module 2

WATERWATCH AUSTRALIA NATIONAL TECHNICAL MANUAL

Getting Started: the team, monitoring plan and site

Module 2 – Getting Started: the team, monitoring plan and site
Waterwatch Australia National Technical Manual
by the Waterwatch Australia Steering Committee
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Preface

The *Waterwatch Australia National Technical Manual* was prepared by the Waterwatch Australia Steering Committee to provide guidance and technical support to the Waterwatch community monitoring network throughout Australia. The content has been gathered from a range of publications, including the existing State Waterwatch Technical Manuals. The guidelines and information reproduced in this document have been agreed by the members of the committee based on their knowledge and experience in coordinating community monitoring programs in Australia with advice from the scientific community.

The Manual has been published as a series of modules. Each module is a stand-alone document addressing an important aspect of community waterway monitoring. The following modules are available in the Manual:

1. Background
2. Getting Started: the team, monitoring plan and site (this module)
3. Biological Parameters
4. Physical and Chemical Parameters
5. Data… Information… Action!
6. Waterwatch and Schools
7. Estuarine Monitoring
8. Groundwater Monitoring

Contents

What is monitoring?

Water quality monitoring is a means of gathering information about the condition — or 'health' — of waterbodies. It consists of observations or measurements of the characteristics of the water itself, of the bed and banks of the waterbody, and also of the aquatic life and vegetation in and around the water.

Monitoring can be low-key and relatively simple — for example, taking photographs — or more ambitious. It can rely on an individual, or a whole team may get involved, taking regular measurements and samples, and arranging precise analyses of collected materials. The important thing is to monitor at defined intervals (preferably over a large number of months or years), in accordance with an agreed plan, recording the observations and results so they can be shared.

How and what you monitor depends on the issues affecting your waterbody and why you are gathering information about it. The information from your monitoring will help you describe the health of the waterway and understand changes that may occur. It can also be used to initiate action in the catchment to benefit the waterbody.

Generally, a single issue will trigger the interest of individuals and groups, but issues are often related. One way to identify issues is to ask questions about uses, values and threats. The sorts of questions you could ask are:

- What factors affect the health of the waterbody?
- How is the waterbody used now?
- How would you like the waterbody to be used in the future?
- What are the waterbody's special qualities (values)?
- Are there any threats to the waterbody's uses and values?
- Have special attributes of the waterbody been lost that should be restored?

Questions of this sort can be discussed with the whole community and the waterbody's stakeholders — the people who are influenced by or have influence over water at this site.

Monitoring is important for a variety of reasons. For instance:

- it can reveal how healthy our waterways are;
- it helps us understand the effects of our activities — good or bad; and
- the data collected during monitoring can be useful or essential for good management decisions and later for evaluating the effects of these decisions.

A team approach

It is usually best to form a group or team to do the monitoring. The group activity promotes community involvement, to improve and protect the condition of our waterways. This is important because a waterway or waterbody is a shared resource, and there will be many people who care what happens to it.

Potential team partners include schools, Landcare or conservation groups, community groups, service clubs, industry, local businesses, State Government agencies, catchment boards, local government and interested individuals.

Through a team approach, you can spread the workload. A team has more contacts than an individual, and can more easily collect local knowledge and the oral history of the waterbody. A team can gain access to the expertise and resources of local authorities concerned with water issues by inviting them to join. Conversely, local authorities can benefit from your monitoring work and from the greater understanding spread through the community. With teamwork, the monitoring project is more likely to be kept on the schedule chosen for it and to be continued for a useful number of months or years.

Start by contacting your State Waterwatch facilitator who will put you in touch with your local or regional coordinator. They will be able to advise you on how to get started. You will have access to the expertise of Waterwatch across Australia, and assistance and guidance as well as training sessions. You will be able to link with other monitoring groups and water authorities within the catchment.

Goals and objectives

As mentioned already, the team needs a reason for monitoring. The reasons chosen are often based on the issues identified for particular waterbodies. Other reasons are given in the box on the next page.

Once you have a reason for monitoring, your team can form a specific objective — for example, to collect the information needed to achieve a set of individual goals.

So, the issues provide the reason for monitoring, and the objective then is to take the steps necessary to gain one or more goals.

In one real-life example, the Goulburn–Broken Catchment Management Authority (Victoria) called in Waterwatch to provide event monitoring after high rainfall events along the Yea River. The Authority monitored monthly to provide some information, but it was most interested in data collected after rainfall. Rain increases turbidity by washing soil, nutrients and litter into a waterway. Finding out where exactly these

Common goals for monitoring

- Identify degraded sites.
- Determine the impacts of land uses.
- Identify water uses, users, diversions and stream obstructions, and barriers to fish movement.
- Form a snapshot of physical and riparian condition to benchmark future changes.
- Screen for contamination and identify sources.
- Identify the effectiveness of contamination (or pollution) controls and river restoration activities, e.g. replanting riparian vegetation.
- Identify water quality trends.
- Determine whether water quality meets minimum standards for the values and uses desired by the community, e.g. recreation or ecologically healthy rivers.
- Show government officials that the local community cares about the condition and management of its water resources.
- Educate the local community and encourage stewardship of the environment.
- Provide students with skills, experience and understanding of the methods of environmental science.

sediment loads come from was seen as essential in order to implement best practice management in the catchment. Here, the issue is the increased turbidity and litter in the river after rainfall, and the reason for monitoring is to find out the sources of the sediment and litter.

The goal of the monitoring is to start using best practice management, particularly in the areas supplying the river's sediment and litter loads. The team's overall objective then is to achieve certain goals, by monitoring chosen physical, chemical and biological characteristics of the water at chosen times and places, both before and after the cause has been removed.

Here is a second example of monitoring goals and objectives. Your State may have classified its rivers according to their most important uses and values, and established goals for water quality and a list of conditions needed to maintain those uses and values. For example, rivers that provide drinking water must be kept free of contaminants (it is important to note that the classifications are goals to be achieved; they do not necessarily describe present conditions). Your team's monitoring objective here might be to identify sources of contaminants that are lowering a local river's classification.

Public workshops, river walks and local history are useful sources of information from which to identify issues associated with your waterbody and define your objectives in monitoring it. In addition to telling you about the river, these activities serve to build a base of support for your plans. When all viewpoints are heard and respected, the result can be a strong sense of collaboration between partners.

Once your group knows the issues facing the waterbody or waterway, you should develop a shared vision of its future, which will be your goal.

Your reasons for monitoring will guide your answers to all other choices, so it is worth considering these carefully. By choosing your question and goals carefully you will avoid difficulties such as:

- solving the wrong problem;
- collecting irrelevant data;
- asking a question in such a way that no solution is possible; or
- accepting the wrong solution before understanding the problem.

During group discussions, you will progressively fine-tune the question/objective for monitoring. In the end, the goals and objectives you tackle should:

- be specific;
- say what is to be measured;
- be achievable given the skills of the group and resources available; and
- indicate when monitoring will be completed or if it is to continue.

Regional Waterwatch groups may identify several complementary goals and objectives for monitoring, which match the individual needs of schools, Landcare and community groups, local government and others.

It is important that your goals and objectives are public, and that everyone involved knows what they are. This is the key to involving others and sustaining group membership.

The next step for the group is to begin preparing a monitoring plan. As you consider the questions that underlie your group's monitoring plan, you will progressively fine-tune the objectives for monitoring.

The monitoring plan

It is most important to prepare a monitoring plan* for your chosen waterway. The plan will describe where, what, why, how and when you will be monitoring, and who will be doing it.

Share the monitoring plan with the people you expect to use your information, and with your Waterwatch group members. If you seek sponsorship (for equipment or other purposes — see the fact sheet called *Waterwatch Sponsorship Guidelines*), then potential sponsors will be interested in the plan as well. Your monitoring plan should be developed in consultation with your local or regional Waterwatch coordinator as they can provide technical advice, training and support.

