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DRINKING-WATER STANDARDS for the COOK ISLANDS

June 2025

FOREWORD

Access to affordable potable drinking-water is a human right and social and environmental justice for all people living in the Cook Islands.

Six principles guide access to affordable potable drinking-water in the Cook Islands.

- Principle 1: protect public health and promote health and wellbeing, and human dignity
- Principle 2: water sources, biodiversity and the environment should be protected
- Principle 3: water is a common good and of economic value for all
- Principle 4: ensure equitable and sustainable water utilisation
- Principle 5: establish preventive risk management strategies
- Principle 6: design climate resilient water systems

The Cook Islands Public Health Act 2024 safeguards public health by regulating the quality and safe use of water in reticulated supplies, public swimming pools, and designated swimming areas, ensuring compliance with established safety standards. Part 6 Section 47 of the Public Health Act also provides for the Secretary of Health (by a **water quality order)** to adopt drinking-water standards for the purposes of imposing a range of duties on drinking-water suppliers or the proprietor of any public swimming pool or area. The provisions of the Cook Islands Ministry of Health Act 2013 authorises the Ministry to regulate or ensure that proper regulatory measures are taken in relation to all health related matters concerning the provision of water.

I am pleased to present the Drinking Water Standards for the Cook Islands (DWSCI) 2025. While the Ministry of Health will take primary responsibility to enforce the DWSCI, the Water (and Sanitation) Sector Committee will oversee the Governance of Water in the Cook Islands. A review of the DWSCI six months after implementation and every five years thereafter will ensure it remains fit for purpose and pragmatic for the Cook Islands context.

The DWSCI will require **water suppliers** to develop and implement a *Drinking-Water Safety Plan* to guide the safe management of their supply, including providers of tankered water. This plan will help suppliers identify, manage and minimise events that could otherwise cause public health risks through poor quality water.

May I thank those involved in the development of the DWSCI including members of the national water (and sanitation) sector stakeholder organisations, as well as WHO and SPC advisors and consultants.

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ABBREVIATIONS

Disinfection by-products (DBPs): DBPs are unwanted but not easily avoidable by-products or breakdown products of disinfectants. Organic disinfection by-products are formed by the reaction of chlorine with natural organic matter in source water. Trihalomethanes (THM) are normally present in the greatest quantity followed closely by haloacetic acids.

Drinking-water Safety Plan (DWSP): An approved risk assessment and risk management tool that is used to reduce the risk of contamination of drinking-water supplies.

Drinking Water Standard Cook Islands (DWSCI): An outline of the minimum safety and quality requirements for all drinking water supplied to the public, public and private, based on the WHO Guidelines for Drinking Water Quality and adapted to the local context of the Cook Islands and enforced through the Public Health Act and related regulations, with oversight by Te Marae Ora, Ministry of Health.

Escherichia coli (*E. coli*): A bacterium used as an indicator of faecal contamination of water. If *E. coli* is present, it is considered likely that pathogens may also be present in the water.

mg/L (ppm): Milligram per litre - concentration at which one thousandth of a gram (1/1000) is found in a volume of one litre; it is equal to the unit parts per million (ppm) in very dilute solutions.

µg/L (ppb): Microgram per litre – mg/L divided by 1000, approximately equal to the unit parts per billion (ppb) in very dilute solutions

Maximum Acceptable Value (MAV): The MAV of a chemical determinand in drinking-water is the highest concentration of a determinand in the water that, on the basis of present knowledge, is considered not to cause any significant risk to the health of the consumer over 70 years of consumption of that water. Wherever possible, the MAVs have been based on the latest WHO guideline values.

DEFINITIONS

Chlorinated water supply: A term used for water in the distribution zone. Water supplies that are chlorinated using chlorine gas or liquid chlorine and demonstrated consistently to have a free available chlorine (FAC) or chlorine dioxide concentration of at least 0.2 mg/L.

Community water supply: The primary source of drinking-water for a village, town; community meeting places; work places, schools and other public spaces.

Disinfection: Treatment of water to inactivate or kill disease-causing microorganisms (pathogens) using chlorine (gas or liquid form), chlorine dioxide, chloramines, ultraviolet radiation, ozone, or other disinfectant. Boiling water is a popular disinfection method at the household level.

Distribution zone: All the pipe work and storage infrastructure post-treatment, and includes pipe work and meters up to the boundaries and/or connections to individual properties.

Drinking-water (potable water): Water that is suitable for human consumption such as drinking and cooking. Also called potable water.

Drinking Water Quality Standards: A document which sets out the Maximum Acceptable Values for a range of constituents in drinking-water, levels below which adverse health effects would not be expected, and how a water supplier is required to act to rectify transgressions of this standard. It also sets out the frequencies for sampling and required methods of analysis.

Faecal Coliforms: Those coliform bacteria originating in the gut of warm-blooded animals.

Grab sample: A one-time sample (collected using a dipper or bottle) representing the water at that particular time and place which can be analysed for a range of parameters.

Groundwater: Water contained beneath the land surface. Often abstracted through a bore and well and used as a source for water supply.

Herbicides: Agricultural chemicals used to eradicate or control plant pests such as weeds or invasive plants.

H_2S field test: The hydrogen sulphide (H_2S) paper strip test is a field test that measures the amount of hydrogen sulphide in the water, and can indicate that the water is contaminated with pathogens.

Inorganic parameters: Non-carbon-based chemicals such as arsenic, cadmium and lead.

Monitoring: Routine collection of water samples for analysis to determine water quality, usually done by water supplier.

Nephelometric Turbidity Unit (NTU): A measure of the turbidity (cloudiness or clarity) of water.

Organic parameters: Carbon-based chemicals such as pesticides and disinfection by-products.

Outbreak: An increase in the number of cases of illness in a defined area or associated with a specific event and usually associated with a single source, for example a drinking-water supply.

Ozonation: Treatment of water by dissolved ozone primarily for disinfection but also for the oxidation of chemical determinands.

Pathogens: Microorganisms including those from the groups of bacteria, protozoa, algae, helminths and viruses that can cause illness.

Pesticides: Agricultural chemicals used to eradicate or control animal pests such as insects, snails, rodents, and mites.

pH: A measure of acidity (low pH) or alkalinity (high pH) of water with a neutral value of 7.

Physical parameters: Physical characteristics of water including temperature, odour, colour, conductivity, suspended solids and turbidity.

Population bands for monitoring: The range of a number of people that are supplied with water from a reticulated community supply.

Raw water: Water that has not received any treatment to make it suitable for drinking.

