



Redwood Barn Nursery

1607 Fifth Street Davis, California

All About Water.

Sacramento River began flowing on June 2 to many homes in Davis. Until now, Davis water has been laden with minerals that rendered the soil alkaline and kept us from growing some popular plants. How will your garden change?

About our water

Residents in central, older parts of east Davis, northeast, and north Davis are now getting surface water. Newer east Davis and a small portion of south Davis will come on line in September. The rest of South Davis and everyone west of highway 113 will get the new water in December.

Until a few years ago our water came from a couple of dozen wells from intermediate-depth aquifers. Those were recently replaced with water from some much wells drawing from hundreds of feet deeper. They all produce *very* hard water, high in calcium and boron and other minerals, and with an alkaline pH above 8.0. Local gardeners have been unable to grow plants that we call “acid-loving” without special soil conditioners. Some plants, sensitive to the salt content, develop burnt leaf margins and fail to thrive. Some common landscape plants get chronic yellowing of the new growth in summer.

How will our water change?

The river water will not be 100% of our water supply, but will be the preferred source when available. I got some answers from the city assistant public works director.

My question: “Will there be a time in any given year when we would be entirely using groundwater again?”

His reply: “As long as surface water is available we will maximize its use. In extreme circumstances we may have to rely on groundwater more heavily for a short period of time but in the vast majority of scenarios we will have surface water available. In normal to moderate circumstances the ratio should be no more than 50/50 and usually will be around 70/30 (surface, ground) in even high demand months. As an example – in 2014 I believe our peak day use was 16 million gallons. With 10.2 [million gallons of river water] available we would be around 60/40. If there was a time we would need to rely on groundwater for our supply, I would think November would be the likely month (given how our water rights work).”

Our water won't be as hard.

You may find you don't need your water softener any more. “Hardness” of water is a measure of the calcium and magnesium ion content, and hard water has a surplus of those ions. Davis well water has been what the US Geological Survey classifies as Very Hard at >180 mg/l (ours ranges as high as 890).

Hard water keeps detergents and soaps from lathering as well. There will be much lower mineral content, which is the key thing from a gardening standpoint. Gardening side note: insecticidal soap sprays will work better.



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Our water will still be alkaline.

The water district can't just mix new, lower pH water into the system and send it out into old pipes. It would dissolve the gunk that's accumulated in those pipes. To prevent corrosion the new water will be buffered up to the pH of the well water, which is somewhat alkaline at 8.1.

The alkalinity will be easier to correct.

All they're doing is adding some sodium hydroxide to the well water as they blend it with the surface water at the treatment plant. The sodium they're adding will be present in much lower quantities than it naturally occurred in our ground water. The calcium and other minerals that were accumulating in our soil over the course of a summer's irrigation, which contributed to the alkalinity, will be greatly reduced. There'll be far fewer cations to try to buffer.

Compared to our well water, the surface water, on average:

- Will have one-third as much calcium, a tenth as much magnesium, one-eighth as much sodium.
- Will be one-sixth as hard.
- Will have one-sixth as much total dissolved salts.

Those were all things that made it harder (pun intended) to reduce the pH for those camellias and blueberries everyone wants to grow. We'll still need to add sulfur to make the soil more acidic for them, but it'll be more effective now.

How soon will we see changes in our soil?

Flushing out excess minerals from our soil will take time. Irrigating with predominantly surface water, and a couple of good, wet winters, will leach built-up minerals past the root zone. I had a customer who had his soil tested by the same soil lab in spring and in summer. Spring levels of several minerals were significantly lower, reflecting the effect of winter rainfall. Boron was down 72%, potassium was down 50%, sodium down 40%, manganese down 26%. But others (calcium, magnesium) were only slightly reduced by a single winter's rainfall. Total mineral content of the soil will drop pretty rapidly, with some exceptions.

What does this mean for the plants we can grow?

Since we will still be using some well water, though in variable proportions, and the pH is being adjusted upward, we will still have some issues. The pH will be much easier to adjust.

The science of soil pH

pH is a measure of the abundance of hydrogen ions (H⁺). It is a log scale with the higher H⁺ meaning lower pH. Neutral pH is 7.0, lower is acidic, higher is alkaline. Plants generally prefer 6.0 – 7.0, i.e., slightly acid soil, though most can tolerate pH up to 8.0. None of this is an issue for your vegetables or fruit trees or most common landscape plants. But there have always been some desirable plant species that you see in Sacramento that we've stayed away from here due to the water quality.

These plants evolved with and adapted to much lower pH. They are unable to take up some soil nutrients at higher pH, and some are sensitive to high levels of minerals. Typical effects are yellow new growth from internal iron deficiency, even with plenty of iron in the soil, and burned leaf edges. They look chronically anemic and scorched, and the plants grow slowly if at all.



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Took some effort, will be easier now:

Planted in amended soil, watered deeply and often, and treated with soil sulfur to reduce the pH, some folks already succeed with these. Examples:

- blueberries
- camellias
- fringe flower (*Loropetalum chinense*)
- gardenias
- hydrangeas
- magnolias

These will all be easier to grow. Continue to apply sulfur, but you'll see better results now. Japanese maples will also establish more readily so long as they are planted with protection from hot sun and drying winds, and given plenty of water.

