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Making Sense of "Alphabet Soup"

Author's Note: This is the second of a series of articles discussing water quality.

The issue of water quality is not going away. Between the impact it has on your turf and the impending environmental considerations, it's something to which we have to pay growing attention.

Last month, we talked in broad generalities about the importance of understanding and considering water quality as part of your overall turf management program. I would guess that each of you at some level recognizes that to be true. I also have had enough conversations on the subject with many of you to know that the industry hasn't made it easy for you to make an assessment of your water. A sample is taken, it is sent to a lab for testing, a written analysis along with some recommendations are returned to you, but can you truly make sense of them?

I'd like you to be able to make your own assessment or at least have some solid background information to help you get a feel for how your water stacks up against generally accepted control limits.

There is an alphabet soup of indices that have been developed to help. They can be tough to understand and even harder to calculate if you don't know what goes into them. We are going to get started on breaking down the more meaningful indices and begin to get a feel for what goes into them and review why those parameters are important to turf quality.

A number of acronyms show up on water quality reports and in articles that in general are poorly explained. Each of them has a purpose and has been developed from years of experience and some research.

You may be working with or have seen the following indices:

SARw – Sodium Adsorption Ratio
adj.SARw – Adjusted Sodium Adsorption Ratio
TDS – Total Dissolved Solids
ECw – Electrical Conductivity of Water
SI – Saturation Index
Ca:Mg – Calcium-to-Magnesium Ratio
RSC – Residual Sodium Carbonate
pHc – Calculated pH

So which one of these indices is the best? Which is most important? Who knows! There are so many interrelationships at work in your water, you ought to consider them all!

Before we tackle the formulas, though, we need to take a step back. For you to have a full understanding of this important element of your management program, simplifying key water issues is critical. Let's begin with a demystification of the water analysis.

Taking a look at typical water analysis, each parameter is compared to desired guidelines. These guidelines are generally expressed as:

pH = 6-7	Chloride = <140 ppm
Alkalinity HCO_3 = <120 ppm	TDS = 125-500 ppm
Alkalinity CO_3 = 0	Sulfur = <180 ppm
Calcium = 40-120 ppm	Iron = 2-5 ppm
Magnesium = 6-24 ppm	Potassium = .5-10 ppm
Sodium = <40 ppm	

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You can see that the parameters for some elements are strictly controlled limits while others have huge ranges! How can you have calcium be okay at 120 ppm **and** 40 ppm? Or TDS be in range at four times the lower control limit? This is because of the interrelationships that exist. A simple check against these desired values isn't enough. We need to know how they relate to each other.

As we review the analysis, we often see the results expressed in mixed terms. Some are ppm, some are meq/l and some are mg/l. Furthermore, the indices used to tell you whether or not you have a problem are based on formulas and terms that calculate seemingly "magical" numbers, but what you really need is to understand each number in context of the full water analysis. Only then will you be able to make sense of the recommendations.

The indices' desirable parameters most commonly seen are:

SAR (Sodium Adsorption Ratio)	< 3*
Adjusted SAR	<6*
pHc (Calculated)	>8.4
RSC (Residual Sodium Carbonate)	<0*

*meq/l

Since these critical values are frequently expressed and calculated in meq/l, we ought to know how to convert ppm to meq/l.

(ppm to meq/l)

Divide ppm by equivalent weights.

HCO_3	61
SO_4	48
CO_3	30
Na	23
CL	35.4
Mg	12.2
Ca	20

So, if your calcium is reported as 80 ppm, you divide by 20 to get a meq/l of 4. By breaking everything down to meq/l, we begin seeing things in equal terms (relating apples to apples) that help us understand the volume relationships better. This will help when we work through the index calculations that will show you whether or not you have a potential problem.

It is widely accepted that many of the problems caused by poor water quality are traced to higher pH and alkalinity values, when the potential for sodium to become the predominant cation increases. This is due to the calcium and magnesium being "tied up" by the alkalinity and made unavailable to soil-exchange sites; since these "good guys" cannot get to the ion-exchange sites, they are replaced with sodium. This seals the soil and dramatically reduces the ability of the turf to take up nutrients. The balance between cations (positively charged ions) and anions (negatively charged ions) is important and relatively easy to get a handle on.

CATIONS +	ANIONS –
Calcium Ca^{++}	Bicarbonate HCO_3^{--}
Magnesium Mg^{++}	Carbonates CO_3^{-}
Sodium Na^{+}	Chlorides Cl^{-}
Potassium K^{+}	Sulfates SO_4^{--}
	Nitrates NO_3^{-}
	Boron B_3^{--}

The balance is important. For example, if the bicarbonate and carbonate (alkalinity) ions outnumber the calcium and magnesium ions, it's certain that they (Ca & Mg) will be tied up, therefore allowing the sodium to fill the cation-exchange sites at the soil particle. This is bad news. Once again, we can use the meq/l conversion to get all these relationships on equal terms to determine the severity of the potential problem.

They key parameters that are examined most closely by the collective group of control indices are:

- pH
- Alkalinity
  (Carbonates and Bicarbonates)
- Hardness
  (Calcium and Magnesium)
- Total Dissolved Solids (Total Salts)
- Sodium

These are the main parameters on which we need to focus our initial review. Next time, we'll review the impact of these critical components and how they are accounted for in the control indices.