Water Quality Monitoring
This booklet is an integral part of the IAWM water monitoring kit. The kit also includes field equipment described in the booklet, field recording forms, calibration records and associated materials to enable participants to test key indicators of water quality in their environment.
Why monitor water quality?

Landholders should get involved in water monitoring to:

- assess the health of dams, drains and neighbouring streams,
- determine if valuable soil, fertilisers, chemicals and hence dollars are being lost in runoff,
- build local and regional knowledge on water quality condition and trend,
- demonstrate good custodianship and the benefits of industry best management practice.

Water monitoring involves assessing key water quality indicators at the same site/s on a regular basis over time. By doing this, you can determine if the health of the site is improving, deteriorating or staying the same.

Remember not to interpret water quality data in isolation. It is important to understand why a particular result occurred and what contributed to that result.

Samples should be collected using the methods outlined in this manual. Anyone using the data can then be confident that it is representative of the water quality at the time it was sampled. Combine your results with local knowledge and land use data so that you and your employees can review farm management practices. For example, you may use the results to improve management practices such as reducing nitrogen losses in irrigation tail water - a direct impact on improved profitability.

Selecting a site

When selecting water monitoring sites consider:

- What information is required from the data?
- Do you want to monitor a number of sites to examine differences down a waterway or drain?
- What tests are required to give the maximum value from the monitoring and analysis?
- Are the chosen sites representative of the stream, waterway or drain conditions?
• Is the site accessible during rainfall events and/or flooding and what safety precautions are required?
• Can the sites be tested as a part of daily management routines (eg. when starting a pump)?
• Will the data be suitable for integration into area wide information systems (eg. IAWM)?

Points to remember
• Plan properly and check the equipment before starting.
• Collect data correctly and with due rigour.
• Maintain accurate records - your data is valuable.
• Integrate the data with other farm information and your experience.
• Establish ‘cause and effect’.
• Share the information with your employees.
• Use the data productively to improve the sustainability and profitability of your farm.
• Seek assistance if required.

Find out about resources and personnel involved in water monitoring and research in your area, and use these effectively to assist you (or your group) to build an effective and efficient water monitoring network.
How to use this guide.

This water quality monitoring guide is intended as a field guide for landowners and catchment groups. It has been designed to be a practical guide with a minimum of ‘techno-talk’.

Symbols used include:

- Estimated time taken.
- Equipment required for this test.
- Personal protective equipment and advice.
- Procedure - steps to complete the test or assessment.
- Data (results) to be recorded on proper field record sheet.
- Clean up and disposal.
- Equipment storage and maintenance.
- Tip to assist the user or provide advice.
- Caution note. Additional safety precautions or advice.

The IAWM group have also included charts, diagrams and tables to assist users to understand what each result means.

**Colours are used in the guide to indicate whether action is required:**

- GREEN - the value is within an acceptable range, adverse effects are minimal
- YELLOW - the value is ‘of concern’ and may indicate an emerging problem, adverse effects may occur.
- RED - adverse effects are likely and action should be taken to reduce these effects.
WATER QUALITY TESTING GUIDELINES

START HERE:

Check equipment and safety procedures.

Assess the water sampling site and surrounding conditions.

Record on IAWM field record sheet.

Check flow rate.

Collect main sample (5L) from undisturbed site.

Pour some of main sample into white dish (3-5 cm deep). Collect macroinvertebrates, put into white basin with water and leave (in shade) to settle.

Take a subsample (1L) of water and measure temperature immediately.

Assessment of pH, EC, nitrate (N), phosphate (P)

Shake the subsample thoroughly and assess turbidity using the turbidity tube.

Greater than 200NTU
Assess necessary dilution using Table 1, page 8-3. Carry out dilution.

Reassess using the turbidity tube.

Note diluted reading and convert to actual NTU using Table 3, page 8-4. Record actual NTU value.

If actual turbidity is >200NTU send to IAWM lab for TSS analysis.

Less than 200NTU
Record reading and dispose of sample.

Count macroinvertebrates, in sunlight. Record your results on the IAWM field record sheet.
Before You Start

☐ Ensure that the pH bulb of the pH/EC meter is wet
  If dry, pour clean tap water in the bulb and leave overnight to moisten
☐ Calibrate your pH/EC meter (sections A1 & A2)

Checklist

General
☐ Field Record Sheet
☐ Pen/pencil
☐ Personal protective equipment (including eye protection, and gloves)
☐ Clean water for rinsing the equipment
☐ Cotton towel

Flow Rate (Section 1)
☐ 10m tape
☐ Buoyant object
☐ Stopwatch (or watch) with a seconds hand
  (Also used for Nitrates & Phosphates)

Collecting the sample (Section 2)
☐ Sampling pole with net and bottle attachments
  (Also used for macroinvertebrate sample)
☐ Wide mouthed sample bottle

Temperature, pH & EC (Sections 3,4 & 5)
☐ HANNA pH/EC combo meter

Nitrates & Phosphates (Sections 6 & 7)
☐ Microquant Nitrate Kit
☐ Microquant Phosphate Kit
☐ Glass ‘waste chemical’ bottle

Turbidity (Section 8)
☐ Turbidity Tube
☐ Dilution equipment (including syringes, 500mL measuring jug & 2L of distilled water)

Macroinvertebrates (Section 9)
☐ White basin
☐ Plastic spoons/ pipettes
☐ Ice cube tray
☐ 6 clean specimen bottles
☐ Macroinvertebrate identification sheet

Pesticide samples (Section 10)
☐ Pesticide bottle (from IAWM)
☐ Esky & Ice
☐ Permanent marker
1. Flow Rate

Flow rate is used in conjunction with the depth and width of a water body to provide an estimate of the volume of water flowing through a system. This can also be combined with turbidity data to estimate the total amount of suspended solids flowing through the system.