It is important to plan carefully because the results from monitoring will tell you and your local community whether action is needed in your catchment. The plan will help you to:

- avoid spending a lot of time and money on equipment that is not suitable for your purpose;
- conduct the right tests in the right places;
- answer the questions you asked; and
- make your data more usable because others will know the quality of it.

* More guidance on water quality monitoring can be found in *Australian Guidelines for Water Quality Monitoring and Reporting* (ANZECC/ARMCANZ 2000).

Eleven questions

A monitoring plan is built around eleven questions:

Q1 Why are you monitoring?

Q2 Who will use your data?

Q3 How will the data be used?

Q4 What will you monitor?

Q5 What data quality do you want?

Q6 What methods will you use?

Q7 Where will you monitor?

Q8 When and how often will you monitor?

Q9 Who will be involved and how?

Q10 How will the data be managed and reported?

Q11 How will you ensure your data are credible?

These questions are not easy to answer. Start by establishing a planning committee composed of your coordinator, key group members, scientific advisers, supporters and data users. The 'General Guidelines for Monitoring' (on page 20) and the 'Short Monitoring Plan' (on page 24) can be used to help you make the necessary decisions. Write your answers in the spaces provided, or on a copy, and keep the completed plan as a record of your decisions. Your plan will provide a solid foundation if you want to develop it further. An example monitoring plan is shown on pages 16–19.

To be successful in the long-run, the group must be prepared to rethink and revise the monitoring plan and the objectives several times, as more information is found out about the condition of the waterbody. Even more revisions to the plan and objectives can be expected after the team has begun to collect data. For example, your group may find that a method is not producing data of high enough quality, or that data collection is costing too much, or that something else needs to be monitored.

Q1 Why are you monitoring?

The first step in planning is to state why you want to monitor. Answers may vary (see the Common goals for monitoring box on page 2). Your reasons for monitoring will determine how detailed your monitoring plan needs to be. They will also guide the degree of quality control and assessment your monitoring program will need.

Q2 Who will use your data?

Knowing who will use the data or information your team collects is helpful in developing a successful Waterwatch program. Some potential data users are:

- Waterwatch members;
- teachers and students;
- environmental organisations;
- local planning officers in councils;
- government departments;
- parks and wildlife staff;
- state or local government water quality analysts; and
- universities and other educational institutions.

While you are planning the Waterwatch monitoring project, you should work with your local coordinator to establish as many links as possible with potential users of your data and ask what data they need. Find out from potential users the circumstances under which they will use your information, and invite their participation in planning to monitor.

Q3 How will the data be used?

For some groups, the data may not have a specific purpose. Simply involving young children and adults alike in collecting data, for example, is an effective way to raise awareness about the importance of healthy waterways.

For other groups, the data may be needed for specific purposes, such as:

- developing a catchment management plan;
- measuring the effectiveness of river restoration work;
- State of the Environment reporting;
- screening waters for potential problems;
- gathering baseline information about the state of the river; and/or
- monitoring of regional water quality standards and targets.

You should find out what will make your data suitable for their intended use. This will help determine the kind of data needed, and the level of effort required to collect, analyse and report them. For example, government planning agencies require data that have been gathered using high levels of quality assurance and quality control.

Q4 What will you monitor?

An important step in developing your monitoring plan is generation of a shared understanding of the main components of the aquatic environment and how they interact. This understanding can be written down as a model.

A model is a simplification of the real world and can be illustrated as a set of components (boxes) that interact (arrows). A box represents a stock or quantity and arrows represent a flow between stocks. Being simplifications, models are imperfect, but they are a useful basis for planning. If the results of your data collection do not seem to match the model, you can change it, using the knowledge you have gained from monitoring your waterbody.

Waterwatch group members, scientists and others with different backgrounds will each often have different mental models about what is important in the aquatic environment. If your group does not have a discussion leading to a shared model, there are very likely to be disagreements about what to test and what data are important. Once a model has been agreed, many answers to questions about monitoring become clearer.

The characteristics of the water (physical, chemical, biological) and its bed and bankside environments are generally called measurement parameters. Parameters are descriptions (or values) of individual factors and can be measured by observation or field sampling. Once you have a model and have considered the questions above, you should list the parameters you have agreed to survey or monitor. Describe how they will help you answer your question(s). Indicate on your list the parameters that are central to the monitoring project and which, if any, are collected for background information.

Some parameters can be combined into indicators that reveal information about the waterway or human health conditions. Indicators can:

- reveal early signs of changes (trends) in the catchment;
- tell you whether the environment is as healthy as you would like;
- tell you whether you have achieved your objectives; or
- suggest why problems have occurred.

The parameters you choose to monitor will depend upon the question(s) you are asking as well as the resources and skills available. For example, if your group wants to learn about the general ecological health of the waterway, the main types of water bugs (macro-invertebrates) may tell an interesting story. See Table 2.1 for a list of parameters that can be monitored.

Some indicators and parameters

- Stream physical condition, which indicates the extent of change in the stream from the natural physical state, is gauged from these parameters: stream bottom composition, bank stability, amount of woody debris, turbidity.
- Catchment stress indicates the effects of human activity and how it may change over time. It is gauged from: the load of pollutants carried by the stream, land use and intensity of use, application of chemicals, wastes or sewage, loss of riparian vegetation.
- Ecosystem integrity indicates the change in the aquatic ecosystem from its natural condition before modern human influence. It is gauged from: woody debris, macro-invertebrates, the area of wetlands, the quality of riparian vegetation.
- Public health indicates trends in human health resulting from contamination of waterways. It is gauged from: the occurrence of water-related illness, closed shellfish waters, restrictions on water use, exposure to disease-causing organisms or chemicals.
- Chemical impact indicates the change from the normal chemical state of the water which affects aquatic life and humans. It is gauged from: pH, dissolved oxygen, nutrients, odour, potentially hazardous chemicals in water or attached to suspended sediment, and macro-invertebrates.

Questions to help the choice

When choosing each parameter of the waterway to measure or test, your group should ask:

- Does the parameter have a role in the group's model of the waterway? If not, it is unlikely to help to answer the question or objective.
- Does the parameter provide early warning of change occurring in the waterway?
- How difficult is it to measure the parameter with acceptable accuracy?
- Do you have the resources to measure it?
- Can you explain it to the users of your data?
- Are there existing records of values of this parameter, held by local or state government agencies?

Table 2.1: Commonly used parameters and what they can tell us

Characteristic or parameter	Reason for monitoring
Habitat condition	Habitat quality affects health of the aquatic ecosystem and human uses downstream.
Riparian vegetation	Quality of stream-side vegetation affects ecosystem health, amount of erosion, etc.
Bank erosion and stability	The amount of slumping, bank collapse and erosion indicates degree of alteration from its natural state.
Riffles, pools and bends	Many riffles, pools and bends in the stream provide habitats for aquatic life. Streams that have been channelled or dredged support less life.
Instream cover	The extent of overhangs, snags, logs, and aquatic vegetation tells us about the ability of the stream to support a wide variety of aquatic life.
Macro-invertebrates	Abundance and diversity of aquatic macro-invertebrates indicate health of waterway.
Algae	Depending on their abundance and type, algae can indicate good environmental health, or over-enrichment of a waterbody with nutrients, or poor condition of the catchment. Some blue-green algae (not strictly algae at all) can pose a risk to human health.
Salinity (conductivity)	Dissolved salts in the water (conductivity) affect the survival of aquatic life.
Dissolved oxygen	Oxygen in the water is essential for the survival of most organisms. It can also indicate organic contaminants and over-enrichment of lakes.
pH	Acidity or alkalinity of the water affects the survival of aquatic life. Indicates contamination and acidification.
Phosphates	Amount of phosphate in the water indicates nutrient status, organic enrichment and consequent health of the waterbody.
Nitrates	Amount of nitrate in the water indicates nutrient status, organic enrichment and consequent health of the waterbody.
Temperature	Rapid temperature changes of the water stress aquatic life. Temperature is also important for the interpretation of dissolved oxygen concentrations and as an indicator of the formation of layers of water in lakes.
Turbidity	Cloudiness of the water caused by suspended particles affects the survival of aquatic life. It indicates erosion and habitat destruction.
Water flow	Volume and velocity of water flow affect loads of contaminants and the survival of aquatic life.

