum_all_stars.aspx
- Eco-Friendly Landscape Design Plans for the New California Landscape: www.ecolandscape.org/new-ca/
- The Bay Area Bringing Back the Natives website includes useful information on using California natives in the landscape.
- California plant database search tool — www.waterwonk.us

Water Conservation

1

Remove & replace lawn

- **Lawn substitutes**

2

Establish Hydrozones

3

Utilize drought-tolerant plants

4

Install dripline irrigation system

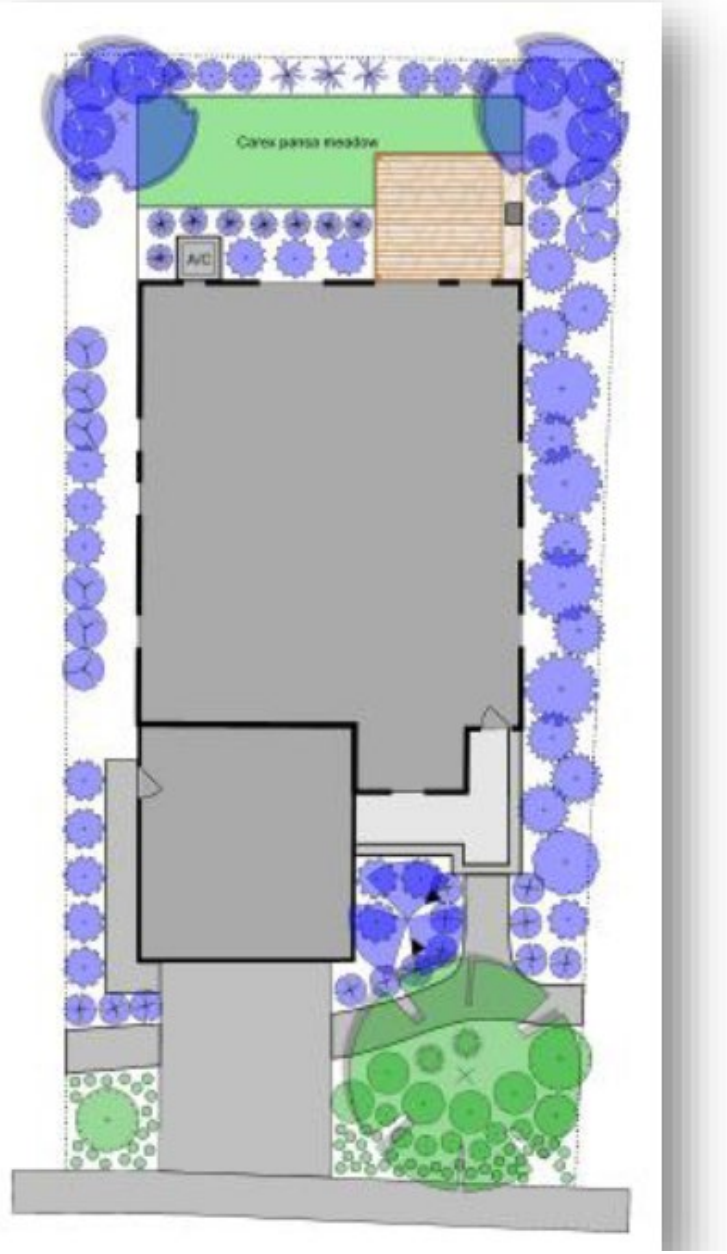
Hydrozoning

The practice of clustering together plants with similar water requirements in an effort to conserve water

- Sun, partial shade, shade
- Water needs (high, medium, low)
- Plants in the ground
- Plants in pots
- Veggie beds

It is a proven effective water management solution

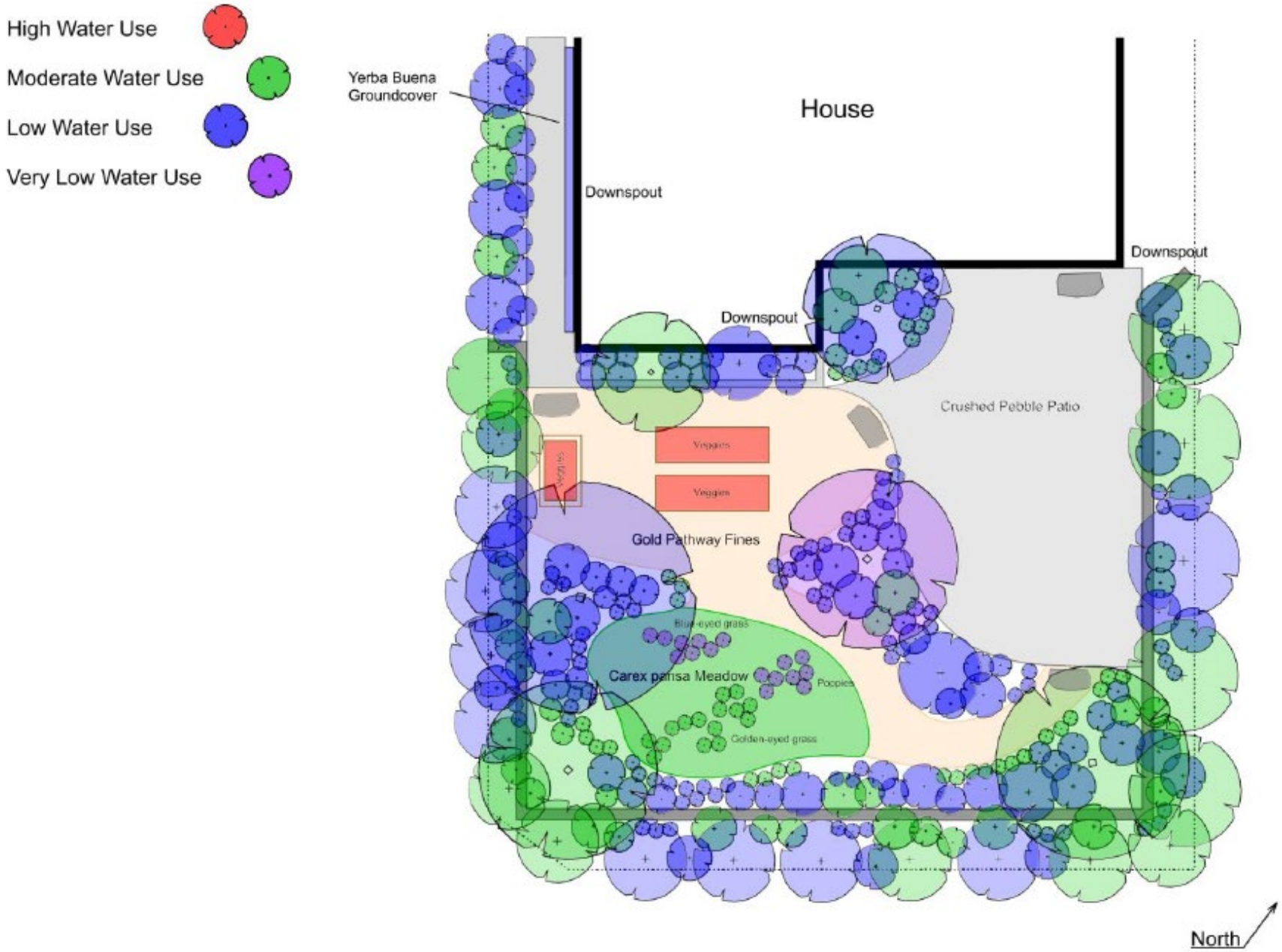
Landscape Design based on Water-use Value of Plants

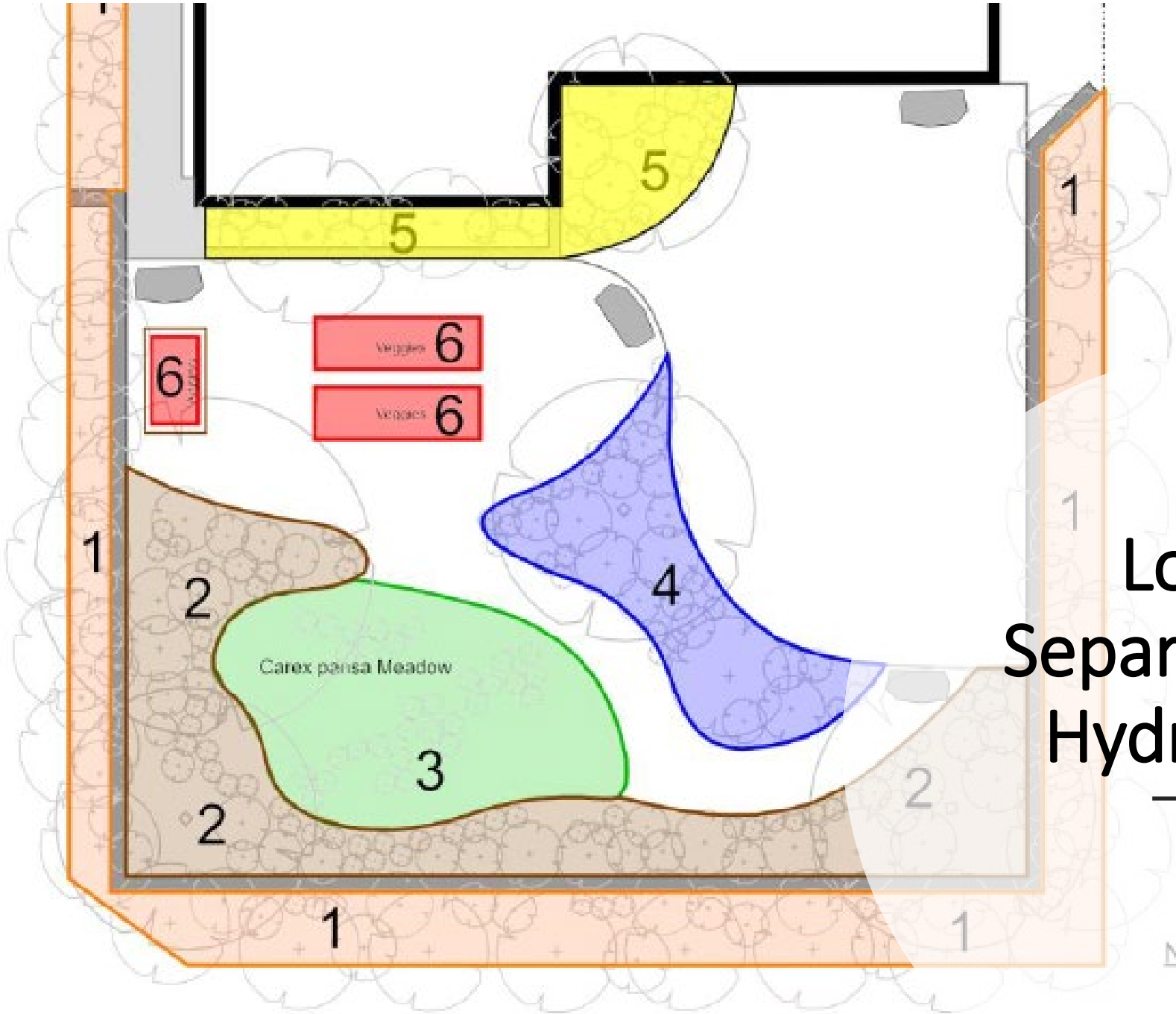


This planting design was based on irrigation.

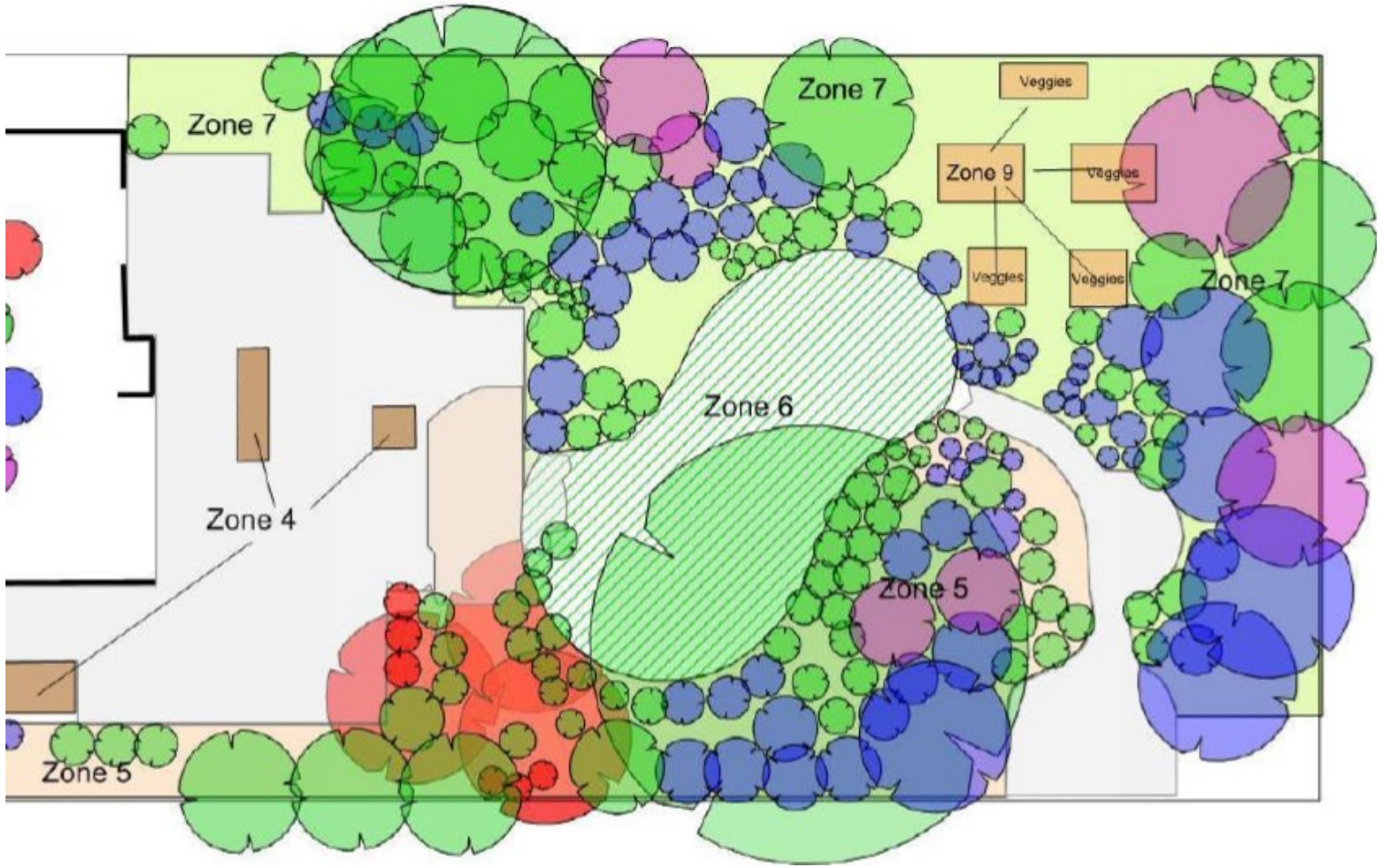
Plants were grouped together according to water use, making it easy to create the hydrozones and valve zones.

Landscape Design based on Water-use





Logical Separations of Hydrozones



Troubleshoot Water-use Differences

Hydrozoning an Existing Landscape

- Draw a plan of your property indicating your trees, shrubs, annuals, lawn, a vegetable garden and other plants
- Circle and group plants with similar water needs in hydrozones
- Separate hydrozones would include:
  - Lawn
  - Mass plantings of perennials and groundcovers
  - Vegetable garden and or mass plantings of annuals/bedding plants
  - Sun vs. Shade
  - Flat vs. Slopes
- Not sure of your plants' watering needs? Find out the water requirements of specific plants, by clicking on the link: http://ucanr.edu/sites/WUCOLS/

- ***The Water Use Classification of Landscape Species***
  - An online system maintained by the UC Division of Agriculture and Natural Resources
  - Developed by and based on the field experience of landscape horticulturalists & professionals
  - User-friendly enough for home gardeners

