DISCLAIMER

Please note that this presentation is general in nature and is not intended to be an exhaustive review of the subject matter. The information contained in this presentation does not necessarily reflect the policies of BAWSCA or its member agencies.

The presentation instructor, information, products and materials are provided as a courtesy to participants and are not endorsed by BAWSCA or its member agencies.
ABOUT BAWSCA

- BAWSCA represents 26 agencies that include cities, water districts, a water company, and a university that purchase water wholesale from the San Francisco Regional Water System.

- The BAWSCA member agencies provide water to 1.7 million people, and over 30,000 businesses and community organizations in Alameda, Santa Clara and San Mateo counties.

- BAWSCA’s Goal: High Quality Supply of Water at a Fair Price
CLASS OBJECTIVES

1. Outdoor water use represent the single largest untapped opportunity for water conservation in the BAWSCA service area.

2. Outdoor water use reduction through the use of water-efficient plants and innovative techniques can help conserve water and ensure that future water supply needs of our communities are met.
Lawn Be Gone!

Participating Agencies

- Brisbane/GVMID
- City of San Bruno
- City of Menlo Park
- City of Redwood City
- Estero Municipal Improvement District (Foster City)
- Town of Hillsborough
- Mid-Peninsula Water District
- North Coast County Water District (NCCWD)

For more information visit www.BayAreaConservation.org
Additional Residential Water Conservation Programs

Rain Barrel Rebate Program

High-Efficiency Toilet Rebate Program

FreeSprinklerNozzles.com

For more information visit www.BayAreaConservation.org
Santa Clara Valley Water District - Rebate Programs

Water Wise Survey
- Water Wise Outdoor Survey
- Do-it-Yourself Water Wise Indoor Survey

Landscape Rebate Program
- Landscape Conversion Rebate
- In-Line Drip Irrigation Conversion
- Irrigation Equipment Upgrade

For more information visit: www.valleywater.org/saving-water/residential
Slides will be available at:

https://suwater.stanford.edu/fact-sheets-and-more
How to Convert Spray Irrigation to Drip

BAWSCA & Stanford University

24-May-2018
Sherri D. Osaka
Sustainable Landscape Designs
Topics

- Tracking water use
- Why switch from spray to drip?
- Designing inline drip
- Installing time-saving tips
- SCHEDULING!
- Controllers, Flow meters, and Rain sensors
- Maintenance and Leak Detection
TRACKING WATER USE
## Water Rates City of Palo Alto
Billing Monthly

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>0-6 Units</th>
<th>$6.66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 2</td>
<td>7+ Units</td>
<td>$9.18</td>
</tr>
</tbody>
</table>

Unit/ CCF = 100 cubic feet
1 CCF = 748 GALLONS
OF WATER
1 CF = 7.48 GALLONS
Check for leaks
Read your water meter

One in every 10 homes has a leak that is wasting at least 90 gallons of water per day.
Landscaping: 57%
Overwatering 9%

Source: California Building Industry Association report, January 2010
Current water use 38,000 gallons per year

1999
Leak 1

2000

1999 to 2015

2006:
Leak 2

2009:
Leak 3, Removed lawn

2010
Rainy

2011
Refilled pool

2014
New Toilets

2015
manual Irrigation

Water Savings: 100,000 gallons/yr, $600/yr
San Jose: 10,000 sf lot w/ pool
Strategies for No Irrigation Landscapes

- Hydrozone
- Use Very Low Water plants – see WUCOLS
- Handwater as needed
- Improve the soil
Why is Spray Irrigation Inefficient?
Why is Spray Irrigation Inefficient?

1. Overspray
2. Runoff
3. Poor design
4. Misting
5. Broken heads
6. Plants blocking spray head
7. Watering when it’s raining
8. Watering when it’s windy
Spray vs. Drip

- **Spray**
  - Good for redwood or other coastal communities
  - 50-70% efficient
  - Good for lawns under existing trees
  - Can damage/ stain fences and wooden structures
  - Uses PVC pipe
  - Does not qualify for rebates
  - Gallons per minute!

- **Drip**
  - Good for all other plant communities
  - 90-99% efficient
  - Can be used for lawns
  - Does not damage/ stain wooden structures
  - Uses polyethylene (PE), or PE and PVC
  - Qualifies for rebates
  - Gallons per hour!
History of Drip Irrigation

- Simcha Blass
- 1960s
Components of Drip Irrigation

- Source of water
- Backflow preventers
- Flow meters
- Punch-in or inline emitters
- Pressure regulator
- End caps or flush valves
Source

- Valves
- Hose bib
Backflow Prevention
Filters – A Must!