Regulatory agency: The government authority in charge of enforcing the drinking-water standards. In the Cook Islands, this is Te Marae Ora Ministry of Health.

Residual Chlorine: The concentration of chlorine in water after the chlorine demand has been satisfied. When chlorine is added to water it combines with organic material in the water. After this process has occurred any free chlorine or chlorine that has not combined with organic material provides a residual or disinfecting function (measured as Free Available Chlorine – FAC).

Reticulation: The network of pipes, pumps, and service reservoirs, that delivers the drinking-water from the water treatment plants to the consumers or where two or more buildings are connected to one source.

Sanitary survey: An evaluation of the physical environment to identify existing and potential sources of health hazards, risks and environmental contamination that may affect water supply and community health.

Surface water: Freshwater such as streams, rivers, lakes, ponds, or reservoirs.

Surveillance: The process of checking if the monitoring of drinking-water supplies conforms to the Standards. Usually conducted by the government health authority, Te Marae Ora Cook Islands Ministry of Health and may include sanitary inspection, water monitoring, data processing, and reporting.

Tankered drinking-water: Water delivered to the consumer by tanker and not through a water network reticulation. It may be delivered by road or vessel to the consumer's storage facility on a commercial or voluntary basis.

Total coliforms: A group of bacteria commonly found in the environment including in soil and vegetation. They may not cause illness but their presence in drinking-water indicates contamination from an environmental source, and the possibility of more harmful organisms being prevalent. They ferment lactose at 35-37^{o}C.

Trihalomethanes (THM): The main Disinfection By-Product produced in highest concentrations. It is formed by the reaction of chlorine in water with naturally occurring organic substances such as humic and fulvic acids.

True Colour Unit (TCU): Measure of colour of filtered water samples that could come from iron or dissolved organic substances, also measured in Hazen Units (HU). In unfiltered samples, it is called "Apparent colour".

Turbidity: The cloudiness of water. The concentration of particulate material suspended in water. Low turbidity is essential for effective disinfection of water.

UV disinfection: Disinfection using electromagnetic radiation (light) emitted with wavelengths in the germicidal range. The UV light effective for inactivating micro-organisms (the germicidal range) is in the UV-B and UV-C ranges of the spectrum (200–310 nm), with maximum effectiveness around 265 nm[1].

Virus: Very small pathogenic organisms which can be excreted in faeces e.g. Hepatitis A and rotaviruses.

Water quality: A description of the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose, such as for drinking.

[1]Guidelines for Drinking-water Quality Management for New Zealand 2013 pp544; https://www.moh.govt.nz/notebook/nbbooks.nsf/0/B97E4331F0C1F869CC257C2E0072BAB9/$file/guidelines-drinking-water-quality-management-for-new-zealand-oct13.pdf

Water Supplier: Any person or entity, government or private company responsible for source development, water abstraction, treatment, and distribution of water.

Water supply authority: Any entity that owns, or is responsible for operating a drinking-water supply system.

Water treatment: A chemical, biological or physical process employed to improve the quality of a drinking-water supply prior to distribution so that it is safe to drink.

1 INTRODUCTION

Access to affordable potable drinking-water is a human right and social and environmental justice for all people living in the Cook Islands.

The aim of the Drinking-Water Standards for the Cook Islands (DWSCI) is to protect public health. The DWSCI define the minimum requirements for drinking-water quality in the Cook Islands based on the best available scientific and technological evidence, and addresses the microbial and chemical contaminants through the control of hazardous constituents in water.

The DWSCI is intended for use by all those residing in the Cook Islands including members of the National Water (and Sanitation) Sector Committee and agencies tasked with responsibilities to ensure the integrity of the water system and the supply of safe, quality drinking-water, including catchment and water resource managers, drinking water suppliers, water regulators and health authorities.

The DWSCI draws from the World Health Organization (WHO) Guidelines for Drinking-Water Quality (2017),[2] and the Water Services (Drinking-Water Standards for New Zealand) Regulations 2022 and seeks to ensure health risks to the consumers and public at large are minimised. The DWSCI also provides a baseline for assessing long-term trends in the performance of each water supply system and serves to inform plans for future water supply projects.

1.1 Principles

Six principles inform the design and implementation of the DWSCI.

- Principle 1: protect public health and promote health and wellbeing, and human dignity
- Principle 2: water sources, biodiversity and the environment should be protected
- Principle 3: water is a common good and of economic value for all
- Principle 4: ensure equitable and sustainable water utilisation
- Principle 5: establish preventive risk management strategies
- Principle 6: design climate resilient water systems

Core to these principles is the notion that safe drinking-water is essential to sustain life and as a common good, there is an ethical role for society to recognise and mitigate situations in which the pursuit of rational self-interest by some, may lead to outcomes that are irrational and harmful to the wider community.

It is also important to acknowledge the cultural nuances, practices and norms that reflect the diversity of our peoples and their environmental contexts, notwithstanding the influence and impact of global public health threats, climate crisis and extreme weather events e.g., sustained periods of drought or heavy rainfall and flooding, which risk disrupting water supplies and drinking water quantity and quality.

[2] WHO 4th Edition (2017)- http://www.who.int/water_sanitation_health/dwq/guidelines/en/

1.2 Legislation

The Cook Islands Public Health Act 2024 safeguards public health by regulating the quality and safe use of water in reticulated supplies, public swimming pools, and designated swimming areas, ensuring compliance with established safety standards. This includes the sampling and analysis of water, notification and disclosure of results, and issuing of public health warnings by the Secretary of Health, if the results suggest that the water poses a health hazard for the people using or likely to use the water.

Part 6 Section 47 of the Public Health Act also provides for the Secretary (by a **water quality order)** to adopt drinking-water standards for the purposes of imposing a range of duties on drinking-water suppliers or the proprietor of any public swimming pool or area, including duties to monitor and record the quality of water, regulate the collection and analysis of samples, or regulate the storage, collection, treatment, supply, and monitoring of water.

The provisions of the Cook Islands Ministry of Health Act (2013) - Part 4, Section 15 1(f), authorises the Ministry to regulate or ensure that proper regulatory measures are taken in relation to all health-related matters concerning the provision of water.

The Public Health Act outlines the high-level obligations for a water supplier while the DWSCI sets broader water quality management obligations for water suppliers through their drinking-water safety plans (DWSP). The DWSCI shall be enforced by Te Marae Ora Cook Islands Ministry of Health (TMO) in accordance with the Public Health Act to ensure the safety and safe use of all drinking-water delivered to the consumer, and the provisions of the Ministry of Health Act, to implement systems of quality control for public health issues such as water resources.