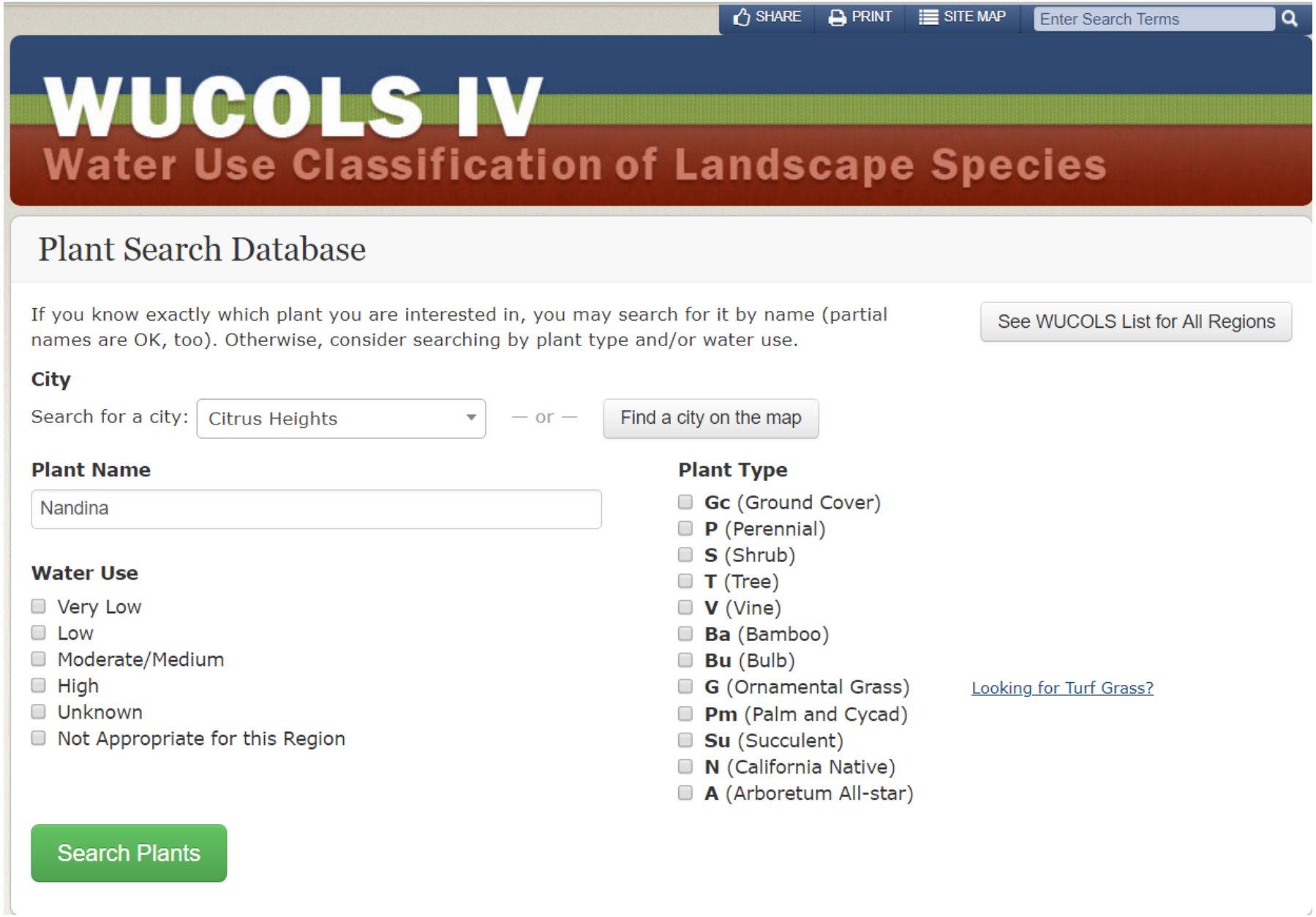
WUCOLS IV

WUCOLS IV

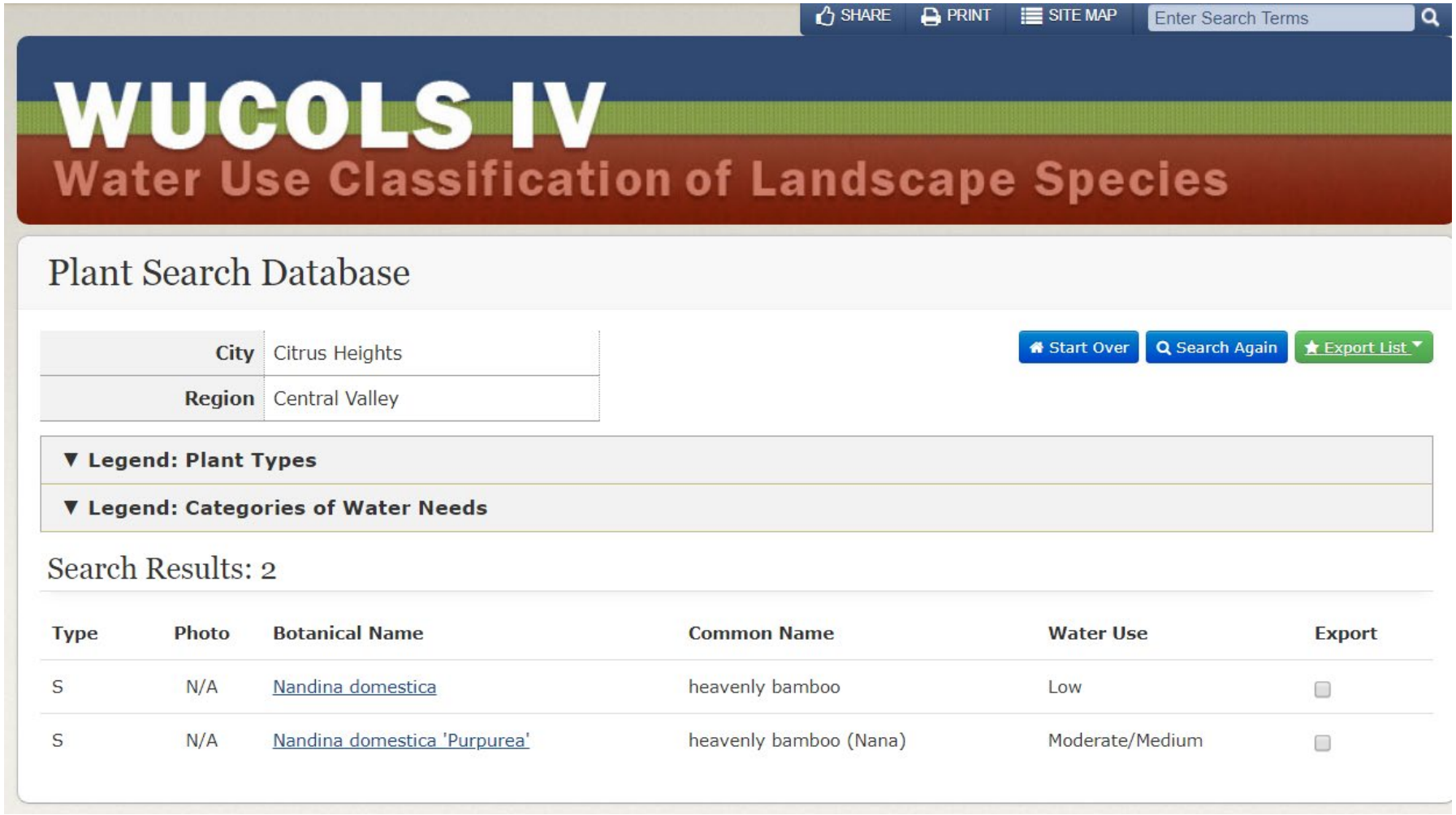
- Provides information on water needs of more than 3500 plants
- Different plant species require different amounts of water for optimal health
- Plant Factor (PF) - Expressed as a percentage of ETo

Water Budget = Weather x Plant Factor x Area

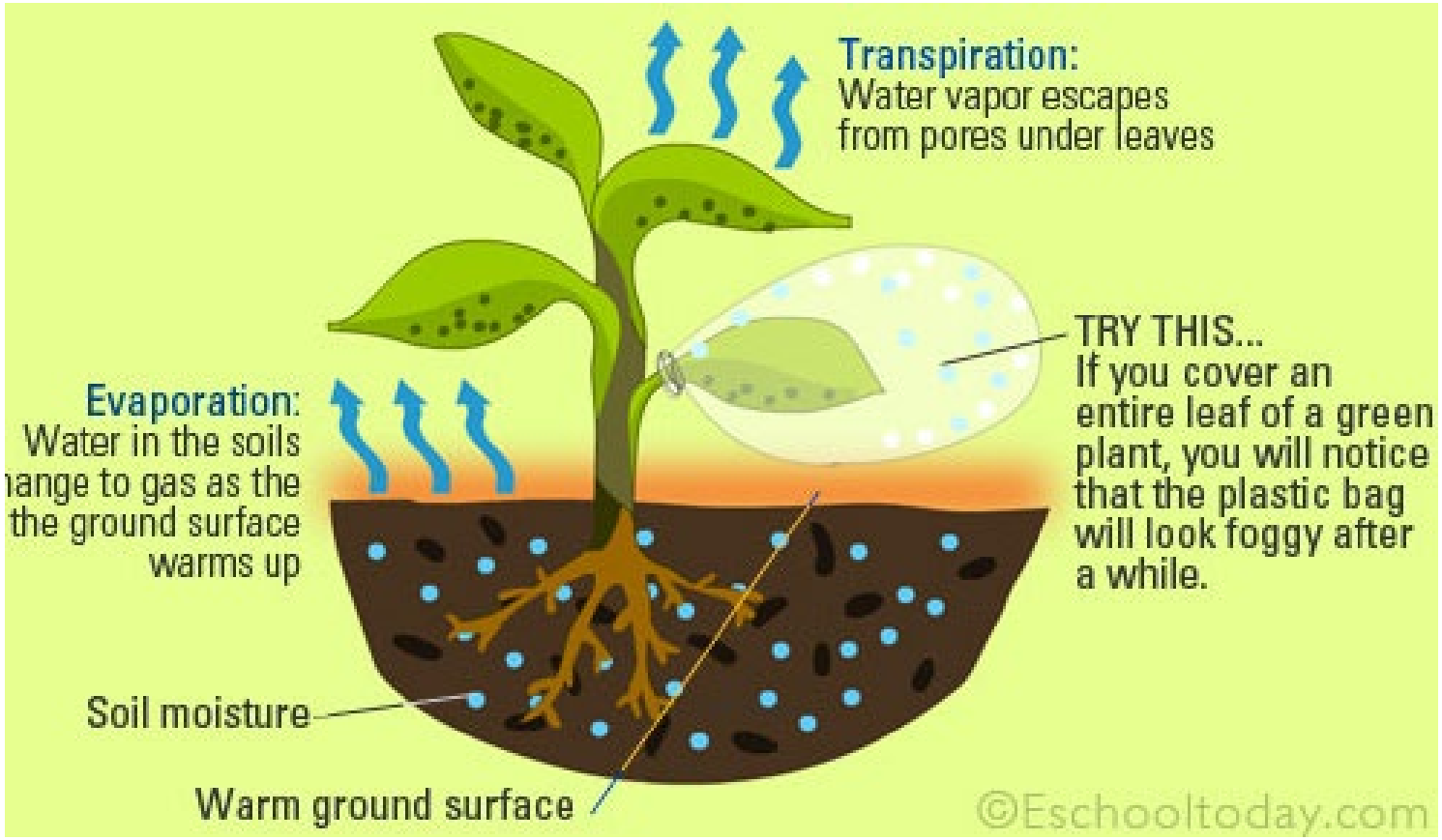
WUCOLS IV


SHARE
PRINT
SITE MAP
Enter Search Terms
WUCOLS IV
Water Use Classification of Landscape Species
Plant Search Database
If you know exactly which plant you are interested in, you may search for it by name (partial names are OK, too). Otherwise, consider searching by plant type and/or water use.
See WUCOLS List for All Regions
City
Search for a city:
Citrus Heights
— or —
Find a city on the map
Plant Name
Nandina
Water Use
Very Low
Low
Moderate/Medium
High
Unknown
Not Appropriate for this Region
Plant Type
Gc (Ground Cover)
P (Perennial)
S (Shrub)
T (Tree)
V (Vine)
Ba (Bamboo)
Bu (Bulb)
G (Ornamental Grass)
Pm (Palm and Cycad)
Su (Succulent)
N (California Native)
A (Arboretum All-star)
Looking for Turf Grass?
Search Plants

WUCOLS IV


SHARE
PRINT
SITE MAP
Enter Search Terms
WUCOLS IV
Water Use Classification of Landscape Species
Plant Search Database
City Citrus Heights
Region Central Valley
Start Over
Search Again
Export List
▼ Legend: Plant Types
▼ Legend: Categories of Water Needs
Search Results: 2
Type Photo Botanical Name Common Name Water Use Export
S N/A Nandina domestica heavenly bamboo Low
S N/A Nandina domestica 'Purpurea' heavenly bamboo (Nana) Moderate/Medium

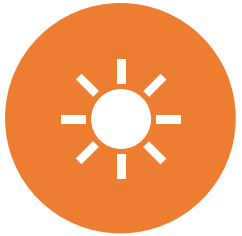
Calflora.org



Evapotranspiration (ETo)

- The loss of water to the atmosphere by the combined process of:
  - Evaporation from the top 1" of the soil and plant surfaces
  - Transporation through plant tissues

Factors Affecting ETo



SOLAR RADIATION

AIR TEMPERATURE

RELATIVE HUMIDITY

WIND SPEED

SOIL EXPOSURE

PLANTING DENSITY

"Lawns, by acreage, are the nation's largest irrigated crop, surpassing corn."

Lawns are a vestige that started with English gardens and spread by those living in water-rich environments in the East and mid-West.

The future profits of the lawn care and horticulture industries rely on the endurance of the myth that we need lawns and persistent sprawl.

Lawn rebate program in L. A. will save approximately 47 million gallons of water each year

9.2 billion gallons of water have been saved through turf removal in Las Vegas

Time and money consuming

Lawns

Ecological deserts

- Monocrop
- Ecological deserts for pollinators

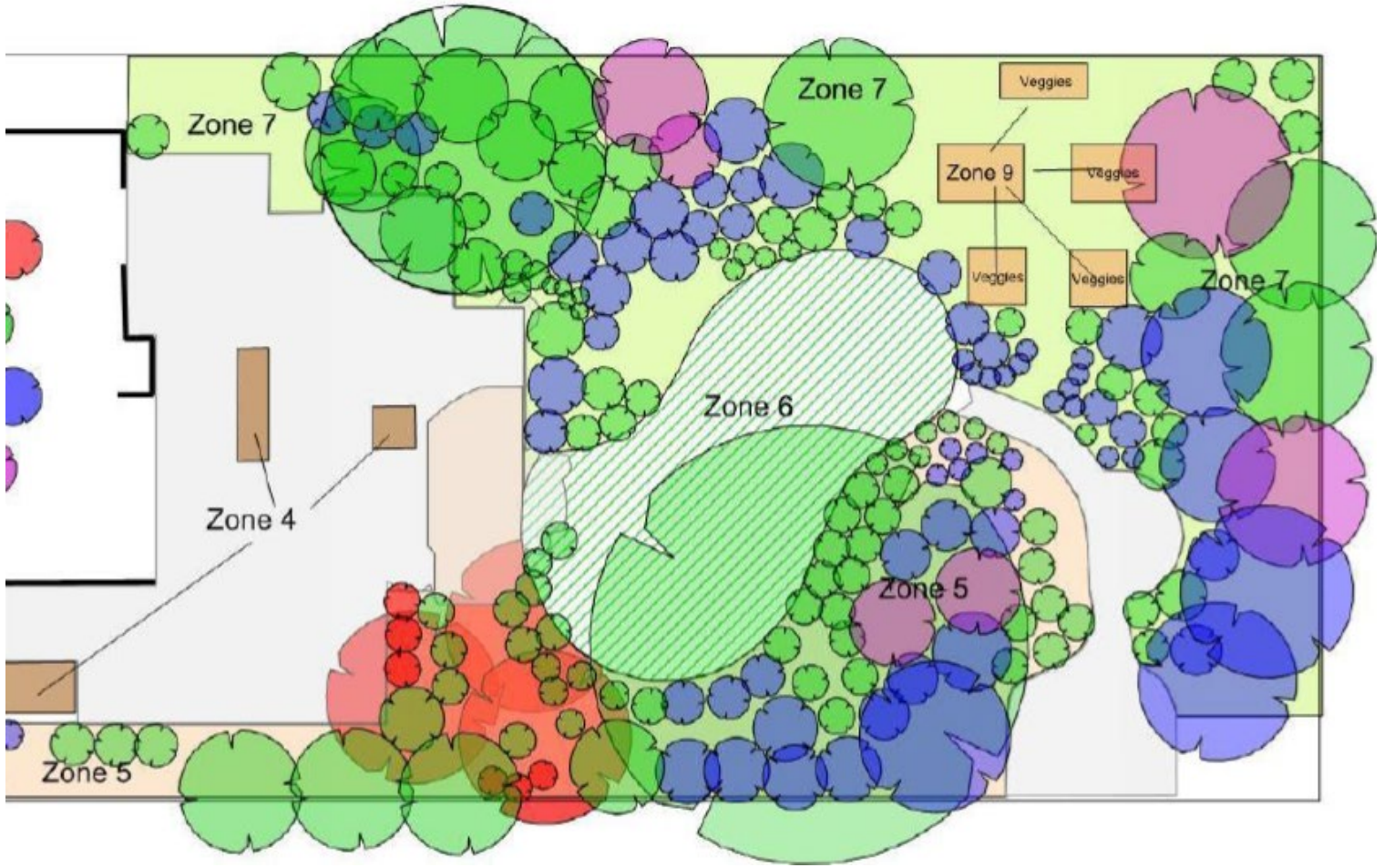
Fertilizers and pesticides

- Contaminate groundwater
- Pollute waterways
- Toxic to children and pets
  - Fourteen of the 30 most commonly used lawn pesticides are neurotoxins are known or suspected carcinogens, and two-thirds of them may cause reproductive harm in humans

Fossil fuels

- Costly
- Air pollution

Contribute to carbon dioxide load



Troubleshoot Water-use Differences

Troubleshooting Water-use Differences

Determine	Determine WUCOLS classification
Prioritize	Prioritize plants to save
Remove	Remove unhealtlhy, diseased plants
Remove	Remove lower priority plants from crowded areas
Move / regroup	Move and regroup plants according to water needs
Replant	Replant where it makes sense; use plants that match the water needs in the area

Irrigation

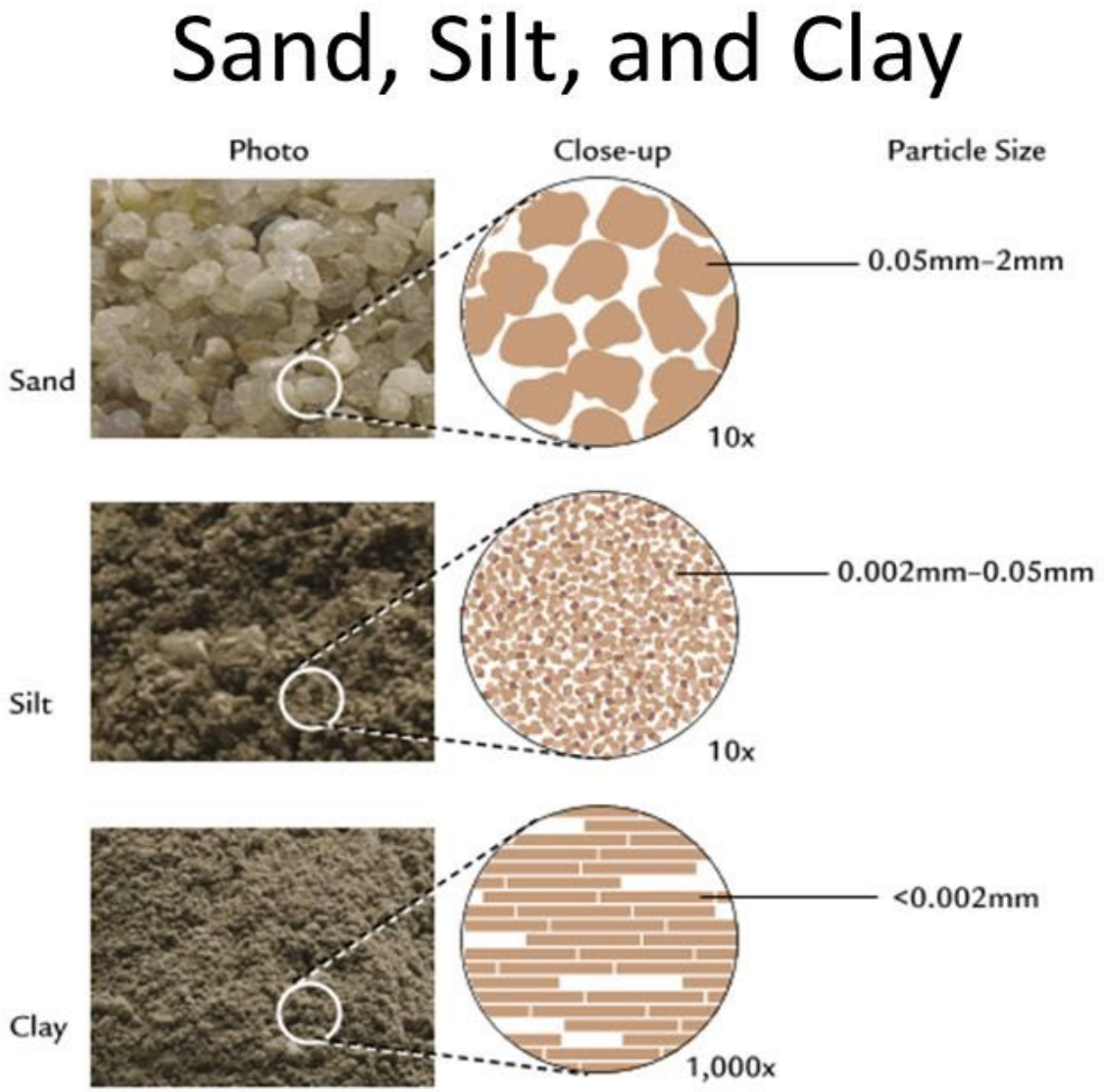
Watering to keep plants healthy

Know Your Soil Texture

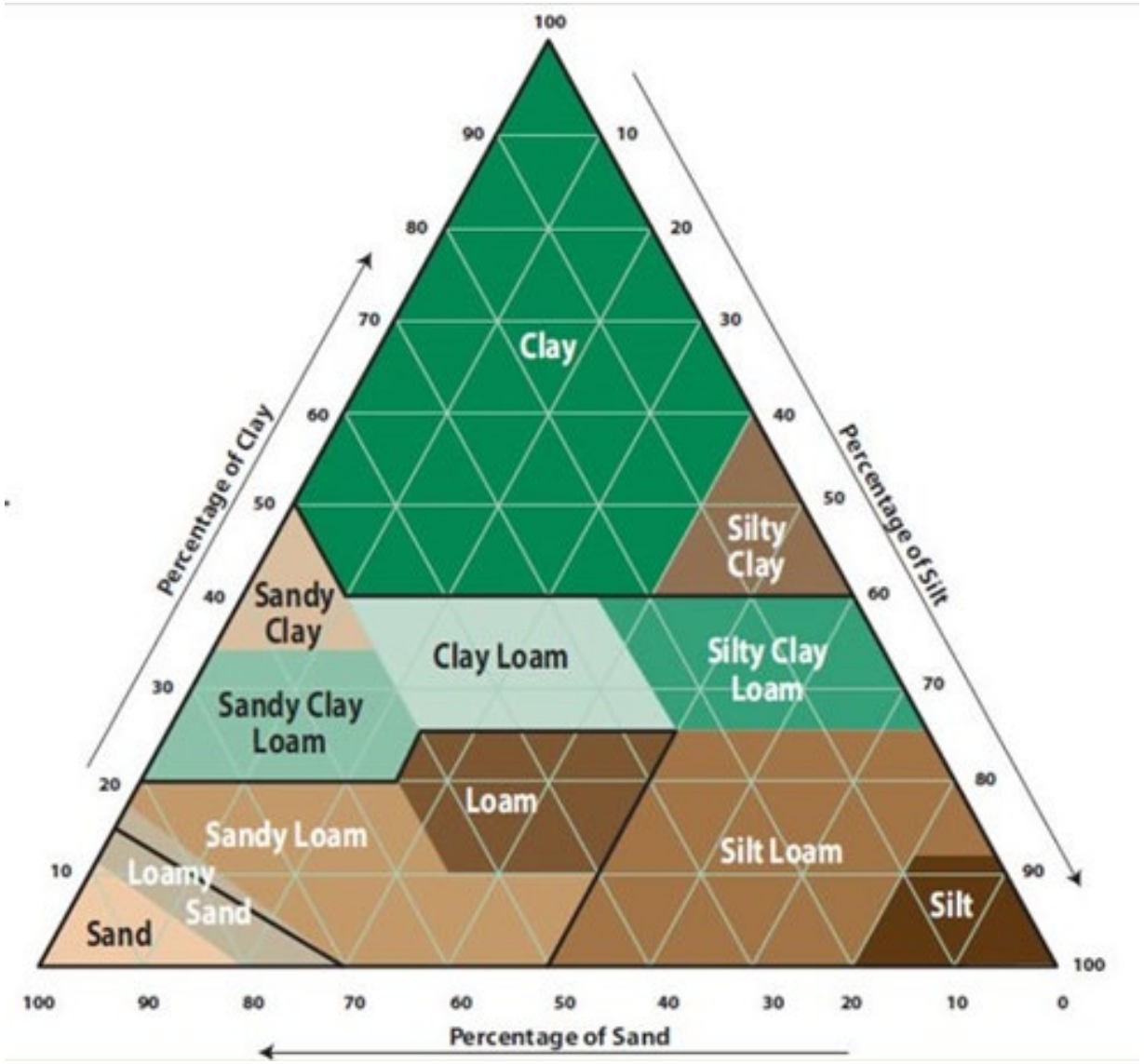
- Soil probe
- Hand test
- Jar test
- SoilWeb app
- Percolation test

Determine Soil Texture

- Sand
- Silt
- Clay



Soil Texture



Sandy Soils

- Particles are loose and coarse
- Squeezed in hand when dry, it falls apart when pressure is released
- Squeezed when moist, it will form a cast, but crumble easily when touched
- Water more frequently and higher amounts

Silty Soils

- Has a moderate amount of fine grains
- When dry, it can be readily broken
- Squeezed when wet, it will form a cast that can be easily handled

Clay Soils

- When dry, forms hard lumps or clods
- When wet, soil is quite plastic and flexible
- When squeezed between the thumb and forefinger, soil will form a ribbon that will not crack
- Water less frequently, and lower amounts

Loam

- Equal parts sand, silt & clay
- Contain more nutrients, moisture, and humus than sandy soils
- Better drainage and infiltration of water and air than clay soils
- Easier to till than clay soils

How Does Water Act in Soil?