Note: The peak flow of a rain event is the point at which the water reached its maximum height level.

Field record sheet
- 10m tape measure or measuring stick
- Buoyant object
- Stopwatch or watch with a second hand

Sun protection
- Reflective safety vests (if on a road reserve or at night)

Procedure

Channel cross-section (width x depth)
1. Measure (or estimate) the width of the water body in metres.
2. Measure the average depth (metres) of the water body, using a measuring stick.

Water speed (velocity)
1. Measure a 4 metre section of the waterway. Time how long it takes (seconds) for the buoyant object to travel through the 4 metre section.
2. Do this three times using the same 4 metre section.

Note: Each buoyant object needs to be approximately the same size and weight to ensure the flow rate is measured accurately.

Tip: If the water body becomes dry, a permanent depth marker can be installed so that it is easier to read the depth during rain events.
Calculations

a) Water speed (velocity) in m/s = $4\text{m} \div \text{time taken}$.

b) Repeat using the other two values and then calculate the average, which = $(V1 + V2 + V3) \div 3$.

c) Flow rate estimate = width (m) x depth (m) x Av.velocity (m/s)

Tip: Mark the 4m section with pegs so that it can be used next time you want to measure flow.

Units: Velocity - metres per second (m/s).
Flow rate - cubic metres per second (m$^3$/s).

Complete the field record sheet and file it.

3 Clean and rinse all equipment with clean tap water, shake dry.

Store equipment in a protective compartment in the storage box.

Notes:
2. Collecting the water sample

Bucket with strong handle and attached rope - or extension pole and collection bottle for inaccessible areas
Wide mouth sample bottle (1.0L)

Sun protection
Protective footwear
Reflective safety vests (if on a road reserve or at night)

**Procedure**

Take the sample from top 30cm of the water source.

1. Move away from the sampling site (downstream). Collect a small amount of water and rinse the bucket three (3) times, tipping the water onto the bank and not back into the water source.

2. Go upstream to the sampling point, lower the bucket into the water and half fill it (about 5L). This will be adequate water for all tests and will be referred to as the main sample. If the site does not permit easy access, you may need to cast the bucket out into the water, or use the pole and collection bottle. In shallow and slow flowing water be careful not to disturb the sediment on the bottom.

3. Take a 1.0L 'subsample' from the main water sample in a wide mouth container. This subsample will be used to assess water temperature, pH, EC and turbidity. The rest of the water will be used for macroinvertebrate analyses.

4. Store main sample in the shade, where it cannot be contaminated or spilled.

5. If macroinvertebrates are not being assessed, the water sample can be taken directly into the 1L sample bottle.

The main sample should be collected before the net is used for macroinvertebrate sampling, a process which disturbs the site and water quality.
Water samples for pesticide and nutrient analyses should be collected directly into solvent cleaned sample bottles (see section on Pesticide residue sampling in this guide), before macroinvertebrate sampling.

3

Once the tests have been completed, clean all mud and debris from the bucket, rinse 3 times, empty completely.

Store with the rest of the equipment in the storage box.

Using a bucket to sample at a dam with deep mud at the waters edge.

Sampling the centre of a stream using a collection bottle and extension pole.

Collecting a sample directly into the 1L wide mouth sample bottle.
3. Surface water temperature

Water temperature varies with depth. Sudden changes in water temperature can have an adverse effect on the plants and animals in the waterway; including fish reproduction.

This section outlines practical methods to sample surface water temperature only. Recording temperatures at different depths requires more detailed procedures which are not covered in this manual. The IAWM team will assist where temperature recording at different depths is required.

- The temperature must be measured as soon as the water is taken from the stream. Water will warm up quickly while it sits in the sample container.

**Hanna pH/EC combo meter HI98129 (low range)**

Field record sheet

Sun protection

Reflective safety vests (if on a road reserve or at night)

- Do not touch the glass bulb at the base of the meter. Avoid pressing the screen of the pH/EC combo meter.

**Procedure**

1. Use the 1.0L subsample that was taken from the main water sample.
2. Remove protective cover from the base of the meter. Stand cover upright so fluid does not spill.
3. Turn the meter on using the MODE button.
4. Immerse probe in the water sample so that the tip is 5 cm (2 inches) under the water surface.
5. Gently swirl the meter until the reading stabilises (about 30secs).
6. Record your temperature reading on the field record sheet.
7. When temperature has been recorded, remove the meter from the water.
8. Turn the meter off using the MODE button.