Compliance with the DWSCI is to be demonstrated by water suppliers through drinking-water quality monitoring and surveillance programmes. The DWSCI shall use and recognise analyses of water samples from accredited laboratories where available and certified field tests.

1.3 Water Policy

While the people of the Cook Islands have enjoyed 100% access to basic drinking water services for over a decade, water quality has varied with water test results demonstrating frequent faecal contamination.

The Cook Islands National Water Policy (2016) provides the overarching framework to ensure people living in the Cook Islands have access to reliable, safe drinking water. This aligns with global and national priorities:

- Sustainable Development Goal (SDG) 6: to ensure availability and sustainable management of water for all, and SDG 6.1: by 2030, achieve universal and equitable access to safe and affordable drinking water for all;
- Pacific Healthy Islands Vision, and the;
- National Sustainable Development Plan 4, for sustainable management of water.

The National Water Policy articulates 12 overarching principles which are consistent with the six DWSCI principles:

1. precautionary principle,
2. sustainability and environmental preservation,
3. health and water quality,
4. water conservation,
5. equity and affordability,
6. engagement and participation,
7. cultural sensitivity,
8. mitigation of the impact of infrastructure and development on ecological flow,
9. collaboration and cooperation,
10. accountability and transparency,
11. compliance with international obligations, and
12. consistency with international best practice.

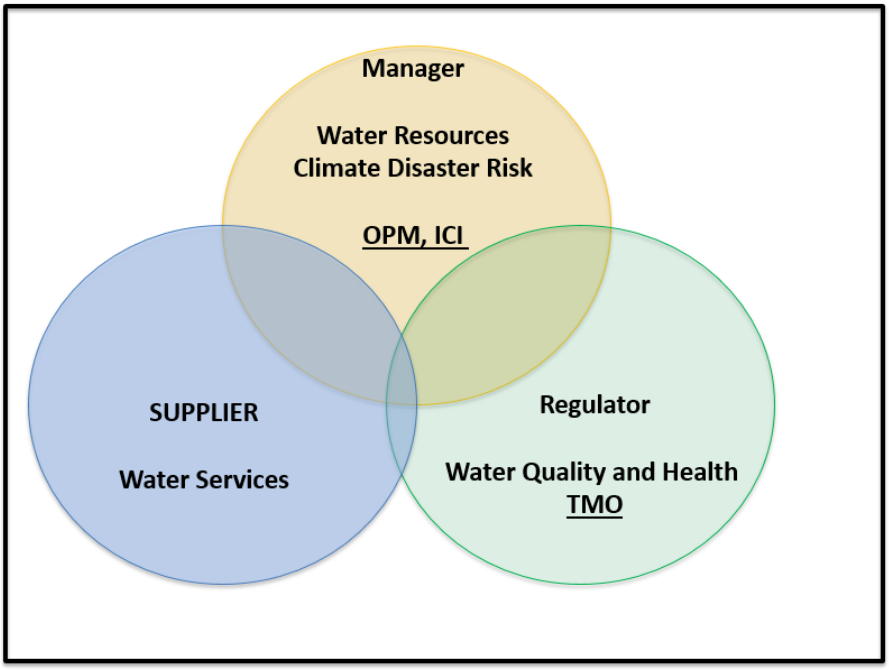
1.4 Water Governance in the Cook Islands

The National Water (and Sanitation) Sector Committee (NWSC) provides sector leadership; by setting a high-level framework to provide governance, leadership, strategic direction, and to coordinate the prioritisation of water-related activities in the Cook Islands.

The NWSC reports to the National Sustainable Development Committee (NSDC) through the office of the incumbent Chair. The committee Chairmanship rotates between the Office of the Prime Minister (OPM), and Infrastructure Cook Islands (ICI).

Membership is at two levels: Core membership, OPM, TMO, ICI and To Tatou Vai (TTV), and Secondary membership consisting of a range of government and non-government agencies where their particular participation is deemed necessary. (Figure 1.4-1: *Governance* of Water in *the Cook Islands – Water resource managers (owners); water suppliers; and water quality regulators*)

Figure 1.4-1: Governance of Water in the Cook Islands – Water resource managers (owners); water suppliers; and water quality regulators



Water sector activities encompass public health, infrastructure, governance, finance, education, weather, disaster management, food production and various income producing aspects. The Cook Islands Water authority TTV is Government's principal agency that oversees the management of water supplies for reticulated systems on Rarotonga.

1.5 Priority to disease-causing organisms (pathogens)

The DWSCI in accordance with acceptable international conventions, prioritises the removal of disease-causing organisms (pathogens) from the water due to the seriousness and acute nature of water-borne infections. These pathogens include bacteria, viruses, protozoa and parasites. The DWSCI also acknowledges the potential harm that may occur from other contaminants, such as naturally occurring substances or chemical or radiological contamination resulting from human activities, along with any physical and aesthetic issues that may arise with the water from time to time.

1.6 Scope of the drinking-water standards for the Cook Islands

The scope of the DWSCI has two components:

1. The maximum acceptable values (MAVs) or water quality standards**,** which define the quality specifications for all drinking-water, which is based on WHO equivalents. Below these levels, specific constituents in drinking-water are considered less likely to produce adverse health effects. These levels are effectively the Standard.

2. The compliance criteria, which specifies monitoring requirements for water suppliers, and remedial actions to follow if MAV levels are exceeded. Included in these criteria are methods for water sampling, frequency and analyses.

The DWSCI apply to reticulated drinking-water supplies, as defined in the Public Health Act, and all community and individual drinking water supplies. These include groundwater, surface water, roof-collected rain water, and desalinated water intended for human consumption.
The DWSCI does not set quality standards for water used for industrial or agricultural purposes. Bottled or packaged water is subject to the Cook Islands Food Act 1992-1993.

There are five categories of water supply covered by the DWSCI;

1. Rarotonga reticulated water supply;
2. Reticulated Outer-Islands (Pa Enua) water supplies;
3. Community purpose water supplies e.g. schools, remote healthcare facilities, community halls and water stations;
4. Commercial properties e.g., hotel resorts and restaurants;
5. Roof-collected rain water that is harvested for community tank water supplies.

For reticulated community water supplies, there are specific requirements to monitor both the water leaving the treatment plant and the water in the distribution zone. There are reticulated water supplies throughout the Cook Islands that are not used for drinking. These are therefore outside the scope of the DWSCI, provided such water supplies are not consumed by any persons or used for potable purposes, and that an alternative supply of safe drinking-water is available.