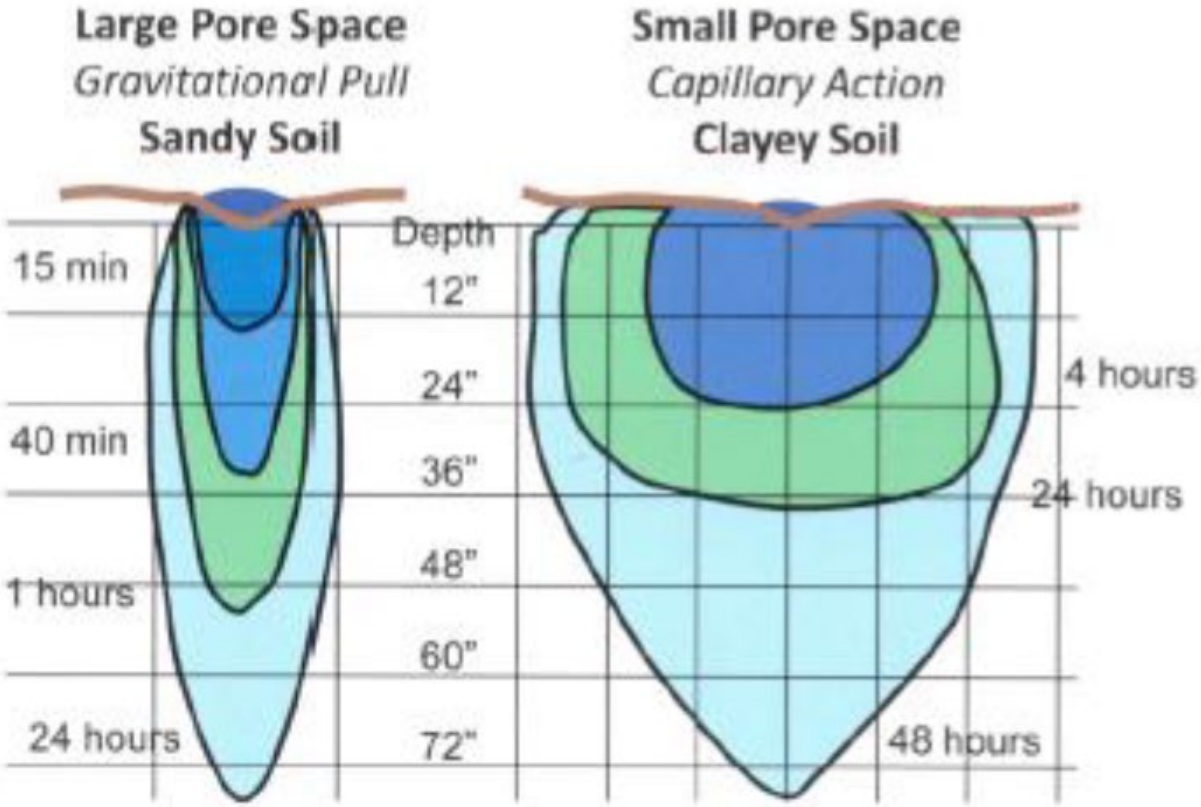


Figure 1. Comparative movement of water in sandy and clayey soils

Soil Type	Intake Rate	Sprinkler
• Clay:	.10 in/hr	Rotary nozzle (cycle
• Clay Loam:	.20 in/hr	Rotary nozzle (cycle
• Loam:	.35 in/hr	Rotary nozzle (cycle
• Loamy Sand:	.40 in/hr	Rotary nozzle (cycle
• Sand:	.60 in/hr	Any sprinkler (cycle)

Match Sprinkler to Soil Type

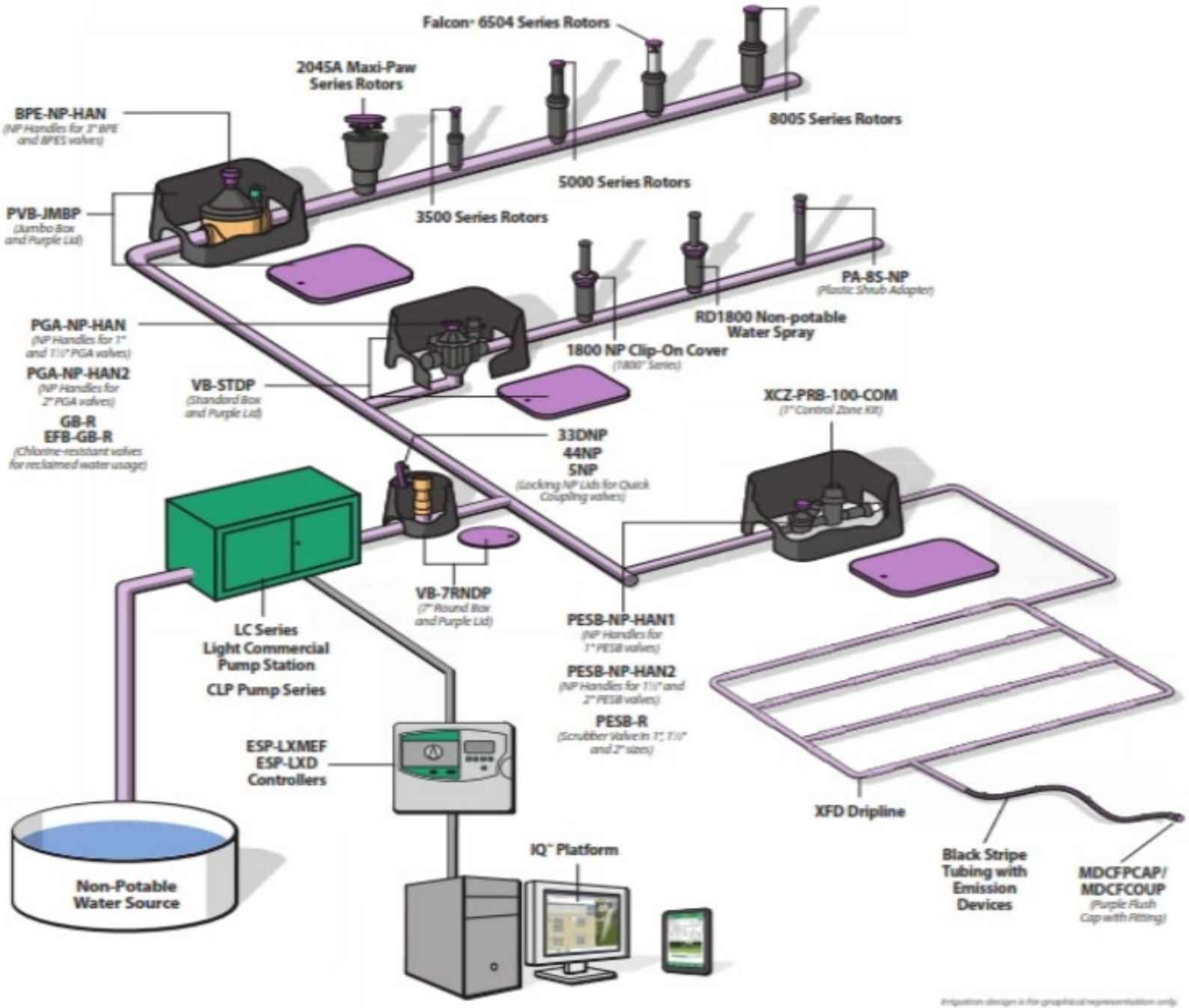
Soil Type	Intake Rate	Emitter Flow
Clay:	.10 inches/hour	.26, .4, .5 gph
Clay Loam:	.20 inches/hour	.26, .4, .5 gph
Loam:	.35 inches/hour	.4, .5, .6 gph
Sandy Loam:	.40 inches/hour	.5, .6 gph
Sand:	.60 inches/hour	.9, 1.0 gph

Match Emitter Flow to Soil Type

Irrigation System Components

Important to understand system components, their function and how they affect efficienty

Anatomy of an Irrigation System



Water Meter & POC

- **Measures water being used**
  - Leak detection
  - Flow rate of an irrigation zone
  - Standard water meter sizes are: 5/8″ & 3/4″
- **Point of Connection (POC)**
  - Where the irrigation mainline connects to the water service line

Pressure Regulation

Remote Control Valves

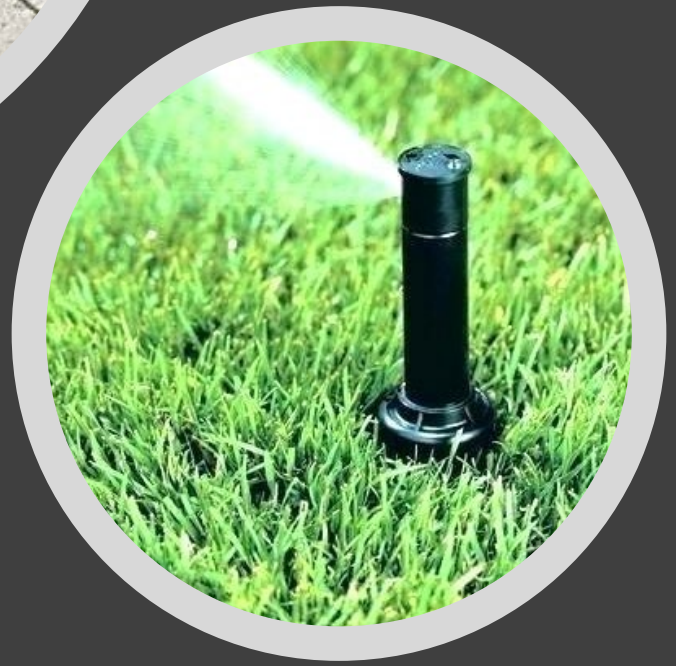
- Remote Control Valves (RCVs): work with Controllers to irrigate various landscape zones
  - A group of RCVs is called a manifold
  - Locate adjacent to walkways or hardscape for easy access
  - Always used normally-closed valves
  - 24-volt or DC (for battery- or solar-powered solinoids)

Remote Control Valves

- In-ground RCVs may only be used when a backflow prevention device is used
- Above-ground RCVs must be installed with anti-siphon valves
  - Must be 12" higher than the highest point of the valve system

Controllers & Sensors

- Irrigation controllers control operation of electric remote-control valves
  - Conventional vs. Weather-based
  - EPA WaterSense-labeled irrigation controllers
- Sensors respond to specific site conditions and modify operation of the controller
  - Soil moisture
  - Rain
  - Flow
  - Wind
  - Evapotranspiration



Irrigation Application Devices

- **Overhead Irrigation**
  - Apply water on the surface through the air
  - Best for turf and low-growing groundcover
  - **Types:**
    - Fixed-spray heads
    - Rotating sprinklers
    - Rotors

Soil Type	Intake Rate	Sprinkler
• Clay:	.10 in/hr	Rotary nozzle (cycle
• Clay Loam:	.20 in/hr	Rotary nozzle (cycle
• Loam:	.35 in/hr	Rotary nozzle (cycle
• Loamy Sand:	.40 in/hr	Rotary nozzle (cycle
• Sand:	.60 in/hr	Any sprinkler (cycle)

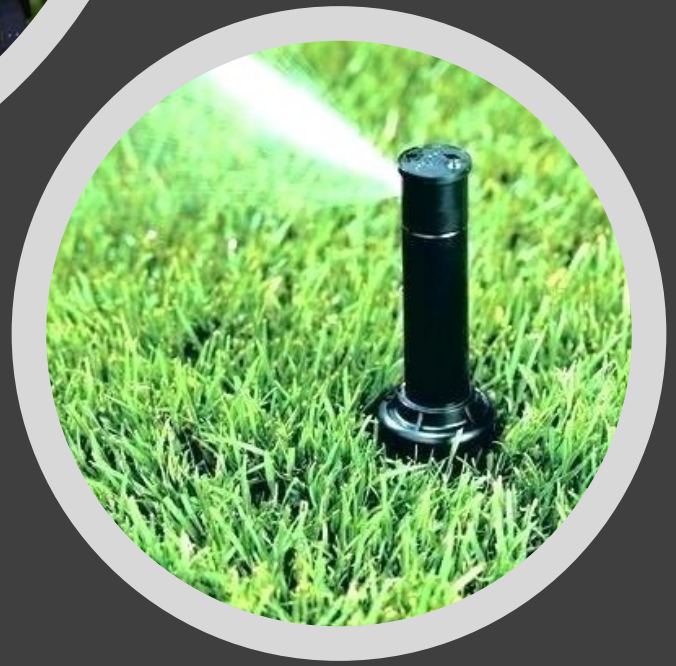
Match Sprinkler to Soil Type

Fixed-spray Sprinklers

- Apply a fan of water over a given area
- Radius: 2-17 feet
- Application rate: 15. - 2.0 inches/hour or more
  - Exceeds the infiltration rate of most soils
- Typical operating pressure: 30 psi
- 6"-pop-ups recommended for turf
- Built-in check valves to prevent low-head drainage
- Pressure regulation to avoid misting
- Matched precipitation rate (MPR) nozzles
- Fixed and variable-arc nozzles
- High-efficiency nozzle can improve Distribution Uniformity

Rotating Sprinklers

- Apply rotating stream of water over a given area
  - Wind-resistant stream
- More uniform coverage than fixed-spray
- Application rate: 0.4 - 0.8 inches/hour
- Radius: 6-35'
- Operating pressure: 35-55 psi
- Nozzles compatible with same bodies for fixed spray
  - Easy to retrofit



Rotors

- Apply a single stream of water over a given area
- More uniform coverage than fixed-spray heads
- Application rate: 0.4 - 15 gallons per minute
- Matched-precipitation rate nozzles
- Radius: 15-52 feet
- Operating pressure: 20-100 psi
  - Can operate at higher pressures
- Impact-type have a lower uniformity of coverage

Inefficient Fixed Spray Sprinklers

Efficient Solution: Rotary Nozzles

Poor Sprinkler Coverage

Good Sprinkler Coverage

Drip Irrigation

- Applies water to a single spot or spots along a pipe
- Suitable for the irrigation of trees, shrubs, groundcover and perennials
- Less water loss to evaporation, runoff, overspray or wind drift
- Application rate: variable depending on design
- Do not mix with other drip devices with different application rates
- Filters and pressure regulation may be needed to meet specification for operation

Two Types of Drip

- **Point Source**
  - Emitters placed at the plants for sparse plantings

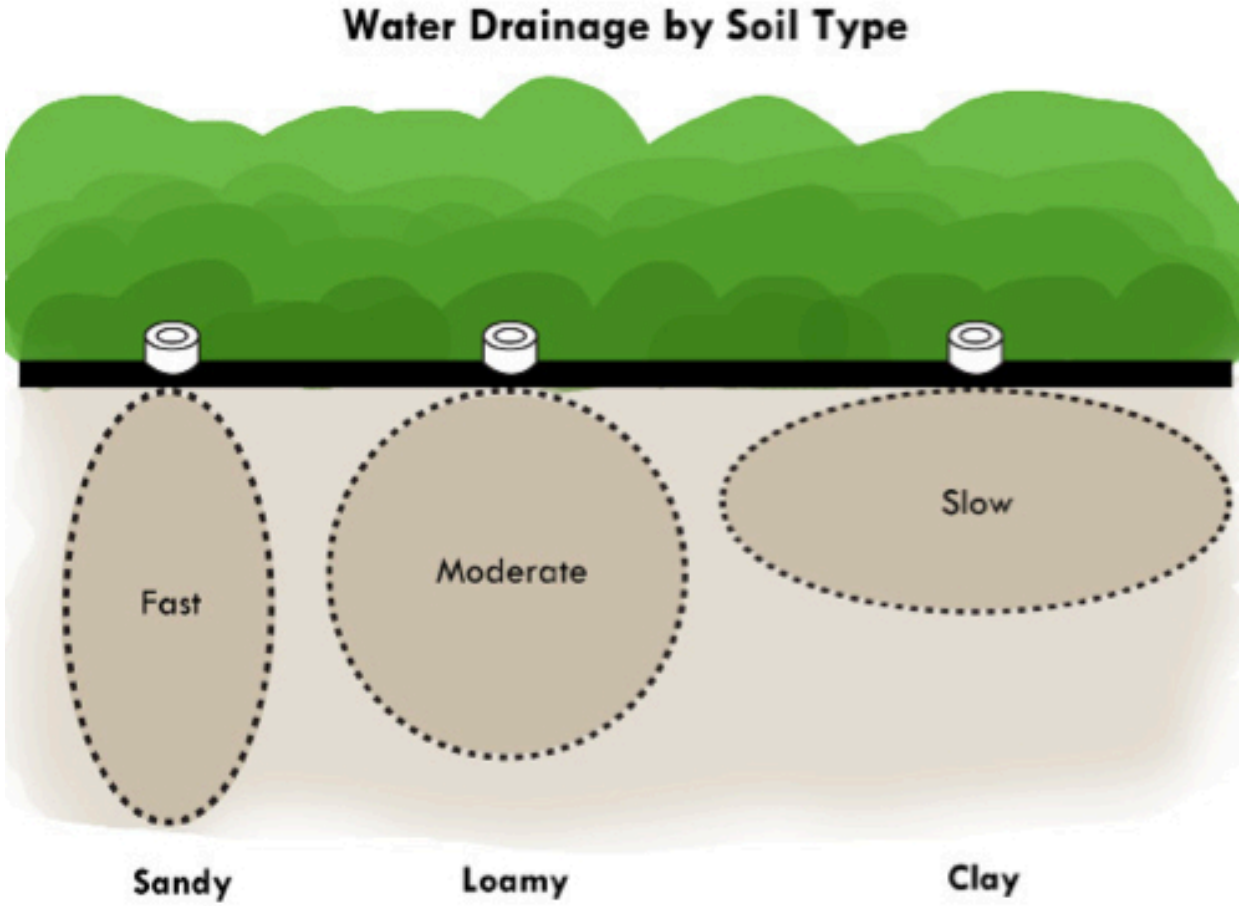
- **Line Source**
  - Built-in emitters in a grid for dense plantings

Line Source: Dripline

- Emitters are embedded inside tubing spaced evenly at various distances (6", 12", 18" or 24")
- Flow rates: 0.26-1.0 gallons per hour (GPH)
- Match emitter flow to soil type and infiltration rate
- Grid layout provides even application of water
- Typical tubing diameter: ¾", ½" and ¼" (short runs only)
  - Netafim: 17mm and 12mm

Dripline

- Never mix dripline of different flow rates or emitter spacing
- Base emitter flow and spacing on soil type and infiltration rate
- Best to select pressure compensating emitters
- Grid layout should have supply and exhaust headers
- Don’t exceed maximum line run length set by manufacturer
- Include flush valves at low points and air vacuum relief at high points


Water Drainage by Soil Type
Fast
Moderate
Slow
Sandy
Loamy
Clay

Dripline Selection

TECHLINE CV	TURF												SHRUB & GROUNDCOVER											
	CLAY SOIL			LOAM SOIL			SANDY SOIL			COARSE SOIL			CLAY SOIL			LOAM SOIL			SANDY SOIL			COARSE SOIL		
EMITTER FLOW	0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH			0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH		
EMITTER SPACING	18"			12"			12"			12"			18"			18"			12"			12"		
LATERAL (ROW) SPACING	18"	20"	22"	12"	14"	18"	12"	14"	18"	12"	14"	16"	18"	21"	24"	18"	21"	24"	16"	18"	20"	16"	18"	20"
BURIAL DEPTH	Bury evenly throughout the zone from 4"to 6"												On-surface or bury evenly throughout the zone to a maximum of 6"											
APPLICATION RATE (INCHES/HOUR)	0.19	0.17	0.15	0.64	0.55	0.43	0.98	0.84	0.65	1.48	1.27	1.11	0.19	0.16	0.14	0.30	0.26	0.23	0.73	0.65	0.59	1.11	0.99	0.89
TIME TO APPLY ¼" OF WATER (MINUTES)	80	89	97	23	27	35	15	18	23	10	12	13	80	93	106	50	58	66	20	23	26	13	15	17
Following these maximum spacing guidelines, emitter flow selection can be increased if desired by the designer. 0.9 GPH flow rate available for areas requiring higher infiltration rates, such as coarse sandy soils.																								

