

Using Recycled Water for Landscape Irrigation

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Understanding the site you have to work with is the first step in successfully using recycled water. Do this by identifying existing conditions, assessing how the landscape is likely to respond to the specific recycled water that will be used for irrigation, and considering appropriate adjustments to the landscape design and maintenance. Here is a brief overview. I've also provided interpretive guides for water, soil and plant tissue analyses.

How a landscape responds to irrigation with recycled water depends on the quality of the water, existing soil conditions, the salt sensitivity of the plants in the landscape, and how the landscape is irrigated.

What is the recycled water quality?

- review water quality reports
- collect samples for analysis
- determine the water quality category (Table 1)

- Category 1: Good water quality with no restrictions on site use.
- Category 2: Moderate water quality that is appropriate for nearly all landscapes except those with plants that are sensitive to salt or boron and soils drain poorly and are not readily leached.
- Category 3: Fair water quality that can be used where plants have at least moderate salt or boron tolerance and soils are at least moderately drained. Landscapes on poorly drained sites must be comprised of plants with good salt or boron tolerance.
- Category 4: Poor water quality that is appropriate only for sites having plants tolerant to salt or boron and soils with good drainage, and drought tolerant landscapes that will be irrigated only a few times per year.

What are the soil conditions?

- investigate the soil profile
- collect samples for laboratory analysis
- evaluate drainage

What plants are present?

- list all plant species present
- determine salt tolerance of each species
- assess overall condition of each species

What is the irrigation?

- identify how is water applied – spray, drip, bubbler, etc.
- determine general irrigation frequency and duration required
- perform a cursory inspection of irrigation uniformity

Put it all together

- evaluate what changes to plant health and appearance can be expected
- establish a soil salinity threshold based on salt sensitive of species present

Table 1. Interpretive guidelines for four categories of water quality for San Francisco Bay Area landscape irrigation.

Parameter	Category 1	Category 2	Category 3	Category 4
Salinity				
TDS, mg/l	<640	640–830	830–1,600	>1,600
ECw, dS/m	<1.0 ^f	1.0–1.3	1.3–2.5	>2.5
Specific ion				
Boron (mg/l)	<0.5	0.5–1.0	1.0–2.0	>2.0
Chloride (mg/l)	<120	120–200	200–350	>350
Sodium (mg/l)	<70	70–150	150–200	>200
Sodium adsorption ratio (SAR)	<3	3-6	6-9	>9
Bicarbonate (mg/l)	<90	90–200	200–500	>500
Residual chlorine (mg/l)	<1.0	1–2.5	2.5–5.0	>5.0

Adjusting landscape management when converting from potable to recycled water

Whether using potable or recycled water, the primary goal in landscape management is meeting plant needs.

How are the plants performing?

- Monitor plant health for stress symptoms.
- Diagnose for biotic or abiotic disorders.
- Know when to collect samples for analysis.

Will recycled water affect my plants?

- Inventory plant species in the landscape.
- Check recycled water quality and plant salt tolerance ratings.
- Monitor plant condition over time.
- Learn how to manage salt-sensitive species, if applicable for water quality.

Look at the soil

- Recognize compaction and know what to do about it.
- Keep the soil moist.
- Leach when necessary.

Putting it all together

- Know what is normal plant health and appearance and how to mitigate potential changes from recycled water.
- Keep your soil healthy.
- Save water resources through water budgeting.
- Become a recycled water landscape manager expert.

Strategies for maintaining landscapes irrigated with recycled water.

- Maintain moist soil
- Leach soil to maintain soil salinity below target concentrations
- Avoid wetting foliage from spray irrigation
- Manage soil sodium with gypsum applications

- Decrease fertilizer applications
- Monitor soil pH and salts
- Monitor plant health
- Plan for increased wear and more frequent repair and replacement of irrigation equipment

Designing new landscapes

- Select plants with appropriate salt tolerance for the water quality to be applied. See Table 2 for examples.
- Evaluate soil characteristics before planting. Soils should be tested for chemical and physical characteristics prior to planting to evaluate their suitability for irrigation with recycled water.
- Identify and solve drainage problems prior to planting. Good drainage is essential to using recycled water. Adjusting finish grades, eliminating hardpans and improving soil structure are methods to improve drainage.

Key considerations for recycled water irrigation systems

Meet health and safety regulations

- Control cross-connections
- Use purple pipe and include signage
- Protect public areas from overspray, runoff, and ponding

Select appropriate equipment

- Valves resistant to chlorine and other chemicals
- Low-trajectory spray nozzles to reduce drift in windy conditions and avoid wetting plant foliage
- Large orifice, turbulent flow drip emitters with micro disc filtration

Design for success

- Use checklists for regulatory requirements and evaluation procedures
- Check with your recycled water supplier for local requirements
- Incorporate recycled-water friendly irrigation technology into your design

MWELO requirements for recycled water

Since January 1, 2010, California Assembly Bill 1881 has required that all cities and counties adopt and implement a water-efficient landscape ordinance. Local agencies must have either adopted the State of California's Model Water Efficient Landscape Ordinance (MWELO, California Code Title 23, Division 2, Chapter 2.7), or have adopted a different ordinance that is at least as effective in conserving water as the MWELO. It includes several requirements regarding use of recycled water (*Note that AB 1881 is currently under review and revision; some requirements may change*).