Units: °C (degrees Celsius)

- Complete the field record sheet and file it.

3. Wash meter with clean tap water, replace cap and wipe dry.

- Take care when replacing the base of the meter, as excess force may damage the probes.

The pH probe must be kept moist, if the probe remains dry for extended periods of time, the meter will give incorrect readings. Check that the protective cover still contains clean tap water to keep the pH probe moist (do not use distilled water). Replace the cover on the meter. Store upright in a protective box or compartment so fluid cannot escape from probe compartment. Store safely in the storage box.

The Hanna HI98129 combo meter should be calibrated at least once a week (or prior to sampling if meter is being used infrequently). Record the date of calibration and your name on the calibration sheet.

- Tip: If the probe becomes dry, pour clean tap water into the protective base and leave the probe to moisten overnight.

Notes:
Water can be acidic, neutral or alkaline. The degree of water acidity or alkalinity is called pH.
pH of water bodies varies depending on the soil and rock types in the catchment area. pH may also be affected by contaminants in the water. Extreme pH levels will affect the ability of plants to absorb nutrients and may lead to plant death.

**Procedure**

1. Use the 1.0L subsample that was taken from the main sample.
2. Remove protective cover from the base of the meter. Stand cover upright so fluid does not spill.
3. Visually check whether the probe sensor is moist.
4. If the probe is moist, continue with the procedure. If the probe is dry, follow the calibration steps and then proceed.
5. Turn the meter on using the MODE button.
6. Press the SET/ HOLD button until pH can be seen in the top right hand corner.
7. Immerse probe in the water sample so that the tip is 5 cm (2 inches) under the water surface.
8. Gently swirl the meter in the water sample until the pH reading stabilises (30 - 60 secs).
9. Record the pH reading on the field record sheet.
10. If measurements are taken in different samples successively, rinse the probe thoroughly in clean tap water between each test.
11. Turn the meter off using the MODE button.

For healthy freshwater ecosystems, pH should be between 6.5 and 8.5. This is also the optimal range for irrigation water to prevent crop damage or equipment corrosion.

Units: pH scale (where 7 is neutral)

Complete the field record sheet and file it.

3. Wash meter with clean tap water, replace cap and wipe dry.

The pH probe must be kept moist, if the probe remains dry for extended periods of time, the meter will give incorrect readings. Check that the protective cover still contains clean tap water to keep the pH probe moist (do not use distilled water). Replace the cover on the meter. Store upright in a protective box or compartment so fluid cannot escape from probe compartment. Store safely in the storage box.

The Hanna HI98129 combo meter should be calibrated at least once a week (or prior to sampling if meter is being used infrequently).
5. Electrical Conductivity (EC)

Electrical conductivity (EC) is an indicator of the concentration of salts in the water. Water containing excess salts can damage the structure of soil (if used for irrigation purposes) and can also affect the growth of plants, and animals (refer to the table on the following page for specific values).

Hanna pH/EC combo meter HI98129 (low range)
Field record sheet

Sun protection (if EC test is done on-site)
Reflective safety vests (if on a road reserve or at night)

Procedure

1. Use the 1.0L subsample that was taken from the main sample.
2. Remove protective cover from the base of the meter. Stand cover upright so fluid does not spill.

Do not touch the glass bulb at the base of the meter. Avoid pressing the screen of the pH/EC combo meter.

3. Turn the meter on using the MODE button.
4. Press the SET/HOLD button until μS can be seen in the top right hand corner.
5. Immerse probe in the water sample so that the tip is 5 cm (2 inches) under the water surface.
6. Wait until the EC reading stabilises (30 - 60secs).
7. Record the EC value on the field record sheet.
8. If measuring a number of different water samples at the same time, thoroughly rinse the probe in tap water between each test.
9. Turn the meter off using the MODE button.
Units: micro Siemens per centimetre (µS/cm)

Complete the field record sheet and file it.

Wash meter with clean tap water, replace cap and wipe dry.

The pH probe must be kept moist, if the probe remains dry for extended periods of time, the meter will give incorrect readings. Check that the protective cover still contains clean tap water to keep the pH probe moist (do not use distilled water). Replace the cover on the meter. Store upright in a protective box or compartment so fluid cannot escape from probe compartment. Store safely in the storage box.

The Hanna HI98129 combo meter should be calibrated at least once a week (or prior to sampling if meter is being used infrequently).
Nitrates

Nitrogen (N) is an important plant nutrient. Plants absorb N as both nitrate (NO$_3^-$) and ammonium (NH$_4^+$). Nitrogenous fertilisers are used extensively in crops and urban areas, and some of this applied N enters waterways as nitrate (NO$_3^-$). This is not only wasteful, but excess nitrates in water can contribute to algal blooms (such as blue-green algae).

Microquant Nitrate-N kit (5-90mg/L 1.14771.0001)
Field record sheet
Glass ‘waste chemical’ bottle
Wrist watch (with seconds hand)
Distilled water (1 litre) for rinsing equipment

Sun protection (if test is done outside)
Reflective safety vests (if on a road reserve or at night)
Protective clothing or apron
Disposable gloves; safety glasses

Procedure

1. Put on disposable gloves and protective eye wear.
2. Place colour wheel on a firm, even surface.

The reagents in this kit are corrosive. Wear personal protective equipment (PPE). Observe all safety directions for use, and dispose of waste properly.
3. Ensure that the two glass tubes in the Microquant kit are completely dry. Place them in the 2 compartments of the colour wheel and remove their caps.