- Y filter
- Inline filter
- Spray body filter
- 120 mesh minimum
Pressure Regulators

- Pressure should be between 20 and < 50 PSI
- Household pressure typically 60-90 PSI
Fittings

- Barbed – I prefer these
- Compression
Emitters

- On-line
- In-line – I prefer these
Flush Caps

For 12 mm and ¼”

For 17 mm and 1/2”
Changing from Spray to Drip

- Rainbird Kit: 1800 Retro
  - 200 mesh filter
  - 30 PSI pressure regulator
  - Flow is 0.5 to 6 GPM
Changing from Spray to Drip
Agrifim Conversion Kit

30 psi pressure regulator
200-mesh filter
5 gpm flow

Quick & Easy to Install!
Better choice than Rainbird Kit
Two Drip Irrigation Methods

- **Per Plant Method**
  - Add emitters per each plant
  - More efficient when plants are small
  - Less expensive to install
  - Limits root and plant growth
  - Requires more maintenance if plants change
  - Can make adjustments for differing water requirements
Two Drip Irrigation Methods

- Grid Method
  - Waters all the soil, mimics rainfall
  - Inefficient when plants are small
  - Better long term for growth
  - More expensive to install
  - Must hydrozone!
Subsurface Drip Irrigation for Lawns and Meadows

Lawn uses subsurface drip irrigation—Recommend Netafim Techline CV products
Subsurface Irrigation for Lawn
Alternatives or
anything that requires mowing
17 mm Inline tubing
No automatic flush valve, use a manual one
## Max. Length for Lite Layout

### Maximum Length of a Single Lateral (Feet)

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>12”</th>
<th>18”</th>
<th>24”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emitter Flow (GPH)</strong></td>
<td>0.26</td>
<td>0.26</td>
<td>0.6</td>
</tr>
<tr>
<td>20 psi</td>
<td>331</td>
<td>468</td>
<td>468</td>
</tr>
<tr>
<td>25 psi</td>
<td>413</td>
<td>584</td>
<td>584</td>
</tr>
<tr>
<td>35 psi</td>
<td>518</td>
<td>737</td>
<td>737</td>
</tr>
<tr>
<td>45 psi</td>
<td>594</td>
<td>845</td>
<td>845</td>
</tr>
<tr>
<td>55 psi</td>
<td>655</td>
<td>932</td>
<td>932</td>
</tr>
<tr>
<td>60 psi</td>
<td>681</td>
<td>969</td>
<td>969</td>
</tr>
</tbody>
</table>
Grid Layout PVC

- Air Relief Valve Kit in Valve Box
- Flush Header
- Flush Valve
- Wetted Area
- Lateral lines
- Lateral spacing
- Dripline Lateral Run Length
- PVC Polyethylene tubing, or dripline supply header
- Insert or Compression Fittings
- Inline Emitters
- XF Series Dripline Laterals
Grid Layout
Sand, Loam, Clay Soils

Water Drainage by Soil Type

- Fast: Sandy
- Moderate: Loamy
- Slow: Clay
### Drip Spacing

#### General Guidelines

<table>
<thead>
<tr>
<th></th>
<th>Turf</th>
<th>Shrub &amp; Groundcover</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emitter Flow</strong></td>
<td>Clay Soil</td>
<td>0.26 GPH</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>0.4 GPH</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td>0.6 GPH</td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td>0.9 GPH</td>
</tr>
<tr>
<td><strong>Emitter Spacing</strong></td>
<td>Clay Soil</td>
<td>18”</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td>12”</td>
</tr>
<tr>
<td><strong>Lateral (Row) Spacing</strong></td>
<td>Clay Soil</td>
<td>18” 20” 22”</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>18” 20” 22”</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td>12” 14” 16”</td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td>12” 14” 16”</td>
</tr>
<tr>
<td><strong>Burial Depth</strong></td>
<td>Clay Soil</td>
<td>Bury evenly throughout the zone from 4” to 6”</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>On-surface or bury evenly throughout the zone to a maximum of 6”</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td></td>
</tr>
<tr>
<td><strong>Application Rate (Inches/Hour)</strong></td>
<td>Clay Soil</td>
<td>0.19 0.17 0.15 0.45 0.41 0.37 0.96 0.83 0.72</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>1.44 1.24 1.08</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td>0.19 0.16 0.14 0.29 0.24 0.21 0.72 0.64 0.58</td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td>1.08 0.96 0.87</td>
</tr>
<tr>
<td><strong>Time to Apply 1/4” of Water</strong></td>
<td>Clay Soil</td>
<td>81 90 99 33 37 41 16 18 21</td>
</tr>
<tr>
<td></td>
<td>Loam Soil</td>
<td>10 12 14 81 94 108 53 61 70</td>
</tr>
<tr>
<td></td>
<td>Sandy Soil</td>
<td>21 23 26 14 16 17</td>
</tr>
<tr>
<td></td>
<td>Coarse Soil</td>
<td></td>
</tr>
</tbody>
</table>