Improving the water quality of the reticulated supply on Rarotonga is an immediate priority with the implementation of the DWSCI and accompanying monitoring and surveillance process. The quality of the water that is provided will be governed by the DWSCI, which prescribes the maximum allowable concentrations of potentially harmful contaminants in the water.

2 A FRAMEWORK FOR SAFE DRINKING-WATER

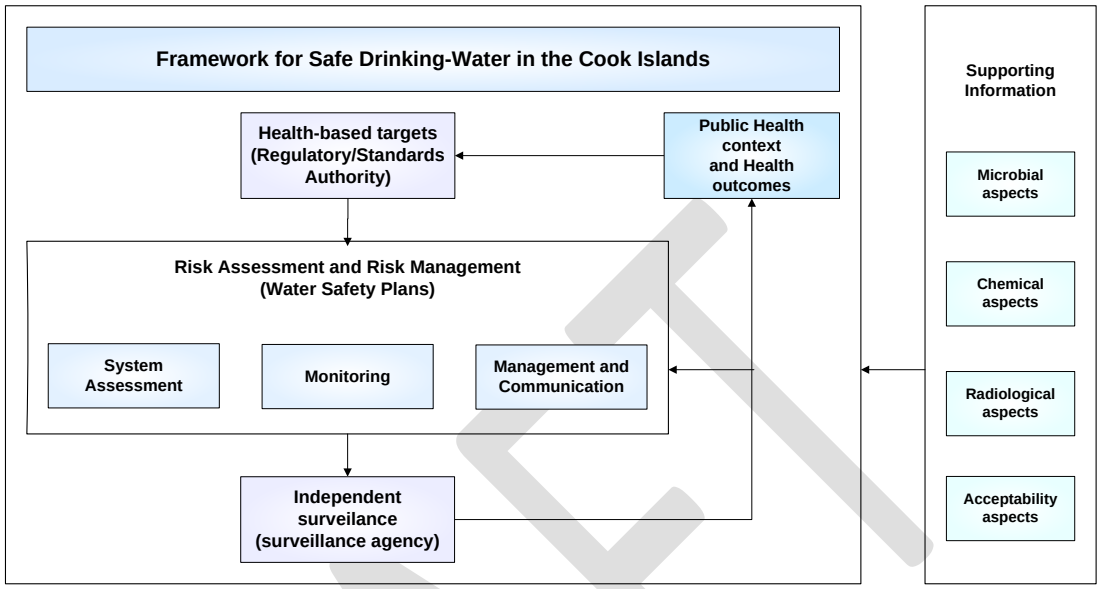
There is confidence in the supply of safe drinking-water when a systematic process is applied to the assessment and mitigation of risks that threaten the integrity of the drinking-water supply system (catchment to consumer).

2.1 A risk assessment and preventative risk management approach

A risk assessment and preventative risk management framework for safe drinking-water, comprises health-based targets established by TMO, adequate and well management water systems (infrastructure, monitoring and effective planning and management) TTV, and a system of independent surveillance. (

Figure 2.1-1: Framework for Safe Drinking-Water in the Cook Islands)

Figure 2.1-1: Framework for Safe Drinking-Water in the Cook Islands



The safe provision of water in the Cook Islands will be promoted through the development and implementation of robust, up-to-date drinking-water safety plans for community supplies, and the application of a multi-barrier approach to the management and operation of community and individual water supplies.

Measures which contribute to the provision of safe drinking-water include:

1. Protection of the catchment and source water from contamination,
2. Treatment of the raw water to remove any contaminants present,
3. Securing water quality in the reticulation and water supply storage tanks following treatment,
4. A regime of regular water quality monitoring and independent surveillance,
5. Properly designed and implemented response plans to any transgressions that may be detected.

All drinking-water suppliers providing drinking-water to over 500 people must develop and implement a DWSP to guide the safe management of their supply. Drinking-water suppliers must take all practicable steps to comply with the DWSCI.

TTV will undertake routine monitoring and water quality control processes on Rarotonga. TMO will undertake water quality surveillance services focussing on compliance by the water supplier and overall quality assurance for public confidence. The same approach will apply through gradual implementation of the DWSCI in the Pa Enua.

2.2 Register of Water Supplies

TMO is responsible for maintaining a Register of Drinking-water Suppliers. The Register will include the name of the supplier, responsible persons, contact details, location, the population, source type, treatment systems, and status of DWSP.

2.3 Revisions

The DWSCI will be reviewed after twelve months, then periodically every three years, or more frequently, if necessary, to reflect changing conditions in the Cook Islands. The level of development will determine the key parameters to be added or deleted and their corresponding values. The enforcement and compliance components of the DWSCI may also be reviewed at this time.

3 WATER QUALITY STANDARDS

This chapter outlines the water quality standards, which specify the maximum concentrations of microbiological, physical and chemical determinands for drinking water that are acceptable for public health, in the Cook Islands.

3.1 The standards

Tables 3.1 to 3.4 present the MAV for microbiological, inorganic and organic determinands of health significance which should not be exceeded in potable water, as well as aesthetic quality. Compliance with the DWSCI should be assessed against these values.

Water samples collected for compliance purposes should ideally be analysed and verified onsite using certified field tests and offsite by an accredited laboratory where one is available.

It is important to note that a select number of determinands of health significance are listed in the tables that follow. If additional harmful substances are suspected to be present in the water supply, these may be added in consultation with TMO and relevant stakeholders.

These tables are based on WHO guidelines and/or Drinking-water Standards New Zealand.

Table 3-1: **Maximum acceptable values for microbial determinands**

Micro-organism	Maximum Acceptable Value[1]
Escherichia coli[2]	0 per 100 mL
Total Coliforms (TC)	See Table 5 and accompanying commentary
Total pathogenic protozoa	Less than one infectious (oo)cyst per 100 L of sample[3]

Notes:

1. These are maximum acceptable values for regulatory purposes. They do not represent a dose/response relationship that can be used as the basis for determining acceptable concentrations of pathogens in drinking-water.
2. Indicator organism.
3. In the absence of reliable methods to enumerate and assess the infectiousness of pathogenic protozoa, routine monitoring of treated water quality is not indicated except if required in an outbreak where giardia and/or cryptosporidium contamination of drinking-water is suspected.

