Aquarius Drilling Services

Water Bore Construction - Pump Installation - Irrigation - Water Treatment

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Analysis certificate explained

It is not possible to solve water quality problems, or improve the performance of water without first knowing what is in it. The term salinity is used heavily to describe a body of water. All this really tells us is the approximate level of the problem. pH is important, then we need to know the what the major base ions are in the supply. These are Calcium, Magnesium, Sodium and Chlorides. The first two are hardness minerals, the latter two are the damaging salts.

We need to know what is the make-up of the water. An analysis report is often essential. Due to the variations in many laboratory reports, we have found it necessary to establish our own service. It is fast. Your water sample must be in to our lab by Wednesday of each week, result out by Friday, reported to you by the weekend, or the Monday following. It is comprehensive, 59 tests. Some of these tests are not available by most water testing laboratories. Here is an explanation of the tests supplied.

pH is your acid alkaline indicator

Electrical conductivity (EC) is the salinity level. This is sometimes expressed as TDS (Totally Dissolved Solids and is usually about half the EC. EC is a more accurate term)

Items such as **Dissolved Oxygen**(DO), Carbon Dioxide(CO2) Chemical Oxygen Demand (COD) have to be explained simply.

The actual ppm of DO in water indicates its vitality and 5 + is a good benchmark not to drop below. 10ppm is excellent.

Levels of **Carbon Dioxide(CO2)** come into play when the pH is lower than it should be and it may be above 7. It can also indicate a problem in the water and it needs to be found. CO2 is a gas in water.

The Chemical Oxygen Demand (COD) of water is an expression for the demand that biological and non-biological matter places on the available Oxygen in, (DO).

Calculations

Calculation formula

Factors such as

TDS is a calculation from EC and is EC x .567, expressed in ppm.

Total Hardness comprises Calcium (CaCO3) and Magnesium Hardness(MgCO3) is an essential calculation of the hardness minerals as a true figure of a combined force. Calcium is the base mineral for causing the white scale build-up and magnesium for green stain respectively, on copper and brass plumbing fittings.

Total Alkalinity is for calculation and our use and is the sum total of carbonates(CO3), bi-carbonates(HCO3)and hydroxides(OH).

Saturation Index is an index of corrosive or scale forming water behaviour. This is made from pH, CaCO3, Total Alkalinity (as CaCO3) and the temperature at the time in C and a constant.

Sodium Absorption Ratio is a ratio between sodium(Na), calcium(Ca) and magnesium(Mg). This provides benchmarks for true salinity as a quick reference. The preferred maximum is 5.00 This is a ration between the three major base cations in water.

Cations and Anions

Your major base minerals(ions) are found here. Calcium(Ca++), Magnesium(Mg++), Potassium(K+) and Sodium(Na+) are cations, or

major base cations with positive charges. Ammonium, Ammonia and Hydrogen also make up part of this but generally have less impact.

On the other side, Chlorides(Cl-) and Silica(Si--) are the major negatively charged base ions. When you mix calcium with magnesium, chlorides and sodium, you have the basis of salinity.

These are joined with Bicarbonates, (HCO3, Temporary Hardness) Sulphates(SO4), Sulphur and oxygen) Phosphates(PO4), (Phosphorous and Oxygen) Carbonate (forms with hardness present as (C03) Nitrates as N, Hydroxide, (not listed, yet as OH)

Out of all this the damaging salts we often look for are represented on both sides of the tables as **Sodium and Chloride**.

Excesses of **Nitrates** can dry kidneys out, cause liver damage, and dehydration can occur. Nitrates convert to **Nitrites** and do damage to the human body. In infants, it can be quite serious. In older adults, it can also severely impact.

Sulphates can cause a bore supply to give off a smell. When Sulphate is reducing, or losing its oxygen atoms, it can become Sulphide and mix with Hydrogen as H2S, only and you have rotten egg gas as it hits the air and naturally attempts to form back to Sulphate, gasses off and stinks.

Silica is a very hard negatively charged ion that needs to be known when it is a problem.

At this point it must be realised that all ions will form **compounds. None will remain as pure ions, generally.**

Trace minerals then follow.

Iron(Fe), and Manganese(Mn) can all cause serious problems together or separately with or without bacterial contamination in the water. Iron stains with calcium as a

hard crust or stain, or alone with bacteria can cause a reddish slime in pipes. When all three are together, they form a slushy mess in the pipes. Manganese can do the same.

