Appendix G.11

Standard Operating Procedure: Water Quality Sampling –
Fifteen Mile Stream Gold Project,
McCallum Environmental Ltd.

STANDARD OPERATING PROCEDURE: WATER QUALITY SAMPLING

1 PURPOSE

The purpose of this document is to provide standard methods for water quality sampling performed by McCallum Environmental Ltd. (MEL) employees and subconsultants.

Site Selection and Scope: Surface Water Quality and Quantity

Surface water assessment sites are selected to monitor baseline water quality and discharge volume at the Fifteen Mile Stream Gold Mine Project.

Water Quality

Baseline water quality sites are selected throughout the local catchment area to capture upstream, midstream and downstream water quality in relation to the proposed mine infrastructure within local lakes, rivers and streams.

Water Quantity

Baseline discharge volume sites are selected within local rivers and streams at locations that best meet the following characteristics:

- Well defined stream bed and banks to allow for accurate flow measurements;
- Laminar flow over a relatively straight reaches with no significant obstructions along the stream bed or banks;
- Lack of significant wetlands contiguous to the stream bank;
- Expected measurable flow (based on upstream catchment area), even under relatively dry conditions;
- Expected depth and flow speeds during high flow periods such that measurements can be taken safely; and
- Accessibility to flow monitoring crews.

A total of eighteen surface water assessment sites are monitored at the Fifteen Mile Stream site for either quality, quantity or both. Each location has been flagged and coordinates recorded. Their locations and monitored metrics are shown on Figure 1 (attached) and recorded coordinates are provided in Table 1 below.

Table 1: Surface Water Assessment Site Locations

Site ID	UTM Zone 20 (NAD 83)		Metric Measured
	Easting	Northing	
SW1	537062	4999553	Water Quality
SW2	538363	5000001	Water Quality and Discharge Volume
SW3	539486	4998181	Water Quality
SW4	537353	4998675	Water Quality
SW5	535917	4998993	Water Quality and Discharge Volume
SW6	539624	4994294	Water Quality and Discharge Volume
SW7	535437	4998109	Water Quality
SW8	535081	5000430	Water Quality
SW11	540996	4999679	Water Quality
SW12	540507	4997710	Water Quality
SW13	540241	4994730	Water Quality (at 1m below surface and 1m above lakebed)
SW14	535409	4998025	Water Quality and Discharge Volume
SW15	540833	4997142	Water Quality and Discharge Volume
SW16	536851	4998633	Water Quality
SW 17	537056	4996870	Water Quality
SW 18	537492	4996977	Water Quality
SW 19	538941	4996049	Water Quality
SW 20	541080	4995039	Water Quality

Monitoring Methodology

Water Quality

Water Quality is sampled for the following parameters quarterly to coincide with the Fall, Winter, Spring and Summer seasons. A complete list of parameters is attached to this document.

- Total metals – (RCAp-MS)
- Total dissolved metals – (Dissolved RCAp-MS)
- Total mercury
- Total dissolved mercury
- Methyl mercury
- Total Phosphorus
- Total Cyanide
- Free Cyanide
- Total Tungsten
- Dissolved Tungsten
- Total Zirconium
- Dissolved Zirconium
- Dissolved Organic Carbon
- Dissolved Fluoride

- Total Chemical Oxygen Demand
- Chlorophyll a
- Salinity
- Acidity
- Total Suspended Solids
- Total Dissolved solids
- Radium -226
- A handheld YSI meter is used to collect the following parameters:
    - pH,
    - Electrical conductivity,
    - Redox potential (ORP),
    - Temperature,
    - Dissolved oxygen
- A portable turbidity meter is used to collect turbidity measurements.
- Secchi Depth measurements are collected at sites located in Antidam Flowage (SW 13, 17, 18, 19 and 20)

Sample bottles are prepared and provided by Bureau Veritas Labratory and field staff collect samples directly from each water quality assessment site using the following methods:

- Collect sample from shoreline without disturbing waterbody bed or banks;
- In flowing water, stand downstream of sample collection to avoid stream bed contamination;
- The sampler should face upstream if there is a current and collect the sample without disturbing the bottom sediment;
- Wear latex gloves while sampling;
- Change latex gloves between sites;
- Use separate syringe and filter per assessment site for samples requiring field filtration (dissolved mercury, etc.);
- Sample bottles not supplied with preservatives, requiring filtering or sampling at depth will be rinsed three times with onsite sample medium prior to collection
- Duplicate samples are collected at the following frequencies per sampling event:
    - Sample size 1 – 10 = 1 duplicate
    - Sample size 11 – 20 = 2 duplicates
    - Sample size 21 – 30 = 3 duplicates etc.;
- Field and filter (equipment) blank samples are completed for each site visit; and
- Laboratory produced trip blanks will be taken and submitted for analysis during each site visit

Additionally, field staff will calibrate the portable turbidity meter and handheld YSI meter for turbidity, temperature, pH, dissolved oxygen, conductivity and oxygen reduction potential prior to each sampling event.

The Anti Dam Reservoir sampling location (SW13) targets the deeper water within the lake. A water quality profile is created by collecting YSI data in 1m intervals from surface to depth. Additionally, full chemistry water quality samples are collected within 1 m of the surface and 1m of the bottom at this location.

Collected samples are stored on ice until submitted to Bureau Veritas Labratory for analysis. Samples are to be submitted the same day as collection to meet the 48hr hold time of the Chlorophyll a analysis. Chain-of-custody documents are filled out and remain with the samples until custody is relinquished.

Water quality results are compared to the Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life (CCME FWAL) guidelines.

During winter (frozen) conditions, water samples are collected through a bore hole in the ice when necessary.

Water Quantity

Data to support stage discharge/rating curves is collected at SW2, SW5, SW6, SW14 and SW15. At these assessment sites, hydrometric stations (staff gauge and level logger) and discharge volume data are collected monthly.

Hydrometric Stations and Automated Water Level Loggers

Each hydrometric station is installed in areas of flat (low velocity) sections of the stream at established discharge volume monitoring locations. The locations are chosen where water depth is expected to remain sufficient throughout the driest times of the year. Each hydrometric station is affixed directly to a rock face when available. At locations where no suitable rock face is available the hydrometric station is affixed to a piece of angle iron driven approximately 1 m into the stream bed and anchored to a shoreline tree using galvanized strapping. Each hydrometric station hosts a staff gauge graduated in centimeters and automated water level logger. Automated water level loggers are connected to direct read cables that extend to the watercourse shoreline. Direct read cables are protected with flexible plastic piping and are affixed to shoreline trees or shrubs.

Water level loggers are set to record every 15 minutes and are suspended within a 5 cm diameter slotted PVC pipe. A barometric pressure logger set to record every 15 minutes is installed in a protective 2.5 cm diameter PVC pipe affixed to a tree at SW5. Water level loggers are compensated for barometric pressure using Solinst Levelogger 4.3.3 Software. During each monitoring event staff gauge readings are recorded and logger data is downloaded. Photos 1 - 5 show the hydrometric stations installed at Fifteen Mile Stream.