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

Dripline Installation

Line Source Dripline

Convert Sprinklers to Dripline

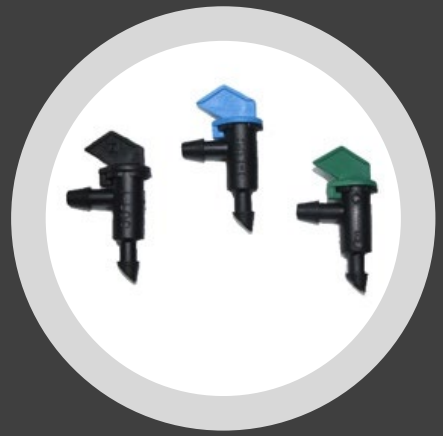
Point-source Drip

Does not encourage a healthy root system


ADT

Point-source Drip

- Drip tubing with individual emitters connected directly or with ¼" spaghetti tubing and fittings
  - ¼" tubing is more prone to UV-damage and foot-traffic damage
- Wide variety of emitter designs with different characteristics
- Flow rates: ½, 1, 2, 4, 6, and 10 GPH



Point-source Drip

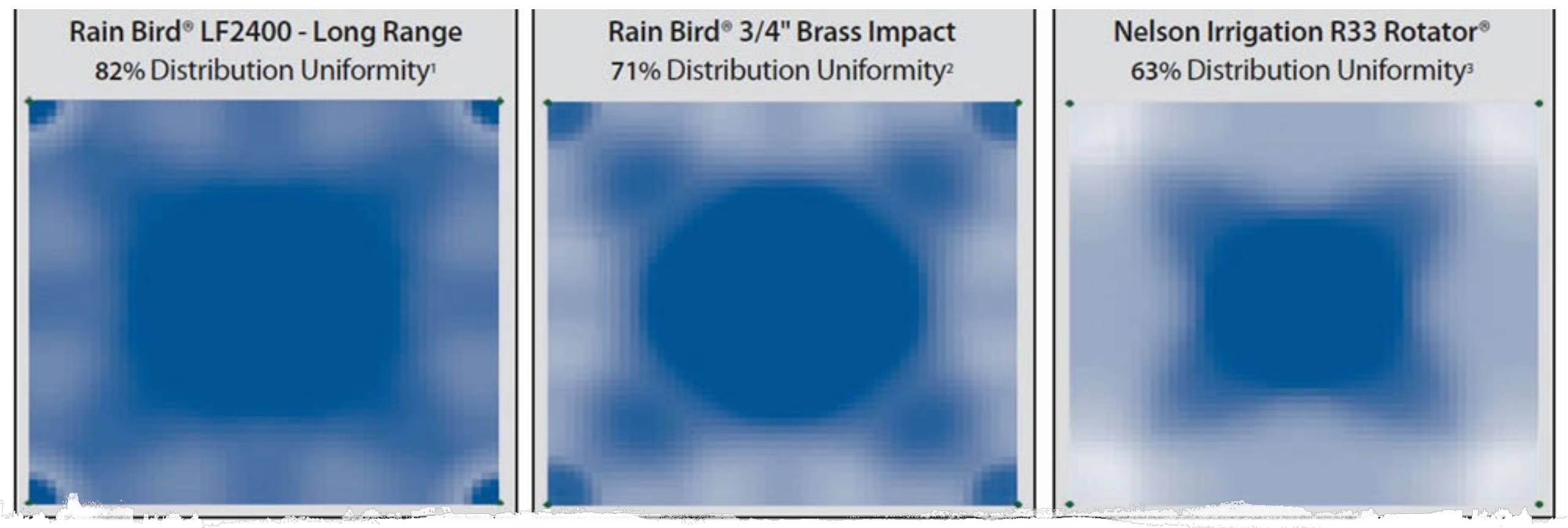
- Pressure regulate per specifications to avoid emitters being blown off
- Place multiple emitters at edge of plant canopy not at base of trunk
- Use the number of emitters appropriate to plant size and water needs
- Pressure-compensating emitters ensure uniform water application over long runs and elevation changes

Bubbler & Micro-sprays

- Low-volume bubblers apply water in a small radius
  - Flow rate: 0.25- 2.0 GPM (15-120 GPH)
    - many time higher than point-source emitters
  - Useful for isolated large shrubs and trees
- Micro-sprays apply water in a fine spray
  - Flow rate: 0.25-30 GPH
  - Radius larger than bubbler and much less efficient
- Soaker hose and laser tubing are not recommended

Water-efficienty Features

- **Matched-precipitation features (MPR)** emission devices improve distribution uniformity
- **Check valves** keep water in the irrigation lines
  - Reduce water lost due to low-head drainage
- **Pressure regulators** compensate for high or fluctuating pressure
- **Pressure-compensating emitters** ensure an even flow at all emitters



Distribution Uniformity (DU)

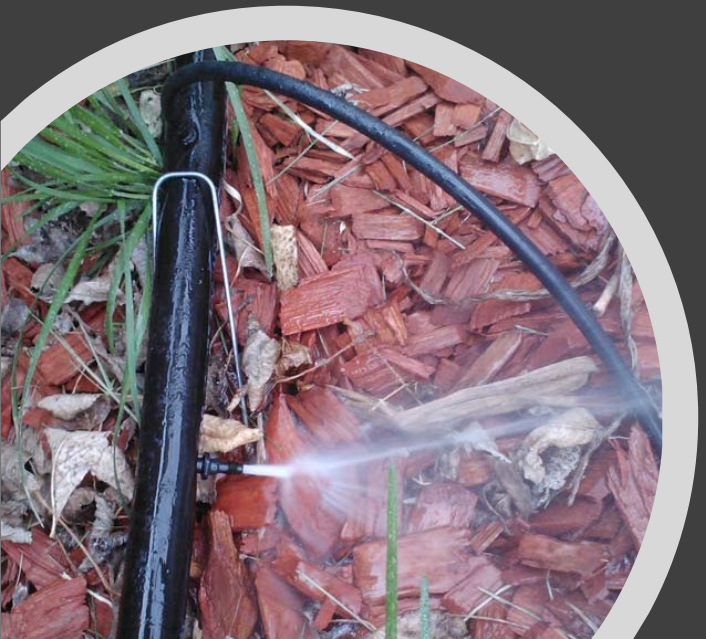
- **Can only be determined by performing an audit**
  - A perfectly uniform application would give a DU of 100%.
  - Sprinkler systems average DU of 35 to 50%
  - Dripline systems average 80-90% uniformity

Irrigation Practices to Avoid

- **Operating pressures** below or above manufacture's recommendations
- **Unmatched-precipation rate nozzles**
- **Mixed types of emission devices**
  - Dripline with micro-sprays
  - Fixed sprays with rotating sprinklers
- Emission devices with **uneven or unkown application rates**
  - Soaker hose, laser tubing
- Plant material **blocking overhead sprays**
- **Drip emitters placed at the base of plant stem or trunk**

Irrigation Maintenance & Troubleshooting

- **Irrigation Controller Check-up**
  - Check date and time and reset if needed
  - Replace battery back up

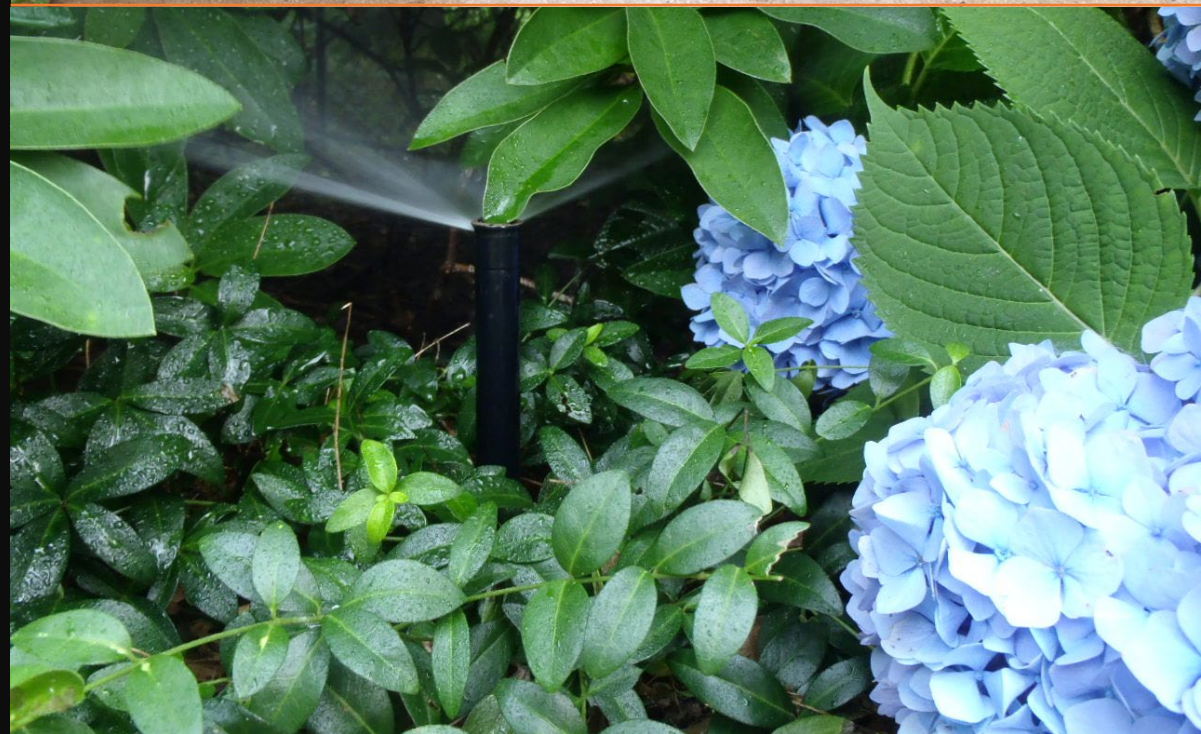


Irrigation System Check-up

- Manually activate valves
  - Look, listen, feel
  - Flag trouble spots
  - Fix the problem
    - Stuck Valves
    - Clogged nozzles
    - Readjust arcs
    - Readjust heads
    - Replace wiper seals
    - Broken lines
    - Plugged emitters
    - Missing emitters
  - Use identical parts

Irrigation System Check-up

- Prune or move plants blocking sprays



Irrigation System Check-up

- **Water Pressure Issues**
  - **<u>Low Pressure</u>**
    - Poor pattern
    - Heads don’t pop-up or only partially
    - Last head may not spray at all
  - **<u>High Pressure</u>**
    - Misting
    - Blowing nozzles

Excessive Water Pressure

Water Hammer: occurs when the flowrate of fluid in the **pipe** changes rapidly

- **Can** cause burst pipes, damaged supports and pipe racks, and leakage at joints.
- The higher the water pressure, the greater the water hammer danger. If your water pressure is over 80 PSI, reduce your maximum flow by 20%

Scrubbing: high water velocity scrubs molecules loose from the inside of the pipe wearing it away enough that the pipe develops a leak

- The higher the velocity, the more scrubbing occurs

Excessive Water Pressure

- **Water Hammer**: occurs when the flowrate of fluid in the pipe changes rapidly
  - **Can** cause burst pipes, damaged supports and pipe racks, and leakage at joints
  - The higher the water pressure, the greater the water hammer danger.
  - If your water pressure is over 80 PSI, reduce your maximum flow by 20%
- **Scrubbing**: high water velocity scrubs molecules loose from the inside of the pipe wearing it away enough that the pipe develops a leak
  - The higher the velocity, the more scrubbing occurs

Measure Water Pressure

- Water pressure - the energy that powers your sprinkler system
  - it will make your sprinklers do the “rain dance”.
  - ignore it, it can bite you hard in the wallet!
- PSI = pounds per square inch
  - Call your water supplier and ask what the “static water pressure” at your address.
  - If given a pressure range, i.e., 40-60 PSI, use the LOW number
  - OR, measure using a pressure gauge that attaches to a hose bib at the house

Check Drip Pressure

Pressure Regulators (PR)

- Pressure regulators are commonly set within a range of 50 and 65 PSI
- Generally located at the house
- Irrigation system typically comes off the mainline before the PR

Measuring Water Pressure with a Gauge

Measure	Turn off	Attach	Turn on	Read
Static pressure: measure with no water moving	Turn off everything that uses water in your home: faucets, ice makers, toilets, etc.	Attach gauge to a water outlet (hose bib will do) at about the same height (elevation) as the tap for the irrigation system supply	Turn on valve the gauge is connected to allowing water to enter the gauge	Read pressure on the gauge

Measure the Maximum Available Flow (GPM)

- Flow is the companion of water pressure (PSI)
- Flow is the measure of how much (volume) water is moved in a given amount of time measured in Gallons per Minute (GPM)
  - Remember: Pressure is the “energy” that moves the water through pipes
- Determine the size of the water supply pipe
  - Measure how many inches of string it takes to go around the pipe once
  - C/π=D (circumferance / 3.14 = diameter)
    - Search outside diameter (OD) of SCH 80 PVC or copper pipe
      - ¾" = 1.05" OD SCH 80 PVC
      - 1" = 1.315" OD SCH 80 PVC
      - ¾" = 0.875" OD Copper pipe

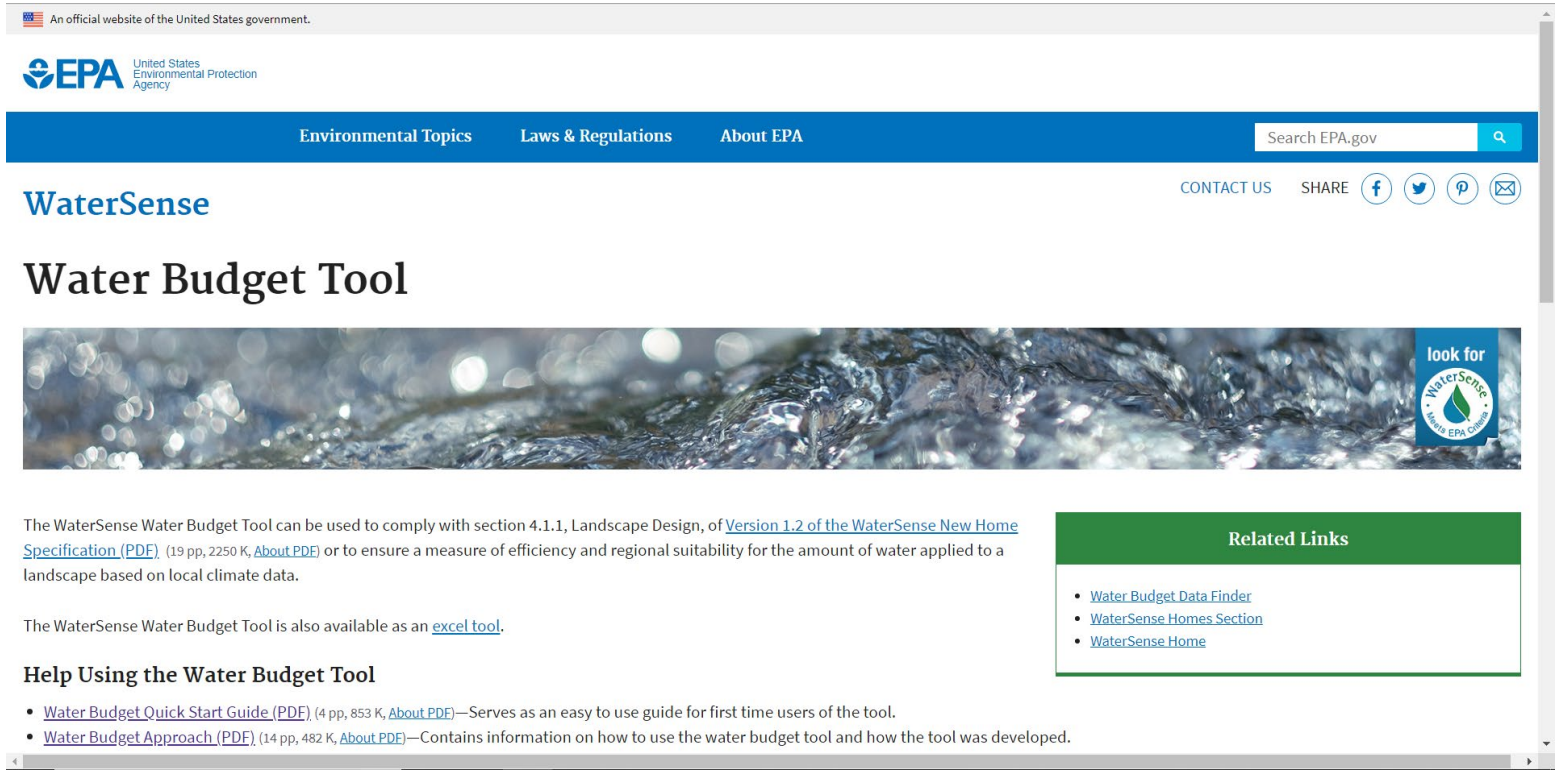
Find Your Maximum Available GPM

Maximum Available GPM Table (Maximum Safe GPM)

	Maximum Available GPM (Maximum Safe GPM)				
Pipe Size	Steel Pipe	Copper Pipe	PVC Pipe	PE (poly) Tube	PEX (CTS) Tube
1/2"	6 GPM(7 ft/sec)	6 GPM(7 ft/sec)	6 GPM(7 ft/sec)	6 GPM(7 ft/sec)	3 GPM(7 ft/sec*)
3/4"	11 GPM(7 ft/sec)	11 GPM(7 ft/sec)	11 GPM(7 ft/sec)	11 GPM(7 ft/sec)	7 GPM(7 ft/sec*)
1"	18 GPM(7 ft/sec)	18 GPM(7 ft/sec)	18 GPM(7 ft/sec)	18 GPM(7 ft/sec)	12 GPM(7 ft/sec*)
1 1/4"	23 GPM(5 ft/sec)	23 GPM(5 ft/sec)	23 GPM(5 ft/sec)	23 GPM(5 ft/sec)	–
1 1/2"	32 GPM(5 ft/sec)	32 GPM(5 ft/sec)	32 GPM(5 ft/sec)	32 GPM(5 ft/sec)	–
2"	52 GPM(5 ft/sec)	52 GPM(5 ft/sec)	52 GPM(5 ft/sec)	52 GPM(5 ft/sec)	–

Develop a Water Budget

- **Calculate you water need (not to exceed amount)**
- **Tools:**
  - EPA WaterSense Water Budget Tool
  - Simplified Landscape Irrigation Demand Estimation (SLIDE)

