

## WATER ANALYSES MONITORING - ELEMENT EXPLANATIONS

Species	Symbol	Notes	Concern Levels
Aluminum	Al	natural component of local bedrock, low pH (from acid rain) can assist in its deposition, low concentrations not known to be toxic to aquatic life, known to control toxic algal blooms by cutting off nutrients such as P, may affect some species respiratory functions	> 200 ug/L (MAR) 50-200 ug/L (NSDWR)
Arsenic*	As	natural component of local bedrock, inorganic As is a carcinogen and highly toxic	> 5 ug/L (CWAG) > 10 ug/L (MDH) - drinking water > 340 ug/L (EPA) - aquatic life
Boron	B	released from rocks and soils through weathering, dietary supplement for green algae	> 0.5 mg/L (MAR) > 100 mg/L toxic
Cadmium*	Cd	usually an atmospheric or mining contaminant, no beneficial effect on human health, toxic in large quantities	> 0.10 mg/L (ATSDR) >0.72 mg/L (EPA)
Calcium	Ca	possible natural component from local bedrock and waste water, levels > 20 ppm may aid in zebra mussel shell growth	> 20 mg/L (MAISRC)
Chlorophyll-a	Chl-a	a specific chlorophyll used in photosynthesis, usually a measure of algae quantity in water, > 10 mg/L considered an algae bloom	> 10 mg/L - bloom (LOTW) > 20 mg/L - nuisance (MAR) > 30 mg/L - severe (MPCA)
Chloride	Chloride	usually from de-icing road salts, a pollutant which threatens fish and aquatic life, 1 tsp of salt (NaCl) permanently pollutes 5 gal of water	> 120 mg/L (CWQG) >230 mg/L (EPA) - aquatic life
Cobalt	Co	natural component of local bedrock, no longer mined in US, essential element required for good health (component of vitamin B12), toxic in high levels (affects heart and lungs)	> 1.8 ug/L (Quest Diagnostics) (risk of systemic toxicity)
Copper*	Cu	usually from geologic deposits or rock/soil erosion, toxic to aquatic organisms, may aid in zebra mussel control	>1.3 mg/L (NSDWR)(EPA)

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Iron	Fe	natural component of local bedrock, low pH can assist in its deposition, contributes to browner water, can combine with toxins such as Pb and As so that they become more mobile	> 0.3 mg/L (NSDWR) > 1.0 mg/L (EPA) - aquatic life
Lead*	Pb	usually an atmospheric contaminant, harmful to heart, kidneys, and reproductive systems if ingested	> 0.015 mg/L (NSDWR)(EPA) (drinking water) >0.065 mg/L (EPA) - aquatic life
Magnesium	Mg	natural component of local bedrock, a component of hardness and the metal in Chl-a, Mg and Ca together determine water hardness, a diagnostic measure in the Minntac EIS	> 1,000 mg/L (LennTech) (as an oxide; aquatic toxicity)
Manganese	Mn	natural component of local bedrock, toxic to aquatic life in large amounts, > 0.05 ppm known to disrupt photosynthesis in starry stoneworts, drinking water safe at 0.30 ppm	> 0.05 mg/L (NSDWR) > 0.30 mg/L (EPA)(MDH) > 0.430 mg/L (CWQG)
Mercury*	Hg	usually an atmospheric contaminant, toxic to fish and humans in large quantities, biomagnifier and bioaccumulator in food chain	> 26 ng/L (CWQG) >144 ng/L (ATSDR)(EPA)
Nickel*	Ni	usually a particulate in lake sediments from weathering of rocks and minerals, essential trace element for aquatics but toxic at higher concentrations	> 52 ug/L contin concentration (EPA) >470 ug/L max concentration (EPA)
Nitrate	NO3	source of nitrogen (food) for algae and plant life, usually from fertilizers animal waste, and human sewage	>10 mg/L (ATSDR) (drinking water)
Nitrite	NO2	source of nitrogen (food) for algae and plant life, usually from fertilizers animal waste, and human sewage	>1 mg/L (ATSDR) (drinking water)
Perfluorooctanesulfonic acid	PFOS	perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are two of the 5,000+ PFAS "forever"man made chemicals which have been linked to (1) cancers (kidney, testicular), (2) problems with liver, thyroid, fertility, developmental, and immune functioning, and (3) reduced vaccine	>4 ng/L (EPA) (drinking water)