Table 3-2: Maximum acceptable values for inorganic determinands of health significance

Name	Maximum Acceptable Value mg/L (ppm)
Antimony	0.02
Arsenic	0.01
Barium 0.7	1.5
Boron 1.4	2.4
Bromate 0.01	0.01
Cadmium 0.004	0.004
Chlorate 0.8	0.8* DBP
Chlorine	5* Expressed in mg/L as Cl_2
Chlorite	0.8* DBP
Chromium	0.05 Total chromium content
Copper	2
Cyanide	0.6
Fluoride	1.5
Lead	0.01
Manganese	0.4
Mercury	0.007 Inorganic mercury only
Nickel 0.08	0.08
Nitrate as NO_3	50
Nitrite as NO_2	3
Selenium 0.01	0.04

* Difficulties in meeting the guideline values must never be a reason for compromising disinfection
**May change to 0.04mg/L with second addendum of the Guidelines for Drinking-water Quality (GDWQ), WHO

Table 3-3: Maximum acceptable values for organic determinands of health significance

Name	Maximum Acceptable Value mg/L (ppm)
Disinfection by-product	
Total Trihalomethanes	Σ ratio < 1. The sum of the ratio of the concentration of each THM to its respective MAV must not exceed 1
Pesticides[3]	
2,4, D	0.04
Chlorpyrifos	0.04
Dicamba	0.1
Diuron	0.02
Glyphosate	0.9
MCPA	0.8
Malathion	0.9
Paraquat	0.03

[3] Refer to pesticide table in Appendix 1

Table 3-4: Guideline values for aesthetic quality

Determinand	Guideline Value*
Odour	Acceptable to most consumers
Taste	Acceptable to most consumers
Colour	10 TCU
Turbidity	2** NTU
Residual chlorine (Free available chlorine)	0.2-0.5 mg/L
pH	6.5 – 8.5 pH
Conductivity	1000 µS/cm
Aluminium	0.1mg/L
Ammonia	1.5 mg/L
Chloride	250 mg/L
Copper	1.0 mg/L
Total Hardness	200 mg/L
Iron	<0.3 mg/L
Manganese	<0.1 mg/L
Sodium	200 mg/L
Sulphate	250 mg/L
Total dissolved solids	600 - 1200 mg/L Taste may become unacceptable
Zinc	1.5 mg/L Taste threshold

*If exceeded may render the water unattractive to consumers without posing a health risk.
** Limit applies within distribution zone – see Section on 'Turbidity' below for more detail

4 WATER QUALITY MONITORING

4.1 Water Treatment Requirements

All water that is supplied to consumers must be treated by the water supplier to ensure it is safe to drink. The only exception to this is where groundwater is abstracted from a depth of greater than 30 metres and has been shown to not be under the influence of surface conditions. To meet the condition of not requiring treatment, this ground water must also be abstracted from a bore head that does not allow infiltration of surface water into the bore or down the side of the casing.

All surface water should be disinfected prior to being supplied to consumers. Prior to disinfection, surface water should be filtered or treated in other ways to reduce turbidity to ensure that disinfection processes are effective.

4.2 Frequency of Sampling

The monitoring of water quality is the responsibility of the water supplier. The frequency of monitoring is dependent on the category of that water supply with minimums indicated in Table 5. Water sample analysis of category 1-4 drinking-water supplies must be undertaken by an accredited laboratory where available. Where an accredited laboratory is unavailable, the water supplier should contact TMO in the first instance to request advice on securing proper analysis of their water samples. TMO will undertake surveillance monitoring where appropriate and will be responsible for auditing the water suppliers' monitoring records.

Grab samples for chemical and physical parameters can be taken from the source water (river, spring, reservoir, borehole or well), from the point leaving the treatment plant or at a suitable point in the distribution system. Detailed sampling procedures can be found in the 4th edition of the WHO Guidelines for Drinking Water Quality.

When the water analysis shows values exceeding the MAV, efforts ~~should~~ must be made to find the source of the problem and to take corrective measures. Re-sampling ~~should~~ must then be undertaken to ensure the contamination has been resolved. If the samples indicate possible health risk, the results ~~should~~ must be reported to TMO.

4.3 Monitoring of Treated Water

Monitoring of treated water will depend on the type of treatment undertaken. A monitoring schedule for treated water must be approved by TMO and should include pH, turbidity, and chlorine where chlorine is used for disinfection. The frequency of monitoring through grab sampling, can be reduced if there are suitable continuous monitors in place. Field testing of pH, turbidity and chlorine can be undertaken by certified field tests or online monitors. If alternative disinfectants to chlorine are used then the appropriate monitoring must be undertaken to show that the water is safe.

4.4 Microbiological

Table 4.1 presents the minimum frequency and number of samples for microbiological analysis.

Table 4.1: Minimum sampling frequencies for microbiological analysis for reticulated supplies

#	Category of drinking-water supply	Minimum frequency	Type of sample
1	Rarotonga Reticulated Water Supply	Two times a week*	*E. coli/TC*
2	Reticulated Outer-island Water Supplies	Weekly*	*E. coli/TC*
3	Community Purpose Water Supplies	Monthly	*E. coli/TC*
4	Commercial Properties	Monthly	*E. coli/TC*

* This relates to a treated reticulated water supply and involves the collection of two samples: one at each treatment plant following treatment, and one at the extremities of the reticulation.

Monitoring should be undertaken for both *E. coli* and total coliforms. The MAV for *E. coli* is zero and therefore no *E. coli* should be present in a drinking-water supply as it indicates faecal contamination of the water. A MAV for total coliforms has not been set but total coliforms should also not be present in a water supply. A positive test result for total coliforms, if the same sample is negative for *E. coli*, indicates environmental contamination (often from decaying vegetation).

Guideline Note 1:

A result that is positive for total coliforms and negative for E. coli indicates that water is considered safe to drink but has been contaminated with non-faecal bacteria. However if non-faecal bacteria can contaminate a water supply, it indicates that there is a contamination pathway present and it is possible that faecal bacteria could also contaminate the water supply. An assessment should be made to determine whether this is indicative of a serious health hazard to the consumers of the supply.

When a water sample is positive for total coliforms and negative for *E. coli* the water supplier must investigate the source of environmental contamination and take steps to ensure contamination does not continue. Follow-up samples for total coliforms need to be taken to demonstrate that environmental contamination of the supply does not continue.

If test results are positive for *E. coli* the water supplier should advise consumers that the water supply is not safe to drink and consider issuing a boil water notice.

4.5 Turbidity

All water leaving a treatment plant must have a turbidity of less than 1NTU. Water in a distribution system should always have a turbidity of less than 2NTU, but must not exceed 4NTU.

For supplies providing water to more than 5,000 people, turbidity should be continuously monitored. For situations where the turbidity exceeds 1NTU leaving the treatment plant, the Drinking-water Safety Plan should determine the response by the water supplier, which may include manual chlorine dosing and/or shut down of the supply until turbidity is within acceptable levels.