Some Waterwatch groups measure parameters such as the biological oxygen demand (BOD) or the concentrations of faecal coliform bacteria in the water. Tests of BOD measure the amount of oxygen consumed when organic wastes, such as sewage or dead plant material, decompose in the water. Healthy waters have low BOD. If faecal coliform bacteria can be detected this may mean there are other disease-causing bacteria, viruses and parasites in the water as well. Speak to your local Waterwatch coordinator if your monitoring plan includes these parameters.

If you want to monitor the water quality parameters of groundwater, you will need expert help. While it is relatively simple to measure the depth to the watertable if bores or piezometers have already been installed, measuring groundwater quality is another matter. Ask your local or regional Waterwatch coordinator for guidance before beginning to monitor groundwater. Module 8 (Groundwater Monitoring) of this Technical Manual also provides guidelines.

Q5 What data quality do you want?

The quality of the data you collect will depend on the question(s) you are asking and how you intend to use the data. It will also depend on the skill of your group members. At the very least, your data should be accurate enough to identify grossly polluted sites.

For groups with a focus on education and awareness raising, the quality of the data is secondary to the actual process of collecting it. It is not always easy to decide on data quality or to achieve it!

Good quality data are derived from surveys or test samples that are complete, representative and comparable.

- Complete refers to the amount of data needed to meet the desired quality. For example, for determining degrees of turbidity, at least five turbidity samples are recommended.
- Representative refers to the extent to which your data actually represent the conditions in the river. For example, sampling 100–200 metres downstream of potential sources of contamination will allow any substances to mix thoroughly so the sample is representative of the true concentration of contaminants.
- Comparable samples allow you to make valid comparisons of data. For example, macro-invertebrate results can be compared between one riffle site and another, but not between a riffle and an edgewater site, because different macro-invertebrates inhabit different habitats.

Good quality data are derived from analysis that is accurate, precise and sensitive.

- Accuracy is how close the sampling result is to the true value. Accuracy is most affected by the equipment and the procedures used.
- Precision, on the other hand, is how well you are able to repeat the result on the same sample regardless of accuracy. Human error in sampling and analytical technique is a major cause of imprecision.
- Sensitivity refers to the smallest change or lowest concentration your equipment or methods can detect. The equipment used should be sensitive enough to give you useful data. For example, if your group is monitoring turbidity, your methods should be sensitive enough to detect a change in turbidity following an event such as a heavy storm or an episode of heavy run-off from urban areas.

You may get some idea about how accurate, precise and sensitive your equipment and methods need to be from looking at data already published for your waterbody.

Data quality is also enhanced by simple quality control checks, such as taking replicate and split samples. In these cases, the two replicates or splits should produce the same results in tests. The closeness of the two results is a measure of your precision.

Q6 What methods will you use?

The methods you use depend on your objective(s) and resources. There are often several methods and costs for testing a single parameter. For example, for high precision turbidity readings from zero to 1000 NTU, a turbidity meter costing several thousand dollars is required, but a turbidity tube (<$40) is suitable for less precise readings of between 10 and 400 NTU.

Use the same methods at all sites to allow comparison of data. List the methods you will use, choosing from:

- surveys, that is, field observations of riparian vegetation and physical condition of waterways;
- macro-invertebrate sampling and assessment on site or in a lab;
- algal sampling and assessment in a lab; or
- water quality sampling and analysis, with samples collected and tested in the field or in the lab.

When choosing each method, ask:

- Will the method produce data of the right quality?
- How accurate is the method?
- How precise is the method?
- How sensitive is the method?
- Will the method measure the parameter in the range you need?
- Will the method give representative results of the conditions you are monitoring?
- Is the method comparable with methods used by government agencies?
- Do you have the resources to do the method?
- How difficult is the method?
- How time-consuming is the method?
- How expensive is the method?
- Will the method produce data that can be used by data users?

For each parameter you have chosen to measure, briefly describe the following six attributes:

- the parameter — what you are measuring;
- the collection procedure — how the parameter is being sampled;
- the containers you will use to hold your water quality sample;
- the preservation method — how you intend to keep the parameters of the water quality sample from changing;
- the maximum holding time — how long the water quality sample will last before the measurements are meaningless; and
- the equipment and method that are used to measure the parameter.

For details on the methods of sampling and measuring a range of biological, physical and chemical parameters, see Modules 3 and 4.

At this planning stage, it is also important to be aware of the need to keep track of samples. Some samples may be transported to a laboratory for further analysis, if resources are available. The labels your group uses on the samples should be clear and unambiguous and allow each individual sample to be tracked accurately from collection to completion.

Every sample collected in the field should be labelled to record the:

- site code — a unique code which identifies where the sample was taken;
- sample number — a unique number for the sample;
- date and time of collection — hour/day/month/year;
- sample type — what will be analysed, and where it was taken, e.g. edge, bottom, surface;
- sampler's name; and
- preservation method, if any.

Q7 Where will you monitor?

It is important to choose suitable geographic boundaries for your monitoring work. The wrong boundaries will focus your efforts away from important causes or effects. Catchment boundaries are useful for investigating human impacts on rivers, although human activities may affect groundwater supplies over a wider area.

The choice of sites will depend on whether you are sampling lakes, rivers or estuaries, the information you want and the parameters you will be measuring. For example, if you want to establish baseline information on the waterbody's overall health, sampling stations should be located at sites that represent the variety of conditions in the catchment. On the other hand, if you want to measure the effect of discharge from a drain, sites should be chosen upstream and downstream to isolate the effect of the drain (see 'Selecting the site' on page 12).

Your sites should be representative of the condition of the waterbody. Use a map to show your sites.

Q8 When and how often will you monitor?

Frequency of monitoring could be regular — weekly, monthly, seasonal, annual — or it could be irregular — during heavy rain ('event sampling'). It depends on what you want to know and on your resources.

Imagine you want to determine a river's 'baseline' or fundamental condition because you are looking for long-term trends. In this case, sampling or surveys should be done at regular intervals during base flow conditions at representative sites to characterise the waterway. If monitoring teams are deployed over the whole catchment at about the same time, you will produce a 'snapshot' of conditions. Biological sampling should be conducted at the same time each year, because of seasonal variations in aquatic invertebrate populations and vegetation. Macro-invertebrate sampling is often done twice yearly, in autumn and spring, but should be done no more than four times per year because extra sampling will deplete animal populations.

Perhaps your group is monitoring to determine the effect of contaminants in the water. In which case, you will time your monitoring to coincide with the suspected effect. For example, if you want to know about the effect of sewage on aquatic ecosystem health, you might choose to sample dissolved oxygen at sunrise when concentrations are at their lowest.

Water quality is often affected by rainfall. Monitoring during rain will catch contaminants as they are flushed from the land surface into the water. For example, if you think the stormwater system is overloaded, sample for turbidity during heavy rainfall. This sampling will need extra care and safety precautions, because surfaces will be slippery and river flow may also be increasing rapidly.

To measure the load (mass transport) of sediment, chemicals and nutrients carried by streams, you should sample during high flow events. Measurements taken during low flows may indicate only a small percentage of the total load transported by the stream.