- (a) Where recycled water is available, the installation of irrigation systems shall allow for the current and future use of recycled water, unless a written exemption has been granted as described in Section 492.14(b).
- (b) Irrigation systems and decorative water features shall use recycled water unless a written exemption has been granted by the local water purveyor stating that recycled water meeting all public health codes and standards is not available and will not be available for the foreseeable future.
- (c) All recycled water irrigation systems shall be designed and operated in accordance with all applicable local and State laws.
- (d) Landscapes using recycled water are considered Special Landscape Areas. The ET Adjustment Factor for Special Landscape Areas shall not exceed 1.0.

Table 2. Examples of plants suitable for each of the four categories of water

Note: The site soil in each case is assumed to be favorable: deep sandy loam with low potential for salt or specific ion accumulation when managed properly. For sites with restrictive soils, refer to Table 5-1 for adjustments to salt tolerance plant selections. This list does not consider boron tolerance (boron concentration in water is assumed to be less than 0.5 ppm).

Plant type	Category 1	Category 2	Category 3	Category 4
trees	coast redwood (<i>Sequoia sempervirens</i>)	London plane (<i>Platanus × hispanica</i>)	ornamental pear (<i>Pyrus calleryana</i> cvs.)	goldenrain tree (<i>Koelreutaria paniculata</i>)
	Japanese maple (<i>Acer japonica</i>)	sawleaf zelkova (<i>Zelkova serrata</i>)	autumn purple ash (<i>Fraxinus americana</i> 'Autumn Purple')	Nichol's willow-leaved peppermint (<i>Eucalyptus nicholii</i>)
	Michelia (<i>Michelia doltsopa</i>)	southern magnolia (<i>Magnolia grandiflora</i>)	Brisbane box (<i>Lophostemon confertus</i>)	Canary Island pine (<i>Pinus canariensis</i>)
shrubs	heavenly bamboo (<i>Nandina domestica</i>)	Japanese barberry (<i>Berberis thunbergii</i>)	blue mist (<i>Caryopteris × clandonensis</i>)	<i>Ceanothus</i> spp.
	Japanese aucuba (<i>Aucuba japonica</i>)	abelia (<i>Abelia grandiflora</i>)	pink breath of Heaven (<i>Coleonema pulchrum</i>)	purple rockrose (<i>Cistus × purpureus</i>)
	princess flower (<i>Tibouchina urvilleana</i>)	gardenia (<i>Gardenia augusta</i>)	Oregon grape (<i>Mahonia aquifolium</i>)	evergreen euonymus (<i>Euonymus japonica</i>)
groundcovers	creeping mahonia (<i>Mahonia repens</i>)	<i>Cotoneaster microphyllus</i>	gazania (<i>Gazania splendens</i>)	<i>Acacia redolens</i>
	<i>Pachysandra terminalis</i>	dwarf periwinkle (<i>Vinca minor</i>)	<i>Juniperus horizontalis</i>	<i>Ceanothus gloriosus</i>
	baby tears (<i>Soleirolia solerolii</i>)	creeping St. Johnswort (<i>Hypericum calycinum</i>)	star jasmine (<i>Trachelospermum jasminoides</i>)	<i>Rosmarinus officinalis</i> 'Prostratus'
herbaceous perennials	bear's breach (<i>Acanthus mollis</i>)	Shasta daisy (<i>Chrysanthemum maximum</i>)	false heather (<i>Cuphea hyssopifolia</i>)	sage (<i>Salvia</i> spp.)
	lily of the Nile (<i>Agapanthus orientalis</i>)	coral bells (<i>Heuchera</i> hybrid)	<i>Coreopsis grandiflora</i>	daylilly (<i>Hemerocallis</i> hybrids)
	western sword fern (<i>Polystichum munitum</i>)	big blue lily turf (<i>Liriope muscari</i>)	society garlic (<i>Tulbaghia violacea</i>)	New Zealand flax (<i>Phormium tenax</i>)
Grasses	Colonial bentgrass (<i>Agrostis capillaris</i>)	Kentucky bluegrass (<i>Poa pratensis</i>)	Red fescue (<i>Festuca rubra</i>)	Bermudagrass (<i>Cynodon dactylon</i>)
	Annual bluegrass (<i>Poa annua</i>)	Perennial ryegrass (<i>Lolium perenne</i>)	Buffalograss (<i>Buchole dactyloides</i>)	Zoysiagrass (<i>Zoysia tenuifolia</i>)
	Hard fescue (<i>Festuca trachyphylla</i>)	Creeping bentgrass (<i>Agostis stolonifera</i>)	Blue grama (<i>Bouteloua gracilis</i>)	Tall fescue (<i>Fetuca arundinacea</i>)

Author's Note: This text is based on an up-coming publication "Designing and Managing Landscapes Irrigated with Recycled Water: A Guide for the San Francisco Bay Area" by Nelda Matheny, Larry Costello, Carol Randisi, and contributing author Eric S. Hansen, P.E., in collaboration with WateReuse, San Francisco Bay Area water agencies and landscape practitioners.