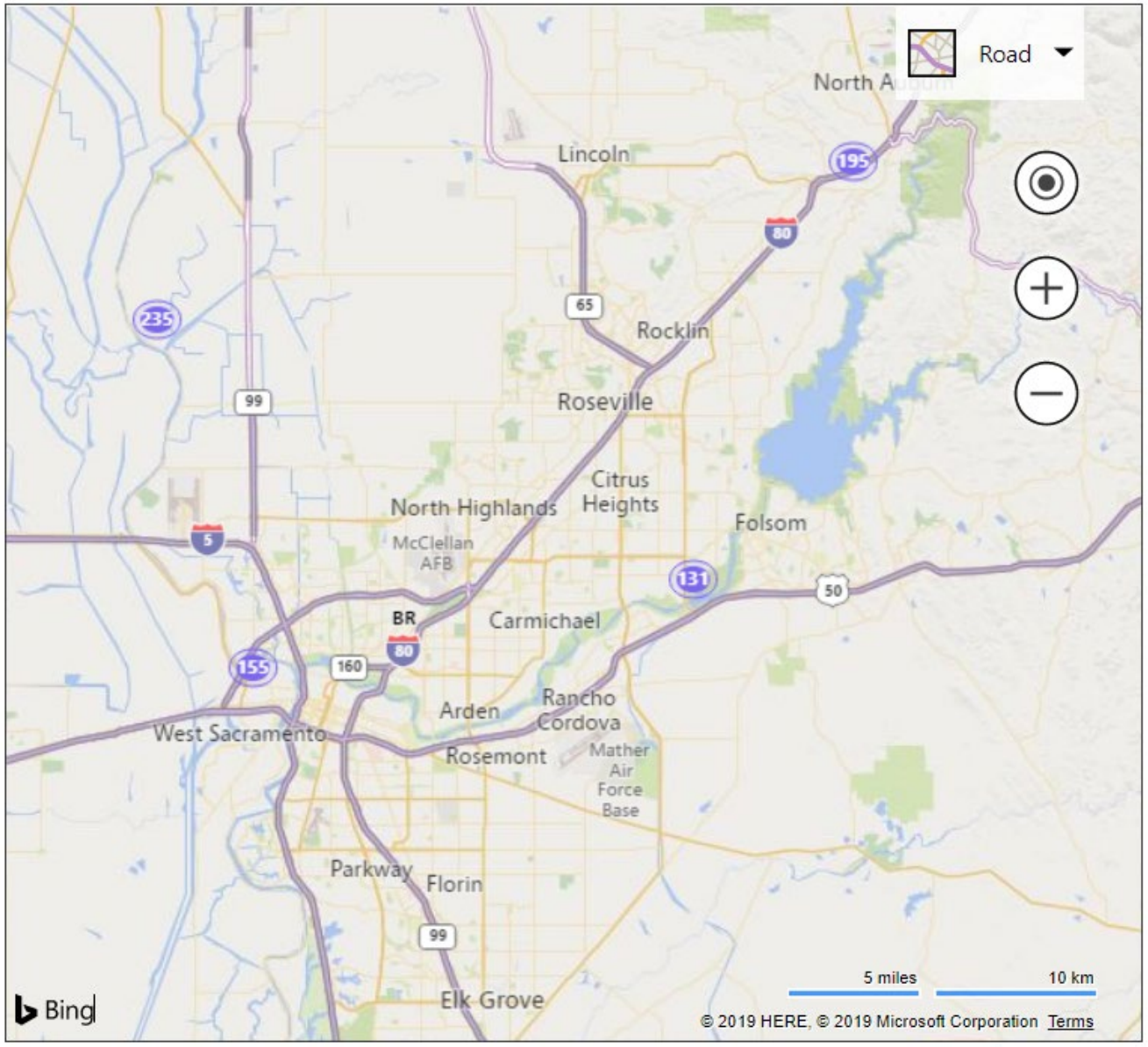


Sources of ETo

- **Weather stations measure:**
  - Solar radiation
  - Soil temperature
  - Air temperature
  - Relative humidity
  - Wind speed & direction
  - Precipitation

CIMIS Map – Sacramento Region

https://cimis.water.ca.gov/Stations.aspx



Irrigation Audits

- Find out how fast the water is being applied
- Find out how evenly the sprinklers are covering their area (DU)
- Both of these values are used to calculate the irrigation schedule
- The information is used to determine the need for repairs and upgrades

Water Conservation Strategies for Irrigation

- **Watering**
  - Water at night or early morning
  - Do not water in high wind
  - Avoid or reduce overspray
  - Water less frequently, but deeply
    - Practice water cycling as needed
  - Gradually reduce water application – 10% at a time
  - Manage irrigation to match microclimates
- **Encourage development of extensive root system**

Capturing & Utilizing Water

Irrigation Alternatives to Municipal Drinking Water

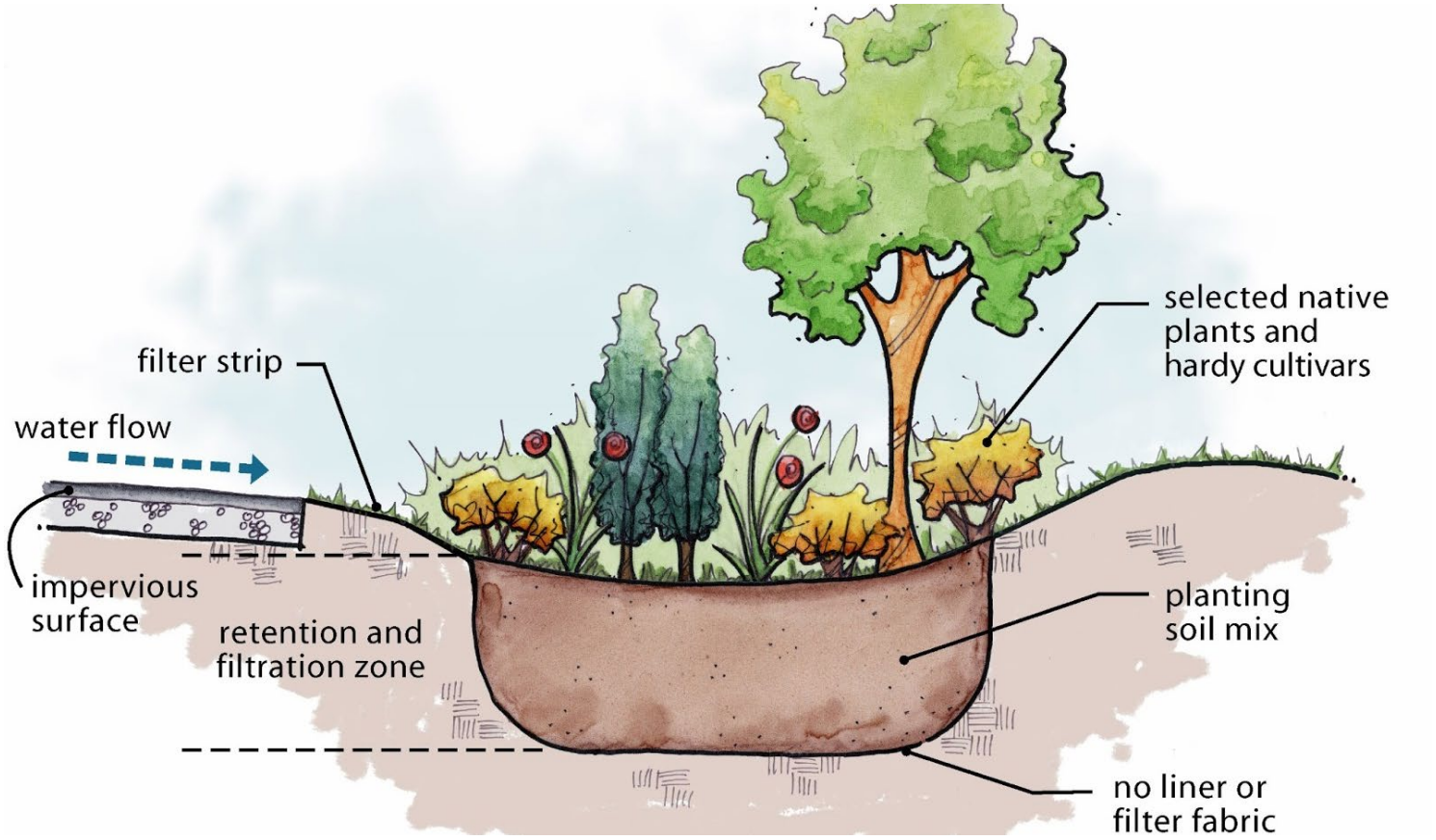
- On-site, non-potable water resources
  - Rainwater harvesting
  - Greywater
  - Air-conditioner condensate

Active Rainwater Harvesting

- Barrels
- Cisterns
- Tanks

Rain Gardens

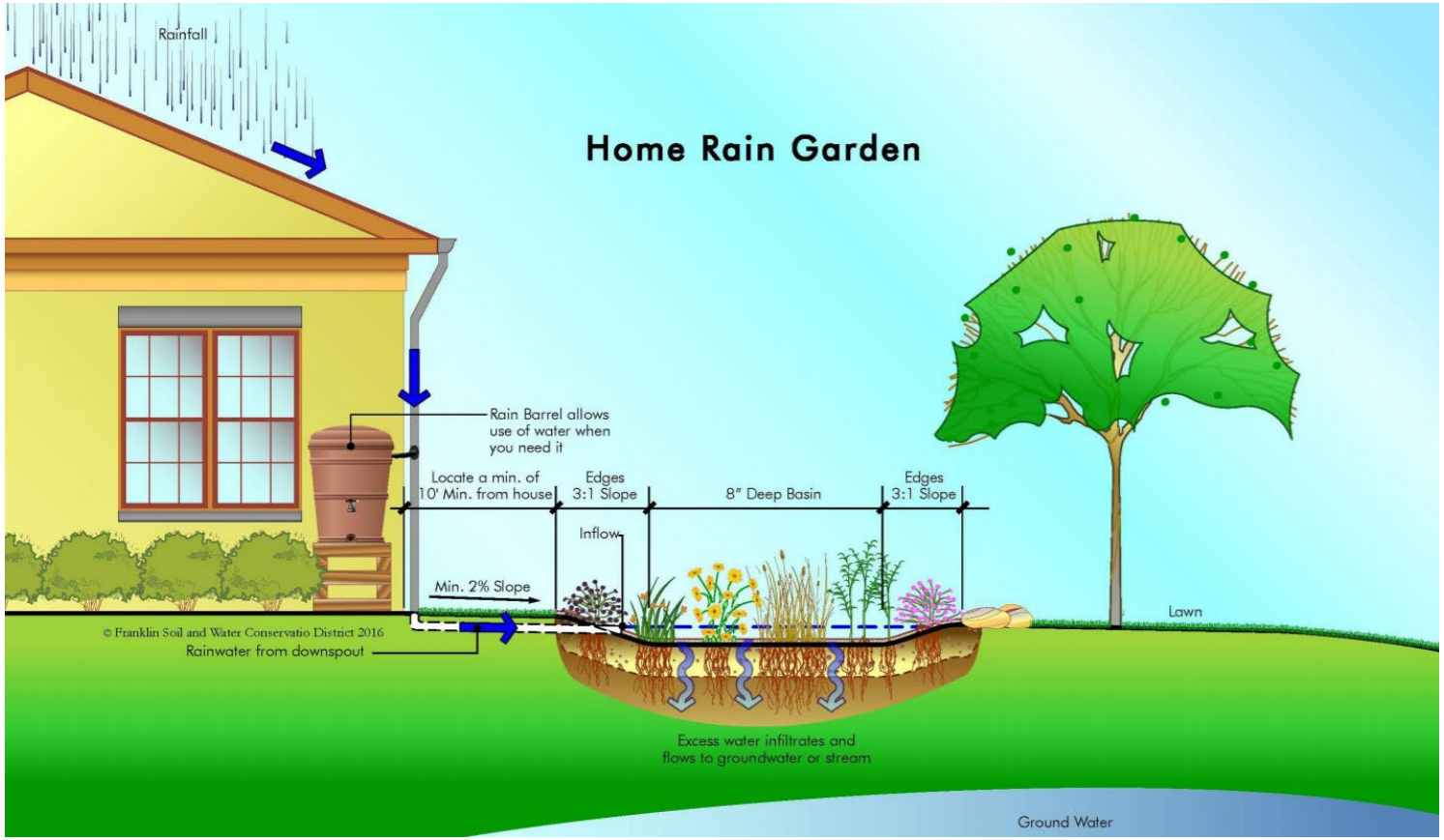
- **Capture water – slow , spread, sink**
- Not a pond - holds water just long enough for it to percolate into the soil
- Equivalent of home **bioretention basins**
  - plants and soil microorganisms break down and remove pollutants such as phosphorus, nitrogen, heavy metals and hydrocarbons
- Collect water from high points letting gravity move it to a downslope natural depression or flat area where a depression can be created



Rain Garden

- Providing habitat for insects and birds
- Providing a place to plant interesting stream and pond-side plants
- Deep watering your garden's trees and shrubs (in winter/spring in our area)
- Adds an aesthetic landscape feature with many planting and design possibilities
- Groundwater recharge

Rain Garden



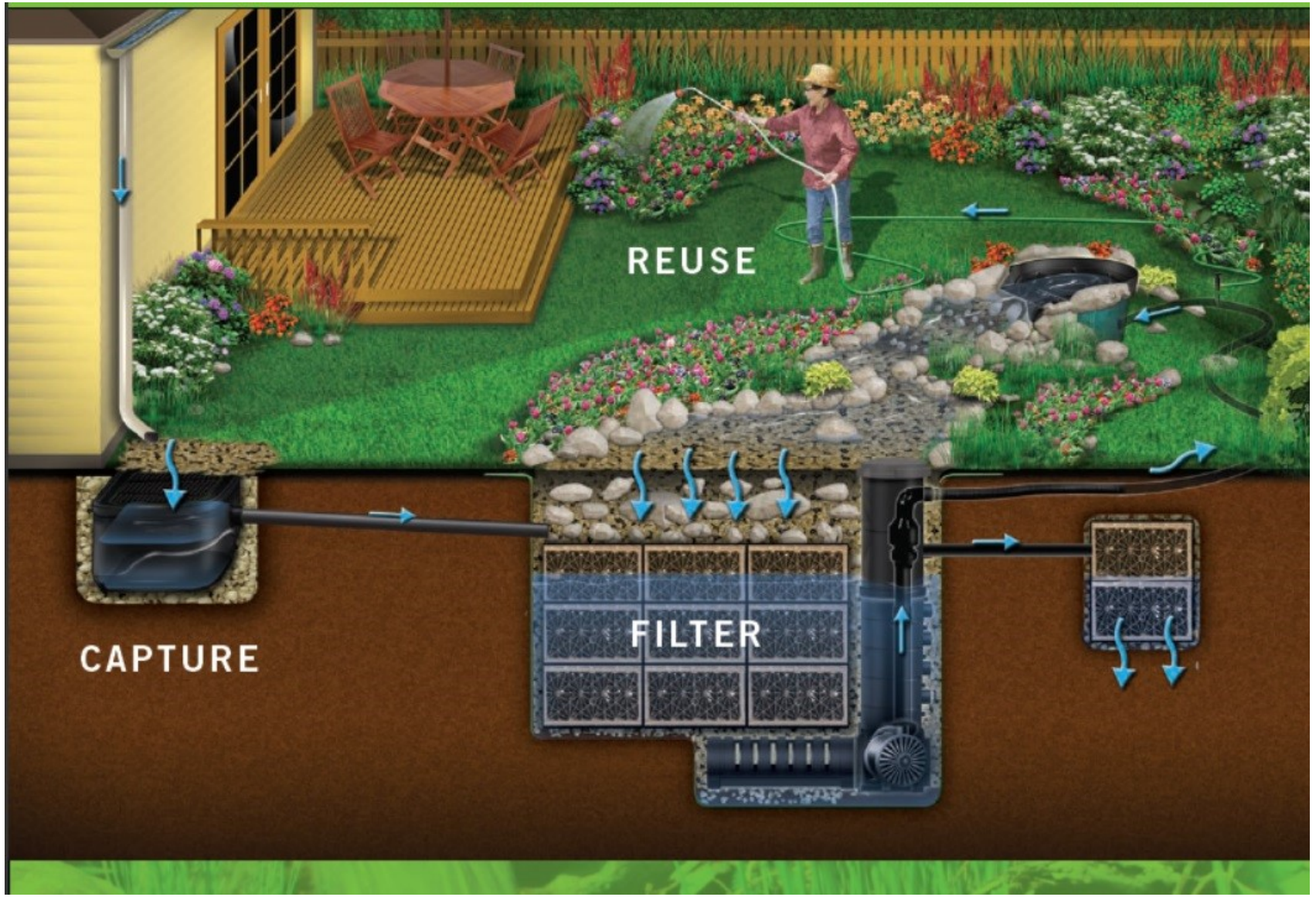
Rain Garden Location

- Site the garden at least 10 feet away from any structures and 5 feet from property lines
- Do not site in soils with high water tables or clay soils without an overflow device

Swales

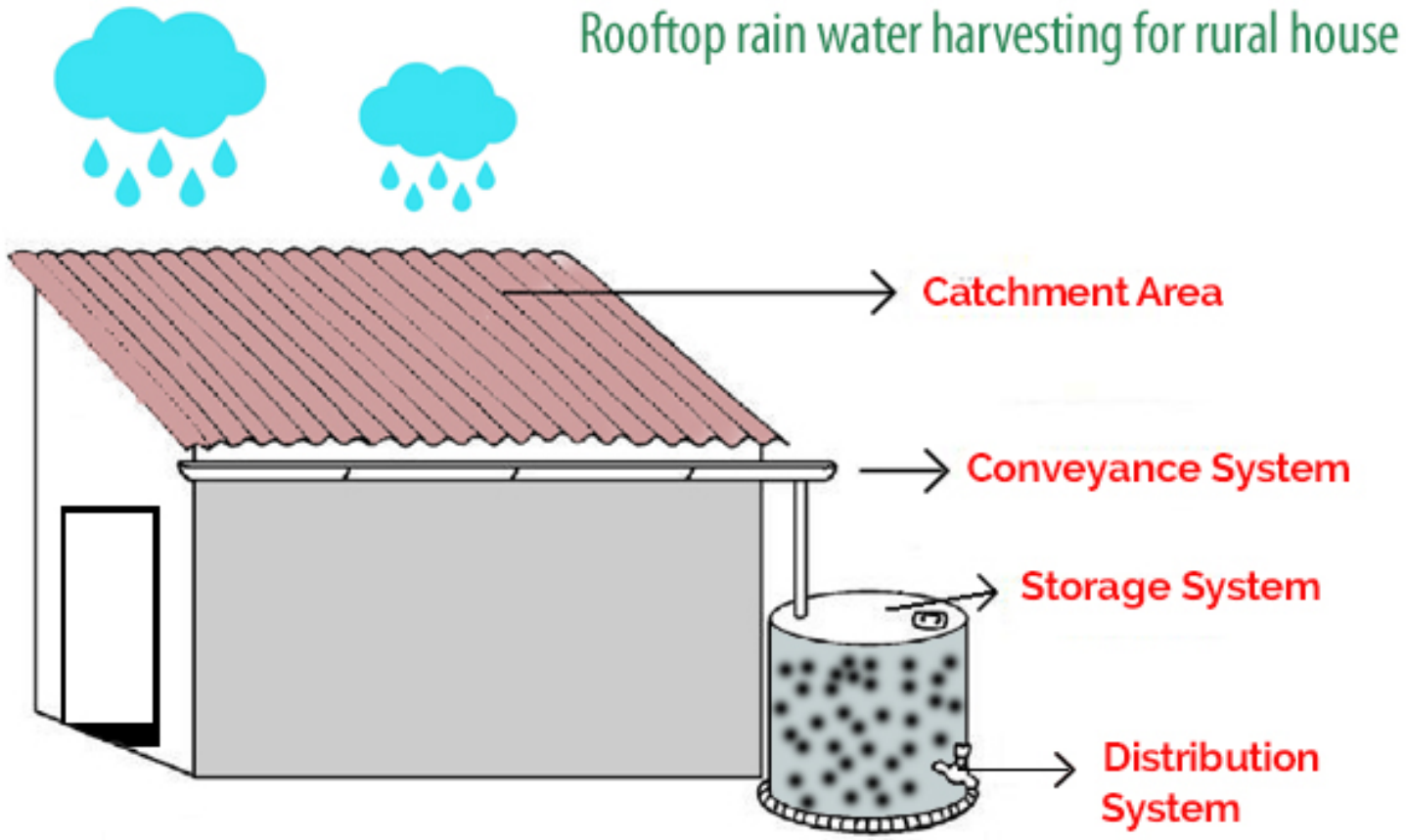
- Shallow channels designed to SLOW , SPREAD and SINK water during low flows
- Can meander or be a straight alignment
- The geometry of meandering swale maximizes the time water spends in the swale aiding the trapping of pollutants and sediments while promoting infiltration
- Two types of swale systems:
  - Vegetated
  - Rock-lined aka dry creek beds

Underground Rainwater Storage



Underground Water Storage

Underground Rainwater Storage



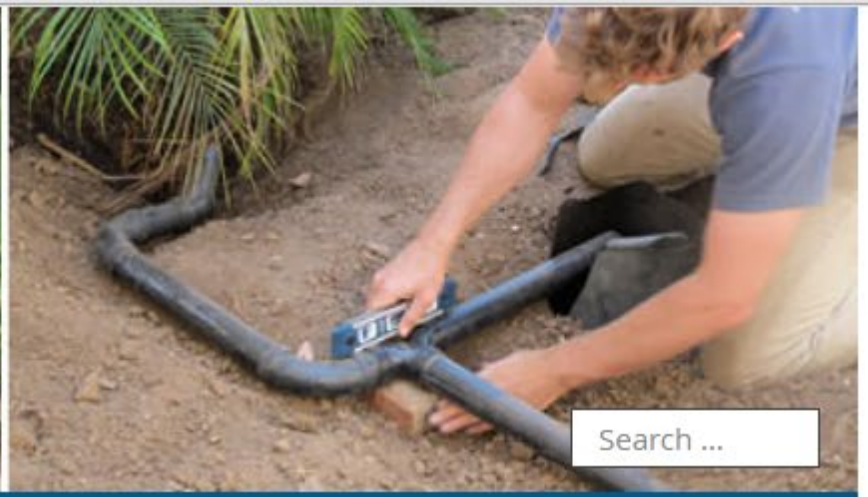
Rainwater Collection Calculations

- **~ 600 gallons of per each inch of rain falling on a 1,000 square feet of roof**
- Different surface materials have varying rates of runoff
  - Metal roof vs. Composition shingles

Greywater

- Typical U.S. household generates an average of 35 gallons of greywater per person per day
- Requires use of landscape-friendly detergents and other cleaning agents
- 50 to 80% of residential “wastewater” is dish, shower, sink, and laundry water





FOR A SUSTAINABLE WATER CULTURE

Search ...