Questions to help you plan

When deciding when and how often to monitor, your group should ask:

- Will there be seasonal differences in natural conditions, land use and discharges that affect your data?
- Will flow levels (base flow, high flow) affect the parameter you are monitoring?
- In rain-event monitoring, how much rain is required before you go out and sample, and how often will you sample during rain?
- In estuarine monitoring, will tidal cycles affect the timing of monitoring?
- Are releases of water from farm or hydro-electric dams planned for your waterway?
- How do macro-invertebrate life-cycles affect your monitoring schedule?
- Do you have to get samples to a lab before the holding time expires or the lab closes?
- Should sampling be done at certain times of day, e.g. sunrise?
- For school monitoring, how will teaching programs and limited duration of lessons affect site selection and monitoring?
- Will the changes you are looking for take longer to happen than the period of sampling?

The schedule

The main challenges on sampling days are: to organise participants so they are effectively and safely occupied; to keep track of each monitoring or survey result; and to ensure parameters are measured within the time limits for accuracy.

Work out a schedule for your monitoring or survey work composed of field observations, sampling, and field and lab analysis. Include the anticipated time for each, and back-up people for emergencies. Allow extra time on the first sampling day to sort out the inevitable last-minute glitches.

Be aware of how long each sample can be held before it has to be processed for a given parameter. For example, the maximum holding time before testing refrigerated water samples for dissolved phosphate is 24 hours, so collecting the water sample, cooling and transporting it to a suitable lab, for example, at school, and testing it must all be done within 24 hours to get accurate results. Take into consideration how long it takes to process each sample. For example, it will take up to 50 minutes to digest a sample's total phosphorus in hot acid and to measure it.

Some parameters, such as dissolved oxygen, ideally should be analysed immediately on site. Macro-invertebrates also can be sorted to taxonomic level on site.

Q9 Who will be involved and how?

Programs can vary in size from ten to hundreds of Waterwatchers and from a single group to many scattered over the catchment. Consider questions such as:

- Who is going to collect and analyse samples?
- Who will take part in surveying the habitat?
- Who will coordinate activities?
- How will members be trained and transported to and from sites?
- Who will photograph the sites?

Consider all the tasks that should be done and encourage someone to fill each position. An easy way to display this is by using an organisation chart. You don't need to list actual names, but rather the positions and a brief description of what each position does, for example:

- draft, and get approval for, monitoring plan;
- ask potential members to become involved;
- organise and present Waterwatch training sessions;
- habitat survey;
- water quality sampling;
- data processing and analysis; and
- reporting.

Training in the consistent use of standard procedures is the best way to ensure each participant is collecting credible data. Your local Waterwatch coordinator can provide you with appropriate training.

When you are ready to test the water it will be very frustrating to find that equipment is not performing — for example, because moisture has ruined reagents or the meter batteries are flat, or the meter has not been calibrated. Your equipment should be regularly checked and calibrated with fresh standard solutions. See the physical and chemical parameters module (Module 4) for details about these and other data confidence procedures for individual parameters. Calibration and inspection should be a part of group training, and can be tasks assigned to one position in your organisation.

Q10 How will the data be managed and reported?

Data collected in the field by Waterwatchers should be written on, or transferred accurately to, record sheets before being sent to the coordinator, and before being screened and reporting to the community and stakeholders (see Module 5, Data... Information... Action!).

All observations, notes and photographs made at registered sites need to be labelled with the relevant site code, date and time. For example, you may label a photograph:

> Don's dairy farm, right bank facing upstream, 50 metres above site AAC120, 20 August 2002, 10am.

If possible, use a camera that automatically imprints the time and date on your photographs. Always use a notebook to keep a record of your photographs as you take them and transfer these notes to the backs of the photographs when they are developed.

For audio-tapes, record the date, person making the tape, who was interviewed and why.

At the end of each day the results, record sheets and photographs must be placed in a recognised secure storage place, such as a lockable metal filing cabinet. They are known as 'raw data' and are the primary links between your group's detective efforts for that day and the information your efforts have produced. Later, you can add results sheets from chemical analyses to your collection of raw data.

Standard record sheets help ensure the data are consistent and comparable, and make it easy for groups to exchange information. The record sheets have spaces for all relevant information, and each type of observation can be recorded consistently. The sheets also simplify entry of the information into a computer database, so long as group members understand how to use them and are careful to avoid errors in transcribing data from instruments to record sheets. (One way to avoid errors is to state each reading aloud, record it, and then repeat it aloud to verify what was reported.)

Your Waterwatch group must form a clear plan for dealing with the data (see Figure 2.1, for example). Encourage a member to take on the role of data manager. That role could include:

- keeping a complete and accurate record of all surveys and tests;
- making a copy and storing all records in a safe place;
- checking result sheets for completeness and unusual results (outliers); and
- entering checked data into the Waterwatch Australia database program (see Question Q11, 'How will you ensure your data are credible?', for some pointers on checking your data).

Waterwatch Australia Database

Waterwatch data is being collected from waterways and coastal areas throughout Australia. The Waterwatch data is collected to help the community assess the health of their own catchments.

To help volunteers manage data and make it more accessible to data users, the Waterwatch Australia Database has been developed.

The Waterwatch Australia Database was developed to enable data to be stored and reported in an easily comparable and consistent manner. The focus when the database was developed was for data sharing and data ownership at the regional level. This remains the focus of the database. Waterwatch also recognises that community data is becoming increasingly in demand, and not just at a regional level, but at a State and national level. As a response to this demand some States, in consultation with the regional Waterwatch monitoring programs, are working with government scientists and data managers to compile regional Waterwatch databases at a State level to be incorporated into State data warehouses.

The Waterwatch Australia Database allows your regional coordinator to:

- enter your Waterwatch data and store it as a record or file;
- develop graphs and produce short reports about your data; and
- perform simple analyses on the Waterwatch data you have collected from your catchment.

Guidelines that describe what to do if an incident of contamination is discovered in your waterway should be discussed and agreed to by the group before monitoring takes place. Data on the contamination should be reported to your Waterwatch coordinator who will immediately notify the local council and land manager or water authority. Your group may have an arrangement to notify downstream water users in the event of contamination.

Finally, the group should have a plan for interpreting the data — that is, organising them so the findings (observations) can be seen — and for developing and reporting conclusions (explanations for any patterns in the data) and recommendations for action and further monitoring.

The importance of data confidence cannot be over-emphasised. Some monitoring groups in your Waterwatch program may use good data confidence techniques while others may not. Keep the data from both groups separate when recording results. You will be able to use the well-controlled data with more confidence to interpret trends, etc., and the other data to support your findings. Your Waterwatch coordinator can play a role in providing feedback to the group on the quality of your monitoring results.

When the time comes to present your information and results, the people you identified in question 2 of the monitoring plan outline will be your primary audience. But others will be interested as well, and you may need to use different presentation techniques for different users.

