

## Description of Services:

### Phycological Services

#### ***Potentially Toxigenic (PTOX) Cyanobacteria Screen:***

Microscopic observation is used to determine if cyanobacteria are present. If potentially toxigenic (PTOX) cyanobacteria are present, dominant cyanobacteria are identified and recommendations are made for toxin analysis.

#### ***Qualitative Algal Identification:***

All algae, including cyanobacteria, are identified but not quantified. A species list is composed in order of relative abundance based on the empirical judgment of the phycologist.

#### ***Cyanobacteria ID & Enumeration:***

Only cyanobacteria species are identified and enumerated.

#### ***Total Algal ID & Enumeration:***

All algae and cyanobacteria in the sample are identified and enumerated.

#### ***Algal ID, Enumeration & Biovolume:***

All algae and cyanobacteria are identified, enumerated and biovolumes are calculated.

### Toxin Analyses

#### ***Microcystins/Nodularin:***

ELISA - A useful screening tool for the detection of microcystins and nodularins (Adda Kit) with a low detection limit. This assay is prone to matrix interference and confirmatory analysis (*e.g.* LC-MS/(MS)) is recommended for any positive samples.

LC-MS/MS - A powerful and highly specific technique used in confirmatory analysis to accurately identify and quantify specific variants of microcystin and nodularin. Currently, the microcystin suite includes 14 variants of microcystin ([DAsp<sup>3</sup>]MC-RR, MC-RR, MC-YR, MC-HtYR, MC-LR, [DAsp<sup>3</sup>]MC-LR, [Dha<sup>7</sup>]MC-LR, MC-WR, [Leu<sup>1</sup>]LR, MC-HiLR, MC-LY, MC-LA, MC-LF, MC-LW) and NOD-R. Internal standards (*e.g.* d7-MC-LR, d5-MC-LF) and standard addition are used in calibration.

#### ***Total MCs/NODs via MMPB (2-methyl-3-methoxy-4-phenylbutyric acid) LC-MS/MS –***

Through chemical oxidation, microcystins/nodularins can be detected equally, regardless of variant. The analysis of MMPB allows for the determination of **total** MCs, bound and unbound, in complex matrix material or water samples.

Method 546 (ELISA) – US EPA approved method for the analysis of microcystins/nodularins in raw & finished drinking water. A freeze-thaw sample preparation is employed resulting in a longer TAT.

#### ***Anatoxin-a:***

LC-MS/MS – A highly specific, this technique is used to accurately identify and quantify anatoxin-a in water and other sources at trace levels. The additional analysis of Homoanatoxin-a can also be conducted if requested.

***Cylindrospermopsin:***

ELISA - A sensitive assay to screen for cylindrospermopsin. Confirmatory LC-MS/MS analysis is recommended for any positive samples due to potential matrix interference.

LC-MS/MS – A highly specific confirmatory and quantitative analysis for cylindrospermopsin and epi-cylindrospermopsin with low detection limits.

***Method 545 (LC-MS/MS)- Anatoxin-a & Cylindrospermopsin***

US EPA approved method for the analysis of anatoxin-a & cylindrospermopsin in finished drinking water.

***Saxitoxins (Paralytic Shellfish Toxins):***

ELISA – A sensitive screening tool for PSTs in water, but may underestimate levels or result in false negatives due to limited cross-reactivity to many analogs of PSTs.

LC-MS/MS – A highly specific analysis utilized to quantify a suite of PSTs, including dcSTX, STX, NEO, C1&C2, GTX (1,2,3,4 & 5), dcGTX2&3

***Dermatoxins – Lyngbyatoxin-a, Debromoaplysiatoxin, Aplysiatoxin:***

LC-MS/MS – Currently the only method available for the reliable detection and quantification of the dermatoxins lyngbyatoxin-a, debromoaplysiatoxin and aplysiatoxin.

***Domoic Acid:***

LC-MS/MS – A specific technique to accurately identify and quantify domoic acid.

***BMAA ( $\beta$ -N-methylamino-L-alanine):***

LC-MS/MS – A specific and direct analysis technique utilized to accurately identify and quantify BMAA in all matrices. BMAA analysis also includes LC-MS/MS of the isomers BAMA, DAB and AEG.

GreenWater Laboratories utilizes a high level of quality assurance and control to provide reliable results to its clients. We maintain standards of all the toxins listed above, which provides the sophistication necessary for accurate confirmation and quantification of toxins.

**Complex matrices**

*GWL/CL has extensive experience with toxin extraction from complex matrices, such as tissues, blood, gastrointestinal contents, and algal supplement material. Additional extraction charges apply.*