All other supplies should have turbidity tested at least daily by grab sample. Samples should be analysed by a photometric method.

Table 4-2: Acceptable Turbidity levels

Parameter	Turbidity level
Turbidity of treated water NTU leaving a treatment plant	Must not exceed 1 NTU
Turbidity of water in the distribution system	Should not exceed 2 NTU[4]
Turbidity of water in the distribution system	Must not exceed 4 NTU[5]

4.6 UV Disinfection

If UV disinfection is used, the following must be demonstrated.

- All of the water being supplied to consumers must pass through a functioning UV disinfection reactor;
- The flow rate of water through the reactor must not exceed the flow rate recommended by the UV reactor manufacture;
- The dose rate of the UV reactor must not be less than 40mJ/cm^2;
- The turbidity of water entering the reactor must not exceed 1NTU;
- UV transmittance (UVT) for water passing through the UV reactor must not be less than 90%;
- For supplies serving fewer than 5,000 people, turbidity and UVT should be measured daily;
- For supplies serving more than 5,000 people, turbidity and UVT should be measured continuously.

4.7 Monitoring for fluoride in reticulated water supplies

Should a decision be made to add fluoride to any reticulated community drinking-water supply the provisions of the Code of Practice for Fluoridation of drinking-water supplies in New Zealand[6] must be followed. In line with that Code, the fluoride content in drinking water should be maintained in the range of 0.7 to 1.0 mg/L for oral health reasons.

4.8 Monitoring for inorganic, organic and aesthetic parameters

Monitoring for any chemicals, organics and aesthetics should be done at a frequency representing the risk of that particular determinand to public health. Aesthetic issues may make the water unpalatable to some consumers, but should not be prioritised over genuine health-related risks with the water.

Community-based approaches to the monitoring of water quality are encouraged.

4.9 Methods of Sampling

Methods of sampling for bacteriological quality

[4] A water supplier should ensure that turbidity remains below 2 NTU and should investigate the cause if it goes above this level.

[5] European Drinking-water Standard for maximum NTU in a distribution system.

[6] Code of Practice for Fluoridation of Drinking-water Supplies, www.waternz.org.nz

Sterilised glass or plastic bottles, provided with either stoppers or plastic screw-caps, should be used for collecting samples. For water that has been chlorinated, bottles containing 0.1 mL of a 3% solution of sodium thiosulfate for every 100 mL of water sample should be used. The bottle should be kept unopened until it is ready for filling. It should be filled without rinsing and ample space (at least 2.5 cm) must be left for mixing samples. Prior to taking the sample, the tap should be cleaned and free from attachments and fully opened with water allowed to run to waste for sufficient time to permit the flushing of the service lines. Flaming or sterilising of the tap is recommended.

Methods of sampling for physical and chemical analysis

Store samples at low temperature (<10°C) in a cooler or refrigerator to preserve them and in all cases must be analysed within 24 hours after sampling.

4.10 Methods of Analysis

Portable testing kits

The use of portable test kits for field-testing is acceptable to use in water quality monitoring as part of sanitary surveys and drinking-water safety plans. There are field kits using membrane filtration for bacteriological analysis and are capable of monitoring thermos-tolerant coliforms (faecal). Presence/absence tests for microbiological quality such as the hydrogen sulphide (H_2S) paper-strip test can be used especially for household or remote water supplies[7]. Portable kits can also analyse priority parameters such as turbidity, pH, colour, conductivity, and total dissolved solids. Follow-up testing of samples from a source must be undertaken if there is a strong indication of faecal contamination. In this case, laboratory analysis, where possible, should be used to verify the results. Field kits should be validated for performance against reference or standard methods and need to be regularly calibrated.

Laboratory Analysis

The handbook Standard Methods for the Examination of Water and Wastewater (23rd Edition or later version), published by the American Public Health Association, the American Water Works Association and the Water Environment Federation (APHA, AWWA, WEF) should be used for all analyses and tests, especially for reticulated water. Recommendations for sampling, preservation and analysis of selected parameters are listed in Table **4-3.** When collecting chlorinated samples for laboratory analyses, add sodium thiosulfate to the sample to neutralise the chlorine and prevent further disinfection. The samples must be transported at controlled conditions preferably in a cooler at less than 10°C.

Laboratory analyses of reticulated community drinking-water samples must be performed in accredited laboratories where available.

Table 4-3: Sampling, preservation and method of analysis of samples for selected parameters

Parameter	Container plastic/glass	Mode of preservation	Holding time rec/req	Minimum sample (ml)
Coliforms	G	refrigerate	6h/24 h	100
Colour (true)	P,G	refrigerate	48h/48h	500
Turbidity	P,G	Analyse same day; store in dark up to 24h, refrigerate	24h/48h	

[7] Alternatives exist for specific *E.coli* and Total Coliforms - still a dip test. cf. litmus test for *E.coli* detection in water. Gunmda. 2017.

Aluminium	P,G	Analyse per dissolved aluminium test		
pH	P,G	Analyse immediately	2h/NSA	
Hardness	P,G	Add HNO3 to pH	6 months/6 months	100
Chlorine residual	P,G	Analyse immediately	0.5h/NSA	500
Cyanide	P,G	Add NaOH to pH > 12; refrigerate in dark	24h/14d; 24h if sulphide present	500
Ammonia	P,G	Analyse asap or add H2SO4 to pH<2; refrigerate	7d/28d	5000
Nitrate	P,G	Analyse asap or refrigerate	48h/48h (28d for chlorinated	100
Nitrite	P,G	Analyse asap or refrigerate	None/48h	100
Nitrate/Nitrite	P,G	Add H2SO4 to pH>2; refrigerate	None/48h	200
Organics	P,G	Add H2SO4 to pH>2; refrigerate	28d	500
Chlorate	P,G	Refrigerate	1 week	100
Chloride	P,G	Refrigerate	1 week	50
Chlorite	P,G	Refrigerate	1 week	100
Fluoride	P	Non required	28d/28d	300
Metals	P(A),G(A)	For dissolved metals filter immediately, add HNO3 to pH<2	6 months/6 months	- 100
Solid total dissolved	P,G			
Sulphate	P,G	refrigerate	28d/28d	-
Arsenic Selenium Mercury	P,G			- 100

Source: APHA Standard Methods for the Examination of Water and Wastewater, 2001[8]

The following abbreviations are used in table 4.4.