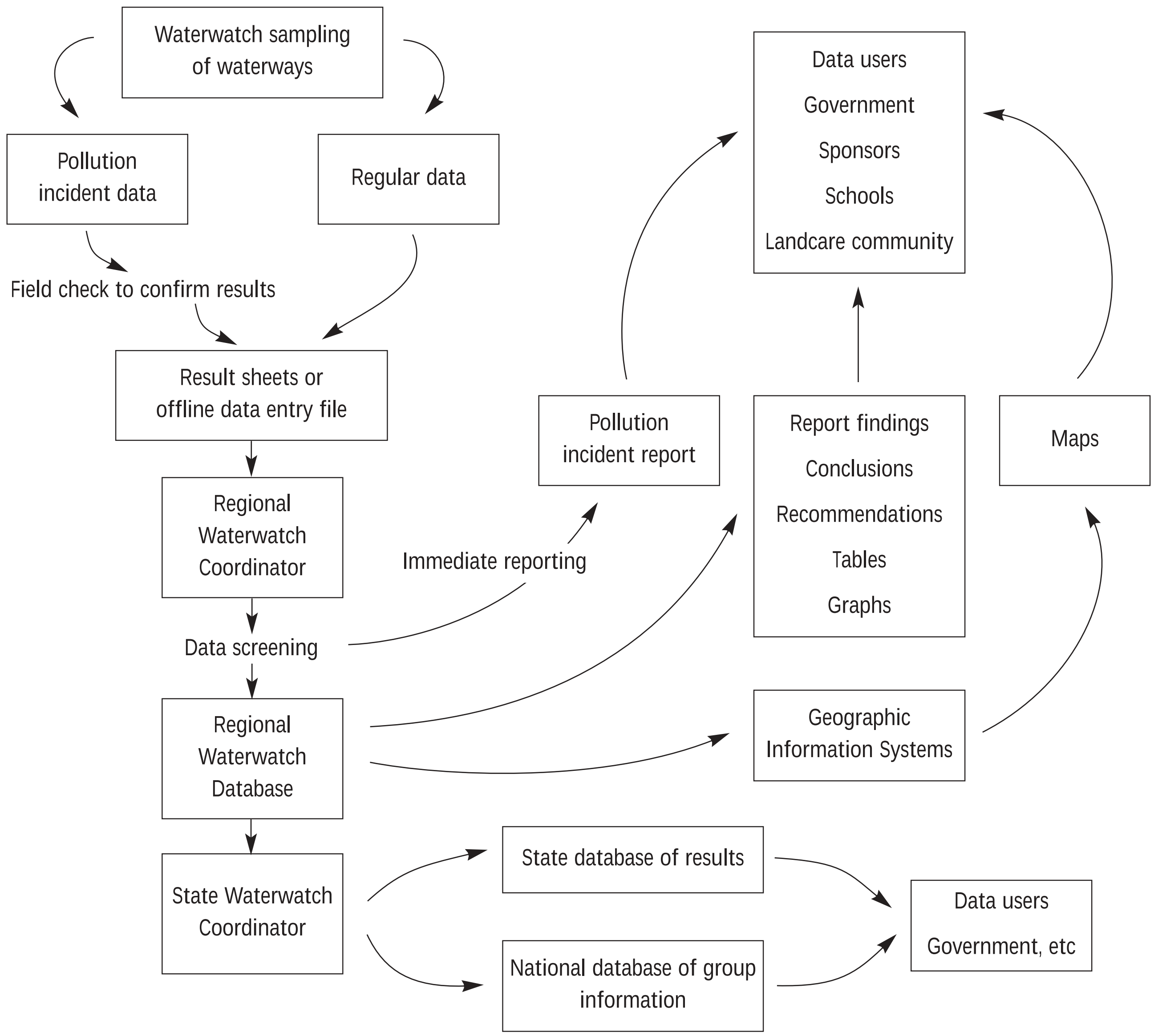
Q11 How will you ensure your data are credible?

Data confidence procedures ensure and assess the quality of the information you collect and check that it meets your data quality goals, as described in question 5.

Data confidence for sampling and analysis includes:

- putting in writing all the steps taken to survey, monitor, analyse, store, manage and present data;
- encouraging qualified individuals to be responsible for specific quality assurance tasks, such as those described for individual parameters in Module 4, Physical and Chemical Parameters;
- proper training, testing and retraining of participants;
- maintaining and calibrating equipment;
- using quality control checks to ensure equipment produces accurate data;
- assessing the quality of your results and making necessary adjustments; and
- reviewing your progress after an initial pilot stage.

Figure 2.1: Data to information



Data confidence for data management includes procedures that ensure the data are properly recorded on result sheets and accurately transferred to the computer; and follow up of unusual results.

Quality assurance or quality control measures (data confidence) allow you to identify contamination of samples, inadequate practices and procedures, and failure of equipment. They also indicate where measures are correct, and whether standard procedures are being followed. The data produced using good data confidence techniques are of high value to users.

Developing specific answers to questions 1–11 (the monitoring plan) is the first step in increasing confidence in your data.

Your written monitoring plan, together with your group's objectives and strategies, is the most valuable document your group can have. It will keep the project running along the path that has been chosen for it, even months or years after it has begun, and will ensure continuity of the project even though the people involved may change completely. Use the Short Monitoring Plan (on page 24) to record your main decisions.

Once your group has made and settled on your monitoring plan, you will need to select the site or sites to be monitored. Remember, your monitoring plan should be done in consultation with your local or regional Waterwatch coordinator.

Selecting the site

To get useful information, it is very important to choose your sites well. The choice of sites will depend on whether you are sampling lakes, rivers or estuaries, what you want to know and what indicators you're measuring. For example, if you want to establish baseline information on the waterbody's overall health, sampling stations should be located at sites that represent the variety of conditions in the catchment. On the other hand, if you want to measure the effect of discharge from a drain, sites should be chosen upstream and downstream of the drain to isolate its effect.

Ideally, you should do an on-ground survey of your catchment at this stage in your project, to cross-check the accuracy of any information already gathered by your group and to get an overall picture of the land that is drained by your stream or waterbody.

On-ground catchment survey

When conducting an on-ground survey, Waterwatch participants regularly walk, drive and/or canoe along a chosen part of the catchment, observing the condition of the water and land and how it is changing over time. These observations are recorded on maps and on On-ground catchment survey sheets (see page 27).

For your group's own survey, first choose the largest areas you feel comfortable assessing and make sure they have easy, safe and legal access. The areas should have clear boundaries that can be marked or found on road maps or topographic maps. This will help future Waterwatch members continue the survey in later years and help the Waterwatch coordinator easily locate any problems you identify.

Describe or draw the significant features of each area and waterbody and its surroundings.

Aim to survey the areas at least twice a year, preferably when water levels are generally high (early spring) and when water levels are generally low (late summer). Always have at least two people on each on-ground survey, for safety and efficiency.

When surveying, it is helpful to have a large-scale map of the area, a spare map you can make notes on, information about potential problem spots, and copies of the On-ground catchment survey sheets (see page 27).

Become aware of the hills, valleys and flat terrain. Does any of this area periodically flood?

Notice how heavy rainfall is controlled. Are portions of the stream running through concrete channels? Is it dammed, diverted or straightened? Where the road crosses the stream, is there evidence of erosion and contamination beneath bridges? Does road runoff directly enter the stream?

Notice the various land uses, and consider how they may affect the health of the waterways and waterbodies:

- There may be potential 'problem spots', such as construction sites, combined sewer–stormwater outfall pipes, animal feedlots, bridge or highway crossings, irrigation off-takes.
- Look for evidence that people use the waterbody positively too, such as for swimming or fishing. Observe if the banks look stable and naturally vegetated. Are there waterfowl or other signs that the stream is healthy?

Fill in your field survey sheets.

Later, describe your survey to your group. If several areas have been surveyed, you will be able to build up quite a large picture of your catchment. Record your findings, both positive and negative, on a catchment base map; label and date any photos so they can be used for comparison on the next survey; and file the completed field survey sheets for future reference.

Finally, select the site(s) you will monitor.

General guidelines for selecting a site are:

- use your catchment map to select possible sites that appear to meet your needs;
- get permission to enter private land;
- go to each site and check that it is accessible and safe to work at, it is representative of conditions in the waterway, and is suitable for your needs;
- photograph each site at the sample collection point and record directions to the site for future visits; place the directions and photographs in a looseleaf binder and store your information with your monitoring plan and catchment map;
- mark site locations on your catchment map;
- record details of the site location in your monitoring plan;
- list all the sites selected, along with your reasons for choosing them;
- describe the precise location of the sampling point for others to do repeat sampling, e.g. 'at overhanging rock on left bank 10m upstream of bridge'; and
- register the site with your Waterwatch coordinator (see site registration form on page 32) — this form is a summary of all site details for the catchment and should be kept up-to-date.

Registering the site

So that all the data collected from waterwatchers around the State and Territory can be available to other waterwatchers, you are invited to fill-in a Site Registration Form (see page 32) and return it to your Waterwatch Coordinator. This form is a summary of all site details for the catchment and should be kept up-to-date. Include all the sites for the catchment or sub-catchment. This data will be added to State and national databases for Waterwatch Australia and it is hoped that it will assist in decision making at all levels within our society.

