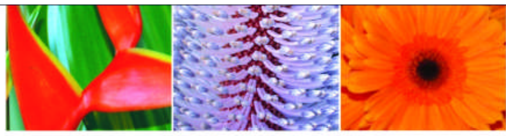
FAQI



Flower Association of Queensland Inc.
www.flowersqueensland.asn.au

Fact Sheet

Interpretation of Water Analysis for Irrigation

Electrical Conductivity (EC)

Electrical conductivity (EC) is a measure of the ability of a substance to conduct electricity. Pure water strongly resists the passage of an electric current. However, when salts are dissolved in water they improve its conductivity, so the greater the quantity of dissolved salts water contains the higher will be its conductivity reading. A measure of Electrical conductivity is therefore commonly used as a fairly reliable indicator of the degree of salinity of a water sample. It does not identify the specific dissolved salts, or the effects on crops or soils. The electrical conductivity reading of a solution is temperature dependant, and EC thresholds are usually based on a temperature of 25˚C.

EC units

The units in which electrical conductivity can be expressed are deciSiemens per metre (dS/m) although it can also be expressed in microSiemens per centimetre (µS/cm) or milliSiemens per centimetre (mS/cm). To add to the confusion electrical conductivity is sometimes also expressed as mil i-mhos per cm.

Table 1. When checking water analysis data make sure you know what the units are:

µS/cm = microSiemens per centimetre
mS/cm = milliSiemens per centimetre
dS/cm = deciSiemens per centimetre
dS/m = deciSiemens per metre

Table 2. To convert between the various units:

1 µS/cm = 1000 mS/cm
1 mS/cm = 1dS/m

Table 3. Some example electrical conductivity values of various water sources

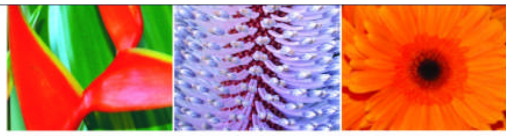
Water type	Electrical conductivity (µS/cm)
Deionised water	0.5-3
Pure rainwater	<15
Town water	200-<800
Freshwater rivers	0-800
Marginal river water	800-1600
Brackish water	1600-4800
Saline water	>4800
Seawater	51500
Industrial waters	100-10000

South East Queensland Irrigation Futures SEQ-IF
Rural Water Use Efficiency for South East Queensland

Rural Water Use Efficiency Initiative
Improving irrigation management for a profitable and sustainable future

Queensland Government
Natural Resources and Water

Queensland Government
Department of Primary Industries and Fisheries



Fact Sheet

Total dissolved salts (TDS)

Total dissolved salts are a measure of the ions in a solution. The total salt concentration of the tested water is one of the most important pieces of information presented in the water analysis report. High levels of soluble salts can induce physiological drought in the plant. The units of TDS are parts per million or milligrams per litre (ppm or mg/L).

Table 4. The units of TDS are:

mg/L – milligram per litre
ppm – parts per million of
1 mg = 1 ppm

Table 5 lists the levels at which the salt concentration poses a hazard when considering the water for an irrigation source.

Table 5: Salinity levels posing a hazard in irrigation water**.**

TDS ppm or mg/L	EC dS/m	Salinity Hazard
<500	<0.8	Low
500-1000	0.8-1.6	Medium
1000-2000	1.6-3	High
>2000	>3	Very High

Conversion between TDS and EC

The total salt concentration can either be expressed as Total Dissolved Salts (TDS) or Electrical Conductivity (EC). Both measures may be presented on the report.

Table 6 Approximate conversion from TDS to EC

TDS in ppm or mg/L = 640 X EC_w in dS/m or mmhos/cm

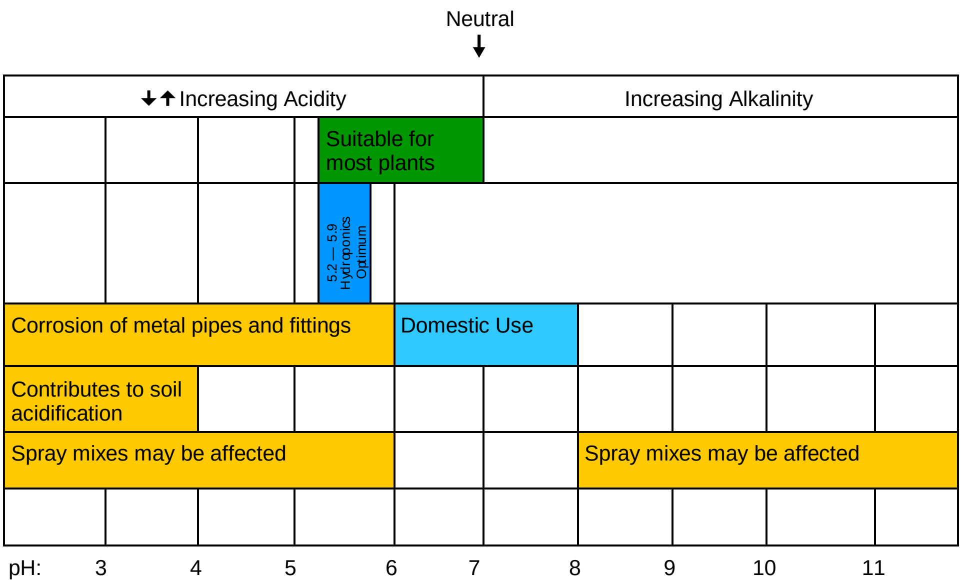
pH

The term pH is a measure of the acidity or alkalinity of a water sample. The pH of natural waters normally fall s between the range of pH 4.0 to pH 9.0. Soils are general y highly buffered systems and the pH of the soil would not be significantly affected by the application of irrigation water within this range. Waters having pH values greater than 8.0 would be expected to contain carbonates and bicarbonates, the calcium form of which can precipitate and block equipment. The waters usefulness would depend on the relative amounts of these salts. Corrosion is more rapid in acid than in neutral or alkaline waters.