**Info** When facing the colour wheel, the original sample water is on the left and the treated water for analysis is on the right.

4. Carefully place 2 level spoons of the NO$_3$-1A powder in the right-hand tube. Replace the NO$_3$-1A powder cap and put the container back into the kit.

5. Hold the NO$_3$-2A upright and remove the containers’ cap.

6. Using a dry 6mL syringe, insert the tip of the syringe into the top of the NO$_3$-2A bottle. Invert the NO$_3$-2A container (so that the bottle is now upside down) and carefully extract 5mL of the solution. Gently depress the plunger to return any air bubbles to the container, and then draw back more solution so that exactly 5mL is measured. Turn the NO$_3$-2A container upright and then remove the syringe. Recap the NO$_3$-2A and return it to the kit.

7. Carefully and slowly (to avoid splashing) place the 5mL of NO$_3$-2A in the right-hand tube (with the powder). Put the cap onto the tube and tighten it (but do not over-tighten). Shake the tube vigorously to dissolve the NO$_3$-1A.
8. Use the 1.0L subsample that was taken from the main sample. If the sample has been standing for longer than 30 seconds, remix it thoroughly by shaking it vigorously.

9. Rinse the 6mL syringe 3 times with sample water.

10. **Preparing the ‘Control’ for comparison (left side tube).**
    Shake the water sample. Fill the rinsed syringe with 6mL of sample water. Place the 6mL of water into the left-hand tube. Place this tube into the left hand side of the colour wheel. This tube will be the control used to compare the test sample.

11. **Preparing the treated Sample (right side tube).**
    Rinse the 3mL syringe 3 times with sample water, then slowly (and carefully!) draw up and place 1.5mL of the sample water into the right-hand tube and replace the cap firmly. Place the tube into the right hand side of the colour wheel. Mix by gently shaking the tube for 10 secs.

    The sample tube will heat up. Caution is required whilst mixing the water in the reagents. Hold the tube by the lid. Have at least 5L of clean water available for use in the event of a spill.

12. Let the tubes stand for 10 minutes to allow the reaction to complete.

13. After 10 minutes exactly, hold the colour wheel (with the tubes in place) at arms length and rotate the colour wheel until the closest match is between the two tubes is achieved. This must be done in a good light source and use the white laminated insert in this guide as a background. **Do not** do this comparison in dim light or at night.

14. Turn the wheel until the closest colour match appears.

15. Check and record the nitrate value (mg/L) on the field record sheet.
Nitrate concentrations greater than 7.5 mg/L are likely to have adverse effects on freshwater ecosystems, and indicate that excessive nutrients are moving into the water.

**Units:** milligrams per litre (mg/L)

-vous should be analysed immediately. If it cannot be analysed immediately after collection, fill the bottle so there is no air space at the top. It can then be stored in the refrigerator (or on ice) for up to 24 hours. **Do not freeze the sample.**

Pour all liquid waste products into a glass bottle labelled ‘waste chemical’, and dispose of properly. Wash all equipment in a phosphate free detergent (e.g. bushland), triple rinse with distilled water and allow to dry completely.

Ensure that the equipment is dry, place in the microquant kit and store in the storage box.

Waste chemical can be disposed of down a sink or in an outside area with copious amounts of water.

If you are using a septic system, **do not** pour the chemicals down the sink.
Phosphorus (P) forms and utilisation in plants are complex. P is mostly absorbed by plants as orthophosphate ions (\(H_2PO_4^-\) and \(HPO_4^{2-}\)) which are present in the soil solution. P is adsorbed onto clays, so the levels of P in water are often related to the turbidity and background levels of P in the soil. Excess phosphates can contribute to algal blooms (such as blue-green algae).

**Microquant Phosphate (0.2 – 3mg/L 1.14846.00010) kit**
- Field record sheet
- Glass ‘waste chemical’ bottle
- Wrist watch (with seconds hand)
- Distilled water (1 litre) for rinsing equipment

**Sun protection (if P test is done on-site)**
- Reflective safety vests (if on a road reserve or at night)
- Protective clothing or apron
- Disposable gloves; safety glasses

**Procedure**

1. Put on disposable gloves and protective eye wear.
2. Use the 1.0L subsample that was taken from the main sample.
3. Place colour wheel on a firm, even surface with the two glass tubes in the compartments of the colour wheel.
4. If the sample has been standing for longer than 30 seconds since it was collected, remix thoroughly by shaking it vigorously.
When facing the colour wheel, the untreated water sample is on the left side and the treated sample for analysis is on the right side.

5. Rinse the 6mL syringe three (3) times with the sample water.

6. Use the syringe to place 6mL of the sample water in each of the tubes.

7. Put the lid on the left-hand tube and place it in the left compartment of the colour wheel. This is the ‘control’ sample used to compare with the treated sample for analysis.

