Drinking water safety planning for a temporary drinking water supply

Contents

Introduction

Kia ora and welcome!

Everyone in Aotearoa New Zealand should have access to safe, reliable drinking water.

To help ensure this vision is achieved, people operating temporary drinking water supplies must have a proper appreciation of drinking water-related risks and options to manage, control, or eliminate risks.

Temporary drinking water supply

The Water Services Act 2021 (the Act) recognises that event organisers may intend to supply drinking water to people attending their events (see Water Services Act 2021 section 33 Planned Events).

Event organisers must either:

- arrange for drinking water to be supplied from a registered drinking water supply, water carrier, or provide bottled water, or
- apply to the Water Services Authority - The Authority (the Authority) to register a temporary drinking water supply.

If you intend to use any of the following supply arrangements to supply drinking water to people attending your planned event, it must be registered as a temporary drinking water supply.

- Unregistered drinking water supplies that were supplying drinking water to consumers immediately before the commencement of the Act on 15 November 2021.
- Existing water supplies that are not drinking water supplies under the Act such as domestic self-supplies and supplies usually used solely for farming.
- Temporary supply infrastructure connected to any source that is not usually set up to supply water.

The application to register a temporary drinking water supply must be accompanied by a drinking water safety plan (DWSP) and the appropriate fee. A template for this DWSP has been developed by the Authority for Event organisers to use. Event organisers must supply drinking water following their DWSP and any other conditions set by the Authority.

It is important that your drinking water safety planning is robust. Failure to adequately address risks to your supply within your DWSP is likely to result in additional conditions being applied and may delay the processing of your application.

The Authority registers a temporary drinking water supply if safe, compliant drinking water can be provided. Registration is subject to conditions.

Applications should be submitted a reasonable period before the start of an event to give the Authority time to complete its assessment. Ideally, this is more than 40 working days before the start of the intended event. The event organiser cannot supply drinking water with a temporary drinking water supply if the Authority does not have enough time to assess the application and register the supply.

When is a DWSP required?

A DWSP must be developed for **each temporary drinking water supply** you operate.

Preparing a DWSP is a risk management process that aims to ensure a safe, reliable, resilient supply of drinking water is provided to your consumers. Your DWSP records the hazards and risks to your temporary drinking water supply and how you will manage them to ensure that drinking water is safe. It focuses on identifying, assessing and managing the risks across the whole drinking water supply system – from where the water is sourced to the point of supply to consumers.

What is Te Mana o te Wai and why does it matter?

Te Mana o te Wai refers to the wellbeing of water and the role all New Zealanders have in maintaining the abundance, safety and care of the water. This is important to all of us because healthy water is essential to any thriving community.

Te Mana o te Wai guides us to practice good stewardship and consider other users, including those in the future, and the needs of our ecosystems as we manage access, storage and use of our water supplies.

Anyone with a duty under the Act, including event organisers, must give effect to Te Mana o te Wai to the extent that it relates to their legal duties, including in their DWSP preparation.

The Authority understands that some event organisers will be unfamiliar with applying Te Mana o te Wai to the management of their temporary supplies.

The most important thing to demonstrate in this section of a DWSP is that you have begun considering what Te Mana o te Wai means to you and that you're committed to enhancing your understanding and application of the concept over time.

Your legal obligations

Temporary drinking water supplies are only required to meet any requirements derived from s 33 of the Act.

As a temporary drinking water supply owner, you are required to apply for registration with the Authority (s 33(2)(b)). This application to register must include a temporary drinking water safety plan (s 33(3)). The Authority may register the supply subject to any conditions it considers necessary to ensure that the drinking water is safe and complies with drinking water standards (s 33(4)).

Instructions

1. To understand what would be required of a permanent drinking water supply as a reference point for your planning, refer to the appropriate sections of the Drinking Water Quality Assurance Rules (Rules). Conditions of registration may include reference to these rules, so it is important to be familiar with them.
2. It may be beneficial for you to have a copy of the National Policy Statement for Freshwater Management 2020 | Ministry for the Environment on hand for guidance on source water management.
3. Answer the questions in the template using the guidance in this handbook. Key terms are explained in Appendix 1.
4. If there are other people involved in managing the supply, it will be helpful to include them in this process.

5. The person in effective control of the water supply signs-off the DWSP to confirm that the water supply details included in the plan are correct and commit to undertaking any identified improvements to the supply.
6. Provide a copy of your DWSP to the Authority (see Next steps on page 15).
7. Keep your DWSP in a central place that is easily accessible to you and any others involved in managing the drinking water supply.

Start completing your plan

The title page

Fill in basic details of your water supply on the title page.

- **Name of owner:** the organisation or name(s) of individual(s) who has/have responsibility for the temporary drinking water supply during the event.
- **Name of operator:** if supply is being operated by someone different from the owner.
- **Name of event:** name of event(s) taking place that is served by this temporary drinking water supply.
- **Event location:** address of event and temporary drinking water supply, please be precise in your description. GPS coordinates are useful.
- **Event date(s):** start and end dates of the event(s).
- **Dates drinking water supply is operational:** if different from event date(s).
- **Population**: state the number of people expected to be served by the water supply.
- **Emergency contact name:** who water supply users or the Authority should contact if an issue is identified with the water supply.
- **Emergency contact phone number**
- **Application ID:** advised when initial application is made and is listed in Hinekōrako (the Authority's online self-service portal).