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.

- Clay– 12” OC, 12-16” rows for lawn, subsurface
- Clay – 18” OC, 18-22” for shrubs, on surface below mulch
Clay Soils Hold More Water

Figure 1. Available Water in the Peach Tree Soil Water Reservoir by Soil Type

Sandy soils hold much less water in the peach tree’s soil water reservoir. Figures are for typical soils and trees on 15 ft x 20 ft spacing.

Maximum available stored water

- Clays: 505 gallons
- Loams: 449 gallons
- Sands: 202 gallons
Slopes

- More water at the bottom of the hill, lay lines farther apart
- Less water at the top of the hill, lay lines closer together
- More pressure at the bottom of the hill. Lay lines parallel to the contour of the hill
Special Cases

- Vegetable beds – \( \frac{1}{4} - \frac{3}{8} \) tubing, 6-12”
- Pots – \( \frac{1}{4} - \frac{3}{8} \) tubing, 6-12”
How to Design a Drip System

- Measure pressure and flow
- Hydrozone areas (exercise)
- Select emitter size and spacing
- Select line spacing
- Determine flow per each area (exercise)
- Is there enough flow for the valves?
- Is there too much flow for the pipe?
Pressure/ water gauge
Hydrozoning

- Hydrozoning is the practice of clustering together plants with similar water requirements in an effort to conserve water. Grouping plants into hydrozones is an approach to irrigation and planting design where plants with similar water needs are grouped together.
Water Use Classifications of Landscape Species (WUCOLS)

Species Evaluation List—1999

<table>
<thead>
<tr>
<th>TYPE</th>
<th>BOTANICAL NAME</th>
<th>COMMON NAME</th>
<th>REGIONAL EVALUATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>S</td>
<td>Brugmansia spp.</td>
<td>angel’s trumpet</td>
<td>M</td>
</tr>
<tr>
<td>S</td>
<td>Brunfelsia pauciflora</td>
<td>yesterday today and tomorrow</td>
<td>M</td>
</tr>
<tr>
<td>P</td>
<td>Brunniera macrophylla</td>
<td>Siberian bugloss</td>
<td>H</td>
</tr>
<tr>
<td>S</td>
<td>Buddleja adpressa</td>
<td>fountain butterfly bush</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>Buddleja davidii</td>
<td>butterfly bush</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>Buddleja marrubifolia</td>
<td>woolly butterfly bush</td>
<td>L</td>
</tr>
<tr>
<td>P</td>
<td>Bulbine frutescens</td>
<td>stalked bulbine</td>
<td>L</td>
</tr>
<tr>
<td>P</td>
<td>Bulbinella robusta</td>
<td>bulbina</td>
<td>L</td>
</tr>
<tr>
<td>T</td>
<td>Bursera hindsiana</td>
<td>bursera</td>
<td>L</td>
</tr>
<tr>
<td>T</td>
<td>Buttia capitata</td>
<td>pindo palm</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>Buxus microphylla japonica</td>
<td>Japanese boxwood</td>
<td>M</td>
</tr>
<tr>
<td>S</td>
<td>Buxus sempervirens</td>
<td>English boxwood</td>
<td>M</td>
</tr>
<tr>
<td>S</td>
<td>Caesalpinea cacalaco</td>
<td>cascabotlote</td>
<td>A</td>
</tr>
<tr>
<td>S</td>
<td>Caesalpinea gilliesii</td>
<td>desert bird of paradise</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>Caesalpinea mexicana</td>
<td>Mexican bird of paradise</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>Caesalpinea platyloba</td>
<td></td>
<td>L</td>
</tr>
</tbody>
</table>