How to complete the Site Registration Form

- Eastings and Northings. These are the coordinates from the universal grid that tell us the exact location of your site on the map.
- Map number, name and scale. You can get this information from the map.
- Site code. The site code has three letters and three numbers. Your Waterwatch State Facilitator will provide the three letters to your Waterwatch Coordinator, who will add three numbers to produce a unique code for each site. The letters correspond to the stream name, and numbers to the relative position of sites in the waterway. Sites with small numbers are found towards the headwaters and those with larger numbers occur downstream.
- Site type. Record whether it is a river, stream, dam, lake, estuary, ocean, bore, stormwater drain, wetland, sewage lagoon or other type of water body.
- Site name. Select a name which means something to you, e.g. ‘Warren’s farm’, ’Deb’s drain’.
- Name of river or waterbody and sampling location. Get this from the maps.

Examples and guidelines

This section consists of:

- a completed monitoring plan to provide you with an example of the type of information you should include on your own monitoring plan; and
- a table providing general guidelines for monitoring to help you decide on the best things to test, where, when and how often.

An example plan

Q1 Why are you monitoring?

A To find out the effect of rainfall in the town on turbidity in the river. If turbidity is affected by rainfall, as expected, is it only by heavy rainfall in the town, or by rainfall elsewhere in the catchment as well?

Q2 Who will use your data?

A The main users of our Waterwatch group's data will be the secondary college, local council, local water treatment staff, the fishing club, local irrigators.

Q3 How will the data be used?

A Our Waterwatch data will be used:

- to help teach college students;
- to provide information to help local councils make decisions affecting the river;
- by the local fishing club to notify its members of good and bad fishing conditions;
- to help water treatment staff predict days when equipment will not work well; and
- to warn irrigators not to use their pumps on days when turbidity is likely to be bad.

Q4 What will you monitor?

A Our group has identified the following characteristics:

Characteristic	How it will help to answer the question?	Critical or background
Rainfall	By helping identify a possible cause of turbidity.	Critical
Turbidity	The turbidity may vary in relation to local rainfall.	Critical

Q5 What data quality do you want?

A Our aim is to produce data that the local officials and irrigators can use to predict times when equipment may not function well.

Our data quality requirements for sampling are to:

- measure rainfall at the town and at two sites upriver, daily;
- collect at least five river samples during and after heavy rainfall periods (for completeness);
- collect samples from the main river current above and below stormwater outlets from the town and above and below likely sediment sources outside the town (representativeness and comparability);
- collect replicate samples (representativeness and comparability).

Our data quality requirements for analysis are:

- to use a method that detects changes as small as 10 NTU (sensitivity);
- to produce results within 50% of results for samples analysed several times (precision);
- to produce results within 50% of results for samples split for analysis at another lab (precision and accuracy).

Q6 What methods will you use?

A Our Waterwatch group will use the following sampling and analytical water quality methods:

	Collecting procedure	Sample container	Preservation method	Maximum holding time	Equipment and method
Rainfall	Rain gauge				Read and empty
Turbidity, suspended solids	Sample main current	Polyethylene 500 mL	Refrigerate	24 hours	Turbidity tube

Q7 Where will you monitor?

A Our Waterwatch group has chosen sites at the following locations:

Site code	Map name	Map no.	Map scale	Easting (6 figs)	Northing (7 figs)	Catchment name	Subcatchment name
SOM 010	Somewhere	1234	1:100 000	460200	5414100	Somewhere else River	not applicable
SOM 020	"	"	"	460900	5414700	"	"
SOM 030	"	1235	"			"	"
SOM 040	"	1236	"			"	"

Our Waterwatch group has chosen the following sites in the river for the reasons listed in the table:

Site code	Site name	Site description	Reason for selecting site
SOM 010	Sullivans Road Stormwater Drain	River 50 metres upstream of stormwater outlet	Reference site upstream of stormwater outlets. By comparing data from the reference site with that from below the stormwater outlets, the source of the turbidity may be identified.
SOM 020	Country Road	River very near gravel road No riverside vegetation	By sampling upstream and downstream of the road's closest approach to the river, another source of turbidity may be found.

Sites SOM 030 and 040 are two upriver rainfall sampling sites. Rainfall will also be measured at the town weather station.

Q8 When and how often will you monitor?

A The timing details of monitoring by our Waterwatch group are as follows:

Type of monitoring	Characteristic	Sampling frequency	Period of sampling	Time of sampling
Volume of rain		Irregular	When it has rained	9 am on appropriate days
Impact of stormwater runoff	Turbidity	Irregular	During winter floods	During heavy rain

Q9 Who will be involved and how?

A To meet our goals, our regional Waterwatch group has identified the following roles and responsibilities:

Role	Responsibilities
Waterwatch coordinator	Oversees monitoring for the catchment; responsible for coordinating monitoring efforts for 15 sub-groups in the catchment, i.e. schools/Landcare groups; liaison with government agencies; obtains funding; coordinates work with communities; responsible for preparing monitoring plan and final reports; coordinates training of participants
Quality assurance (QA) officer	Oversees all QA/QC activities; responsible for developing and updating the monitoring plan; supports the coordinator in training, QA and procedures; checks quality of data and carries out follow-up
Data manager	Enters data from field sheets onto the Waterwatch database and prepares reports for users
Participants: Grade 10 Science classes of WW and XX High Schools Environmental Science class at YY College ZZ Landcare group Others	Responsible for implementing the monitoring plan; carrying out surveys/sampling/analysis of data at sites

Our regional Waterwatch group has made the following plans for 2003 and 2004:

Project task	Main position responsible and supporting positions	Task complete by:
Draft and get approval of Monitoring Plan	Waterwatch coordinator QA officer Agency QA officer	February 2003
Ask potential members to become involved	Waterwatch coordinator QA officer Project coordinator	April 2003
Waterwatch training sessions	Waterwatch coordinator QA officer	Three Sunday training sessions in May 2003
Habitat survey	WW and XX Schools	As scheduled in Questions 4, 6, 7 and 8 using Waterwatch Technical Manual
Water quality sampling	YY College and ZZ Landcare group	As scheduled in Questions 4, 6, 7 and 8 using Waterwatch Technical Manual
Data processing and analysis	Waterwatch coordinator QA officer Data manager Waterwatch group members	June 2003 to April 2004
Reporting	Waterwatch coordinator Data manager Waterwatch group members	Regular monthly media release June 2004, public meeting

The May training sessions will be run by the Waterwatch coordinator, with help from the QA officer and aquatic ecologist, for eight high school teachers at Pollington Flats. All participants will be asked to evaluate the training sessions at the end of training. Teachers will be expected to demonstrate competence in macro-invertebrate identification to order level and rate the quality of sites using the Macro-invertebrate Rating Method.

Students from Environmental Science at YY College will be transported to sites SOM 010 and SOM 020 during rainfall events during term time. They will be under close supervision of the teacher when sampling. The emergency phone number is 2345 6789.

Our quality assurance coordinator will maintain and calibrate the group's equipment according to the following table:

Equipment type	Inspection frequency	Type of inspection	Calibration frequency	Standard or calibration instrument used
Rain gauge	Monthly	Visual check for foreign bodies or damage	Not applicable	
Turbidity tube	Before each use	Visual check of cleanliness of tube	Not applicable	Check against formazin standards

Q10 How will the data be managed and reported?

A Schools in our regional Waterwatch group will use water quality data record sheets to record rainfall and turbidity.

Our data manager will store data from record sheets on the Waterwatch Australia Database. Record sheets will be stored and catalogued by site and date. A library of photos of all activities and sites in the catchment will be maintained.

