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course irrigation water can be quite variable," says Rain Bird’s Roche.

That’s why golf course superintendents should test their water frequently. So what are some elements that, if found in water, could be bad news for your turf?

Boron, for one. According to Larry Lennert, North Central territory manager for Aquatrols, boron can be toxic to some turfgrass species at concentrations as low as 2 to 4 ppm in the soil. Irrigation water should contain less than 1 ppm.

“Boron can be leached from sandy soils, but it accumulates and is more difficult to leach from fine-textured soils,” Lennert says. "Also, it is more commonly a problem 

Bryozoa can gum up sprinkler heads.

For more ...

Looking for more information on this topic? The USGA’s Brian Whitlark recommends the following resources. Simply enter the following URLs into your browser to access the online content.

- Water Quality Testing
  The agony and the ecstasy.
  bit.ly/1dhDZ4L

- A Step-By-Step Guide For Using Recycled Water:
  An outline of the costs and maintenance practices necessary to manage this valuable resource.
  bit.ly/IB75Uq

- Interpreting Water Tests: It’s as easy as 1-2-3.
  bit.ly/J7hWVu

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Reclaimed water can harbor unwanted microorganisms.

Hear it first...
Check out this podcast featured on GCI’s Superintendent Radio Network which features Larry Lennert, territory manager for Aquatrols, who discusses soil salinity by outlining management practices. To listen, simply enter bit.ly/JHHUUr into your browser.

Chlorine is usually only present in minor amounts in recycled water sources where chlorine-containing compounds are commonly used as a disinfectant. Residual chlorine levels above 5 mg/L can be toxic to turfgrass. Also, chlorine is generally unstable in water and will form chlorides—different than chloride.

“Chloride is an anion (or negatively charged ion) commonly found in irrigation water and can be a major contributor in landscape plants than in mowed turf.”

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to the overall salinity of water," Lennert says. "Chloride is not particularly toxic to
turfgrass, but many landscape plants are
very sensitive to it."

Carbonate and bicarbonate are inter-
esting, too. They are anions in alkaline
irrigation water that commonly react with
calcium cations (positively charged ions)
in higher pH soils and precipitate out as
calciun carbonate, also known as calcite
or free lime.

"Less commonly, magnesium cations
can also precipitate out of alkaline irri-
gation water or the soil solution in higher
pH soils to form magnesium carbonate
(MgCO3), says Lennert. "Either of these
events will elevate the sodium absorp-
tion ratio."

Rain Bird's Roche explains that the so-
dium absorption ratio (SAR) indicates the
amount of sodium in the water in relation
with calcium and magnesium.

"There are different types of acid
products that can be used to help manage
waters that have a high SAR," says Roche.
"Acid products are typically injected
at the pump station using proportional
pumps that work in conjunction with the
pump station's flow meter so that a bal-
anced amount of material is added to the
irrigation water throughout an irrigation
cycle at variable flow rates. In some areas
of the country, a permit must be used
to install acid injection equipment, and
containment areas and backflow preven-
tion devices must be in place to contain
and prevent any spillage or leaks and to
protect from back siphonage into the
water source."

So what about sodium, that common
element found in water? High concentra-
tions of it will increase the total salinity
of the water. Salinity and organic compo-
nents are two of the top issues with water,
says Brian Whitlark, agronomist with the
USGA Southwest Region.

"The warmer the weather, the more
types of organisms you'll find in water," he says. "Bryozoa, protozoa and clam
shells can be problematic in gumming up
the screens at the base of sprinkler heads.
If you don't have a good filtration system

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at the pump station, you'll be chasing around with heads that get stuck or don't come on at all.”

Whitlark relates the story of one superintendent he ran into at a meeting who showed him a photo of his pump station filled with bryozoa. Despite the fact that it was a self-flushing system, they had to mechanically remove the filters and clean them off every three weeks; otherwise, they were pumping at reduced efficiency, which, of course, costs energy. This was a new pump station, too – prior to acquiring it, the mess was living in his irrigation lines.

Treating those types of organisms can be dangerous, Whitlark says. Potassium per-
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manganate is the most popular, followed by hydrogen peroxide or some sort of oxidation strategy (even ozone) to kill the organic organisms in an irrigation lake or wet well.

"These organisms are often associated with reclaimed water with elevated nutrient levels, specifically nitrogen and phosphorus," Whitlark says.

Having nitrogen and phosphorus in your water can be helpful from the standpoint of providing, in some reclaimed water, up to four to five pounds of nitrogen per 1,000 square feet per year. But, during times of limited growth, supers run the risk of leaching those materials through the rootzone.

"In hot environments that are growing bentgrass greens, the nitrogen is a real concern," says Whitlark. "You don't want to be applying nitrogen in July and August when it's 105 degrees and elevated humidity. The additional nitrogen is unwanted and creates puffy conditions on the greens."

Whitlark has seen courses where this is a great concern form conglomerates with other courses using the same reclaimed water and work with the water provider to implement reverse osmosis or additional denitrification strategies at the plant.

"Furthermore, the nitrogen and phosphorus in the water create a good environment for algae formation in the lakes,

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and regardless of how diligent superintendents are at avoiding putting fertilizer in the lakes, if those nutrients are coming from the effluent plant, that can be a real issue,” says Whitlark.

When it comes to salinity, you’re trying to evaluate the water based on total salts and whether you have a sodium hazard – two different things, Whitlark points out.

“You could have high salts and sulfates and calcium magnesium that make the water salty, but the sodium is low, and that will determine whether you can treat the water or whether it’s beneficial to treat the water,” says Whitlark.

Water with high electrical conductivity (over 1) may start to cause problems if you have poorly drained soil. Whitlark warns that, outside of reverse osmosis, you cannot reduce the salts in water. But as far as reducing the sodium hazard, if you have a sodium absorption ratio equal to or greater than 5, you might consider treating the water with gypsum to increase calcium. If the water is high in carbonates and bicarbonates, and the residual sodium carbonate (sum of carbs and bicarbs minus the sum of calcium magnesium) is greater than 1.5, then the potential exists to cause precipitation of calcium and magnesium – which would render sodium more potentially destructive in the soil. GCI

Jason Stahl is a Cleveland-based writer and frequent GCI contributor.

“Bryozoa, protozoa and clam shells can be problematic in gumming up the screens at the base of sprinkler heads. If you don’t have a good filtration system at the pump station, you’ll be chasing around with heads that get stuck or don’t come on at all.”

— Brian Whitlark, agronomist with the USGA Southwest Region