L. R. Costello
Environmental Horticulture Advisor Emeritus
University of California Cooperative Extension

K. S. Jones
Environmental Horticulture Associate
University of California Cooperative Extension

January 2014
High Water-Use Plants

- Lawn – Kentucky blue grass
- European birches, Alders
- Maidenhair fern
- Western chain fern – Woodwardia fimbriata
Medium Water-Use Plants

- Fruit trees, Japanese maples
- Vegetable gardens
- Coral bells
- Boxwood
Low Water-Use Plants

- Oak trees
- Sages, Rosemary, Lavender
- Native iris
- Warm season grasses
Very Low Water-Use Plants

- Oaks, Buckeyes
- Woolly Blue Curls
- Sages, some
- Native bulbs
- Cool season grasses
Hydrozoning
Hydrozoning Exercise
Flow Calculation

- Tubing will only support so much flow.
- ½” or 17 mm tubing maximum flow is 5 GPM
- Valves won’t turn on if the flow is too low.
- Minimum flow is often 0.5 or 1.0 GPM
- So the sweet spot is 1.0-4.5 GPM otherwise you need to use larger PE or PVC pipe
Exercise: Calculate Flow
Calculations

<table>
<thead>
<tr>
<th>Zone</th>
<th>Emitter 0.9 gph</th>
<th>Emitter 0.6 gph</th>
<th>Emitter 0.4 gph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.33 gpm</td>
<td>2.22 gpm</td>
<td>1.48 gpm</td>
</tr>
<tr>
<td>2</td>
<td>7.27 gpm</td>
<td>4.84 gpm</td>
<td>3.23 gpm</td>
</tr>
<tr>
<td>3</td>
<td>0.67 gpm</td>
<td>0.44 gpm</td>
<td>0.30 gpm</td>
</tr>
</tbody>
</table>

- Valve needs 0.5 GPM to turn on
- \(1/2\)” or 17 mm line can’t handle more than 5 GPM
- Can we add zone 3 to zone 2?
Exercise: Layout
Exercise: Scheduling or How Long and How Often to Run Your Irrigation System
- New plants – wean them off the daily watering they got in the nursery for 2 weeks
- Established plants
  - Perennials every one-two weeks minimum
  - Trees and shrubs every two-four weeks
How Much Water?

- High water plants ~1” of water per week, applied 2-3 times per week
- Medium water ~1/2” of water per week, applied once per week
- Low water ~1/4” of water per week, applied once every 1-2 weeks
- Very low water ~1/8” of water per week, applied every 2-4 weeks
Zone 2: 3.25 GPM flow

Area = 1190 sf (includes parking strip)

1/4” of water per week (0.02’)

1190 sf * 0.02’ * 7.48 gallons/ cu ft = 178 gallons

178 gallons * 1/3.25 gallons/ minute = 54 minutes in JULY the hottest month
Installation

- Obtain all the equipment ahead of time:
  - Drip line
  - Fittings: elbows, Tees, straights
  - Staples for every 2-4’
- See the Netafim Calculator App
Other Helpful Equipment

- Pipe cutter
- Knee pads
- Box with all your equipment to keep them close and protect them
- 100’ tape
- Metal stakes
- Yard stick
Time-Saving Tips

- Use the lite-layout when possible, less Tees and fittings
- Use a thermos of hot water to soften the line before inserting the fittings (~10-20 seconds)
- Keep the line in the sun while working to keep it soft
- Cut approximate lengths from the roll instead of moving the roll (it’s heavy and awkward!)
- Get a buddy to help you!
HOW AND WHEN TO WATER
Watering Factors

- Water requirements of the plant
- Type of soil
- Climate
- Time of day
- Slope
- Efficiency of irrigation
- Bare or covered soil
When to water – test the soil prior to watering
Tips to using a moisture meter

- Test the surrounding soil, AND
- Test the soil the plant was grown in (planting medium)
- Planting medium vs clay soil
- Hydrophobic soils

Too Little Water
Tips to using a moisture meter

- With drought-tolerant plants, allow the soil to dry out prior to watering
- Water when meter is about 2-4 (on a scale of 10 where 10 is wet)
- Don’t let the soil dry out completely or it may become ‘hydrophobic’
- Keep the soil between medium and low
When to water – test the soil after watering to make sure the area got deep water.
Water BEFORE we have a heat wave