G	Glass
G(A)	Rinsed with 1 + 1 HNO3
NSA	No storage allowed; analyse immediately
P	Plastic (polyethylene or equivalent)
P(A)	Rinsed with 1 + 1 HNO3
Rec/Req	Recommended/required

Guideline Note 3: ***If samples cannot be returned to the laboratory in less than six hours and holding time exceeds this limit, the final reported data should indicate the actual holding time.***

Detailed bacteriological and chemical information

Detailed and up-to-date information on the various bacterial and chemical contaminants indicated in this Standard can be found in the following WHO document: Guidelines for drinking-water quality, 4th edition, incorporating the 1st and 2nd addenda (WHO, 2022). Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda

[8] Current version is 23rd edition, 2018.

5 TANKERED DRINKING-WATER

5.1 General Requirements

Tankered drinking-water is water delivered by tanker and not through a water network reticulation. It must be sourced from water that complies with the DWSCI. It may be delivered by road or vessel to the consumers' storage facility on a commercial or voluntary basis.

Every carrier of drinking-water in the Cook Islands should ensure any water sold or supplied for potable purposes – drinking, food preparation or personal hygiene, meets the requirements of this section and the water quality is protected from contamination at all times during its loading, transit and delivery.

When water is to be taken from a reticulated water supply, the supplier's requirements in respect of backflow prevention, metering, access points and the use of the supplier's equipment must be complied with at all times.

Whenever non-potable water has been transported by tank, the tank must be washed, cleaned and refilled with potable water and a sample collected and analysed after the refilling or during the next delivery to meet monitoring requirements.

All samples must be collected during the unloading or discharge process, and records kept.

5.2 Operation

Every tanker must maintain and carry a logbook that contains the details of each load transported and each cleaning schedule.

The operator of any vehicle used to transport water must ensure the following.

- All tanks and the systems used for loading or unloading water have not been used for transporting any noxious, toxic or hazardous matter, non-food liquids, or human or animal wastes.
- All tanks and the systems used for loading or unloading water are protected from contamination during loading, transportation and delivery.
- All tanks and the systems used for loading or unloading water are kept clean and clear of any possible contaminants before sourcing the water to be delivered, with all openings and connections sealed to protect them from possible contamination.

Following the transport of non-potable water, or any other consumable liquid such as milk or beer, the tanker must be subjected to an appropriate cleaning and disinfection process as specified by TMO.

Tankered drinking-water carriers are required to complete a Drinking-water Safety Plan in relation to the method of transporting water intended for drinking, per the requirements of the Section above on Drinking-water Safety Plans.

5.3 Documentation and records

For all tankered water, a log should be kept by the water carrier of the:

- Nature of any cargo tankered;
- Details of filling and discharge points;
- Cleaning carried out before drinking water is tankered;

6 SURVEILLANCE AND RESPONSE

Surveillance is carried out on behalf of the public by an independent agency. In the case of the Cook Islands this agency is TMO.

The purpose of drinking-water surveillance is to identify risks to public health from poorly managed water supplies so that timely action can be taken to correct faults and prevent disease outbreaks and other public health problems.

The most common and widespread health risk associated with drinking-water is microbial contamination, so this is given the highest priority for both monitoring and surveillance. When the standard is exceeded, this should be a signal to investigate the cause with a view to taking remedial action; and to consult with, and seek advice from the responsible authority.

6.1 Response to transgression of the DWSCI

Where a parameter is found to exceed the MAV in these standards, it is the responsibility of the water supplier to take immediate action to address it satisfactorily. The following steps should be taken when routine monitoring indicates a parameter has exceeded one or more maximum values of this standard:

1. Inform TMO immediately;
2. Water supplier must investigate cause and assess the safety of the water by resampling and reanalysing another sample;
3. Action must be taken by the water supplier to correct the cause where possible;
4. Implement *appropriate* testing in consultation with TMO to monitor the remediation of the issue e.g. *E. coli* testing etc.;
5. Community to be notified in consultation with TMO (e.g. boil water notice applied, water management protocol applied etc.);
6. TMO to follow-up with an inspection of the water supply if required;
7. Water supplier to provide a written transgression report (to TMO)

The primary responsibility for the monitoring of reticulated community drinking-water supplies falls to the water supplier. TMO will be responsible for auditing compliance to the DWSCI and surveillance of individual drinking-water supplies during routine inspections or when requested by the individual tank owners, and for directing appropriate community communications, and/or actions of the water supplier in a response to a water-borne disease outbreak or epidemic.

Inspectorates at relevant agencies at the national and local level should implement these standards and will have the following responsibilities:

- Implement and maintain the drinking-water quality surveillance programme according to the national guidelines and internal standard operating procedures;
- Approve the sampling programmes and the information presented by a water supplier;
- Have access to laboratory facilities to implement their surveillance activities;
- Systematically assess the human health risk by inspecting and auditing relevant data regarding the water source, the physical characteristics of the water systems, through sanitary inspections, and by reviewing the drinking-water quality history and trends;
- Audit the drinking-water quality control programmes e.g. DWSP implementation, monitoring plans;
- Inform the public about drinking-water quality and associated risks;
- Maintain records on drinking-water quality characteristics;
- Create transparency and allow the public to express their complaints and concerns;

- Inform the water service of anomalies detected in the water system and demand the required corrective actions.

7 DRINKING-WATER SAFETY PLANS

7.1 Introduction to DWSP

TMO will enforce the DWSCI on behalf of the consumer through the approval and audit of preventative drinking-water risk-management plans alongside a robust surveillance and compliance regime. Water suppliers will be required to develop and implement DWSPs for all community drinking-water supplies. DWSP involve a proactive process of assessing and managing risks to the quality of the water supply and promotes the provision of safe and quality drinking-water supplies for everyone.

The implementation of a properly designed DWSP helps to guarantee the safety of the drinking-water delivered to the consumer. A DWSP involves a risk identification and risk management approach to managing the quality of water from the source to the consumer. The primary objective of a DWSP is to ensure good drinking-water supply practices contribute to the prevention of water contamination during storage, transit and distribution. Using the multi-barrier approach as the foundation for assessment, the water supplier can identify all the hazards that could adversely affect water quality and indicate how they will remove or reduce those risks through operational management of the supply. Where gaps in a water supplier's ability to control risks are identified, the supplier indicates how and when they will be able to address those risks and indicates how they will manage those risks in the meantime.

DWSP comprises, as a minimum, the three key components that are the responsibility of the drinking-water supplier in order to ensure that drinking-water is safe.