Question 1: How will you give effect to Te Mana o te Wai?

Te Mana o te Wai is to be considered by the temporary drinking water supplier, to give priority to the health and wellbeing of water, the wider environment and the community. In the development of your DWSPs and source water risk management plans, and in policies, processes and procedures.

Actions or activities that support Te Mana o te Wai will be different in different places. You need to think about what is appropriate for your supply in your region and any statements from mana whenua relating to Te Mana o te Wai.

The Authority has developed some guidance on Te Mana o te Wai here. Other helpful resources include the Kāhui Wai Māori report to the Hon Minister David Parker, available here, and the Ministry for the Environment's YouTube video 'Te Mana o te Wai: Introduction and overview', which is available here.

Some considerations for a temporary drinking water supply include the following.

- What steps have you taken to ensure that your temporary drinking water supply will not have a negative impact on the source of water? For example, contamination by chemicals, discharging unused water or changing the flow of water.

- Do you need any consultation with iwi, hapū, and the local community to consider other factors? For example, protection of places from where food is gathered (mahinga kai)?
- Does your water source intake have any controls in place to prevent or reduce a hazard (or hazards) such as flow control?

Question 2: Who is responsible for your water supply?

Provide details of the key roles and responsibilities of people involved in the operation, and management of your temporary drinking water supply.

2.1 Who owns this plan and approves budget for the water supply?

The DWSP owner is responsible for signing off the DWSP and submitting it. They have the ultimate responsibility to prepare and implement the DWSP and ensure the supply operators follow the DWSP.

The owner of the DWSP and the budget approver are responsible for ensuring improvements and activities identified in the DWSP and post-event report (if applicable) are completed before a temporary supply is used. These may be the same or separate people.

For this section, provide the name, contact details and other relevant details of the DWSP owner, as well as the budget approver if this is a separate person.

2.2 Who helped you prepare this plan?

To help ensure the DWSP is robust, the DWSP owner should ideally develop it using a team of people with a range of relevant skills and knowledge. The DWSP owner and the supporting team will be responsible for gathering information to complete the DWSP, must know about how the water system operates, and have a schedule to review the DWSP and system if the supply is being used repeatedly for multiple events. If a third-party operator is involved in the supply, they should also be involved in this planning process.

Some additional knowledge the team may provide could include:

- water consent requirements
- activities around the source and catchment
- how the pump and treatment systems work
- piping and storage systems as well as operational requirements.

We also require the following information.

- List the key team members involved in preparing this DWSP. Clearly describe the role and responsibilities of each member of the team.
- Describe the skills, knowledge, experience and qualifications of team members relevant to drinking water and the supply.
- Include contact numbers for team members.

2.3 Does your team have the skills, training and experience needed?

You must ensure that your employees, contractors, volunteers or other personnel have the appropriate skills, training, and experience to operate the drinking water supply and manage issues that may arise.

Consider whether your staff have adequate knowledge of the supply to step in if key people operating the supply are unavailable when the supply is operating, e.g. due to illness.

As a minimum, you should consider the following matters and questions.

- The skills, training, and experience required to operate your supply. Please provide details of relevant qualifications, skills, and experience for all operators.
- Will additional training specific to your supply be required?
- Will suitably qualified staff be available to deal with any issues or incidents which may arise?
- Do you have or need a suitably qualified person such as a water engineer available to assist you?
- Do you have capacity or a back-up plan if a key person is unavailable, e.g. due to illness?

Use the table in the template to record the current team capability, identification of training and resourcing gaps, and the resulting planned training and/or recruitment that you are committing to undertake.

Question 3: What makes up your water supply?

Your water supply is more than the treatment and pipes. Your water supply includes everything from the abstraction of the water at its source all the way to the point of supply to a consumer. That means it can include bore heads or river intakes, reservoirs or tanks, treatment equipment and pipes and pumps. Use the categories in the template to identify the different parts of the water supply that you own and operate.

If you are using an unregistered supply, consider the supply up to the source of the unregistered supply. You can find the public register of drinking water supplies, including water carriers, on the Authority website: https://hinekorako.taumataarowai.govt.nz/publicregister/supplies/

Question 4: What does your water supply look like?

How do all the components fit together?

Provide an accurate diagram of your drinking water supply, showing its components and the order in which the water moves or is transported through them. An example diagram is provided in **Appendix 2.**[1]

The drinking water supply system is defined as everything from the abstraction of the water at its source to the point of supply to consumers.

[1] Please note: this diagram is an **example only** and is not representative of an actual supply.

The schematic or flow diagram should include all elements of the water supply, including sources, treatment plants, storage tanks, points of supply (e.g. tap stands, buildings) and any other key infrastructure such as shut-off valves.

