Physical and chemical assessment

Version: February 2018

Water quality sampling using *in situ* water quality instruments

1 Purpose and scope

This document describes the correct method for the use of *in situ* water quality instruments.

2 Associated documents

Physical and chemical assessment:

- *Background information on water quality measurements using in situ water quality instruments*
- *In situ water quality sampling using a Secchi disc*

Sampling design and preparation:

- *Permits and approvals*
- *Record keeping including taking field photographs and videos*

3 Health and safety

Before following the methods contained in this document, a detailed risk management process (identification, assessment, control and review of the hazards and risks) must be undertaken. All work carried out must comply with the Queensland Work Health and Safety legislative obligations.

4 Permits and approvals

Permits and approvals may be required to conduct activities involving animals, plants and/or in protected areas (for example National Park/Regional Park, State Forest or State Marine Park). See *Permits and approvals* document for more information on requirements.

5 Skills, training and experience

Staff using this method should have previous training and experience in the use and calibration of the equipment described.

6 Field equipment

Equipment specific to this method includes:

- single or multi-parameter water quality instrument
- data sheets, notebook or field computer
- waders, gumboots, lifejacket or similar personal protective equipment (shore based sampling).

7 Procedure

7.1 Instrument maintenance and calibration

Due to the variety of water quality instruments available, it is not practical to provide instrument-specific advice on storage, calibration and maintenance in this document. Before taking an instrument into the field, you should be familiar with the contents of the operating manual for that specific instrument, and ensure that it is stored, calibrated, maintained and used as per manufacturer's instructions. Detailed records of calibration and maintenance must be kept.

7.1.1 Records

For each instrument the following procedures and documents should be established and kept up to date:

- list of spare parts and suppliers/sources of repair
- written inspection, maintenance and calibration schedules
- log book which has a record of inspection, maintenance and repair activities detailing dates and people involved
- log book which has a record of calibration activities detailing dates, times, results, standard(s) used and people involved.

Keeping such records allows it to be determined whether the equipment has been maintained in a sound operating condition and the recorded data are credible. This information is vital when undertaking investigations.

7.1.2 Calibration

Calibration must be undertaken as per the instrument manufacturer's instructions. Some general issues to consider are that:

- adequate supplies of calibration standards should be available. Make sure the standards have not expired. Standards can be reused provided the probes are rinsed in distilled water and dried thoroughly between standards, as to not contaminate them or dilute them.
- the calibration should be conducted using standards in the range of values expected to be encountered in the field. This is particularly important when calibrating electrical conductivity for use in fresh, tidal or marine waters
- if manufacturer's procedures does not refer to temperature calibration, manual temperature readings taken using a thermometer should be compared to the instrument temperature readings
- the calibration must be performed and recorded before the start of a field trip, and should be checked at the conclusion of each field trip
- it is advisable to re-check calibration daily during an extended period of field use. These in-field checks should be recorded in a notebook and later transcribed into the calibration logbook for the instrument
- variability in performance shown by calibration checks should be reported with the data, and provided to the instrument servicing agent.

Because laboratory calibrations rely on buffered solutions, a cross check comparison (shadow testing) of multiple instruments using an environmental water sample should be conducted from time to time. This is done using two or more instruments simultaneously to test a bucket of typical environmental water (e.g. from a creek). The comparison of readings should be within the range of the stated accuracy specifications of the parameter (refer to the operating manual of the instrument). If only one instrument is available and it is not possible to undertake shadow testing, it is recommended to return it to the manufacturer for regular calibration (as per the manufacturer's instructions).

7.2 Taking a reading with a multi-parameter water quality meter

7.2.1 Shore based procedure

1. One person holds the water quality meter on the shore, whilst another takes the sonde and wades out into the water body.
2. Move to the centre of the water body if possible. If water is flowing face so the current is flowing towards you.
3. Allow any water disturbed by your movement to the site to flow past you.
4. Turn the meter on and place the sonde in the water to a depth of 0.2m (to reduce impact surface slicks) upstream from where you are standing if there is flow, or beyond the area of disturbance if there is not flow.
5. Allow the readings to stabilise.
6. Follow the manufacturer's direction for taking the readings.
7. Record the measured values in a notebook and save the reading if a memory function is available.
8. Where the water is deep enough, repeat steps 5-7 at 0.5m to 1m intervals (depending on depth) until the bottom is reached (to provide a depth profile).
9. Record the following details:
    - site details (e.g. site code, site name, waterway, GPS co-ordinates)
    - date and time of measurement
    - all measured values
    - any factors that may have affected the measurement (e.g. presence of an algal bloom, recent rainfall etc.).