Copper(Cu) in water can be toxic when it exceeds safe levels and can cause a bitter metallic taste. It can also turn water and fixtures blue. This is usually caused by aggressive water.

Zinc(Zn) is harmless as a rule and **Boron(B)** can be quite aggressive. Normally, you would see very low, or no concentrations of most trace elements. That is generally desirable.

Toxic Elements

The best way to describe these elements is that they are quite undesirable in a water supply.

Reporting

It is essential that you and your customer understand what is contained in the certificate. I report by way of a table colour coding the results so that the colours or highlighted areas stand out as the problems. We provide the WHO standard for drinking water, then your limits for the area of use, drinking, home, garden, agriculture, stock.

A simple explanation below this in colour again provides the explanation break-up and the recommended treatments.

This is where we usually start solving your water supply problem(s)

We need this information when a problem water quality issue arises. We need to pinpoint the problem and it may arise in more than one area and it may surprise you with what is actually the problem. Most can be simple issues, but this is not always the case and you may get a run of tough problems where we seek a second opinion from the water treatment industry.

This and the technology of water treatment, water chemistry, microbiology, are essential ingredients of successful water treatment.

Some examples

Hard water is largely caused by higher than desirable levels of calcium.40ppm plus parts of calcium(Ca) and at that level is definitely into hard water territory and the starting point for salinity issues. Magnesium also plays a part in this but does not leave a white stain. Ideally we prefer to see magnesium to be a much less ion value than calcium in water supplies. This is not always the case.

Where calcium will precipitate out very quickly in water in certain conditions (Saturation Index at temperature tells us whether it will happen) magnesium remains a highly soluble mineral.

Brackish water is a term that is used when the TDS as ppm of water is high. 1400ppm is a good example that it can taste a little salty or just plain hard. When you get to this level and the water tastes or behaves in a particular

manner, then that indicates the balance and dominance of particular ions in water.

Your major base ions, Ca, Mg, Na, Cl are likely the main culprits of the problem. It just depends on the balance as to which ion is going to be dominant.

The next issue is trace elements such as Iron and Manganese, both come into play with water quality issues on a constant basis. Iron tends to fall out in samples and really needs to be accurately tested on site. Manganese is not a lot different in behaviour but drops out as a solid very quickly.

High levels of iron, 3ppm up, are likely to drag down the pH and when they are removed, it will bounce back up. Iron can make water smell and manganese and unfortunately feeds bacteria. This can render water quite useless and cause stink and sludge build up and block pumps and pipes.

Sulphur will cause sharp smells as SO4 and worse when it appears as H2S (rotten egg gas). Need to explain. When the oxygen in any body of water is depleted by the Biological Oxygen Demand (BOD refers to the pure action of plants, decomposing matter and bacteria) then this compound SO4 starts to lose its oxygen's, breaks down as the bacteria attacks and consumes it.

The end result is that Sulphur then forms with Hydrogen (H) and you have rotten egg gas (H2S). When it hits the surface or is used, it gasses off as it tries to balance back up with Oxygen and.

Compounds

No ion, generally, will remain in true ion form. They all form compounds with other ions by attraction.

The simplest and most common are

$Ca + O3 = CaCO3$

$Fe + O2 = FeO2$

There are many forms of compounds.

Summary

This is why many fail when trying to correct water quality issues without a base knowledge of water chemistry and even a base knowledge is often, no where near good enough without expert help for some very difficult problems.

Bacteria testing

This is an essential test when dealing with bacteria issues, such as smelly dam water where soluble iron, manganese and sulphur feeds bacteria as it does in bore water supplies.

Bacteria testing is a good confirmation test on all private water supplies where the quality is suspect due to smell, and is making people sick, or sludges pipes up.

You must never assume that a stored rain-water tank system is bacteria free unless you know it isn't. This particularly applies to water supplied to workers, or the general public, whether at profit or not. If people are suffering mystery illnesses, then you need to confirm or eliminate this issue.

Bacteria testing is collected and performed quite differently than a mineral sample. It must be taken in a separate container, which is sterilised, half sample only, no contamination, kept cold and taken to a microbiological lab within 24 hours, or drop point where it will get to the testing facility within that time period. We supply sampling guide sheets on all testing by request.