The reagents in this kit are corrosive. Wear personal protective equipment (PPE). Observe all safety directions for use, and dispose of waste properly.

8. Squeeze 5 drops of P-1A in the right-hand tube. Recap and place back in kit. Screw the cap on the glass tube and shake the solution to mix.

9. Reopen the treated sample tube and place one (1) level spoon of P-2A in the tube. Recap and place back in kit. Replace tube cap and shake until the P-2A has completely dissolved. Place this treated tube in the right side compartment of the colour wheel.
10. Let the tubes stand for one (1) minute until the reaction is complete.

11. Compare the colours of the two tubes by rotating the colour wheel until the closest colour match is achieved. This must be done in good light using the white laminated insert as a background. Do not do this comparison in dim light or at night.

![Diagram of increasing total phosphate levels on freshwater ecosystems and long term effects if irrigation water contains elevated levels of phosphates.](image)

13. Record the phosphate value (mg/L) on the field record sheet.

Units: milligrams per litre (mg/L)

Complete the field record sheet and file it.

Water should be analysed immediately. If it cannot be analysed immediately after collection, the bottle should be filled so there is no air space at the top. It can then be stored in the refrigerator (or on ice) for up to 24 hours. Do not freeze the sample.

3 Pour all waste products into a glass bottle labelled ‘waste chemical’, and dispose of properly. Wash all equipment in a phosphate free detergent (e.g. bushland), triple rinse with distilled water and allow to dry completely.
Ensure that the equipment is dry, replace in the microquant kit and store in the storage box.

Waste chemical can be disposed of down a sink or in an outside area with copious amounts of water.

If you are using a septic system, **do not** pour the chemicals down the sink.

Notes:
8. Turbidity

Turbidity is a measure of the transparency of water due to suspended and dissolved particles. Increasing turbidity reduces the distance that light can penetrate into water. Higher turbidity levels can increase water temperature and decrease photosynthesis of submerged plants.

Turbidity levels provide an indicator of soil loss in the catchment. Therefore turbidity and total suspended solids are related. Turbidity is not a direct measure of the amount of Total Suspended Solids (TSS), but is strongly correlated.

- Vendart Turbidity Tube 7519
- Field record sheet
- Plastic 1.0L sample bottle (wide mouthed)

Sun protection
Reflective safety vests (if on a road reserve or at night)

Turbidity should be assessed as soon as the sample is taken. If sample is not assessed immediately (within 30 seconds) after being taken, the sample will need to be shaken thoroughly to remix sediment. Turbidity tubes cannot be used in dim or artificial light conditions, at night or while wearing sunglasses.

Procedure

1. Use the 1.0L subsample that was taken from the main sample.
2. Hold the turbidity tube at midpoint of the tube (between your thumb and forefinger) and at arms length.
3. Turn so that your back is to the sun and the turbidity tube is in the shade of your body.
4. Place the white laminated insert (from this manual) on the ground in front of you as a background for the turbidity tube readings.
Remove any excess algae before taking the reading.

5. Shake your water sample vigorously. Pour the sample water into the tube until the 3 lines become hazy, but still distinguishable as three separate lines (see examples below).

6. Look at the scale on the side of the turbidity tube and record your result to the nearest value.

The Vendart turbidity tube has a logarithmic scale. Record the closest value that is marked on the tube and do not try to ‘estimate’ an intermediate value.

7. If the value is >200 NTU, a dilution will be necessary - refer to the next section for details on how to dilute the sample. It is also recommended that the sample be dried down to assess the Total Suspended Solids (TSS). Refer to guidelines for assessing TSS in this manual.

Units: Nephelometric Turbidity Units (NTU)

 пенетrometer

Wavy lines in bottom of turbidity tube before pouring sample water in.
Wavy lines just visible - Stop adding sample water and take a reading.
Wavy lines not distinguishable as three separate lines - pour out some water.

Complete the field record sheet and file it.

3. Wash turbidity tube with clean tap water, drain completely.

Store the assembled turbidity tube in a clean cloth and storage box so that the perspex tube does not get scratched.
Dilutions for turbidity samples

Vendart Turbidity tube 7519
500mL measuring jug, 60mL syringe, 5mL syringe
2 litres distilled water
Field record sheet

Sun protection (if dilutions are done on-site)

Procedure

1. Check your turbidity tube reading, and use the table below to determine the appropriate dilution process.

<table>
<thead>
<tr>
<th>Turbidity tube reading NTU</th>
<th>Dilution code</th>
<th>Volume of Sample water (mL)</th>
<th>Volume of Distilled Water (mL)</th>
<th>Total mixed volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 or less</td>
<td>Do not dilute. Read directly from the turbidity tube.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200-300</td>
<td>A</td>
<td>20</td>
<td>200</td>
<td>220</td>
</tr>
<tr>
<td>300-400</td>
<td>B</td>
<td>10</td>
<td>200</td>
<td>210</td>
</tr>
<tr>
<td>&gt;400</td>
<td>C</td>
<td>5</td>
<td>200</td>
<td>205</td>
</tr>
</tbody>
</table>