Things we can try now.

When we plant these in soils where minerals are abundant, the levels are actually toxic to them; the roots are damaged and the leaves burn. All of this in addition to the yellowing mentioned above. In short, they pretty much decline from the time you plant them.

Examples:

- Azalea and rhododendron
- dogwood (*Cornus florida* and *C. kousa*)
- huckleberry, currant and gooseberry (heat sensitivity may still be a problem)
- tupelo (*Nyssa sylvatica*)

Appearance of these will probably vary as the proportion of surface to well water does. Proceed with caution, add sulfur, water thoroughly, and see how it goes.

Better results with some common landscape plants

As soil gets more alkaline, some minerals react to form insoluble compounds that plant roots can't absorb. You may have an abundance of iron in the soil, but it isn't available to the plant. Some common landscape shrubs and trees grow fine but show iron deficiency as the irrigation season progresses. That will change for the better.

Examples: Escallonia, red oak (*Quercus rubra*), dwarf spiraea (*Spiraea bumalda*), *Viburnum davidii*.

Citrus will be greener and healthier looking, especially Meyer lemon which often gets iron deficient from the well water.

What causes alkalinity?

The main cause of soil alkalinity is the presence of lots of cations, especially calcium, magnesium, potassium, ammonium, and sodium.

We have LOTS of these minerals in our well water. The new water has much less, though they'll be adding *some* sodium back in as they balance the pH.

I'm not concerned about the use of sodium hydroxide to buffer the pH for a couple of reasons. First, the total sodium they're adding will still be much lower than what has naturally been present in our groundwater. Second, sodium is quite easy to remove from the root zone by means of leaching (watering with sufficient volume to flow off the site or past the root zone). Some



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experts may recommend adding gypsum to facilitate that. I won't quibble with that, but consider it unnecessary.

Boron has been a unique problem locally.

The well water has excess boron due to natural borax deposits along nearby streams. Taken up by the roots (it is a plant nutrient needed in small quantities), it passes through the plant to the leaf edges where it collects to toxic levels and kills cells. Leaf margins of some species get blackened and look ugly. Strawberry tree (*Arbutus unedo*) and Southern magnolia are examples that show this leaf burn. With far less boron in our water blend, that problem should go away.

As you experiment with these new plant choices, bear in mind that many are high water users and should be designed into your landscape in higher water zones.

For more information about the city water project, visit cityofdavis.org and click on New Surface Water to Start Flowing June 2.

http://redwoodbarn.com/images/DE_AllAboutWater/camelliaalbaplana2.jpg

http://redwoodbarn.com/images/DE_AllAboutWater/Camellia%20japonica%20Magnoliaflora.jpg

http://redwoodbarn.com/images/DE_AllAboutWater/camelliaalbaplana.jpg

There have always been some successful camellia growers in Davis. My conversations with them, particularly old professors in College Park, yielded recipes for regular fertilizer regimens to combat the effects of our alkaline water and soil. So the flower that is the signature of Sacramento will be easier to grow in Davis now.

http://redwoodbarn.com/images/DE_AllAboutWater/Gardeniajasminoides.jpg

For gardenias, Sunset Western Garden Book tells us "where water is poor, leach salts monthly." Even that has not always been sufficient to keep them deep green and healthy. Gardenias get anemic when watered regularly with high-mineral water and grown in alkaline soil. Popular for the intensely fragrant flowers, they will be less fussy now.

http://redwoodbarn.com/images/DE_AllAboutWater/Cornus3.jpeg

http://redwoodbarn.com/images/DE_AllAboutWater/Cornus2.jpeg

http://redwoodbarn.com/images/DE_AllAboutWater/Cornus1.jpeg

Dogwoods in our future? *Cornus florida* and *Cornus kousa* are popular small flowering trees in Sacramento and the Bay Area. We've never grown them here because the leaves burn from salts



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in the water. Perhaps with our new water blend, and seasonal applications of soil sulfur, and care to site them in lightly shaded areas. dogwoods will become part of our landscapes.

Photo courtesy of Christina Salwitz, <https://personalgardencoach.wordpress.com>. Printed with permission.

http://redwoodbarn.com/images/DE_AllAboutWater/blueberry.JPG

Most types of fruit and vegetables have been unaffected by our hard water. But blueberries need rich, fast-draining, acid soil (pH 4.5 – 5.5). Gardeners have succeeded by planting them in heavily amended soil using peat moss and fine bark, and lavishing them with soil sulfur. We'll still want to do that, but we should get better growth and yield now.

http://redwoodbarn.com/images/DE_AllAboutWater/Loropetalum.jpg

Some common landscape shrubs have always been prone to late season chlorosis. It's an iron deficiency that results from the iron mineralizing in the soil into a form that those plants can't take up. Growth and bloom are ok, but the plant appearance is harmed. Shrubs such as Fringe flower (Loropetalum, shown here) and Pink escallonia (Escallonia 'Frades') will look greener and more attractive with the new water supply.