Contamination incident guidelines for our Waterwatch Group are: If you discover a severe contamination incident, immediately contact the coordinator (phone 9876 5432), who will contact the council.

Severe incidents include:

- large oil spills;
- paint in the stream;
- unusual colour change in the water;
- fish kills, or kills of any animals;
- large change in pH;
- odours, an unusual appearance, fumes;
- dumping of waste.

For unusual water quality results, i.e. more than plus or minus 20% of normal results, check calibration of the meter (if applicable), the procedure and reagents used, and then re-sample. If the original result is confirmed, record the result and contact the coordinator so they can inform neighbouring groups in the catchment. For small regular incidents of this kind, keep a record of the time and day that it occurs for about a month and if possible try to identify the source. The coordinator will report the information to the local council, land manager, and water authority.

Our monthly media releases to the general public about turbidity levels will raise general awareness of the problem in the river. A workshop for members of the fishing club, irrigators, local water treatment staff and the council will be held in June to present our year's data for discussion and action.

Q11 How will you ensure your data are credible?

A Our Waterwatch group will check the quality of data of the following parameters using the methods listed in the table.

Parameter	Equipment and method	Quality control checks	QC sample frequency
Turbidity	Turbidity tube	Field replicate to measure natural variation and precision of method	Collect a replicate at 10% of sites

As soon as possible after each sampling event, calculations for precision and accuracy will be made by the QA officer to check data quality. If data are not good enough for the intended use, then reviews of training, methods, equipment and reagents will be done with the coordinator to identify the source(s) of the problem. The required standards of data quality may need to be revised. Comparability, completeness, and representativeness will be assessed after each sampling run. Any limitations on the use of the data will be reported to data users.

Our Waterwatch data manager will continually review the completeness of data. They will screen data for transcription errors before entering onto the Waterwatch database. Decisions about accepting, rejecting or modifying data will be made in conjunction with the coordinator and QA officer.

General guidelines for monitoring

How to use this table

1. Identify on your catchment map the potential sources of contaminants and/or different land uses from the headwaters to the mouth.
2. For each potential contamination source and/or land use read along the row in the table to determine the best things to test, where, when and how often.
3. Choose tests and surveys as determined by your group's expertise, equipment and objectives.
4. Record your decisions in your Monitoring Plan.

Key

Conductivity (dissolved solids)

DO	dissolved oxygen
NO_3	nitrate
PO_4 (o)	ortho-phosphate
PO_4 (t)	total phosphate
temp	temperature

Main purpose	Comments	Critical things to test or survey						Locating your sites			When do you test?	
		Physical/chemical tests			Macro-invertebrates	Algae	Habitat	Reference, impact and recovery sites	Sample in paired catchments	Other areas to test	Regular	Other times
Establish a baseline	Essential if condition of waterway is not known	pH turbidity temp flow	PO_4(o) nitrate DO	PO_4 (t) conductivity velocity	✔	✔	✔	✔ reference site		Choose representative sites, bottom of main tributaries	Weekly – monthly for physical/ chemical site tests during base flow conditions Twice yearly for macro-invertebrates	
Determine suitability for particular uses:												
Protection of aquatic ecosystems	Ecosystems are affected by many contaminants and by clearing of riparian vegetation	turbidity temp pH	PO_4 (o) nitrate DO	PO_4 (t) conductivity	✔	✔	✔			Sample within waterbody to be protected	As above	
Drinking water	Quality determined by chemicals, bacteria and taste	turbidity pH	nitrate taste	conductivity		✔	✔			Sample drinking water	Weekly to monthly for physical/ chemical tests	
Recreation	Bacteria and aesthetics are main problems	turbidity				✔	✔			Sample at recreation site		During times of recreational use
Agriculture	Farm productivity may be affected by poor water quality	conductivity pH	nitrate	pesticides	✔	✔	✔	✔	✔	Sample water used for agriculture	Weekly to monthly for physical/ chemical tests	Sample water used for irrigation during summer
Assess effect of land uses/contamination sources:												
Forest practices	Roading, clearing and fires can lead to soil erosion and algal growth Herbicides may be used	turbidity velocity	PO_4 (o) nitrate	flow	✔		✔	✔	✔			During rain

Main purpose	Comments	Critical things to test or survey				Locating your sites			When do you test?	
		Physical/chemical tests	Macro-invertebrates	Algae	Habitat	Reference, impact and recovery sites	Sample in paired catchments	Other areas to test	Regular	Other times
Urbanisation/ stormwater	Runoff contamination and flooding are common problems	pH, turbidity, flow, PO_4 (o), nitrate, velocity, DO	✔	✔	✔	✔	✔	Sample at run-off points	✔	During rain and discharge events
Livestock operations	Manure, bacteria and nutrients from feedlots affect waterways	turbidity, DO, PO_4 (o), nitrate	✔	✔	✔	✔			✔	Per discharge from feedlot and rain
Cropland/ pastures	Soil erosion from heavy grazing. Fertiliser or herbicide runoff and salinity problems.	turbidity, velocity, PO_4 (o), nitrate, flow, conductivity, PO4(t)	✔	✔	✔	✔	✔	Sample within cropping areas Sample ground water	✔	During rain and after fertilising
Mining operations	Sediment, tailings, dust, chemicals can have very long-term effect	turbidity, conductivity, DO, flow, pH, velocity	✔		✔	✔	✔	Sample at single point discharge sites		During rain and discharge events
Construction sites	High sediment and chemical runoff from poorly managed sites	turbidity, velocity, pH, flow, conductivity	✔		✔	✔	✔	Sample at run-off points		During rain and discharge events
Septic systems	Leaks, overflows and leachate can have severe effect on quality and cause health problems	nitrate, PO_4 (o)	✔	✔		✔	✔	For lakes, sample near and away from contamination source	✔	During times of high demand, rain and recreational use of waterway
Golf courses and playing fields	Runoff carries nutrients and pesticides	NO_3, PO_4 (o)	✔	✔	✔	✔	✔	Sample at runoff points	✔	During rain
Dams	Changes in flow rates during filling or releases stress aquatic ecosystem. Low DO release water is a problem.	turbidity, temp, DO, flow, pH, velocity	✔		✔	✔	✔	Profile temp and DO from top to bottom	✔	During filling of dam or release of stored water

Record sheets

This section includes the record sheets you will need to record your data. Make sufficient copies of each. The forms are:

- The short monitoring plan
- On-ground catchment survey sheets
- Site registration form

The short monitoring plan

Write your answers in the spaces and keep this as a record of your decisions. This plan provides a solid foundation should you wish to develop your monitoring plan further.

1 Why are you monitoring?

The first step in planning is to ask why you want to monitor. Answers may vary, but often groups simply want to know what the stream is like. Record your answer below.

2 Who will use your data?

Potential users might include students and/or group members. Name the main groups you think will want to use your data.

3 How will the data be used?

Data could be used for more than one purpose, e.g. to educate students about the principles of ecology or to identify major trouble spots in the waterway. Knowing their main use will help determine the right kind of data to collect. Describe their intended use.

4 What will you monitor?

The things you choose will depend on the question(s) you are asking as well as the resources available. For example, if your group wants to learn about the general ecological health of the waterway, the main types of water bugs (macro-invertebrates) present could tell an interesting story. List the things you will monitor (see 'General guidelines for monitoring' on page 20 for a full list of things that can be monitored).

5 What data quality do you want?

This depends on the question(s) you are asking and how you intend to use the data. At the very least, your data should be accurate enough to indicate the location of grossly contaminated sites. Depending on your findings, you may then choose to refine your monitoring program. For groups with a focus on education and awareness raising, the quality of the data is secondary to the actual process of collecting it.

6 What methods will you use?

This depends on your objective(s) and resources. There are often several ways of testing the same parameter. For example, for high precision turbidity readings from zero to 1000 NTU, a turbidity meter costing several thousand dollars is needed, but a turbidity tube (<$40) is suitable for less precise readings of between 10 and 400 NTU. Use the same methods at all sites to allow comparison of data. List the methods you will use.

