Discrete Water Quality – Taking Clarity Tube Readings

1. Overview:

The Discrete Water Quality Program requires the assessment of the clarity of stream/river water at surface water State of Environment (SoE) and Point Discharge sample sites (excluding discharge/waste effluent sites). The primary method for obtaining this information is by Black Disc; a full methodology is available here: Section 15.6 appendix 9 of the Hydrology Operations manual. The secondary method is a clarity tube measurement detailed below.

This iteration of the SOP complies with the requirements set out within the National Environmental Monitoring Standards (NEMS): Water Quality; Part 2 of 4 (March 2019), and outlines the correct use of the clarity tube equipment and the recording of data obtained.

2. Equipment required (shown below):

1. The clarity tube: a 1-metre-long, 50-mm-diameter (44 mm inside diameter) clear acrylic tube, graduated along its length in centimeters. One end is clear (for viewing).
2. 1 x matt black pipe cap (this goes over the open end of the clarity tube).
3. 1 x 20-mm diameter black semicircle (the disc) that is fixed onto a magnet so that it is in the center of the tube (this can be slid along inside the tube using another magnet on the outside).
4. 1 x matching 'normal' magnet (this goes on the outside of the tube).
5. 1 x protective case.

The Discrete Water Quality Program currently has six sets of clarity tubes, caps and magnet/disc pairs plus spare caps and magnet/disc pairs. Maintenance comes under the care of the Discrete Water Quality portfolio holder.

Check the equipment prior to leaving the office:

(i) all components are present and in good condition,
(ii) Clarity tube lens and body is devoid of any major damage. *If damage is present inform the discrete water quality portfolio holder ASAP*
(iii) Carry case is in a good workable condition.

3. Use of clarity tube:

The back disc methodology is to remain as the Discrete Water Quality Program's primary water clarity method. However certain flow and/or site conditions prevent this being undertaken in a safe manner. Therefore the clarity tube is to be used in lieu of the black disc when:

(i) flow conditions do not allow the safe undertaking of black disc measures (i.e. high flow events)
(ii) site conditions do not allow the safe undertaking of black disc measures (i.e. water depth and access constraints)
(iii) flow conditions are not suitable for black disc measurements (i.e. very low velocity sites combined with fine bed material causing bias).

In addition, when the visibility range is 0.02 to 0.5 meters (as determined by black disc measurement) the clarity tube may be used in place of the black disc as per the NEMS.

The same method (black disc or clarity tube) should be used at upstream and downstream sites where possible, for example at sites upstream and downstream of a STP.

4. Taking a clarity tube reading:

4.1. Site selection:

Care should be taken to maximise staff safety and avoid bias; therefore, site selection needs consideration.

- Select a suitable section, ideally a run, within the immediate reach of the sample site.
- Ensure the site is safe prior to the commencement of any sampling activity (refer to HMP18).
- The site should be representative of the sample location (i.e. hydrologically the same).
- The site should ideally be upstream of any other activity that may disturb the streambed.
- Sample from the main flow of the stream (if safe and practicable) making sure that no sediment on the bed gets erroneously collected.

4.2. Light conditions:

- Try to take clarity readings in uniform, diffuse sunlight or shade, avoiding patchy light with shadows.
- If it is impossible to avoid bright sunlight, work with the tube perpendicular to the sun's plane - any shadow should therefore be cast to the side of the tube rather than directly along it. In bright sunlight there will be a reflection from the top of the black disk – you should try to ignore this when taking a reading.
- Do not take readings in conditions where the light is not intense enough for full colour vision (i.e. very shaded conditions or close to sunrise or sunset).
- For heavily shaded sites, take the sample and tube to a more open location to make the observations.

If a sampling bias is unavoidable, document it in the comments section of the Field Sampling Form.

4.3. Taking a clarity tube reading:

1) The clarity tube reading should be taken at the start of sampling.
2) Fill up the tube completely either directly from the stream if safe to do so without disturbing the substrate or by using a 1 litre sample bottle multiple times. These bottles fit our sampling poles to ensure that this can be carried out safely on site without entering the water.
3) Locate yourself away from the watercourse for performing and recording the reading.
4) Place the black disk magnet inside and ensure that it is held in place by the external magnet. The disc should be facing the viewing window.

5) Place the black tube cap firmly on the end - check that the viewing window is free of condensation before taking a reading.
6) Hold the tube horizontally (alternatively place on a level surface i.e. vehicle roof or use a second sampler (if present) to hold one end).
7) Whilst looking through the viewing window move the disc away from you (toward the end with the rubber cap) until it disappears – note this distance via the graduations on the tube exterior.
8) Repeat this process by moving the disc back toward you until it re-appears – note this distance via the graduations on the tube exterior.
9) The average of these two values equals the visual clarity measurement.

5. Recording a clarity tube reading:

1) In the Field Sampling Form record the visual clarity measurement to the value of 2 decimal places in the black disc field (clearly identify the value as being derived from a clarity tube reading).
2) Record the light conditions (Sun/Shade) during the clarity tube measurement.

Black Disc (m) Light conditions	 Sun / Shade

Table 1: Excerpt from field sampling form (HRC)

3) Under the comments section record the reason why the clarity tube was used over the black disc methodology.
4) Record any other pertinent observations (see below).

6. Notation and Recording Observations:

All comments written on the Field Sampling Form are entered onto the Sampler Database (and by extension Hilltop Manager) verbatim. It is important to comment your findings clearly and legibly.

In good visibility it is possible to observe a value in excess of the distance from the eye piece to the disc on the magnet (i.e. you can effectively see the end of the tube) therefore record these occurrences as **>0.95m** and comment appropriately. *NOTE: >0.95m has been chosen as it allows for the length of the magnet from the end of the tube.*

If a black disc reading ***and*** clarity tube reading cannot be undertaken comment why (in the comments section at the bottom of the Field Sampling Form).

7. Care of the clarity tube:

- Keep the viewing window of the tube free from scratches (the acrylic ring that projects beyond the window offers some protection). Cover the end of the tube when not in use by putting it back into its carry case.
- Only take the clarity tube and ancillaries out of the carry case when (i) at inspection and (ii) when taking a measurement.
- Don't drop the disc and magnets into the tube after use – this will damage the viewing window. Put the magnets in the pocket of the carry case.
- Do not empty the tube (with the magnets and disc inside) over the watercourse. Empty, clean and pack in a suitable and safe area away from the watercourse.
- Ensure that the black disk remains free of scratches. If paint chips off the edge, the resulting bright outline can make readings very difficult – it is designed to match the black stopper cap at the opposite end of the viewing window.

8. Equipment Maintenance:

As per section 2 of this SOP, staff should make equipment checks prior to leaving the office. Documentation, repair and maintenance is the responsibility of the portfolio holder. **If any equipment is either missing or damaged, please contact the portfolio holder as soon as possible. Remove any faulty equipment and take to the portfolio holder's desk ASAP to prevent use. Damaged equipment will affect Quality Coding given to the data.**

As a minimum, the portfolio holder is responsible for the equipment to be:

- Documented in Environmental Data's Asset Database
- Prevented from use by staff if in need of repair, damaged or if incomplete
- Maintained in appropriate condition
- Stored in a suitable location
- Replaced as and when needed
- Inspected annually as per NEMS.