These are:

1. A *system assessment* to determine whether the drinking-water supply chain (up to the point of consumption) can deliver water of a quality that meets identified targets. This also includes the assessment of design criteria of new systems;

2. *Identifying control measures* in a drinking-water system that will collectively control identified risks and ensure that the health-based targets are met. For each control measure identified, an appropriate means of *operational monitoring* should be defined that will ensure that any deviation from required performance is rapidly detected in a timely manner;

3. *Management and communication plans* describing actions to be taken during normal operation or incident conditions and documenting the system assessment, including upgrade and improvement planning, monitoring and communication plans and supporting programmes.

Specific treatment of water includes the removal of organic substances to reduce the formation of DBP.

All of this information should be recorded in a DWSP. For individual household drinking-water supplies, the sanitary survey approach can be used. The Keeping Your Drinking-water Safe

Toolkit[9], which has been developed by WHO and Pacific Islands Applied Geoscience Commission (SOPAC) outlines this approach to improve drinking-water quality.

7.2 Further guidance on DWSP

Further guidance on DWSPs may be obtained from the WHO publication, *Water Safety Plans - Managing Drinking-Water Quality from Catchment to Consumer (2005).* Additional advice on how to develop and implement a DWSP can be found in the WHO / SOPAC publication: Drinking-water Safety Planning: A practical Guide for Pacific Island Countries (WHO/SOPAC Joint Contribution Report 193), and in the related Pacific Drinking-water Safety Plan Audit Guidelines document. These resources are available online at: www.pacificwater.org

Risk management approaches will be implemented for all reticulated community and non-household drinking water supplies. The water supplier will be responsible for developing and implementing the DWSP; Te Marae Ora – Cook Islands Ministry of Health will have approval and audit responsibilities.

Tankered drinking-water carriers will be required to complete a DWSP in relation to the method of transporting water intended for drinking. The DWSP must identify potential risks and put programmes in place to mitigate such risks, and be reviewed and revised regularly.

[9]http://www.pacificwater.org/userfiles/file/WASH%20and%20Wastewater/01%20Book%201%20HANDBOOK%20WITH%20CVRS1.pdf

8 ANNUAL REPORT OF DRINKING-WATER QUALITY IN THE COOK ISLANDS

An important part of every drinking-water surveillance, record keeping and control programme is its availability to the public, so that the public are better able to make informed decisions about whether the water they are consuming is safe for themselves and their families. In line with government policy to be more open and accountable, and utilising the water quality data received through monitoring and surveillance reporting, TMO will, with assistance from other relevant organisations such as the National Environment Service, Ministry of Marine Resources, and ICI, prepare an "Annual Report of Drinking-water Quality in the Cook Islands" by **31 March** each year.

9 REFERENCES

1. American Public Health Association, the American Water Works Association and the Water Environment Federation (APHA, AWWA, WEF) published handbook for Standard Methods for the Examination of Water and Wastewater

2. Code of practice for fluoridation of drinking-water supplies in New Zealand 2014

3. Drinking-water Standards for New Zealand 2005 (Revised 2018)

4. Water Services (Drinking Water Standards for New Zealand) Regulations 2022

5. Fiji National Drinking-water Standard 2011

6. Guidelines for Drinking-water Quality Management in New Zealand 2014

7. Vanuatu's Draft Drinking-water Quality Standards 2013

8. World Health Organization Global Drinking-water Quality Guidelines 4th edition, 2022 incorporating the first and second addenda

9. World Health Organization Equitable water safety planning 2019

10 APPENDIX 1: PESTICIDES IMPORTED TO THE COOK ISLANDS AS OF 2015

Pesticide Type	Product	Manufacturer	Formulation Type	Name (ai)	Concentration
Insecticide	Icon 10 CS	Syngenta	Emulsifiable Concentrate	Lambda Cyhalothrin	100g/L
Insecticide	Lannate L	DuPont	Emulsifiable Concentrate	Methommyl	200g/L
Herbicide	Fusilade	Syngenta	Emulsifiable Concentrate	Fluazifob-P-Butyl	150g/L
Herbicide	Woody Weedkiller	Yates	Soluble Concentrate	2,4-D + Dicamba	100g + 500g/L
Insecticide	Confidor	Bayer	Suspension Concentrate	Imidacloprid	350g/L
Insecticide	Confidor	Bayer	Suspension Concentrate	Imidacloprid	125g/L
Insecticide	Abamectin	Syngenta	Emulsifiable Concentrate	Avermectin B1a	1.8 w/v
Insecticide	Conqueror	Yates	Emulsifiable Concentrate	Mineral Oil	839g/L
Insecticide	Bug Oil	Yates	Emulsifiable Concentrate	Petroleum Oil	20g/L
Herbicide	Gramoxone	Syngenta	Emulsifiable Concentrate	Paraquat	200g/L
Insecticide	Mavrik	Yates	Soluble Concentrate	Tau-Fluvalinate	7.5g/L
Fungicide	Lime Sulphur	Yates	Soluble Concentrate	Sulphur	200g/L
Insecticide	Pyrethrum	Yates	Emulsifiable Concentrate	Pyrethrum + Piperonyl Butoxide	14g + 56.5g/L
Insecticide	Avid	Syngenta	Emulsifiable Concentrate	Abamectin	18g/L
Insecticide	Attack	Nufarm	Emulsifiable Concentrate	Pirimiphos Methyl + Permethrin	475g + 2.5g/L
Fungicide	Taratek 5F	Agrecovery	Soluble Concentrate	Chlorothalonil + Thiophanate	250g/L + 250g/L
Fungicide & Bactericide	Kocide	DuPont	Water Dispersible Granule	Copper Hydroxide	300g/L
Herbicide	Roundup	Monsanto	Aqueous Concentrate	Glyphosate	360g/L
Insecticide	Velcloprid 200	Zelam	Soluble Concentrate	Imidacloprid	200g/L
Herbicide	Diuron	Makteshim Agan	Water Dispersible Granule	Diuron	900g/kg
Insecticide	Steward	DuPont	Soluble Concentrate	Indoxacarb	150g/L
Herbicide	Ken-zu Aquatic 360	Kenso NZ	Soluble Concentrate	Glyphosate	360g/L
Insecticide	Avid	Syngenta	Emulsifiable Concentrate	Abamectin	18g/L
Fungicide	Taratek 5F	Zelam	Soluble Concentrate	Chlorothalonil + Thiophanate	250g/L + 250g/L
Herbicide	Weed-out	Nufarm	Soluble Concentrate	Glyphosate	360g/L
Insecticide	Maldison	Agchem Ltd	Emulsifiable Concentrate	Malathion	500g/L
Insecticide	Albatross	Agrecovery	Soluble Concentrate	Fipronil	200g/L