HOME ABOUT US GREYWATER REUSE RAINWATER HARVESTING COMPOSTING TOILETS EN ESPAÑOL 中文 FORUM

Greywater Action

UPCOMING EVENTS

Greywater Workshop (Ashland, OR)
July 27 @ 9:30 am - 4:00 pm

Hands-on Greywater Workshop (Eugene, OR)
August 4 @ 10:00 am - 3:00 pm

Greywater Installer's Course (5 day, Los Angeles)

California Greywater Regulations

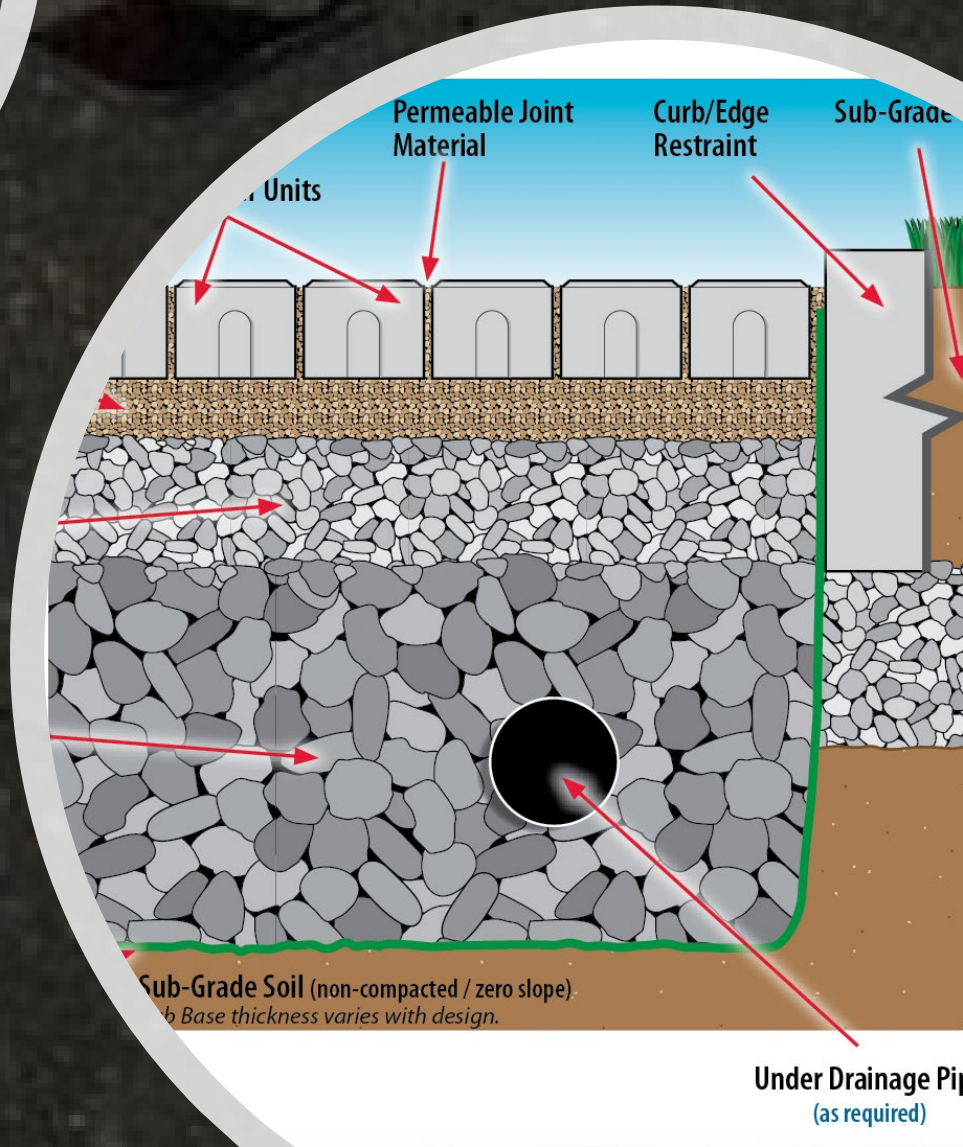
California's greywater code is found in Chapter 15 of the California Plumbing Code (CPC) (as of 2017, previously it was in Chapter 16) . Under the current code washing machine systems can be constructed without a permit in single family homes (1 or 2 units), so long as 13 guidelines are followed (see below). Other types of systems require a permit in the state.

You can download the greywater chapter here. Note that Chapter 15 includes regulations for both "HCD" – the residential code, and "BSC"- the commercial code. If you are building a system in a residential home disregard any requirements that start with "BSC".

Permeable Paving

Permeable Paving

Driveways, walks and patios



Plants: What & Where

Water-wise Landscapes

Don't have to look like cactus gardens or moonscapes!

Existing Landscapes: Prioritize Your Plants

- ***High Priority:*** trees and shrubs
  - Leave large, mature shade trees and shrubs alone unless they are declining
- ***Medium to High Priority***: perennials, fruit and nut trees, small fruits and vegetables
- ***Low Priority*:** annual flowers and herbs, ornamental grasses, turf

- Compost and mulch to increase soil water-holding capacity
- Modify irrigation to water less frequently but more deeply
- Consider removing and replacing plants that show stress when water is cut back
- Do not fertilize, especially in summer
- Right plant, right place

Existing Landscapes

New Landscaping or Renovation

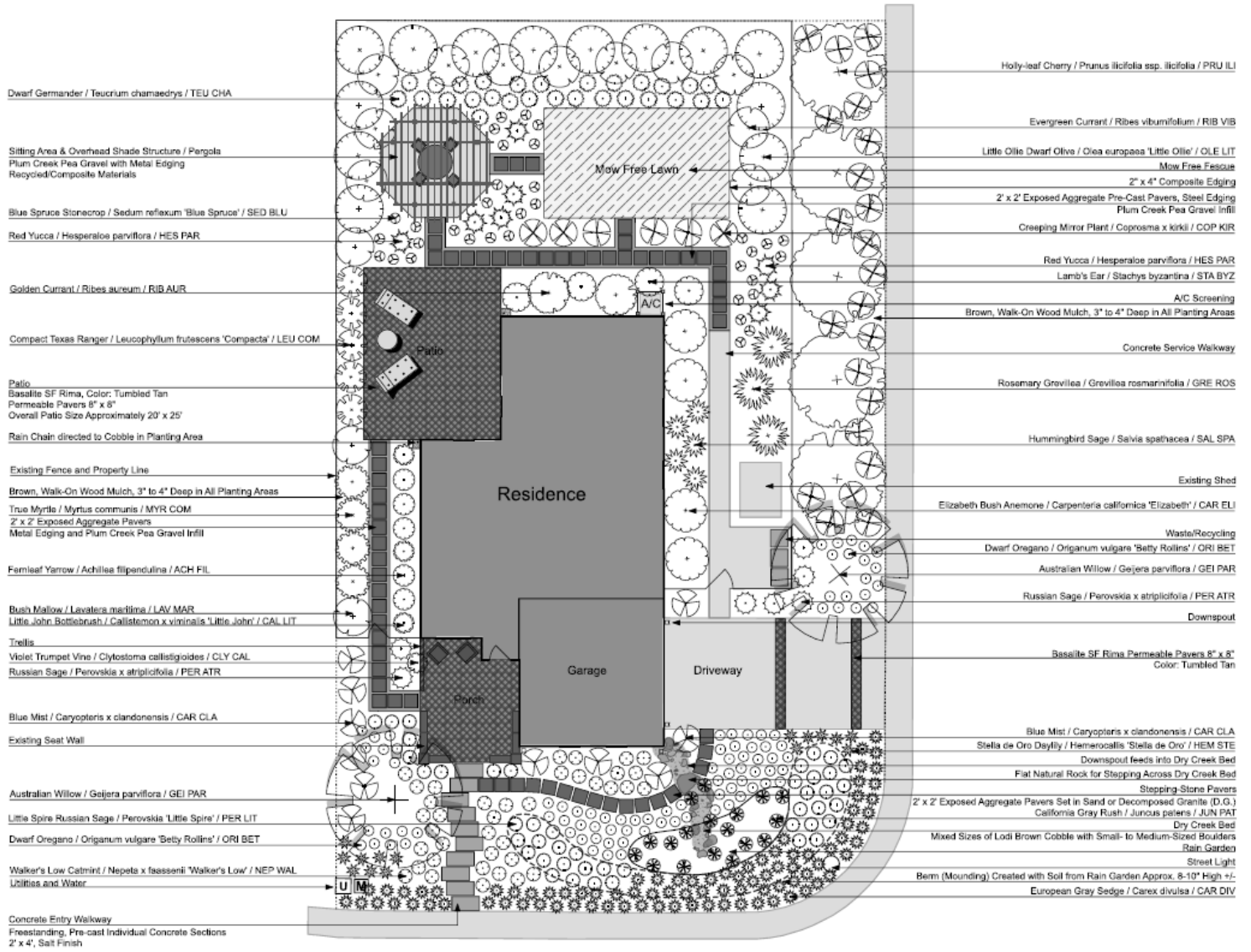
- Rescape (previously EcoLandscape California) offers model landscape plans
  - http://www.ecolandscape.org/new-ca/

Eco-Friendly Landscape Design Plans for The New California Landscape

Capture and manage water on site

- Rain garden & rain chains
- Dry creek bed
- Permeable materials
- Meadow-like garden year-round color

1


Dwarf Germander / Teucrium chamaedrys / TEU CHA
Sitting Area & Overhead Shade Structure / Pergola
Plum Creek Pea Gravel with Metal Edging
Recycled/Composite Materials
Blue Spruce Stonecrop / Sedum reflexum 'Blue Spruce' / SED BLU
Red Yucca / Hesperaloe parviflora / HES PAR
Golden Currant / Ribes aureum / RIB AUR
Compact Texas Ranger / Leucophyllum frutescens 'Compacta' / LEU COM
Patio
Basalite SF Rima, Color: Tumbled Tan
Permeable Pavers 8" x 8"
Overall Patio Size Approximately 20' x 25'
Rain Chain directed to Cobble in Planting Area
Existing Fence and Property Line
Brown, Walk-On Wood Mulch, 3" to 4" Deep in All Planting Areas
True Myrtle / Myrtus communis / MYR COM
2' x 2' Exposed Aggregate Pavers
Metal Edging and Plum Creek Pea Gravel Infill
Fernleaf Yarrow / Achillea filipendulina / ACH FIL
Bush Mallow / Lavatera maritima / LAV MAR
Little John Bottlebrush / Callistemon x viminalis 'Little John' / CAL LIT
Trellis
Violet Trumpet Vine / Clytostoma callistigioides / CLY CAL
Russian Sage / Perovskia x atriplicifolia / PER ATR
Blue Mist / Caryopteris x clandonensis / CAR CLA
Existing Seat Wall
Australian Willow / Geijera parviflora / GEI PAR
Little Spire Russian Sage / Perovskia 'Little Spire' / PER LIT
Dwarf Oregano / Origanum vulgare 'Betty Rollins' / ORI BET
Walker's Low Catmint / Nepeta x faassenii 'Walker's Low' / NEP WAL
Utilities and Water
U
M
Concrete Entry Walkway
Freestanding, Pre-cast Individual Concrete Sections
2' x 4', Salt Finish
Mow Free Lawn
A/C
Patio
Residence
Garage
Driveway
Porch
Holly-leaf Cherry / Prunus ilicifolia ssp. ilicifolia / PRU ILI
Evergreen Currant / Ribes viburnifolium / RIB VIB
Little Ollie Dwarf Olive / Olea europaea 'Little Ollie' / OLE LIT
Mow Free Fescue
2" x 4" Composite Edging
2' x 2' Exposed Aggregate Pre-Cast Pavers, Steel Edging
Plum Creek Pea Gravel Infill
Creeping Mirror Plant / Coprosma x kirkii / COP KIR
Red Yucca / Hesperaloe parviflora / HES PAR
Lamb's Ear / Stachys byzantina / STA BYZ
A/C Screening
Brown, Walk-On Wood Mulch, 3" to 4" Deep in All Planting Areas
Concrete Service Walkway
Rosemary Grevillea / Grevillea rosmarinifolia / GRE ROS
Hummingbird Sage / Salvia spathacea / SAL SPA
Existing Shed
Elizabeth Bush Anemone / Carpenteria californica 'Elizabeth' / CAR ELI
Waste/Recycling
Dwarf Oregano / Origanum vulgare 'Betty Rollins' / ORI BET
Australian Willow / Geijera parviflora / GEI PAR
Russian Sage / Perovskia x atriplicifolia / PER ATR
Downspout
Basalite SF Rima Permeable Pavers 8" x 8"
Color: Tumbled Tan
Blue Mist / Caryopteris x clandonensis / CAR CLA
Stella de Oro Daylily / Hemerocallis 'Stella de Oro' / HEM STE
Downspout feeds into Dry Creek Bed
Flat Natural Rock for Stepping Across Dry Creek Bed
Stepping-Stone Pavers
2' x 2' Exposed Aggregate Pavers Set in Sand or Decomposed Granite (D.G.)
California Gray Rush / Juncus patens / JUN PAT
Dry Creek Bed
Mixed Sizes of Lodi Brown Cobble with Small- to Medium-Sized Boulders
Rain Garden
Street Light
Berm (Mounding) Created with Soil from Rain Garden Approx. 8-10" High +/-
European Gray Sedge / Carex divulsa / CAR DIV

Eco-Friendly Landscape Design Plans for The New California Landscape

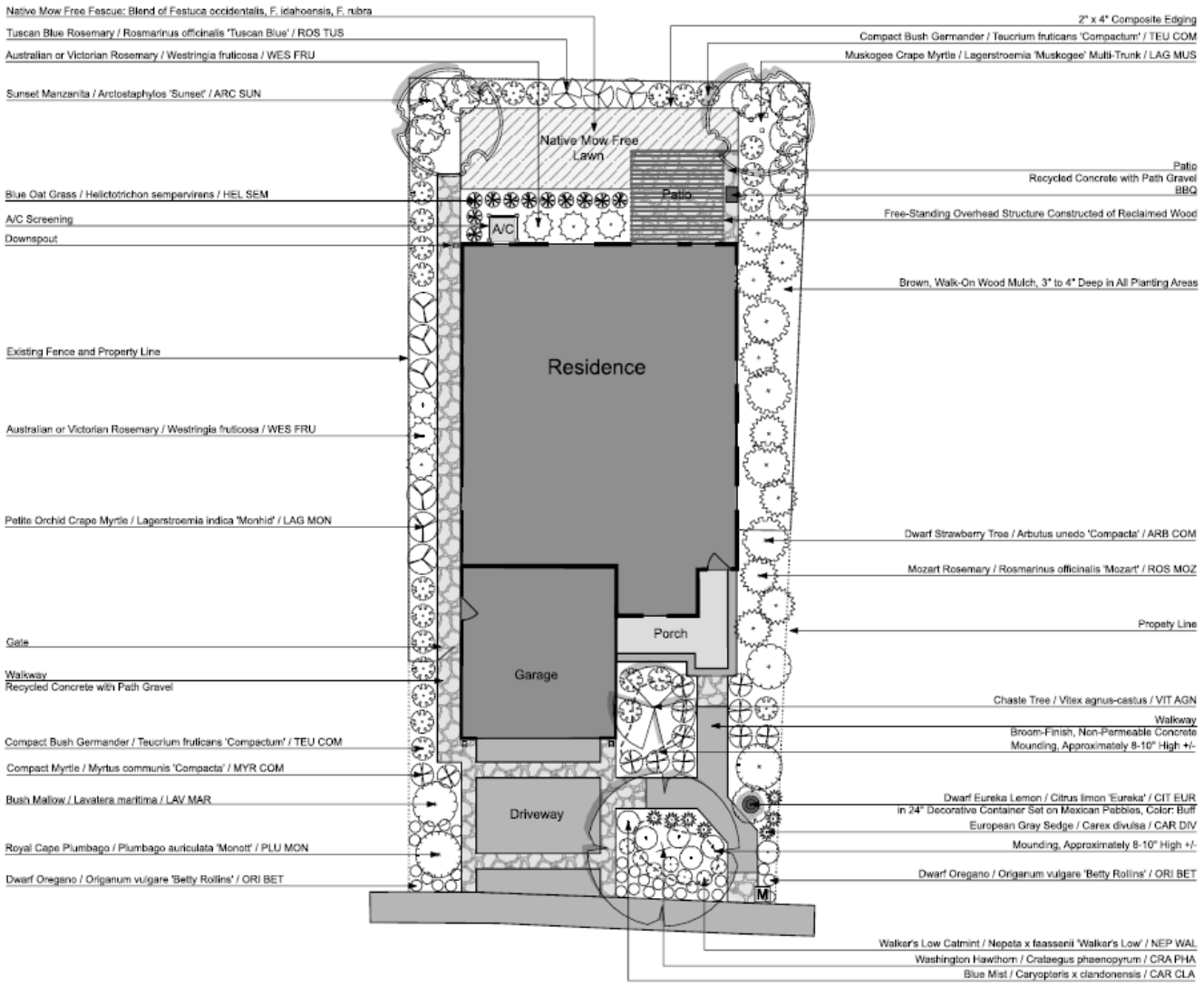
Small scale bountiful beauty

Lower maintenance

Tidy, low-water-use plants

Easy-care, resource-efficient lawn

Recycled & repurposed materials


Native Mow Free Fescue: Blend of Festuca occidentalis, F. idahoensis, F. rubra
Tuscan Blue Rosemary / Rosmarinus officinalis 'Tuscan Blue' / ROS TUS
Australian or Victorian Rosemary / Westringia fruticosa / WES FRU
Sunset Manzanita / Arctostaphylos 'Sunset' / ARC SUN
Blue Oat Grass / Helictotrichon sempervirens / HEL SEM
A/C Screening
Downspout
Existing Fence and Property Line
Australian or Victorian Rosemary / Westringia fruticosa / WES FRU
Petite Orchid Crape Myrtle / Lagerstroemia indica 'Monhid' / LAG MON
Gate
Walkway
Recycled Concrete with Path Gravel
Compact Bush Germander / Teucrium fruticans 'Compactum' / TEU COM
Compact Myrtle / Myrtus communis 'Compacta' / MYR COM
Bush Mallow / Lavatera maritima / LAV MAR
Royal Cape Plumbago / Plumbago auriculata 'Monott' / PLU MON
Dwarf Oregano / Origanum vulgare 'Betty Rollins' / ORI BET
Native Mow Free Lawn
Patio
A/C
Residence
Porch
Garage
Driveway
M
2" x 4" Composite Edging
Compact Bush Germander / Teucrium fruticans 'Compactum' / TEU COM
Muskogee Crape Myrtle / Lagerstroemia 'Muskogee' Multi-Trunk / LAG MUS
Patio
Recycled Concrete with Path Gravel
BBQ
Free-Standing Overhead Structure Constructed of Reclaimed Wood
Brown, Walk-On Wood Mulch, 3" to 4" Deep in All Planting Areas
Dwarf Strawberry Tree / Arbutus unedo 'Compacta' / ARB COM
Mozart Rosemary / Rosmarinus officinalis 'Mozart' / ROS MOZ
Propety Line
Chaste Tree / Vitex agnus-castus / VIT AGN
Walkway
Broom-Finish, Non-Permeable Concrete
Mounding, Approximately 8-10" High +/-
Dwarf Eureka Lemon / Citrus limon 'Eureka' / CIT EUR
in 24" Decorative Container Set on Mexican Pebbles, Color: Buff
European Gray Sedge / Carex divulsa / CAR DIV
Mounding, Approximately 8-10" High +/-
Dwarf Oregano / Origanum vulgare 'Betty Rollins' / ORI BET
Walker's Low Catmint / Nepeta x faassenii 'Walker's Low' / NEP WAL
Washington Hawthorn / Crataegus phaenopyrum / CRA PHA
Blue Mist / Caryopteris x clandonensis / CAR CLA