- A few days prior if the soil is getting dry
- In the early morning, so the soil around the crown can dry out before it gets really hot
How to ensure baby plants get enough water

- Hand water
- Use a moisture meter
- Create a berm
- Add extenders to dripline
- Remove all the potting soil
Create a Berm

- Set top of rootball slightly above (≤1") finish grade.
- 3" layer of bark mulch kept 6" away from trunk.
- 3" high earthen berm.
- Finish grade.
- Backfill mix with organic compost (25%) and native soil.
Use Extender - tlmtubeadp
Rebates!
High Water Using
Landscape Conversion:
Lawns & pools

- $1.00 /sq. ft.
- Cap of $2,000 for combined landscape conversion and irrigation equipment rebates
- Cost sharing partners:
  - Palo Alto
## Landscape Equipment Rebates - SCVWD

### Qualifying Irrigation Hardware and Rebate Amounts

<table>
<thead>
<tr>
<th>Hardware Type</th>
<th>Rebate Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inline drip irrigation</td>
<td>$0.25 per square foot</td>
</tr>
<tr>
<td>Rain Sensor</td>
<td>Up to $50 per sensor</td>
</tr>
<tr>
<td>High-Efficiency Nozzles</td>
<td>Up to $5 per nozzle</td>
</tr>
<tr>
<td>Dedicated Landscape Meter</td>
<td>Up to $1000 per meter</td>
</tr>
<tr>
<td>Rotary Sprinkers or Spray Bodies with Pressure Regulation and/or Check Valves</td>
<td>Up to $20 per set</td>
</tr>
<tr>
<td>Weather Based Irrigation Controller, 1-12 Stations*</td>
<td>Up to $300 per controller</td>
</tr>
<tr>
<td>Weather-Based Irrigation Controller, 13-24 Stations*</td>
<td>Up to $700 per controller</td>
</tr>
<tr>
<td>Weather-Based Irrigation Controller, 25 Stations Or Greater*</td>
<td>Up to $1,000 per controller</td>
</tr>
</tbody>
</table>
Rain Sensors
Spray heads to MP Rotators
Weather-based Controller

Use weather information to determine precise water needs

- Some monthly fees for connection to weather station

- Several manufacturers: Weathermatic, Toro, Hunter, Rainbird, Irritrol, etc.
Imagine... Create... Enjoy...

Lawn Be Gone!

Rebates of $1.00 Per Square Foot of Lawn Replaced

Visit www.bawsca.org

- To view BAWSCA’s Water Wise Gardening in the Bay Area for Water-Efficient Gardening ideas and inspirations!
  www.bawscawatersavingplants.com

- For a list of FREE Water-Efficient Landscape Classes offered throughout the Bay Area.
  www.bawsca.org/classes

Get Paid to Transform Your Landscaping!

Effective July 1, 2014 through June 30, 2015

BAWSGCA
Bay Area Water Supply & Conservation Agency
650-349-3000 www.bawsca.org

BAWSGCA
Bay Area Water Supply & Conservation Agency
650-349-3000 www.bawsca.org
Water-Efficient Landscape Rebate Program

Trade in your high-maintenance and water-thirsty lawn for a more natural, low maintenance, and water-efficient landscape, and ACWD will give you money back for doing it!

Get a Rebate of up to $1,500-$20,000*

*Rebate is based on $1.00 per square foot of lawn converted to water-efficient landscape. Single family residential customers are eligible for up to $1,500, multi-family residential, commercial and industrial customers are eligible for up to $20,000. Rebates are issued on a first-come, first-served basis. Funding is limited and may be exhausted without prior notice.
Maintenance

- **Spring tasks**
  - Check/clean the filter
  - Open the flush valve and turn on the station, flush for 5 minutes
  - Close the flush valve and walk the system, listen and look for leaks

- **Monthly summer tasks**
  - Read your water bill
  - Turn on and walk each zone listening and looking for leaks
Summary

- Tracking water use
- Why Switch from Spray to Drip?
- Designing inline drip
- Installing time-saving tips
- How to get a rebate
- SCHEDULING!
- Controllers, Flow meters, and Rain sensors
- Maintenance and Leak Detection

A pdf of these slides is available at: sustainable-landscape.com under Articles and News

Fremontodendron californica ‘Ken Taylor’

Thank you!