Photo 1: Hydrometric Station Installed at SW2

Photo 2: Hydrometric Station Installed at SW5

Photo 3: Hydrometric Station Installed at SW6

Photo 4: Hydrometric Station Installed at SW14

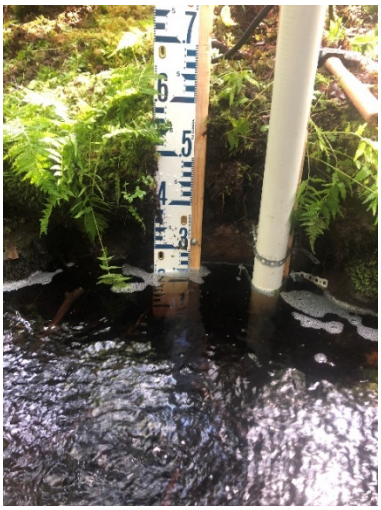


Photo 5: Hydrometric Station Installed at SW15

Each hydrometric station elevation has been recorded for true elevation by WSP surveyors and compared to two established benchmarks using a survey level and rod by McCallum Environmental Ltd. Benchmarks are comprised of a large spike driven into the base of a shoreline tree. Benchmarks are flagged and have locations GPS coordinated. These relative elevation surveys are confirmed seasonally to ensure stability of each hydrometric station

Discharge Volume Measurements

Discharge volume is established using the mid-section method described in The Water Survey of Canada, Hydrometric Technician Career Development Program (1999). The wetted width is determined with a metered tape secured between two flagged, fixed station posts installed on either side of the watercourse. The wetted width of the watercourse is divided into a minimum of 20 cross-sectional intervals when the watercourse is greater than 2.0m wide. Where the watercourse is less than 2.0m wide the wetted width is divided into 10 cm intervals. Point velocities are determined in each interval with a flow meter that displays average flow velocities over 30 second intervals and depth via meter stick readings. To determine the mean velocity at each interval, the one-point method is used for water depths less than 1.0m (i.e., velocity is measured at 0.6 of the total depth below surface). When depth is 1.0m or greater or upstream obstructions are present, the two-point method is used (velocity is measured at 0.2 and 0.8 of the total depth then averaged). Multiple flow measurements in the deeper water sections of the channel provide more accurate data than single measurements.

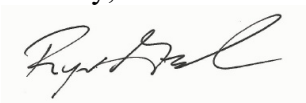
The volume (m^3/s) of water flowing within a watercourse past a given point is calculated by multiplying its flow velocity (m/s) by the cross-sectional water depth (m) and width (m). To obtain the volume flowing across the entire width of the river, a series (generally a minimum of 20) of single point velocity and depth measurements are combined to create a cross-sectional flow profile of the river. The data is entered into a spreadsheet that calculates volume discharge by combining the individual depth and interval measurements (flow and width) of the stream. A secondary pass is also completed to determine the confidence level of the data collected.

Flow velocity measurements are taken using an OTT MF Pro Flow Meter. The meter can read velocities ranging from 0 to 6 m/s. The flow meter accuracy is +/- 2% of a given reading when the velocity is between 0 and 3 m/s and +/- 4% when the velocity is between 3 and 6 m/s.

During winter (frozen) conditions thin river ice is removed from the discharge volume cross sections and hydrometric station prior to monitoring.

During winter conditions (January to March) and spring freshnet conditions (April – May) snow accumulation or weak ice cover and high flow velocities or depth can cause unsafe monitoring conditions. In these circumstance employee safety takes priority and water quality and discharge volume data may not be retrievable monthly or seasonally. Water quality samples will generally be collected the following month if suitable conditions are present. All efforts will be made to continue the program unless restricted by site conditions and safety considerations. Prior to winter work, a site-specific safety plan will be provided to all McCallum Environmental Ltd. employees.