Eco-Friendly Landscape Design Plans for The New California Landscape

Worthy of National Wildlife Federation designation

Provides water, shelter & food for wildlife

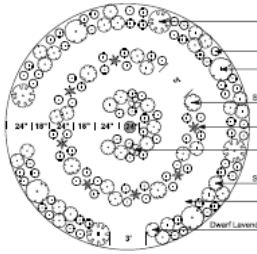
Variety of features for the entire family—Connects children with nature

Edible garden

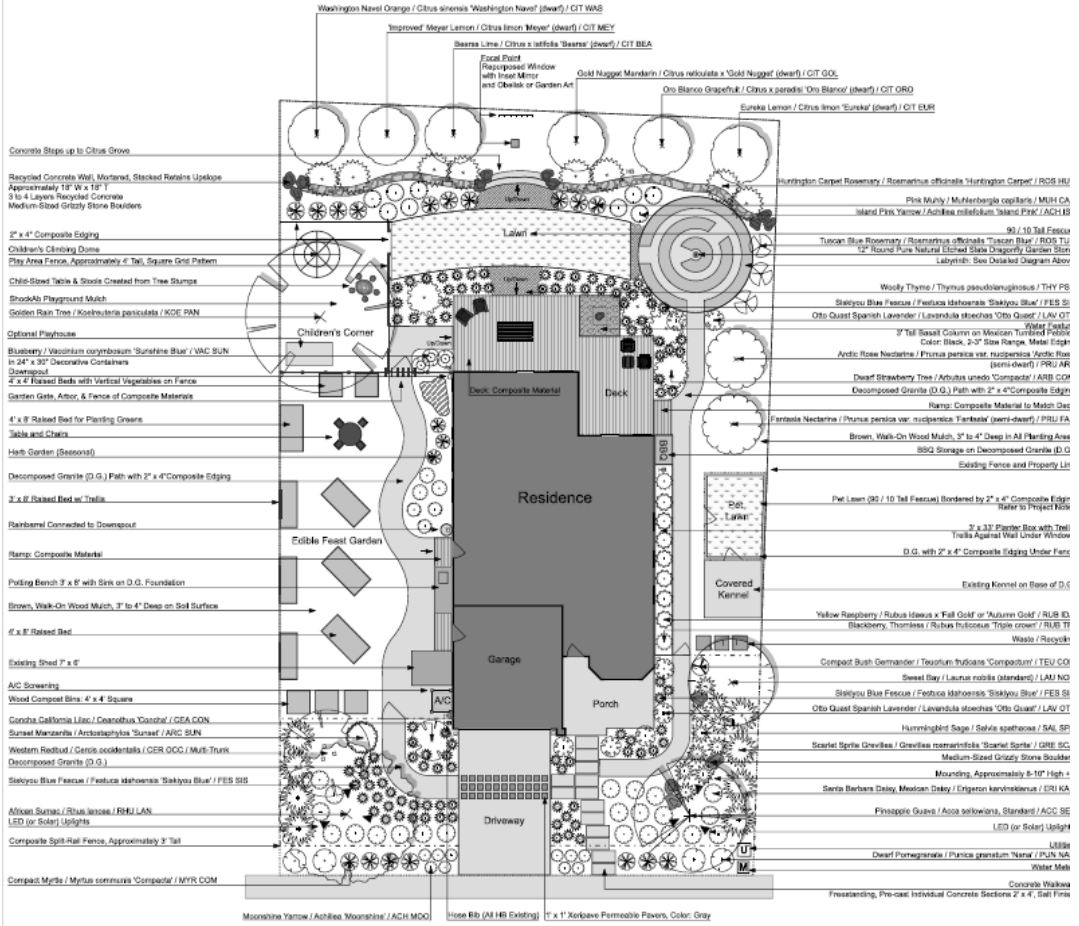
Abundance of textures & colors

Center of Labyrinth
12" Round Pure Natural Etched Slate Dragonfly Garden Stone or Beneficial Insect

Detailed Labyrinth



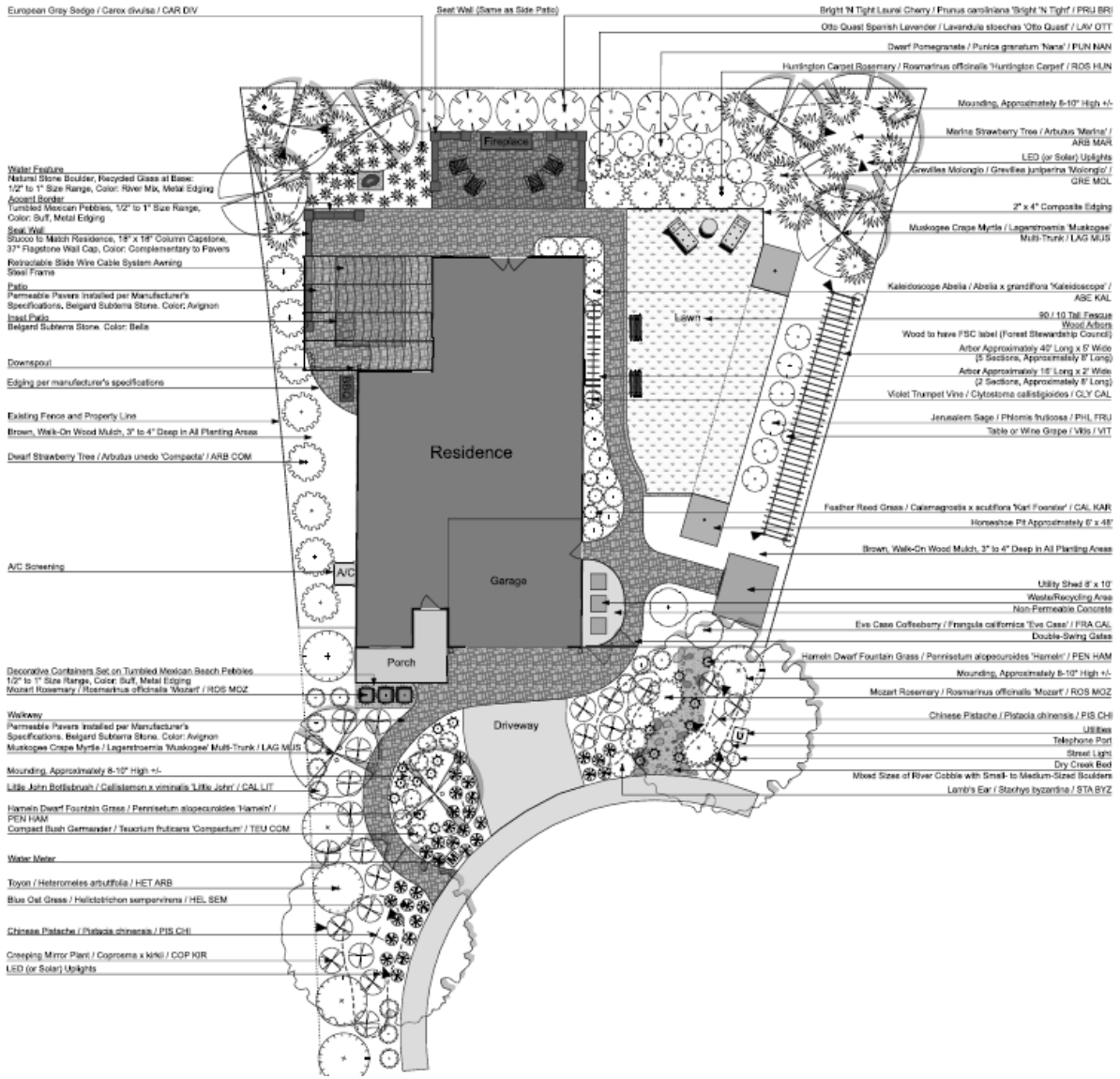
Culinary Sage / Salvia officinalis / SAL OF
Annual / ANI
Thyme / Thymus vulgaris / THY VU
Scented-leaf Geranium / Pelargonium x / PEL
Chive / Allium schoenoprasum / ALL SC
Sweet Violet / Viola odorata / VIO OD
Sweet Alyssum / Lobularia maritima / LOB MA
Walk-On Mulc
Dwarf Lavender Hybrids / Lavandula angustifolia / LAV AN



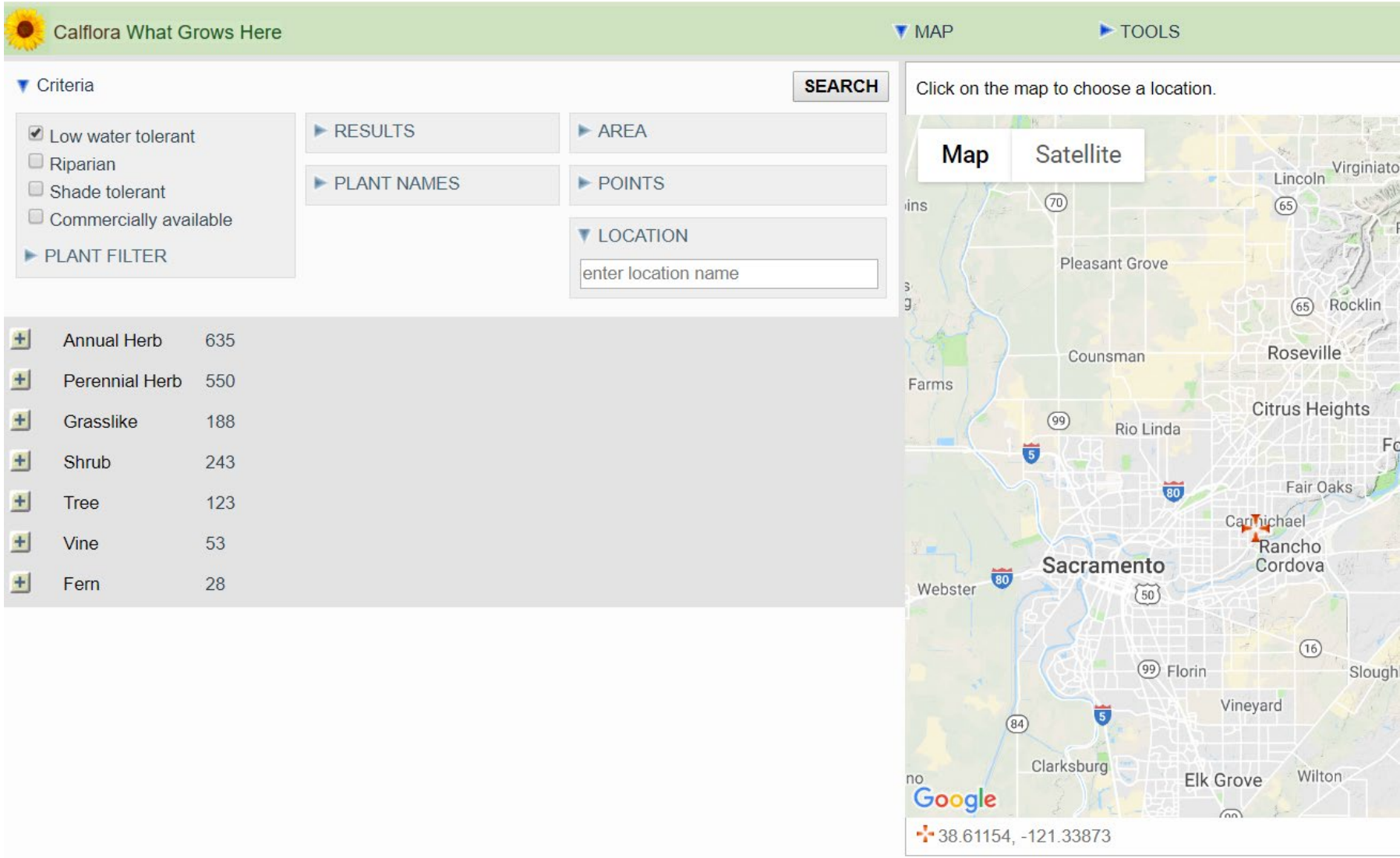
Eco-Friendly Landscape Design Plans for The New California Landscape

Something for everyone

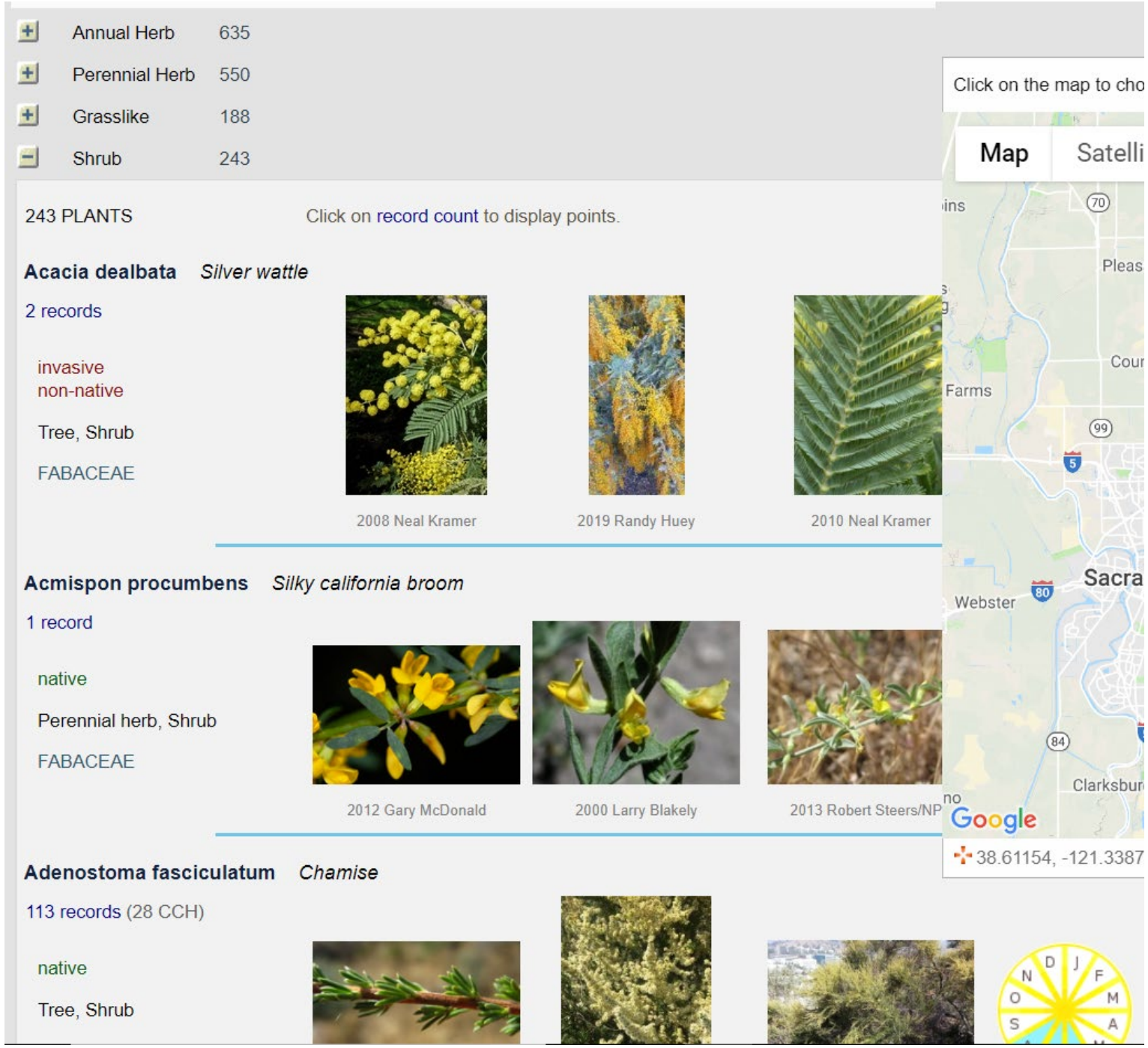
- Sophisticated style
- Park-like front yard
- Entertainment extravaganza back yard
- Vibrant, colorful plant palette


European Grey Sedge / Carex divulsa / CAR DIV
Seat Wall (Same as Side Patio)
Bright 'N Tight Laural Cherry / Prunus carolliniana 'Bright 'N Tight' / PRU BRI
Otto Quast Spanish Lavender / Lavandula stoechas 'Otto Quast' / LAV OTT
Dwarf Pomegranate / Punica granatum 'Nana' / PUN NAN
Huntington Carpet Rosemary / Rosmarinus officinalis 'Huntington Carpet' / ROS HUN
Mounding, Approximately 8-10" High +/-
Marina Strawberry Tree / Arbutus 'Marina' / ARB MAR
LED (or Solar) Uplights
Grevillea Molonglo / Grevillea juniperina 'Molonglo' / GRE MOL
2" x 4" Composite Edging
Muskogee Crape Myrtle / Lagerstroemia 'Muskogee' Multi-Trunk / LAG MUS
Kaleidoscope Abelia / Abelia x grandiflora 'Kaleidoscope' / ABE KAL
90 / 10 Tall Fescue
Wood Arbors
Wood to have FSC label (Forest Stewardship Council)
Arbor Approximately 40' Long x 5' Wide
(5 Sections, Approximately 8' Long)
Arbor Approximately 16' Long x 2' Wide
(2 Sections, Approximately 8' Long)
Violet Trumpet Vine / Clytostoma callistegioides / CLY CAL
Jerusalem Sage / Phlomis fruticosa / PHL FRU
Table or Wine Grape / Vitis / VIT
Feather Reed Grass / Calamagrostis x acutiflora 'Karl Foerster' / CAL KAR
Horseshoe Pit Approximately 8' x 48'
Brown, Walk-On Wood Mulch, 3" to 4" Deep in All Planting Areas
Utility Shed 8' x 10'
Waste/Recycling Area
Non-Permeable Concrete
Eve Case Coffeeberry / Frangula californica 'Eve Case' / FRA CAL
Double-Swing Gates
Hameln Dwarf Fountain Grass / Pennisetum alopecuroides 'Hameln' / PEN HAM
Mounding, Approximately 8-10" High +/-
Mozart Rosemary / Rosmarinus officinalis 'Mozart' / ROS MOZ
Chinese Pistache / Pistacia chinensis / PIS CHI
Utilities
Telephone Port
Street Light
Dry Creek Bed
Mixed Sizes of River Cobble with Small- to Medium-Sized Boulders
Lamb's Ear / Stachys byzantina / STA BYZ
Water Feature
Natural Stone Boulder, Recycled Glass at Base;
1/2" to 1" Size Range, Color: River Mix, Metal Edging
Accent Border
Tumbled Mexican Pebbles, 1/2" to 1" Size Range,
Color: Buff, Metal Edging
Seat Wall
Stucco to Match Residence, 18" x 18" Column Capstone,
37" Flagstone Wall Cap, Color: Complementary to Pavers
Retractable Slide Wire Cable System Awning
Steel Frame
Patio
Permeable Pavers Installed per Manufacturer's
Specifications. Belgard Subterra Stone. Color: Avignon
Inset Patio
Belgard Subterra Stone. Color: Bella
Downspout
Edging per manufacturer's specifications
Existing Fence and Property Line
Brown, Walk-On Wood Mulch, 3" to 4" Deep in All Planting Areas
Dwarf Strawberry Tree / Arbutus unedo 'Compacta' / ARB COM
A/C Screening
Decorative Containers Set on Tumbled Mexican Beach Pebbles
1/2" to 1" Size Range, Color: Buff, Metal Edging
Mozart Rosemary / Rosmarinus officinalis 'Mozart' / ROS MOZ
Walkway
Permeable Pavers Installed per Manufacturer's
Specifications. Belgard Subterra Stone. Color: Avignon
Muskogee Crape Myrtle / Lagerstroemia 'Muskogee' Multi-Trunk / LAG MUS
Mounding, Approximately 8-10" High +/-
Little John Bottlebrush / Callistemon x viminalis 'Little John' / CAL LIT
Hameln Dwarf Fountain Grass / Pennisetum alopecuroides 'Hameln' /
PEN HAM
Compact Bush Germander / Teucrium fruticans 'Compactum' / TEU COM
Water Meter
Toyon / Heteromeles arbutifolia / HET ARB
Blue Oat Grass / Helictotrichon sempervirens / HEL SEM
Chinese Pistache / Pistacia chinensis / PIS CHI
Creeping Mirror Plant / Coprosma x kirkii / COP KIR
LED (or Solar) Uplights
Fireplace
Residence
Garage
Porch
Driveway
Lawn
A/C
BBQ
UT