Irrigation with strongly acid water may dissolve iron, aluminium and magnesium from the soil in amounts that could be toxic to plant growth.

The test for pH measures the balance between positive hydrogen ions (H^+) and negative hydroxyl ions (OH^-). This indicates if water is alkaline (pH >7), neutral (7) or acid (<7) as shown in Figure 1.

Figure 1. Degree of acidity or alkalinity



Turbidity

Turbidity is a measure of water clarity, and is an indicator of how much solid matter (such as clay, silt, organic matter and micro-organisms) is suspended in the water

Fact Sheet

FAQI Flower Association of Queensland Inc.
www.flowersqueensland.asn.au

Hardness

There are several definitions of water hardness – it could mean the water has high concentrations of iron, manganese, sulphates, carbonates and/or bicarbonates. Or it could specifically refer to the concentration of calcium or calcium carbonates. Without knowing what each water quality report is referring to it is difficult to identify. Below are some simple limits that may be of use.

Bicarbonate concentrations between 90 and 200 mg/L can cause increasing plant growth problems and cause foliage or container staining, > 500mg/L is unsuitable for micro-irrigation.

Calcium is required for plant growth in low concentrations and is not considered toxic but high concentrations can affect the calcium:magnesium ratio and cause scale build up. Maintaining pH below 7.2 will prevent scale formation. Calcium carbonate (Alkalinity) levels greater than 125 mg/l may cause pH to rise to unacceptable levels through time. Above 500 mg/L will cause severe problems and is not suitable. High concentrations will cause scale build up in irrigation systems.

Specific ions

Specific ions can be toxic to plants and/or detrimental to the soil physical structure. Certain salt ions (Sodium, Chloride, and Boron) can cause direct root injury, accumulate in shoot tissues and cause shoot toxicity problems, or cause direct foliar toxicity on plant leaves. These problems are almost always present when high total salinity is present.

Soluble salt ions found in recycled irrigation water are:

Cations

Calcium (Ca^{++})
Magnesium (Mg^{++})
Sodium (Na^{+})
Potassium (K^{+})

Anions

Carbonates (CO_{3--})
Bicarbonates (HCO_{3-})
Chloride (Cl_{-})
Sulfate ($S0_{4--}$)
Nitrate (NO_{3-})
Boron (B^{3+++})
Phosphate ($P0_{4---}$)

Iron (Fe^{+++})

Dissolved iron in water is present in the ferrous state. Except at low pH values, ferrous iron is readily oxidised to ferric iron, an insoluble reddish brown precipitate on exposure to air and sunlight. For information on how to take water samples for iron analysis, check with the laboratory that will be conducting the analysis.

For localised irrigation schemes that use very small emitters, the presence of iron in the irrigation water has proved to be a problem. It has been found that iron bacteria flourish in water that contains as little as 1.0 mg/L of iron. The bacteria extract the iron out of solution and convert it into a rust coloured sludge, which quickly blocks filters and emitters.

South East Queensland Irrigation Futures SEQ-IF
Rural Water Use Efficiency for South East Queensland

Rural Water Use Efficiency Initiative
Improving irrigation management for a profitable and sustainable future

Queensland Government
Natural Resources and Water

Queensland Government
Department of Primary Industries and Fisheries

Fact Sheet

FAQI

Flower Association of Queensland Inc.
www.flowersqueensland.asn.au

Nitrate (NO_3-)

For many crops nitrate in the irrigation water will provide them with some extra nitrogen. Nitrate sensitive crops could be affected by concentrations greater than 22 mg/L nitrate and problems may occur with increasing concentrations up to 133 mg/L nitrate, above which severe problems could arise.

Nitrogen could be found in dams containing decaying organic matter; or in underground water contaminated with seepage from soils, that have had large quantities of nitrogen fertiliser applied, or by effluent from various sources.

Sodium (Na^+)

Symptoms of sodium toxicity appear as burning or drying on the outer edges of older leaves. Progressing inwards towards the centre. Sodium can be absorbed through roots or leaves if sprinkler irrigation is used. Tree crops and woody perennials are most affected.

Manganese

Dissolved manganese can precipitate out to block irrigation equipment and cause black bacterial slime to grow within the irrigation system thereby reducing efficiency.

0.05 mg/L can lead to slime build up in irrigation systems

0.2 mg/L is the maximum concentration for irrigation. Higher levels are toxic to plants.

South East Queensland Irrigation Futures SEQ-IF
Rural Water Use Efficiency for South East Queensland

Rural Water Use Efficiency Initiative
Improving irrigation management for a profitable and sustainable future

Queensland Government
Natural Resources and Water

Queensland Government
Department of Primary Industries and Fisheries