The diagram should outline all steps and processes, whether or not they are under the control of the supplier and identify where key monitoring points are located.

What does the supply look like?

Attach photographs of the site(s), including source (where appropriate), treatment plant, storage tanks and other equipment associated with your supply.

Provide clear descriptions for each. If some infrastructure is not yet installed but will be for the planned event, be sure to make this clear in descriptions.

Question 5: How does your water supply work?

Gather as much information as possible on your drinking water supply. Examples of what to consider include:

- quality of the source water including whether it varies with seasons or following heavy rainfall
- vulnerabilities of the source water quality or quantity such as drought or algal blooms
- key parts of the drinking water supply, including source, treatment, storage, and distribution
- infrastructure that will be used to provide water for the event
- any known issues or challenges with any parts of the drinking water supply
- previous incidents or adverse events which had the potential to affect the quantity, safety or compliance of drinking water supplied from the drinking water supply
- the actions needed to ensure that you maintain a sufficient supply of safe and compliant drinking water for the duration of the event.

5.1 Do you understand your source water?

To treat drinking water effectively, you must understand what contaminants are likely to be in the water and what treatment will be required to manage those contaminants.

Source water testing is essential for effective drinking water safety planning. This means you will have to arrange for the source water to be tested or, where applicable, obtain sample results from a third party. Please attach a copy of your source water test results to your DWSP.

When assessing the hazards and hazardous events which could impact the safety, compliance or sufficiency of your supply, you should, as a minimum, consider the following.

- Type of source water – e.g. surface (river, lake), ground (spring, aquifer), roof water, mixed.
- If you are using a ground water source, what is the depth of the bore (to the top of the screen/s)?
- Are the bore heads in good condition and when were they last inspected?
- What activities are happening in the catchment that could contaminate the source water? These could include livestock grazing, crop spraying, industrial activities, landfill sites, construction works, or forestry.

- Is the source water quality stable or prone to change, due to events like heavy rainfall?
- If the source is surface water (dams, ponds, lakes, streams), have you assessed the risk from cyanobacteria?
- Are there other seasonal variations to source water quality or quantity?
- Do samples taken of source water indicate any potential concerns in relation to bacteria or chemicals?
- If you have more than one source, you must assess the risks from each source. Even if a source is rarely used, you should understand the impact a change of source is likely to have on your treatment processes and plan for this, especially if that infrastructure is not often used.
- Does your intake have any controls which will prevent or reduce a hazard(s) to an acceptable level? Document these carefully.

Refer to Appendices 4, 5 and 6 for guidance about specific types of source water.

5.2 Can you provide sufficient drinking water?

To ensure enough safe and compliant water, you will need to know how much water is needed for your event and what could affect your temporary supply. As a minimum for a planned event, you should consider the following matters.

- How many people will be attending? This must include people working on site who will use the supply, in addition to people attending your event.
- Is this number fixed or subject to change? For example, is it open entry or a ticketed event?
- How long will the supply be used? This may be longer than the duration of the event.
- If you intend to use your temporary supply for several events in a 12-month period, you must consider seasonal variations. For example, changes to source water availability and quality or the population served.
- Will you be providing drinking water for other activities such as food preparation?
- Do you require resource consent(s) or need to comply with local authority bylaws? Will your resource consent allow you take enough water to meet demand throughout the event?
- Do you have more than one source associated with the supply?
- Have you planned for external events that may impact on the supply, like extreme weather events, contamination of the source water or rāhui?
- Can you treat or store the volume of drinking water required?
- How will you manage your supply to ensure that water is not wasted, for example, through leakage?
- Do you have a back-up plan for if any sufficiency issues occur? Please provide details.

5.3 Are the treatment processes effective?

The treatment process you have in place must be designed to control the potential contaminants (hazards) that you have identified in source water. The following guidance on treatment outcomes will help you to work out whether treatment processes are effective.

Refer to Appendices 7, 8 and 9 for more guidance on types of treatment.

5.4 How do you store and distribute your water?

Storage and distribution systems include any pre-treatment storage as well as post-treatment movement and storage of drinking water through pipework, reservoirs and other distribution infrastructure.

All storage and pipework should be designed and maintained to minimise contamination and water loss through leaks. As a minimum, you should consider the following matters.

- What steps have been taken to ensure that drinking water in tanks is suitably protected from contamination?
- Do you have documented procedures for inspection, cleaning, and maintenance of storage tanks? How will you ensure that the storage and distribution system are cleaned and disinfected before use?
- What steps have been taken to prevent backflow within the treated water and distribution systems? This may include air gaps and/or backflow prevention devices.
- Do you use pumps to transfer treated water? For example, if the pumps cannot operate due to power cuts or mechanical failure, can water still reach the supply point? How are pumps in the system controlled and maintained? Are there any documented procedures for this?
- Does your temporary supply have residual disinfection (normally chlorination)? Residual disinfection is required for supplies with reticulation under section 31(1)(j) of the Act.
- Have samples confirmed that suitable FAC and pH levels are being maintained throughout the distribution system?
- How has the infrastructure been constructed and what materials have been used? Is the infrastructure in place on a permanent or temporary basis?
- What steps have you taken to protect the storage and distribution system from physical damage and deliberate tampering during the event?
- What steps have you taken to assess and prevent leakage from the storage and distribution system?