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		and hormonal responses; EPA has proposed an enforceable level of 4 ng/L for drinking water but nothing for lake water; ref EPA method 537.1	
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Phosphorous	P/TP	most likely from fertilizers and failing septic systems, aids in increasing nutrients for algae growth, commonly reported as total phosphorous (TP) ortho-phosphorous represents P that is readily available for use by algae; reducing non-native plants (eg Eurasian milfoil) will help lower P levels	10-20 ug/L (CWQG-mesotrophic) > 30.5 ug/L (MPCA, historical)
Potassium	K	natural component of local bedrock, aids plant growth (starry stoneworts favor an environment of 1.0 to 1.5 ppm), essential nutrition element	> 164 mg/L (Health Canada)
Sodium	Na	usually from de-icing road salts, a pollutant which threatens fish and aquatic life, 1 tsp of salt (NaCl) permanently pollutes 5 gal of water	> 250 mg/L
Sulphate	SO <sup>4</sup>	most likely from the oxidation of iron sulfide during mining, aids in the methylation of mercury which increases the toxicity of mercury in fish, harmful to aquatic vegetation including wild rice	> 600 mg/L (MAR) > 250 mg/L (NSDWR) > 10 mg/L wild rice (MAR)
Zinc*	Zn	usually an atmospheric or mining contaminant, can lead to adverse health effects, not known as a carcinogen	> 0.120 mg/L (EPA) (chronic aquatic life) > 5 mg/L (NSDWR)
pH	pH	measure of acidity or alkalinity, measured 1-14 where 1 is very acidic (hydrochloric acid), 7 is neutral (water, tears) and 14 is very alkaline (sodium hydroxide)	outside a range of 6.0 - 9.0 (MAR) 6.5 - 8.5 (NSDWR)
Alkalinity	TA	measures water's ability to neutralize acid and maintain a stable pH level amount of sulfuric acid needed to bring the pH to 4.2, indicates sensitivity to acid rain, waters with a high TA are better to maintain a fairly constant pH, sometimes expressed as TA	< 10 mg/L CaCO <sub>3</sub> equiv (EPA) 20-200 mg/L typical
Coliform	-	fecal coliform bacteria are indicators of possible sewage contamination, could be from failed septic systems, feed lots, etc	> 0 cfu/100ml (EPA)-drinking water

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Dissolved Oxygen	DO	measures amount of oxygen available to aquatic life, cold water holds more oxygen than warm water; DO levels less than 3-4 mg/L usually do not sustain fish life although carp can survive at 1 mg/L (walleye prefer greater than 5 mg/L but can survive at 2 mg/L for a short time)	< 5.5 mg/L (EPA 4/1986 AR1236)
Hardness	-	amount of dissolved calcium (Ca) and magnesium (Mg) in water	(USGS) soft: 0-60 mg/L CaCO <sub>3</sub> medium: 61-120 mg/L hard: 121-180 mg/L very hard: > 180 mg/L
Secchi	-	measure of water clarity, is considered an indirect measurement of algae or suspended sediment in the water, one of the 3 measures to characterize the trophic (nutrients available) status of the water; other 2 measures are chlorophyll-a and total phosphorous (TP)	varies
Total Dissolved Solids	TDS	suspended solids present in a water solution, typically inorganic salts and small amounts of organic matter (Ca, Mg, K, and Na cations & carbonate, sulphate and nitrate anions), TDS changes the mineral content of water potentially harming aquatic life	> 500 mg/L (EPA)(NSDWR)
Total Suspended Solids	TSS	suspended solids (typically < 2 micron inorganic, bacteria, and algae particles) which influence transparency, color, and overall water health, high levels may decrease DO levels	> 1,200 mg/L (drinking water)