7 Where will you monitor?

The location of monitoring sites depends on whether you are monitoring a river, lake or estuary, and also on the purpose of monitoring. For example, monitoring at a variety of typical sites in the catchment is good for providing information about its overall condition. On the other hand, sites located above and below a source of contamination are needed to indicate its effect. Your sites should be representative of the condition of the waterway. Use a map to show your sites.

8 When and how often will you monitor?

This depends on your resources and the purpose(s) of monitoring. For example, if you are interested in a snapshot of the waterway, monitor a number of sites on the same day; monitoring contamination events, e.g. discharges from pipes, depends on the timing of the discharge; surveying the physical form of the stream is best done during low flows for safety reasons. Describe when and how often you will monitor.

9 Who will be involved and how?

Indicate who will carry out surveys and/or test water samples, who will arrange transport to sites and back, who will prepare the water testing equipment to be used, who will photograph sites, etc.

10 How will the data be managed and reported?

It is important to record and present the data. It helps to raise awareness of the condition of the waterway amongst members and helps you to refine your monitoring activities. Name who will look after the data and describe how the data will be managed.

11 How will you ensure your data are credible?

Developing answers to the first ten questions is the first step to conducting an effective visit to the waterway. For all surveys and tests, make sure group members are adequately trained. For water quality tests, make sure any instruments used are calibrated and read correctly and any water samples from rivers are taken from the main current at about 25 centimetres below the surface. List what you will do to improve the credibility of your data.

On-ground catchment survey sheets

Background information

Date: ______________________ Time: ________________________

Name of group: ____

Name of investigators: ______________________________________

Name of catchment: ____

Map name: ____

Approximate size of the catchment being surveyed: _______________

Name of suburb, nearest town or settlement: ____________________

Describe the weather both now and in the past 24 hours.

	weather now	weather in past 24 hours
clear/sunny	☐	☐
overcast	☐	☐
showers	☐	☐
rain (steady)	☐	☐
rain (heavy)	☐	☐

Land uses in the catchment

1. Specific land uses identified (tick as many as apply)

	Stream-side	Within 1 km of stream	Within the catchment
Agriculture			
Cropping	☐	☐	☐
Grazing	☐	☐	☐
Feeding lot or animal holding area	☐	☐	☐
Orchard	☐	☐	☐
Inactive agricultural land	☐	☐	☐
Tree farming	☐	☐	☐
Other (name)	☐	☐	☐
Construction underway			
Housing development	☐	☐	☐
Commercial development	☐	☐	☐
Road bridge repair construction	☐	☐	☐
Recreation			
Swimming/ fishing/ canoeing	☐	☐	☐
Power boating	☐	☐	☐
Picnic area	☐	☐	☐
Camp-ground	☐	☐	☐
Golfing	☐	☐	☐
Other (describe)	☐	☐	☐

	Stream-side	Within 1 km of stream	Within the catchment
Built environment			
Urban residential	☐	☐	☐
Rural residential	☐	☐	☐
Industry (factories)	☐	☐	☐
Commercial (stores, offices)	☐	☐	☐
Schools	☐	☐	☐
Formal park/ gardens	☐	☐	☐
Roads or bridges	☐	☐	☐
Sewage treatment plant	☐	☐	☐
Water treatment plant	☐	☐	☐
Petrol stations/ car repair workshops	☐	☐	☐
Other land uses			
Abandoned mine	☐	☐	☐
Landfill site	☐	☐	☐
Mining, quarry or gravel pits	☐	☐	☐
Other (name)	☐	☐	☐
Bush, forests, nature reserves			
Bushland area	☐	☐	☐
Water supply catchment	☐	☐	☐
Forestry	☐	☐	☐
Inactive crown land	☐	☐	☐
Nature reserve	☐	☐	☐
Other (name)	☐	☐	☐

2. Summary of the major land uses in the catchment (use approximate percentages to show the area)

Agriculture ☐ %

Built environment ☐ %

Bush, forests, nature reserves ☐ %

Other land uses ☐ %

3. Comments on land uses

Use this space to expand or explain land use descriptions you have identified above. For example, you may want to say where construction sites are located, or note the presence of cows in the water, or note contamination controls such as settling ponds.

General features of stream or catchment

4. Note the number of artificial structures that change the natural stream flow in the catchment (hydrological modifications)

None ☐

Dams ☐

Bridges ☐

Weirs ☐

Concrete banks/bottom ☐

Other ☐

5. Note the approximate length of stream that is affected by the following

Diversions (e.g. for irrigation) ☐ metres or ☐ kilometres

Stream straightening ☐ metres or ☐ kilometres

concrete stream bank/bottom ☐ metres or ☐ kilometres

6. Tick the boxes that best describe the general appearance of the waterway

Litter

- ☐ none visible
- ☐ small litter occasionally (e.g. paper, cans)
- ☐ small litter common
- ☐ occasional large pieces of litter (e.g. tyres, shopping trolleys)
- ☐ large litter common

Erosion

- ☐ no streambank erosion, or areas of erosion are very rare, no artificial stabilisation
- ☐ occasional areas of streambank erosion
- ☐ areas of streambank erosion common
- ☐ artificial bank stabilisation present, e.g. man made rock walls, rip rap

Special problems (note in detail in comments section below)

- ☐ spills of chemicals
- ☐ fish kills
- ☐ wildlife, bird kills
- ☐ flooding
- ☐ periods of no flow

7. Comments on general appearance of the waterway (e.g. note time, date and size of fish kill, litter evident after heavy rain)

Record of pipes and drains

In this part, record observations on each pipe and drainage ditch found on the banks or in the stream. Photocopy additional sheets sufficient for each pipe or ditch that you are likely to find. These pipes or drains can be abandoned or active.

8. This information applies to a:

☐ pipe ☐ drainage ditch ☐ other (name)

9. Location of pipe or ditch

☐ in stream ☐ in streambank ☐ near stream

Describe location for purpose of adding to map

____

____

10. Identify type of pipe

☐ Industrial outfall ☐ Storm drain
☐ Agricultural field drainage ☐ Parking area drainage
☐ Sewage treatment plant outfall ☐ Combined sewer overflow
☐ Settlement pond drainage ☐ Unknown
☐ Other (name) ____________________

11. Approximate diameter of pipe

☐ centimetres or ☐ metres

12. Describe the discharge flow

Rate of flow	☐ none	☐ trickle	☐ heavy	☐ intermittent	☐ steady
Appearance	☐ clear	☐ foamy	☐ turbid	☐ oily sheen	☐ coloured (name) ______
Odour	☐ none	☐ sewage	☐ fishy	☐ chemical	☐ chlorine
	☐ other (name) __________				

13. Describe the stream bank below the pipe or drainage ditch

☐ no problem evident ☐ sewage litter, e.g. toilet paper ☐ litter, e.g. cans, paper
☐ eroded ☐ lots of algae ☐ other (name)

14. Comments on the pipe or drainage ditch

Use this space to expand on or explain information provided above. For example, you may want to comment on the condition of the stream below the discharge.

____

____

____

____

____

Site registration form

Complete one form for each waterbody you are monitoring

Waterwatch group name: ______________________________

School: ____________________ Teacher: ____________________ Year level: ________

Landcare group: ____________________ Other group: ____________________

Eastings (6 figures)						Northings (7 figures)							Map no.	Map name	Map scale	Site code	Site type	Site name	Name of river or waterbody and sampling location
4 *	6	0	2	0	0	5	4	1	4	1	0	0	8215	Tamar	1:100 000	COI 020	Stream	Coiler Crossing	Coilers Creek 10 metres from south side of bridge

* Example

Contact address: ____________________ Phone: ____________________

Form completed by (please print): ______________________________

Don't forget - send a copy of this form, when completed, to your Waterwatch coordinator