Refer to Appendices 10 and 11 for more guidance about distribution infrastructure.

Question 6: What can go wrong?

Most of the time, your temporary drinking water supply will provide clean and ample drinking water. But sometimes the water supply will be compromised (e.g. animals entering tanks, pipe break in an unsanitary area), and people can get sick from unsafe water. Sometimes there may not be enough water available (e.g. during a drought or infrastructure failure). The best way to make sure there is less chance of people becoming sick and ensure they have continued access to safe drinking water is to consider what can go wrong and adopt management practices that will prevent or manage the impact if it does.

The Authority website has useful guidance prepared by the Ministry of Health that may help.

What are the risks to your water supply system?

Identify those things or events that may contaminate or affect the safety or sufficiency of your drinking water, such as reduced quality of the source water, pipes breaking, power cuts, extreme weather events, or a treatment process failing. Even if these events are not recorded as causing issues in the past at this site or in similar supplies, it is important to identify possible events.

Some of the major contamination events that have caused illness or death were from previously unrecorded events. Some are events that may have occurred in the past, and some occur regularly, such as a drought which can occur during summer most years. Illness is often assumed to be food-related when it may in fact have been caused by drinking water.

Once identified, rank the risks according to their health impact (high, medium or low). For example, issues that affect the taste of the water but are unlikely to cause illness are a lower risk. However, having bacteria such as *Campylobacter* in water because of contamination from livestock are a much higher risk with more severe consequences to users of the supply.

How are the risks controlled and monitored?

Consider if you have ways to eliminate or minimise the impacts of these risks. These management measures are called controls. Examples of controls include fencing to keep livestock out, regular inspection and maintenance and water treatment.

Describe how you know a control is working, i.e. monitored. This may be by inspecting visually, monitoring the operation of the treatment process or taking samples of the drinking water regularly to test the quality. It is important to record who is responsible for checking the controls, when they will do it and how they will keep records of their findings – this is expanded in Question 7.

Can you improve your drinking water supply system?

If you have identified high risks or gaps in the temporary supply, identify improvements that can address these. Think about what you can do to improve the drinking water system or your management of the system to further protect from the risks you have identified.

Start with documenting any shortcomings and then identify improvements that could be made. For example, if you do not inspect equipment regularly or the team does not have a member with training on the equipment. In this case, an improvement may be planning a regular check of the equipment or to get the manufacturer to provide a team member with training.

Prioritise your improvements and give them a time frame you will be able to achieve. This may be before the temporary event or for any future events. This will eventually also be informed by the post-event report if this planned event will be repeated – see Question 9.

Question 7: How do you manage your water supply?

It is important to have a plan to proactively manage your temporary drinking water supply and not only take action in reaction to something going wrong. You also must record when you do the activities so you can show the system has been managed well.

7.1 What inspection and maintenance do you complete and record?

Regular inspection and maintenance are essential to maintaining a well-functioning and safe water supply.

Activities may include:

- check upstream of an intake for contamination after rainfall events or for algae blooms in summer

- check the intake or bore head area is clear, including fenced-off from livestock areas
- check and maintain pumps
- check tanks, making sure screens for bird and vermin protection (including any lid) is intact and secured, checking the sludge level inside, checking the structural integrity and roof condition
- replace filters and UV lamps as per the manufacturer's advice
- follow manufacturer's instructions on routine maintenance of all equipment.

Keeping records of the inspections and maintenance is important to help detect equipment deteriorating faster than expected or troubleshoot when something goes wrong with the supply.

Identify any procedures that you need to develop or equipment purchases required to make sure the inspection and maintenance is carried out effectively.

7.2 How will you know your water supply system is working as expected? (Monitoring and sampling)

To check that your system is working as expected and to detect when things start to change, you will need to monitor many parts of it. This is called operational monitoring. This monitoring can be undertaken by online monitors or manual sampling.

Team members need to know when and what they are monitoring, how monitoring must be done and what the results mean. There are three types of levels in the DWSP template.

- Target levels – results confirm that the process is working as expected.
- Action levels – results indicate that a process is drifting and will require action such as more frequent monitoring, process adjustment or escalation to senior team members.
- Critical levels – results indicate that drinking water may be unsafe, and a timely and effective response will be needed to address any public health risks. You may be required in conditions of registration to notify the Authority if critical levels beyond Maximum Acceptable Values (MAVs) are reached.

You will have to carefully consider where to set the monitoring thresholds for these levels. You will need to ensure team members with monitoring duties fully understand what is required.

When developing your monitoring plan, you must consider the following matters.

- What procedures are in place to ensure that monitoring equipment is giving accurate readings?
- Are all key points in the supply being monitored appropriately, with target, action and critical levels?
- How frequently will monitoring need to be undertaken?
- Are there documented procedures for operators who undertake monitoring?