2. Shake the sample vigorously to remix the sediment.
3. Use a syringe to extract the specified volume of sample from the centre of the sample bottle (not the top). Put this sample water into the 500mL measuring jug.
4. Measure the required amount of distilled water using the 60mL syringe. Add this to the sample water that is already in the measuring jug and mix thoroughly.
5. Measure the turbidity of the diluted sample using the turbidity tube. If the reading is less than 200 NTU, go to 7 and calculate the actual turbidity value from Table 3.
6. If you used dilution C, and the turbidity reading is still >200 NTU - rinse the jug and the turbidity tube and follow dilution process D as shown in Table 2.
Table 2: Additional dilution for very turbid samples

<table>
<thead>
<tr>
<th>Dilution Process</th>
<th>Sample water (mL)</th>
<th>Distilled Water (mL)</th>
<th>Total (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>5</td>
<td>500</td>
<td>505</td>
</tr>
</tbody>
</table>

7. Go to table 3 to calculate actual turbidity.

Table 3: Conversion table from diluted readings to actual NTU

<table>
<thead>
<tr>
<th>Diluted turbidity reading NTU</th>
<th>Dilution used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>15</td>
<td>165</td>
</tr>
<tr>
<td>20</td>
<td>220</td>
</tr>
<tr>
<td>30</td>
<td>330</td>
</tr>
<tr>
<td>40</td>
<td>440</td>
</tr>
<tr>
<td>50</td>
<td>550</td>
</tr>
<tr>
<td>60</td>
<td>660</td>
</tr>
<tr>
<td>80</td>
<td>880</td>
</tr>
<tr>
<td>100</td>
<td>1100</td>
</tr>
<tr>
<td>150</td>
<td>1650</td>
</tr>
<tr>
<td>200</td>
<td>2200</td>
</tr>
</tbody>
</table>

Actual turbidity readings

8. If the sample is greater than 200NTU, send the sample to the laboratory for Total Suspended Solids (TSS) to be assessed.

Units: Nephelometric Turbidity Units (NTU)

Complete the field record sheet and file it.

3 Rinse all the equipment with clean tap water and dry.

Store the turbidity tube in a storage box so that the perspex tube does not get scratched.
Total Suspended Solids (TSS)

TSS is a measure of dissolved and suspended solids in water. TSS results provide an assessment of soil loss. Phosphorus and chemical residues attach to soil particles, so water with significant TSS may also contain these contaminants.

Measuring TSS requires weighing balances (scales) that are accurate to 1.0 microgram (0.01g), and dehumidifying ovens that can dry down the water samples. The IAWM team will assist with this procedure.

ℹ️ TSS does not need to be done if turbidity is <200NTU. Test the turbidity using the Vendart turbidity tube before proceeding.

🛠️ Sample drying bottles that are suitable for oven use
Electronic scales accurate to 0.01g
Commercial dehumidifying drying oven
Laboratory batch recording sheet

⚠️ Safety glasses and gloves (whilst handling hot samples)

📚 Laboratory procedure
1. Check that the sample has been assessed for turbidity, and that it is in a numbered oven proof container.
2. Remove the container lid. Weigh the sample and container and record the date, time, container reference number and weight (grams) on the laboratory batch record sheet.
3. Place the container in the drying oven (without the lid).
4. Set the oven temperature to 100°C and fan ON. The sample should take between 24-48 hours to dry down depending on oven performance.
5. Check the sample at 24 hours. Remove if completely dry. Otherwise, continue to check the sample at 12 hour intervals until completely dried down.

ℹ️ Containers may be very hot after removal from the ovens. Handle with care.
The oven controls may need to be adjusted if the samples are taking longer than 48 hours to dry down.

6. Reweigh the sample bottle and its dry contents (without the lid). Record the date and dried weight (grams) against the container reference number on the laboratory batch record sheet.

7. Scrub the sample bottles thoroughly using phosphate-free detergent. Triple rinse with distilled water and dry properly.

8. Reweigh dry, empty container (without the lid) and record container weight.

9. Calculate the TSS using the following formula:

\[
TSS \text{ (grams/L)} = \frac{\text{Dry weight (g)} - \text{Container weight (g)}}{\left(\text{Initial wet weight (g)} - \text{Container weight (g)}\right) \times 1000}
\]

Units: grams per litre (g/L)

- Complete the laboratory batch record sheet and file it.
- 15 minutes preparation and weighing time
- 24-48 hrs drying time

3. Scrub the sample bottle lids thoroughly using phosphate-free detergent. Triple rinse with distilled water and dry properly (bottles should already be clean and dry).

- Store the clean dry sample bottles in the storage box with the lids loosely screwed on to avoid contamination.

Notes:
9. Macroinvertebrates

**Sampling net** (eg. Vendart V117)
**Extension pole** (eg. Vendart V48E)
**White basin** (washing up basin), plastic spoon, pipette, ice cube tray(s), 6 clean specimen bottles
**Macroinvertebrate identification sheet**
**Field record sheet**

**Sun protection**
**Reflective safety vests** (if on a road reserve or at night)

**Procedure**

Macroinvertebrate sampling should only be done after a water sample has been taken for temperature, pH, EC, turbidity, nutrient or pesticide analysis.