Sincerely,



Ryan Gardiner
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Meghan Milloy
Vice President,
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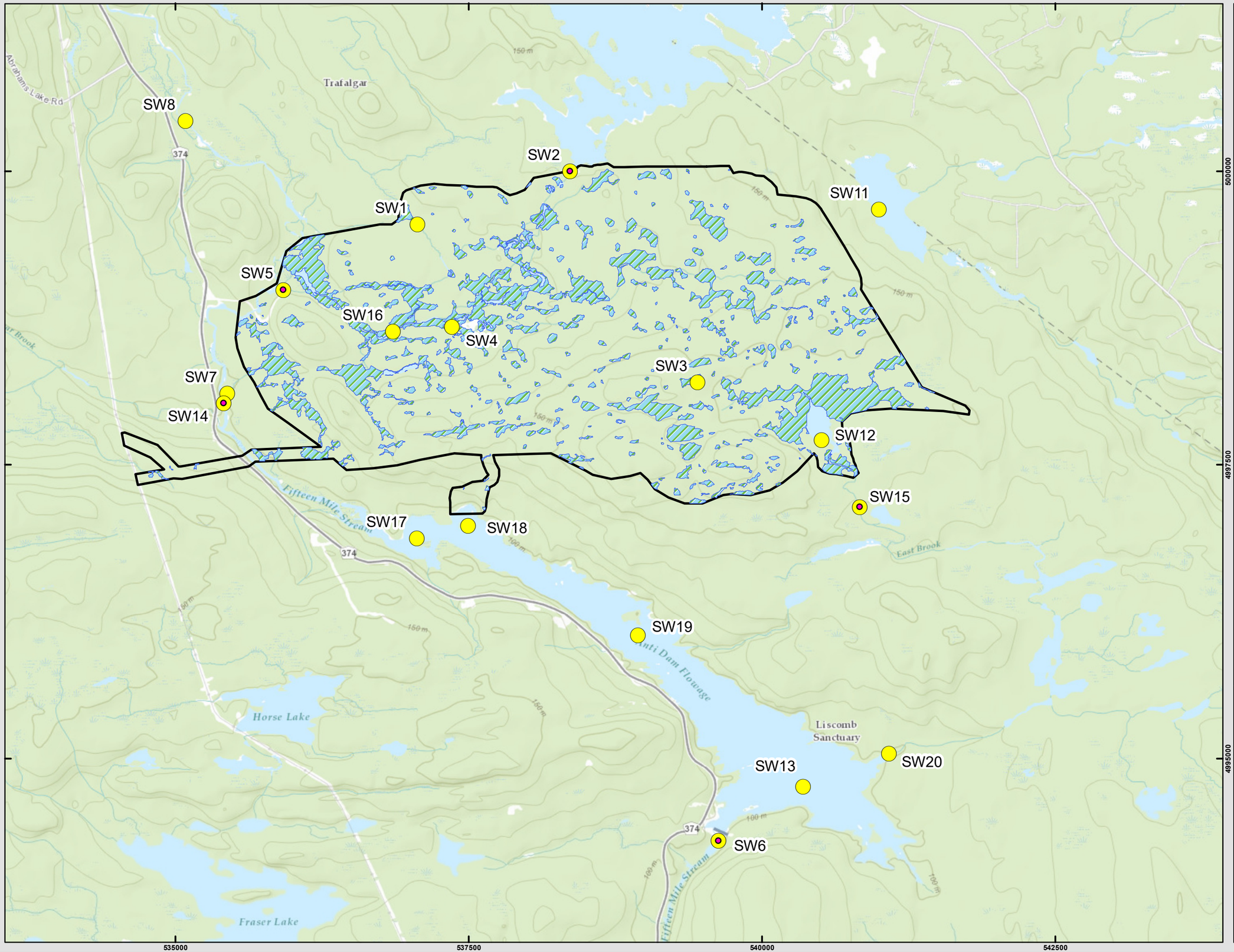
Attachment: Figure 1: Surface Water Sampling Locations -- Fifteen Mile Stream Gold Mine
Complete list of Water Quality Parameters



Prepared For:

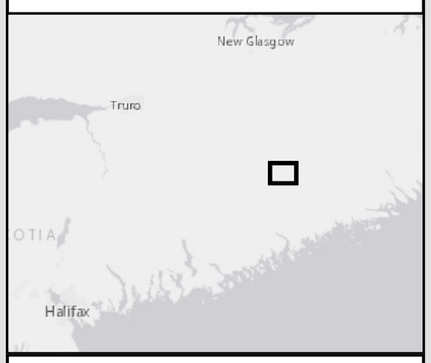
Atlantic Gold

FIGURE 1

Surface Water Assessment Locations

Fifteen Mile Stream, NS

- Hydrometric Station
- Water Quality Sample Location
- Wetland
- FMS Study Area



Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 250 500 1,000 m

1:30,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner

Date: 2020-07-30

McCallum Environmental Ltd.