Manual sampling throughout the water supply system provides valuable information on water quality and provides a check that monitoring equipment is working. You should consider the following matters.

- What sampling is required in addition to the operational monitoring to understand your water quality or provide additional information?

- What laboratory will be used? International Accreditation New Zealand (IANZ) accredited laboratories provide confidence in the results of analysis for source water, raw water and drinking water.
- How will you ensure that samples are taken, stored and transported correctly? Provide details as an attachment to the DWSP.
- How regularly will samples be taken and what determinands (e.g. microbiological, chemical and water properties) will be tested for?

It may be a condition of registration that all water samples must be analysed by a laboratory accredited by IANZ and must be collected according to the requirements provided by the laboratory, unless otherwise specified in conditions.

7.3 How do you know your monitoring equipment is effective? (Calibration and checks)

To know if your system is protecting the public health of those who drink it, you need to confirm the results of operational monitoring and observations with some retrospective monitoring. This will generally not prevent an incident occurring. However, it may identify that a problem that was not detected by operational monitoring and give you opportunity to remedy it for future use. You should consider the following:

- how do you know you can rely on your operational monitoring results?
- how and when will monitoring equipment be calibrated to make sure it is providing accurate results?
- what sampling do you do to check your monitoring instruments?

Manufacturers will generally provide recommended calibration and verification processes for users to follow.

7.4 What written procedures and manuals are in place to guide and record operations and maintenance?

Procedures describing how activities (operational and maintenance) are to be carried out support the ongoing operation of a safe drinking water supply. They help make sure team members consistently complete activities and provide instruction to new or temporary team members brought in to manage the system.

Think about:

- what documented procedures are available to support the team to operate the supply effectively?
- how are the procedures documented?
- who does the checking, how frequently and how do they record the result?
- where is this recorded, who has access to the information and who is responsible for signing off on the information?

Question 8: How will you respond when an incident occurs?

How have you planned for factors that could impact on your supply and require a response?

What would be an emergency for your water system?

Potential issues leading to an emergency response may include:

- power cuts or loss of electricity supply
- damage to or problems with reticulation infrastructure
- loss of key staff members
- natural disaster
- illness among attendees – indicator of potential waterborne illness
- incident affecting a registered drinking water supply you intend to connect to.

How will you respond to an incident?

You need to act immediately to ensure that public health is protected if the drinking water you supply does not comply with the Drinking Water Standards or is likely to be unsafe. Identify key personnel, their responsibilities and the procedures that will be followed if this occurs.

Potential conditions of a registration can include notifying the Authority, investigating the cause and implementing measures to ensure the problem does not recur.

As a minimum, consider:

- what will you do if water is unsafe or unavailable?
- do you have a suitable alternative supply on standby?
- how will you advise event attendees if there is an issue?
- have you prepared messaging in advance?
- do appropriate people know how to notify the Authority if required?
- what other key stakeholders need to be advised?

Incident response procedures

It is important to have procedures or flow charts for actions to be followed for some of the more common incidents (like boil water advisories for a positive *E. coli* result). These should be accessible and familiar to those operating and maintaining the supply to enable swift action when necessary.

Your temporary drinking water supply registration may be subject to conditions requiring you to notify the Authority of certain matters.

Notifying the Authority

- If an imminent risk of serious illness or death arises from your temporary drinking water supply, or to discuss an urgent matter, call the Authority at **04 889 8350**. PDF forms are also available on the website to notify The Authority - https://www.taumataarowai.govt.nz/for-water-suppliers/incident-notifications/. If in doubt, contact your regional Authority Water Services team with whom you have discussed registration.

You may be required to notify the Authority under certain circumstances, most commonly:

- where a drinking water test sample exceeds the relevant MAV (maximum acceptable value) of a water quality parameter
- if the supply of water is interrupted for more than eight hours.

You should also investigate the cause and implement measures to ensure that the problem does not recur.

Question 9: What will you include in your post-event report?

The Authority may register a temporary drinking water supply, subject to conditions it considers necessary to ensure the drinking water is safe and complies with drinking water standards. A post-event report is a standard condition for all registrations of planned temporary drinking water supplies.

In this section, consider the following matters.

- What will you include in your post-event report?
- How will you note these down during the event?
- Will these feed into a DWSP revision?

As a minimum, this report should include:

- water quality monitoring results
- information on any conditions that have not been met
- incidents or notifications
- any complaints about the water
- any engagement with local iwi, hapū or wider community.

If the event will be repeated in future, this report should also include any improvements that have been identified and carried over into the DWSP.

Next steps

Please submit your completed DWSP in Hinekōrako for the Authority to assess. This can be accessed on the Authority website.