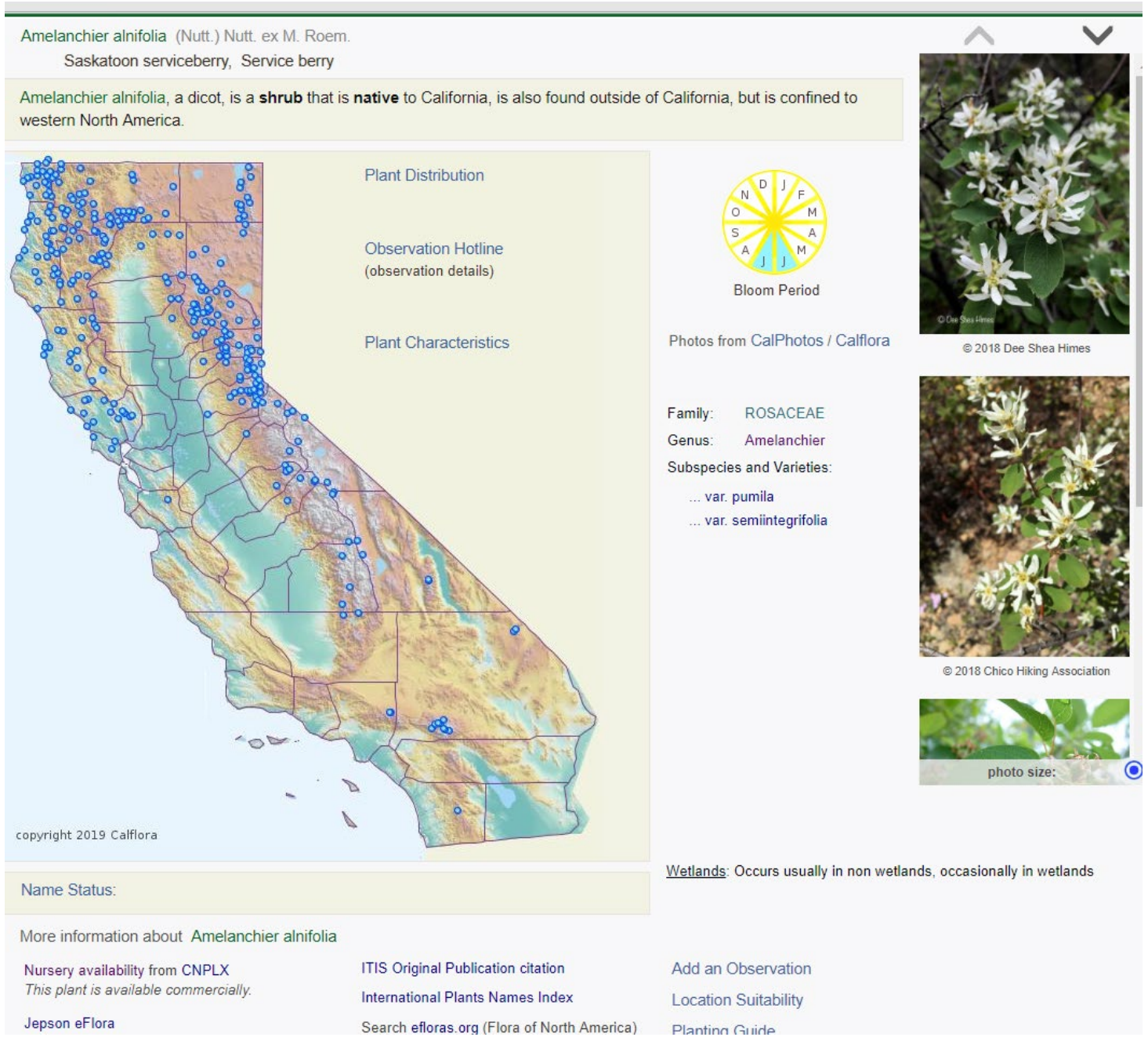
Calflora.org: What Grows Here



Calflora.org: What Grows Here

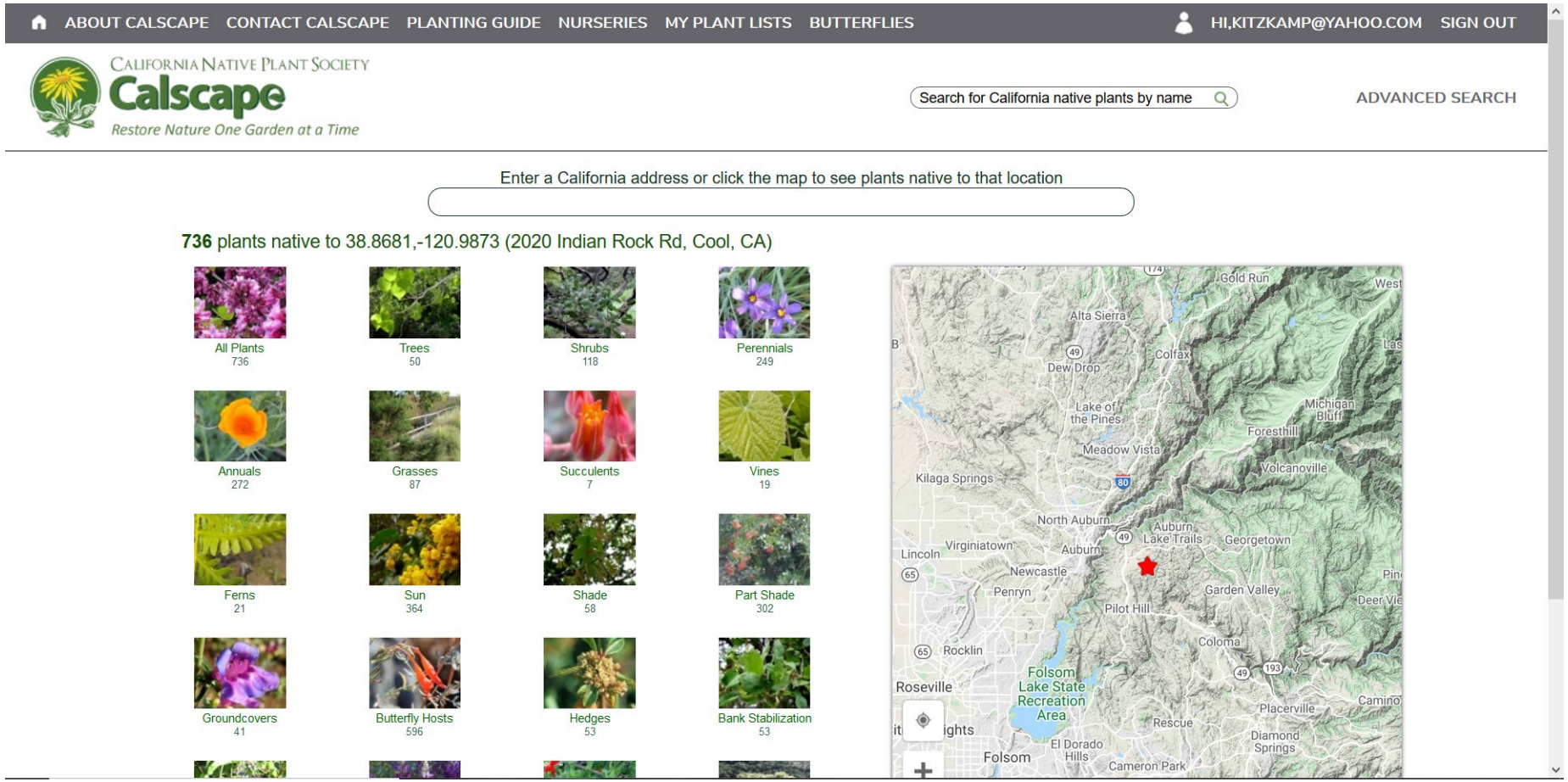


Calflora.org: What Grows Here



Calscape.org

- **Advanced Search**



Calscape.org

Advanced Search Search Clear

Select desired plant characteristics and then click 'Search' to see matching plants

Native To California

Type
- ☐ Annual herb
- ☐ Fern
- ☐ Grass
- ☐ Perennial herb
- ☐ Shrub
- ☐ Succulent
- ☐ Tree
- ☐ Vine

Sun
- ☐ Full Sun
- ☐ Part Shade
- ☐ Full Shade

Drainage
- ☐ Fast
- ☐ Medium
- ☐ Slow
- ☐ Standing

Water Requirement
- ☐ Extremely Low
- ☐ Very Low
- ☐ Low
- ☐ Moderate - High

Ease of Care
- ☐ Very Easy
- ☐ Moderately Easy
- ☐ Fairly Difficult
- ☐ Very Difficult

Common Uses
- ☐ Bank Stabilization
- ☐ Bee Gardens
- ☐ Bird Gardens

Common Uses
- ☐ Bank Stabilization
- ☐ Bee Gardens
- ☐ Bird Gardens
- ☐ Bogs and Ponds
- ☐ Butterfly Gardens
- ☐ Butterfly Host Plants
- ☐ Deer Resistant
- ☐ Groundcovers
- ☐ Hedges
- ☐ Hummingbird Gardens

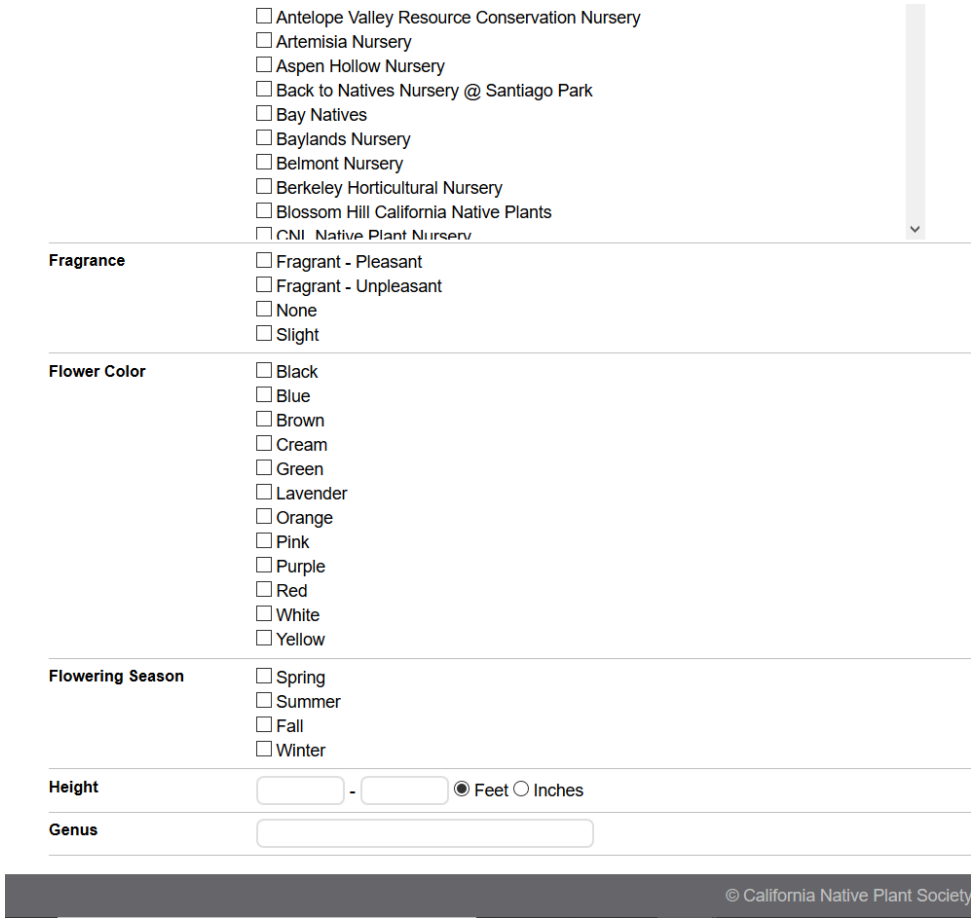
Availability in Nurseries
- ☐ Commonly Available
- ☐ Sometimes Available
- ☐ Rarely Available
- ☐ Never or Almost Never Available
- ☐ Available Through Seed Stores

Nurseries
- ☐ 3 Rivers Blooms
- ☐ Ackerman Native Plant Nursery
- ☐ Annie's Annuals and Perennials
- ☐ Antelope Valley Resource Conservation Nursery
- ☐ Artemisia Nursery
- ☐ Aspen Hollow Nursery
- ☐ Back to Natives Nursery @ Santiago Park
- ☐ Bay Natives
- ☐ Baylands Nursery
- ☐ Belmont Nursery
- ☐ Berkeley Horticultural Nursery
- ☐ Blossom Hill California Native Plants
- ☐ CNL Native Plant Nursery

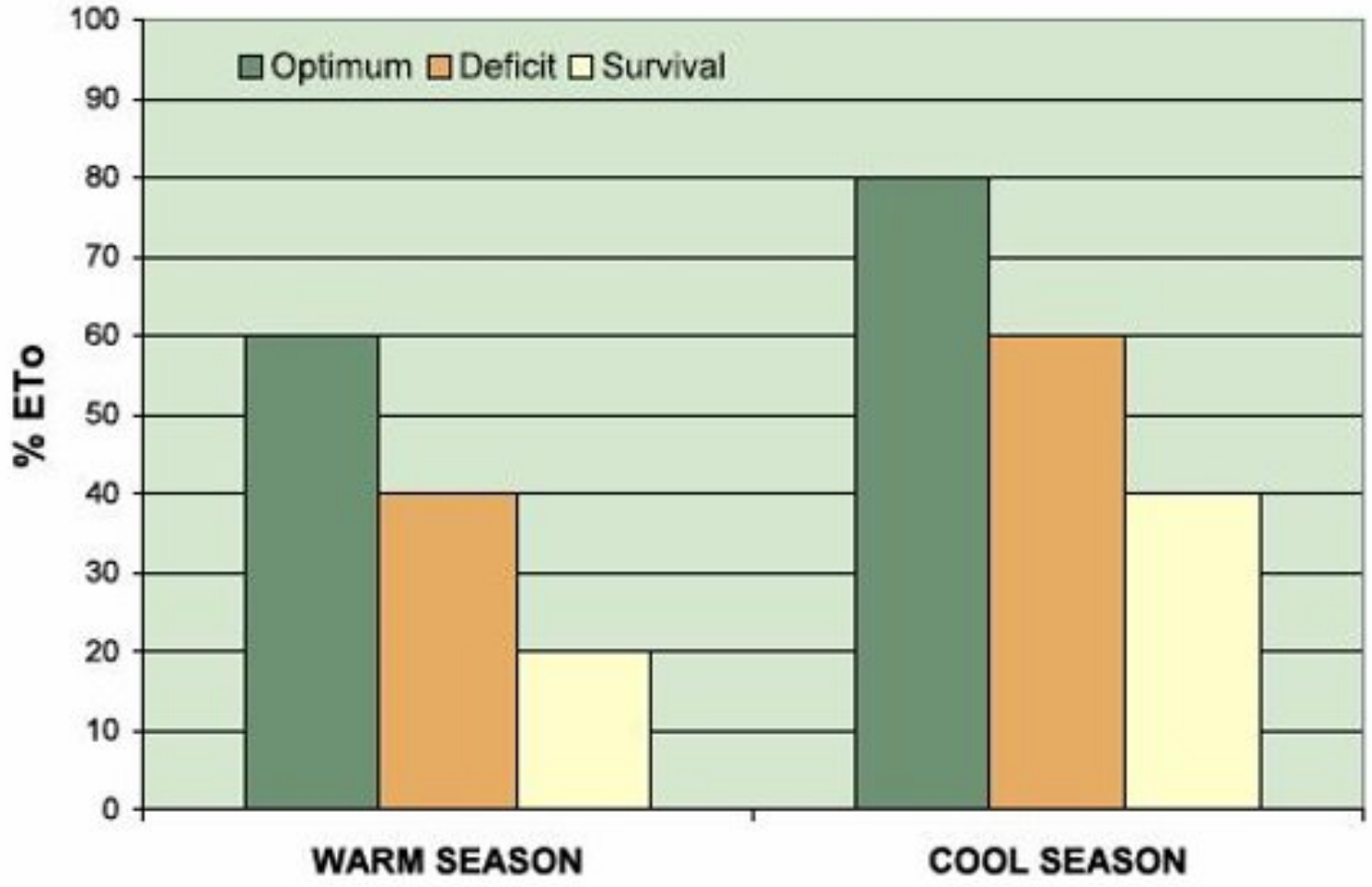
Fragrance
- ☐ Fragrant - Pleasant
- ☐ Fragrant - Unpleasant
- ☐ None
- ☐ Slight

Flower Color
- ☐ Black
- ☐ Blue
- ☐ Brown
- ☐ Cream

Calscape.org



Turf Selection



Water Conservation Strategies for Turf

- **Mowing strategies**
  - Frequency of mowing affects ET
    - Tall grass = high ET
  - Mow at tallest recommended height for type of grass
  - Mowing when hot or dry can injure plants
  - Mow less frequently at a taller height

Turfgrass species	Cutting Height range (inches)
Cool season turfgrasses	
creeping bentgrass	0.2-0.5
colonial bentgrass	0.5-1.0
red fescue	1.0-2.0
Kentucky bluegrass	1.5-2.5
perennial ryegrass	1.5-2.5
tall fescue	1.5-3.0
Warm-season turfgrasses	
bermudagrass	0.5-1.0
zoysiagrass	0.5-1.0
seashore paspalum	0.5-1.0
St Augustinegrass	0.5-1.5
kikuyugrass	0.5-1.0

Lawn Alternatives

- **Grassland mix (Delta Bluegrass)**

- ***Agrostis pallens* - native bent grass lawn**

Lawn Alternatives

- Koeleria macrantha natural

- Koeleria macrantha mown

Lawn Alternatives

- Festuca rubra mown

- Festuca rubra long

Lawn Alternatives

- Carex pansa natural

- Carex pansa mown

For Slopes

- Festuca idahoensis

- Festuca rubra

- Native mix (Delta Bluegrass)

Resources

Native & Drought-tolerant Plants

- CNPS – What Grows Here? https://www.calflora.org/entry/wgh.html
- Eco-Friendly Landscape Design Plans for the New California Landscape: www.ecolandscape.org/new-ca/
- River Friendly Inspiration Garden: http://www.ecolandscape.org/riverfriendly/topics/inspiration-garden.html
- The Regional Water Authority's Water-Wise Gardening software: http://www.rwa.watersavingplants.com/
- The UC Davis Arboretum All-Stars: http://arboretum.ucdavis.edu/arboretum_all_stars.aspx

Resources (cont.)

- Native plants for Northern California: https://www.wildflower.org/collections/collection.php?collection=CA_north
- The Bay Area Bringing Back the Natives website includes useful information on using California natives in the landscape.
- California plant database search tool — www.waterwonk.us

Additional Resources and Citations

- **Water Storage**
  - California WaterBlog: https://californiawaterblog.com/2018/09/09/water-storage-successes-failures-and-challenges-from-proposition-1/
  - California Water Myths: https://www.ppic.org/content/pubs/report/R_1209EHR.pdf
  - Rain Gardens: https://www.ccwater.com/861/Rain-Gardens
  - Rain Gardens: http://www.waterwisesb.org/asset.c/289
  - Harvesting Rain: Rain Gardens and Vegetated Swales: http://mother-natures-backyard.blogspot.com/2013/03/harvesting-rain-rain-gardens-and.html
- **Lawn Alternatives**
  - http://www.deltabluegrass.com/sod-products/california-native-sod

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