1. Within 2m of the site marker, identify the most ideal habitat for macroinvertebrates. This is an area with edge vegetation (eg. grasses, water weeds) and limited soil erosion.
2. Fill the white basin to a depth of 2-4 cm from the bucket.
3. Use the net to agitate the water weed at the edge of water body by moving the net horizontally back and forth. This creates a small current which dislodges the creatures from grass and sticks. The creatures are captured as the net is turned back to meet the washing water. Carry this action out in an area of about 2m$^2$. Walk up and down and continue this motion for 2 minutes. Do not disturb the bottom silt unnecessarily or the sample may become too dirty to see the macroinvertebrates.
4. Gently empty the contents of the net into the white basin. Leave the macroinvertebrate sample to settle while you are testing the subsample for turbidity, pH, EC, N, P etc. (if applicable) - then follow the guidelines to assess macroinvertebrates.

Do not use this disturbed water for temperature, pH, turbidity, EC, pesticide or nutrient analyses. Use the undisturbed subsample that was initially taken.

5. Remove any large sticks or weed and let the sample settle for 240 minutes.
minutes, taking care not to remove any smaller weeds or debris that may have creatures clinging to them.

6. Use the spoon to gently place one of each type of creature (with a small amount of water) into individual sections of the ice cube tray.

7. Use these samples, and the identification chart, as references to identify each macroinvertebrate in the white dish.

8. Separate all the macroinvertebrates in your sample and count total numbers of each type.

9. Record the macroinvertebrate counts on the field record sheet.

If you find a creature that you are unable to identify, count the number in the sample, put one in a specimen bottle that is labelled with date, time, sample number, person who took the sample, and site number. Ask an IAWM technical officer for assistance (note this on the field record sheet). If the specimen is being held for longer than 12 hours, preserve it in a methylated spirits:water mix (70:30).

10. When you have finished looking at your sample, return the creatures to the water body.

Units: Counts of each of the macroinvertebrates that are present

Complete the field record sheet and file it.

Clean and rinse all equipment with tap water, shake dry.

Store in storage box.

Notes:
Macroinvertebrate identification

- **Water flea x4 (Daphnia)**: 0.5mm
- **Water flea x4 (Cyclops)**: 0.5mm
- **Water mite (bright red or blue-grey)**: 0.5-3mm
- **Midge larva**: 10-15mm
- **Back swimmer adult**: 4-7mm
- **Threadworm**: 4-8mm
- **Mosquito larva**: 5-10mm
- **Leech**: 8-20mm
- **Snail**: 3-10mm
- **Boatman adult**: 5-8mm
**Macroinvertebrates**

- **Damselfly larva**
  - 7-20mm

- **Mayfly larvae**
  - 5-18mm

- **Caddisfly larvae**
  - 4-30mm

- **Caddisfly larva inside a larval case made from small sticks or stones.**

- **Caddisfly larva without larval case.**

- **Caddisfly larval case made from small stones or sand grains.**
Beetle larvae
10-35mm

(Dytiscidae)

(Berosus)

Horsefly larvae
10-20mm

Soldierfly larvae
10-20mm

Beetles 5-20mm

(Aeshnidae)

(Corduliidae)

Dragonfly nymphs
5-40mm
All creatures on this page are actual size

Freshwater shrimp

Crab

Water scorpion adults

(Ranatra)

(Laccotrephes)
10. Pesticide & Nutrient samples

Pesticide contaminants may include industrial chemicals, petroleum products, insecticides, herbicides, fungicides, animal health products or other chemical residues. These may have a direct, acute effect (e.g. a fish kill), a cumulative effect (where levels accumulate over time or in the food chain) or a long term effect (e.g. long term herbicide effects on aquatic plants).

Pesticide residue analyses have to be done at specialised laboratories so the IAWM team will assist with this procedure. Detailed pesticide and nutrient analyses are costly, so sampling should be done strategically. For example: consider sampling when there are changes in the pesticides being used, during major rainfall events after pesticide application or if the routine testing (e.g. macroinvertebrates) indicates a problem.

Clean solvent washed pesticide sample bottle (IAWM can provide these)
Esky and ice
Field record sheet
Permanent marker

Sun protection
Reflective safety vests (if on a road reserve or at night)

If possible, advise the IAWM team that you are taking a pesticide sample, so that they can prepare storage and dispatch details and advise the analytical laboratory.

Collecting the sample for analysis

1. Collect a sample directly into the sample bottle from the water body.
2. Hold the mouth of the bottle upstream while collecting the sample. Fill the bottle completely but then tip some out so that about 75% (3/4) remains. This allows room to expand when the sample is being chilled, and reduces the risk of the bottle cracking.
3. Seal the bottle and label it with the sample code, site name, date, time and person who took the sample.
4. Record the details on the field sheet. This should include sample code, site, date, time, person doing the sample and details of whether the sample was from tailwater, drainage, natural flows or stormwater.
5. Wipe the bottle and place in an esky filled with ice.
6. Deliver the chilled sample to the IAWM office to be sent for analysis.
7. Record the sample details and the types of analyses that are required on a new laboratory analysis sheet. This sheet should be copied and one copy should accompany the samples when they are dispatched for analysis.