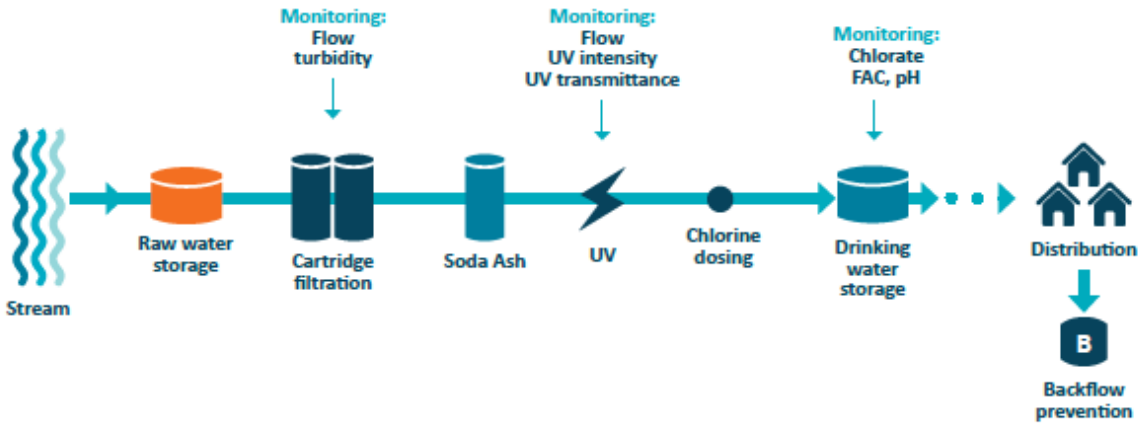
Get in contact if you are experiencing issues with this, either with your existing contact or email opssupport@taumataarowai.govt.nz.

Appendix 1: Key terms explained

Term	Definition
Controls	• A measure or step which is designed to reduce the likelihood or severity of harm. • Also known as 'preventative measures', 'mitigation measures' and 'barriers to contamination'.
Drinking Water Quality Assurance Rules	The Drinking Water Quality Assurance Rules 2022 are compliance rules made by the Authority under s 49 of the Water Services Act 2021 and can be found on the Authority website.
Drinking Water Standards	The Water Services (Drinking Water Standards for New Zealand) Regulations 2022. The Drinking Water Standards are regulations made under s 47 of the Water Services Act 2021 and can be found on the New Zealand Legislation website.
Hazard	• An object, substance (including biological, chemical, physical or radiological agents) or a set of circumstances that has the potential to make a drinking water supply unsafe or insufficient to meet the drinking water needs of consumers.
Hazardous event	• An incident or situation that can lead to the presence of a hazard in the drinking water supply or prevent sufficient supply of drinking water. • The point at which control of the hazard is lost.
Hinekōrako	• A self-service portal for water suppliers and laboratories, and our Operational and Intelligence system. Hinekōrako personifies the lunar rainbow. This name was gifted to the Authority by Te Atiawa.
Risk	• The likelihood that the hazards will cause harm combined with the severity of the consequences if the hazard does occur.
Source water	• The water body from which water is abstracted for use in a drinking water supply (e.g. river, stream, lake or aquifer) and rainwater.
Te Mana o te Wai	• A universal concept for all Aotearoa New Zealanders. It refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and wellbeing of the wider community environment.

Appendix 2: Example flow diagram

Please note: This is just an example of how you could draw your own water source.



Appendix 3: Example of some potential hazards and sources of hazards to a water supply

Components of drinking water supply system		Hazard	Potential sources of hazard/hazardous event
Source	Lake, river (surface water)	**Bacteria** **Protozoa** **Viruses**	• Animal or human waste entering the source water from farm run-off, wastewater treatment plant discharges or septic tanks.
		Chemicals	• Chemicals used on farms within the catchment, discharges from industry within the catchment, run-off from roads, vehicles entering water (road accidents), or chemicals from natural sources (e.g. deposition of volcanic ash).
		Cyanotoxins	• Benthic or planktonic cyanobacteria producing toxins (seasonal).
	Bore, spring (ground water)	**Bacteria**	• Animal or human waste entering the aquifer from farm run-off, wastewater treatment plant discharges or septic tanks.
		Protozoa	• Animal or human waste entering the aquifer from farm run-off, wastewater treatment plant discharges or septic tanks (typically only in very shallow aquifers or through defective bore heads).
		Viruses	• Animal or human waste entering the source water from farm run-off, wastewater treatment plant discharges or septic tanks.
		Chemicals	• Chemicals used on farms within the catchment, discharges from industry within the catchment, run-off from roads, vehicles entering water (road accidents) or naturally occurring chemicals from soil and rock.
		Radiological determinands	• Chemical isotopes from soil and rock that are radioactive, like alpha and beta emitters including radon. These typically occur naturally.
	Roof	**Bacteria** **Protozoa**	• Animal or bird waste entering rainwater system.
		Viruses	• Typically only an issue when people have direct access to the roof.
		Chemicals	• Chemical found in roofing materials, discharge from nearby chimneys.
	Registered water supply	**Bacteria**	• Biofilms building up inside the water pipes and entering the supply system when repairs are undertaken or via backflow.
		Viruses	• Viruses entering system through leaks when repairs are undertaken or via backflow.