Note: If it is not safe to enter the water (e.g. due to fast flowing current or potential presence of dangerous fauna such as crocodiles) or if there is no flow and the sediment is disturbed by the sampler wading into the water, the procedure may be modified to lower the sonde into the water from a river bank, bridge or boat.

7.2.2 Boat based procedure

1. Whilst the boat is moving forward, switch off the engine and allow the boat to drift forward and clear of possible contamination caused by the motor or propeller.
2. Turn the meter on and place the sonde in the water to a depth of 0.2m (to reduce impact surface slicks).
3. Follow the manufacturer's direction for taking the readings.
4. Allow the readings to stabilise.
5. Record the measured values in a notebook, and save the reading if a memory function is available.
6. Repeat steps 5-7 at 2m intervals in estuarine water (1m intervals in freshwater) until the 0.5m off bottom is reached (to provide a depth profile). It is usually possible to take an extra reading between the deepest two-meter interval and the bottom. This is taken at the closest 0.5m interval from the bottom.
7. Record the following details:
    - site details (e.g. site code, site name, waterway, GPS co-ordinates)
    - date and time of measurement
    - all measured values
    - any factor that may have affected the measurement (e.g. presence of an algal bloom, recent rainfall etc.).

Note: Generally, if sampling in a tidal area, sampling is to be conducted on the ebbing (outgoing) tide.

7.2.3 On return to the office

1. Download data from water quality meter (always keep a copy of unmodified data files on a backed up drive).
2. Store notebook or field sheets in a safe place.

7.3 General considerations

- Sensors on sondes should be kept moist or wet at all times (depending on the sensor), and not be allowed to dry out. See the manufacturer's manual for specific directions on storing and transporting your instrument. Distilled water should not be used.
- Between sites, it can be advantageous to sit the sonde in water from the previous site to maintain sensor stability.
- Do not allow the sonde to touch the substrate as there is a risk of damage to the sensors from sticks, rocks, debris and anoxic sediments. Touching the bottom can also stir up sediments into the water column, changing the natural characteristics of the water being sampled. Depth can be determined in a boat by using the depth sounder. Thoroughly clean the sonde if it has accidently made contact with the substrate before taking any further readings.
- Stratification with the water column can occur for a number of parameters, therefore depth profiling is necessary in waterbodies deeper than 0.5m.
- Verify that the instrument you are using compensates for factors such as temperature when measuring electrical conductivity, or whether results need to be adjusted by calculation (see *Background information on water quality measurements using* in situ *water quality instruments* document).
- Under natural conditions such as high algal density during sunlight, it is possible to have dissolved oxygen (DO) super-saturation (more than 100% DO).

7.4 Atypical instrument readings

Atypical readings may be due to abnormal conditions in a waterbody, but they could also be a sign of problems with the equipment or equipment failure. Typical readings for dissolved oxygen, electrical conductivity and pH in potable (drinking), fresh and marine water are presented in Table 1. If readings appear atypical, the first step should be to check for equipment problems, such as a broken electrical cable or insulation, fouled sensor or faulty probe, depleted batteries, etc. If the equipment appears sound take extra measurements to confirm that the results are valid (i.e. move to another site) and check the calibration.

Table 1: Typical ranges for dissolved oxygen, conductivity and pH in different water types

Parameter	Potable water	Fresh water	Marine water
Dissolved oxygen (DO)		Typical concentrations under ambient conditions 6–10mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.	
Electrical conductivity (EC)	50–500µS/cm	<1500µS/cm	~52 000µS/cm
pH		6–8.5. These may be lower if acid rock drainage or acid sulfate soils/sediments are present. The total range of pH values is generally 0–14.	