Document Name: 200730_SW_Locations

Water Quality Parameters (Laboratory Analysis)
Acidity
Total Alkalinity (Total as CaCO3)
Total Chemical Oxygen Demand
Dissolved Chloride (Cl-)
Colour
Total Dissolved Solids
Dissolved Fluoride (F-)
Nitrate + Nitrite (N)
Nitrite (N)
Nitrogen (Ammonia Nitrogen)
Dissolved Organic Carbon (C)
Total Organic Carbon (C)
Orthophosphate (P)
pH
Total Phosphorus
Salinity
Reactive Silica (SiO2)
Total Suspended Solids
Dissolved Sulphate (SO4)
Turbidity
WAD Cyanide (Free)
Total Cyanide (CN)
Conductivity
Anion Sum
Bicarb. Alkalinity (calc. as CaCO3)
Calculated TDS
Carb. Alkalinity (calc. as CaCO3)
Cation Sum
Hardness (CaCO3)
Ion Balance (% Difference)
Langelier Index (@ 20C)
Langelier Index (@ 4C)
Nitrate (N)
Saturation pH (@ 20C)
Saturation pH (@ 4C)
Radium -226
Metals
Total Aluminum (Al)
Total Antimony (Sb)
Total Arsenic (As)

Total Barium (Ba)
Total Beryllium (Be)
Total Bismuth (Bi)
Total Boron (B)
Total Cadmium (Cd)
Total Calcium (Ca)
Total Chromium (Cr)
Total Cobalt (Co)
Total Copper (Cu)
Total Iron (Fe)
Total Lead (Pb)
Total Magnesium (Mg)
Total Manganese (Mn)
Total Molybdenum (Mo)
Total Nickel (Ni)
Total Phosphorus (P)
Total Potassium (K)
Total Selenium (Se)
Total Silver (Ag)
Total Sodium (Na)
Total Strontium (Sr)
Total Thallium (Tl)
Total Tin (Sn)
Total Titanium (Ti)
Total Tungsten
Total Uranium (U)
Total Vanadium (V)
Total Zirconium (Zr)
Total Zinc (Zn)
Dissolved Aluminum (Al)
Dissolved Antimony (Sb)
Dissolved Arsenic (As)
Dissolved Barium (Ba)
Dissolved Beryllium (Be)
Dissolved Bismuth (Bi)
Dissolved Boron (B)
Dissolved Cadmium (Cd)

Dissolved Calcium (Ca)
Dissolved Chromium (Cr)
Dissolved Cobalt (Co)
Dissolved Copper (Cu)
Dissolved Iron (Fe)
Dissolved Lead (Pb)
Dissolved Magnesium (Mg)
Dissolved Manganese (Mn)
Dissolved Molybdenum (Mo)
Dissolved Nickel (Ni)
Dissolved Phosphorus (P)
Dissolved Potassium (K)
Dissolved Selenium (Se)
Dissolved Silver (Ag)
Dissolved Sodium (Na)
Dissolved Strontium (Sr)
Dissolved Thallium (Tl)
Dissolved Tin (Sn)
Dissolved Titanium (Ti)
Dissolved Tungsten
Dissolved Uranium (U)
Dissolved Vanadium (V)
Dissolved Zirconium (Zr)
Dissolved Zinc (Zn)
Others
Dissolved Mercury (Hg)
Total Mercury (Hg)
Methyl Mercury (Net CH_2Hg as Hg)
Chlorophyll a (Acidification Technique)
Chlorophyll a (Non-Acidification)