		Chemicals	• Chemicals entering system through leaks when repairs are undertaken or via backflow. These leach from pipe materials, joints and fixtures, like lead. • Water treatment processes in source supply with potential to malfunction or change chemical composition of water received.
Treatment	**Treatment**	**Chemicals**	• Failure of the water treatment equipment. • Impurities in treatment chemicals or unloading of the wrong chemical.
Distribution	**Storage (tanks/ reservoirs)**	**Bacteria**	• Animals or birds able to enter the reservoir, or from human access to reservoirs like swimmers or divers.
		Protozoa	• Animals or birds able to enter the reservoir.
		Viruses	• Human access to reservoirs such as swimmers or divers.
		Chemicals	• Materials used in the construction of reservoirs, deliberate tampering.
	Reticulation systems	**Bacteria**	• Biofilms building up inside the water pipes and entering the supply system when repairs are undertaken or via backflow.
		Viruses	• Viruses entering system through leaks when repairs are undertaken or via backflow.
		Chemicals	• Chemicals entering system through leaks when repairs are undertaken or via backflow. Leaching from pipe materials, joints and fixtures like lead.

Appendix 4: Controls – bores and springs (groundwater)[2]

A bore or well is a small diameter hole sunk or drilled into the ground, tapping into a layer of water. Usually, with the aid of an underground pump, water is pushed to the surface. A spring is where this groundwater naturally reaches the surface.

The intake (bore or spring) is an important part of your system. A good intake is usually only a little more expensive than a poor one, yet a good intake will fix many problems caused by turbidity and other contaminants.

Bore heads should be sealed at the surface to prevent surface water and contaminants from entering. The bore should be cased so that shallow groundwater does not mix with the deeper water. Ensure that your bore is away from any septic tank soakage areas, offal or rubbish dumps, and animals are excluded from within five metres of the bore head.

Springs should have a wall or berm around the abstraction area to prevent surface runoff mixing with the spring water, and the area should be fenced to keep livestock out.

Appendix 5: Controls – lakes, rivers, and streams (surface water)

Locate your stream or lake intake upstream of any waste discharges, drawing sufficiently below drought level to prevent sucking air into the system. Intakes normally incorporate a screen to remove larger items such as leaves, sand or stones and aquatic animals.

If the source water becomes dirty after rain, consider introducing a system that shuts off the intake until the water is clear.

Appendix 6: Controls – rainwater (roof water)

Rainwater may not be suitable for drinking if the property collecting rainwater is near a busy highway or factories discharging contaminants to the air and while pesticides are being sprayed nearby.

Avoid collecting water from the section of roof that collects fall-out from a flue from a slow combustion heater or oil burner.

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[2] Information in Appendices 4 – 11 is provided courtesy of the Ministry of Health and modified where appropriate by the Authority.

Avoid using lead flashings and lead-headed nails on roofs harvesting rainwater. If the roof does have lead flashings, you may be able to isolate the lead by painting it.

Asphaltic and bitumen-based roofing have been known to impart taste and colour to rainwater. Unpainted treated timber shingles may leach chemicals like copper, chromium and arsenic.

The metals lead, chromium and cadmium are toxic and a roof painted with paint containing these metals should not be used as a source of drinking water. Lead and chromium are more likely to be found in primers and rust control coatings.

While modern roof paints are generally labelled for their suitability for painting a roof for water supply, talk to a technical representative from a paint manufacturer before painting.

Guttering should be installed so water does not pond and stagnate – this can allow micro-organisms to grow.

Apart from carrying out maintenance, the quality of the water running off the roof can be improved significantly by:

- adding leaf guards or mesh to the guttering, installing a debris diverter or both
- installing a first-flush diverter – most need manual cleaning so require regular maintenance
- installing the inlet pipe so the water enters the bottom of the tank through a U-bend without disturbing the sediment
- attaching the draw-off pipe to a float so the water is extracted from near the water surface
- installing a vacuum device that uses the overflow to automatically de-sludge the tank
- operating small tanks running in series rather than installing one large tank; as the water passes to successive tanks, the water quality improves significantly.

Appendix 7: Controls – water treatment – filtration

Filtration is a process where water is passed through a treatment device that screens or removes certain types and sizes of particles. Filters may be coarse and remove large particles, or fine, such as ultrafilters, capable of removing most substances.

Cartridge filtration is a water filter housing installed in a way to ensure all water passes through it. Replaceable cartridges are installed with a tight seal so that all water must pass through the filter.

Activated carbon is a form of charcoal which is activated by steam treatment at high temperatures, making the material extremely porous and reactive. Granulated activated carbon comes in small lumps or granules. The sizes vary but are usually about 3 - 5mm in diameter. Powdered, activated carbon is a very fine powder that is normally impregnated on to a cartridge.

Plain and activated carbon cartridge type filters can both remove protozoan cysts if the nominal particle retention size of the filter is 1 micron or less. Activated carbon filters should not be exposed directly to water containing biological contaminants – carbon granules can act as a growth medium for bacteria. If you think your water could be contaminated, then activated carbon may not be the best filter for you.

Activated carbon will eventually become full of contaminants and must be replaced to prevent contaminants returning to the water.