Units: µg/L (Micrograms per litre)

Different units may be used for specific analyses. Refer to the test results for each pesticide that was specified in the analysis.

Complete the field record sheet and laboratory analysis sheet file both.

3 Not applicable.

Not applicable.

Notes:
A1. Hanna HI98129 calibration - pH

You must calibrate your equipment regularly. Equipment that is not calibrated regularly will give incorrect readings.

Calibration of the Hanna HI98219 meter involves using a solution of a known value to check the 'cell constant' in the meter.

A two point calibration is carried out for better accuracy. Calibration solutions of pH 7.01 and 10.01 (for a two point calibration) are used in areas with alkaline soils.

Hanna pH/EC combo meter HI98219 (low range)
Calibration record sheet
Hanna 7.01 and 10.01 calibration sachets (one of each)

Sun protection
Reflective safety vests (if on a road reserve or at night)

Procedure

1. Check the expiry date of the calibration solution. If old, do not use.
2. Open one sachet of pH 7.01 and one sachet of pH 10.01 buffer solution.
3. Stand the two sachets upright in a container to avoid spilling the contents.
4. Remove protective cover from the base of the meter. Stand cover upright so fluid does not spill.
5. Rinse the base of the meter in tap water. Wipe dry with a tissue.
6. Press the MODE button to turn the meter on.
7. Press the SET/HOLD button until pH can be seen in the top right hand corner of the screen.
8. Take a reading from each of the buffer solution and record in the 'Pre' column of the Calibration Record sheet. Rinse and wipe meter.
9. Press the MODE button again firmly. Do not release the button until CAL is displayed on the screen. Release button immediately to commence calibration.
If the MODE button is held for too long, TEMP will appear on the screen. Press the MODE button repeatedly until OFF is displayed, then repeat from step 5.

10. Place the meter directly into the pH 7.01 sachet when this screen is displayed.

11. Remove the meter from pH 7.01 solution when the second screen is displayed, rinse in tap water and wipe dry with a tissue.

12. Place the meter in the pH 10.01 sachet until CAL stops flashing and the temperature value can be seen in the bottom right corner of the screen.

13. Remove the meter and rinse with tap water when calibration is complete. The calibrated meter is now ready to take readings or be stored.

14. Take a second reading from each of the buffer solutions and record the value in the ‘Post’ column on the calibration record sheet.

Complete the calibration sheet and file.

Dispose of calibration fluid, tissues.

The pH probe must be kept moist, if the probe remains dry for extended periods of time, the meter will give incorrect readings. Check that the protective cover still contains clean water to keep the pH probe moist. Replace the cover on the meter. Store upright in a protective box or compartment so fluid cannot escape from probe compartment. Store safely in the tote box.

Tip: If the probe becomes dry, pour clean tap water into the protective base and leave the probe to moisten overnight.
Calibrating your equipment is extremely important. Equipment that is not calibrated regularly will give incorrect readings.

Calibration of the Hanna HI98219 meter is a process where a solution of a known value is used to adjust the ‘cell constant’ in the meter. A solution of $1413\, \mu S$ ($\mu S = \text{microSiemens}$) is used to calibrate the EC function of the Hanna HI98219 meter.

**Procedure**

1. Open a sachet of Hanna $1413\, \mu S$ buffer solution.
2. Stand it upright in a container to avoid spilling the contents.
3. Remove protective cover from the base of the meter. Stand cover upright so fluid does not spill.
4. Rinse the base of the meter in tap water. Wipe dry with a tissue.
5. Press the MODE button to turn the meter on.
6. Press the SET/HOLD button until $\mu S$ can be seen in the top right hand corner of the screen.
7. Take a reading from the buffer solution and record in the ‘Pre’ column of the Calibration Record sheet. Rinse and wipe meter.
8. Press the MODE button again firmly. Do not release the button until CAL is displayed on the screen. Release button immediately to commence calibration.

**Note:** If the MODE button is held for too long, TEMP will appear on the screen. Press the MODE button repeatedly until OFF is displayed, then repeat from step 5.
9. Place the meter directly into the $1413\mu S$ sachet when the following screen is displayed.

![Meter Display](image)

10. When CAL stops flashing and the temperature value can be seen, remove meter and rinse with tap water. The calibrated meter is ready to take readings or be stored.

11. Take a second reading of the buffer solution and record the value in the ‘Post’ column of the calibration record sheet.

- If the EC calibration takes longer than 60 seconds, remove the meter from the sachet. Run a clean damp cloth between the prongs of the EC component to clean off any residue. Repeat steps 5-8.

- Complete the calibration sheet and file properly.

3. Disposal of calibration fluid, tissues.

- The pH probe must be kept moist, if the probe remains dry for extended periods of time, the meter will give incorrect readings. Check that the protective cover still contains clean water to keep the pH probe moist. Replace the cover on the meter. Store **upright** in a protective box or compartment so fluid cannot escape from probe compartment. Store safely in the tote box.

- Tip: If the probe becomes dry, pour clean tap water into the protective base and leave the probe to moisten overnight.