Ultrafiltration is a type of membrane filtration that can remove particles down to the size of approximately 0.1 micron (1/10,000th of a mm). Some ultrafilters can remove all biological contaminants. They can clog quickly and should only be used with relatively clear water or following upstream filters.

Appendix 8: Controls – water treatment – UV disinfection

Ultraviolet (UV) light is used to disinfect water by treating microbiological contaminants, making the organism harmless. A UV device must be used with relatively clean water, allowing the light to penetrate with sufficient intensity throughout the reaction chamber. A dose of 40 mJ/cm^2 is effective against bacteria and protozoa.

The lamps degrade with time and must be replaced every six months or up to a year. UV disinfection devices should have a built-in monitoring system that indicates that the device is operating correctly and warns of lamp deterioration or failure.

UV devices must be installed by a suitably qualified person such as a registered plumber.

Appendix 9: Controls – water treatment – chlorination

Chlorine is a common disinfectant used to reduce the risk of harmful micro-organisms in drinking water. Nearly all pathogenic organisms can be destroyed with chlorine when suitable volumes and concentrations are added to drinking water with a sufficient contact time.

Chlorine can be used as both a primary disinfectant in the treatment of a water supply and as a residual disinfectant in the distribution. This protects water from contamination events once it leaves the treatment plant.

It can also be used as a one-time shock disinfection to the water supply in response to a contamination event or as a part of a maintenance schedule and can be flushed through the system to treat the whole supply.

Chlorine is available in multiple forms for water treatment. It is important to remember that chlorine compounds can be harmful to people when mishandled. Check the concentration and recommended dose of the chlorine compound before adding it to the water supply and follow product manufacturers' instructions.

One type of chlorine is liquified chlorine gas, Cl_2. Chlorine gas must only be used by an approved handler under the Hazardous Substances and New Organisms Act, due to the risks of storing and handling it.

Sodium hypochlorite (NaOCl) is a liquid which is the common ingredient in bleach. It can also be made from brine solutions. Sodium hypochlorite used to disinfect drinking water must be less than three months old. This is because of a reaction which decreases the strength of the free available chlorine and the formation of chlorate ions (ClO^{3-}) after approximately three months, depending on the conditions it is stored in.

Calcium hypochlorite ($Ca(OCl)_2$) is a solid compound provided in the form of powder, granules or tablets. The powder must be mixed with water for dosing. Calcium hypochlorite has the same issue of degradation over time as sodium hypochlorite but has a longer shelf life depending on storage conditions.

Chlorate concentrations can reach health-significant levels in water supplies due to the use of hypochlorite, therefore appropriate preparation, dosing and monitoring methods should be used.

Free available chlorine is the standard method of monitoring chlorine in a water supply. This measure indicates if there is enough chlorine in the water to act as a disinfectant. It can also indicate whether something has changed in the supply which has used up a lot of free available chlorine and therefore a potential contamination event.

Sources:

Supply of Chlorine Third Edition (Water New Zealand)

Instructions for dosing tanks ESR0940-Household-water-supply (Ministry of Health)

Appendix 10: Controls – treated water – pipework and connections

Many of New Zealand's waters are soft and drinking water may be corrosive. As corrosive water can leach out metals from metallic pipes and fittings, you may need to use plastic pipes and valves for drinking water.

The most used plastics are:

- unplasticised polyvinylchloride (UPVC)
- low-density polyethylene (LDPE, e.g. alkathene)
- medium-density polyethylene (MDPE)
- high-density polyethylene (HDPE)
- polybutylene.

Consider the following parameters when selecting pipe types:

- cost
- availability
- resistance to handling, trenching and superimposed loads
- flexibility and ease of laying
- ease of connection
- resistance to frost.

Roofing, guttering, downpipes and pipework used in conjunction with drinking water should comply with AS/NZS 4020: Testing of Products for Use in Contact with Drinking Water.

An experienced master plumber or plumbing goods supplier should be able to give useful advice. However, a low-cost quality system might consist of low-density polyethylene pipes, approximately 20 mm internal diameter for main runs and 15 mm internal diameter for spurs/laterals. For long runs or high flow, a 25 mm pipe connecting the source and the buildings being supplied may be desirable.

Pipes should be buried at least 400 mm deep, from the source to storage tanks. If that isn't possible due to the temporary nature of the supply, consider cable and hose protectors to protect pipes where they are exposed to foot and vehicle traffic.

Appendix 11: Controls – treated water – backflow prevention

Backflow prevention devices should be installed between a drinking tap and any place where there is a connection which could allow contaminated water to be drawn into the distribution system.

Examples include connections to chemical containers, cattle troughs etc. An air gap is a very simple backflow prevention device. Air gaps must be checked regularly to ensure they are still working (e.g. an overflow pipe can become blocked meaning the air gap no longer exists).

Commercially purchased toilet flushing cisterns have a backflow preventer built in but any "do-it-yourself" device needs a backflow preventer.

In many cases, the fitting of such a device to the specifications of AS/NZS 3500.1:2015 Plumbing and Drainage – Part 1: Water Services 3 will meet the requirements of the Building Code.