Hygiene Code of Practice

Preventing contamination of the water supply

Christchurch City Council

Version 2.0

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Christchurch City Council

Version Control

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1 Objectives

Preventing contamination of the water supply protects public health by ensuring safe drinking water. Maintaining the integrity of a well-managed distribution network is one of the most important barriers protecting drinking water from contamination.

The hygiene standards of all persons working on the network need to be maintained at a high level as they are the first line of defence against contamination. This code of practice outlines the mandatory health and hygiene requirements that must be adhered to by Council staff and approved contractors working within treatment plants (including intakes, abstraction points and suction tanks) and on the network (including reservoirs and pump stations) to provide a safe drinking water supply.

This code of practice has been prepared jointly by Christchurch City Council staff and its water supply maintenance contractor.

Council and its approved contractors must comply with regulatory requirements in the following legislation:

- Drinking Water Quality Assurance Rules 2022 (DWQAR)
- Water Services (Drinking Water Standards for New Zealand) Regulations 2022 (DWSNZ)
- Water Services Act 2021
- Health and Safety at Work Act 2015
- Resource Management Act 1991 & National Policy Statement on Freshwater Management 2020

To ensure that the water supplied to consumers is safe to drink, Council uses the six principles of safe water that arose from the investigation into the Havelock North outbreak in 2017, to guide the management of its water supply network. These principles are committed to by Council's Chief Executive Officer in the Drinking Water Quality Statement found in the Water Safety Plan:

Six principles of safe water

- A high standard of care must be embraced.
- Protection of source water is of paramount importance.
- Multiple barriers against contamination must be maintained.
- Change precedes contamination.
- Suppliers must own the safety of drinking water.
- A preventive risk management approach must be applied.

All six principles apply across management of the entire water supply from source to consumer, but in particular when working on the network the principle '**A high standard of care must be embraced**' is paramount.

"Unsafe drinking water can cause illness, injury or death on a large scale. All those involved in supplying drinking water (from operators to politically elected representatives) must therefore embrace a high standard of care akin to that applied in the fields of medicine and aviation where the consequences of failure are similarly detrimental to public health and safety. Vigilance, diligence and competence are minimum requirements and complacency has no place." (Report of the Havelock North Drinking Water Enquiry – Stage 2)

Carrying out work in accordance with this Hygiene Code of Practice is a key part of demonstrating a commitment to this first principle.

The Hygiene Code of Practice is intended as a general guide to be used in conjunction with the following Council authorisations, permits and standards for installations and repairs of the water supply network:

- Authorised Water Supply Installer
- Permit to work: Water supply network
- Christchurch City Council Civil Engineering Construction Standard Specification (CSS) (https://ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications/download-the-css/)
- Christchurch City Council Infrastructure Design Standards (IDS) (https://ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards)
- Water Supply. Treatment, Pumping Station and Reservoir Design Standard (Water and Waste Assets and Network Unit) (https://www.ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/IDS/Water-Supply-Pumping-Stations-and-Reservoirs-Design-Standard-Version-3.1.PDF)

2 Scope

The scope of work to which this code applies is broadly all work which there is potential for contamination of the water supply. This specifically includes:

- Council reticulation inspections / repairs / maintenance (including suction tanks and reservoirs) (undertaken by Councils nominated maintenance contractor)
- Council water mains contracts (asset renewals and new main installations, including new reservoirs or suction tanks) (undertaken by Authorised Installers)
- Council water submains contracts - asset renewals and new submain installations (undertaken by Authorised Installers).
- New subdivision reticulation works connection to the council reticulation (undertaken by Authorised Installers).
- Connection of new/renewal pump station/treatment plants or reservoir to the council reticulation (undertaken by Authorised Installers)
- Installation and maintenance of fire service and fire service connections (undertaken by Authorised Installers)
- The operation and use of tanker filling facilities

- Repairs and maintenance of backflow devices and meters
- Any work on the network or within treatment plants which has the potential to have contact with potable water

This code of practice is not intended to replace Standard Operating Procedures (SOPs), it is expected that SOPs will be aligned with the Code of Practice to make sure that a high standard of care and good work practices are being followed.

3 Regulatory Requirements

The Water Services Act 2021 states that its main purpose is ensuring that drinking water suppliers provide safe water to consumers. Section 29 of the Act specifies that if the drinking water supplier has a duty under a legislative requirement, then **every officer, employee and agent must exercise due diligence to ensure that the drinking water supplier complies with that duty.** The main duty of a water supplier relevant to this Hygiene Code of Practice is the duty to supply safe drinking water which incorporates taking immediate action, if there is reasonable likelihood that the water is or maybe unsafe, to ensure that public health is protected, investigating immediately and taking remedial action to rectify the problem.

The Drinking Water Quality Assurance Rules, prepared by regulator Taumata Arowai, contribute to safe drinking water by setting out the minimum compliance requirements for drinking water suppliers.

These Rules are detailed and cover several areas regarding hygiene requirements. The detailed Rules that apply specifically to this Code of Practice are replicated in the table below.

Rule Number	Detailed requirement
General Rules	
G10	All work (planned or unplanned) on a water supply must be completed by suitably trained or experienced personnel
G11	Drinking water suppliers must prepare a hygiene code of practice for people working on a water supply which must include: 1. Maintenance of personal hygiene at all times; and 2. Prohibition of people working on a water system who are experiencing any gastrointestinal illness; and 3. Protection of the work site, materials and tools from contamination; and 4. How all reasonable steps will be taken to minimise the entry of contamination into the water supply during any activity.
Distribution Rules	
D3.7	Before carrying out or commissioning repairs to pipes in a water distribution system, a drinking water supplier must undertake and keep records of a risk assessment to determine the risk of contamination of the network and the procedures required to minimise that risk

Rule Number	Detailed requirement
D3.8	All materials used in construction and repairs must be free of visible contamination and remain protected from contamination until installation.
D3.9	All tools contacting the water supply or its parts, particularly cutting surfaces, must be adequately disinfected prior to commencing work and subsequently as necessary when tools contact soil or backfill material.
D3.10	Disinfection of mains (when required) must follow best management practices including but not limited to methods such as tablet, slug, spray chlorination, or equivalent as appropriate.
D3.11	Drinking water suppliers must develop and document standard operating procedures for planned unplanned and emergency repairs.
D3.12	Drinking water suppliers that have storage facilities within a distribution system must prepare a water storage management plan for the operation of the storage facilities which included the minimum and maximum operating levels, target turnover rates, inspection and cleaning. **Reference storage management plan – TRIM 23/1929712**
D3.13	All storage facilities must be subject to an annual security and contamination inspection and assessment by the drinking water supplier.
D3.14	Drinking water suppliers must prepare and use written disinfection procedures for storage facilities that are consistent with industry best practices.
D3.15	All new storage facilities, and existing storage facilities that have been drained for maintenance purposes, must be cleaned and disinfected and tested for E. Coli prior to being brought (back) into use.
D3.16	Divers' suits, rafts, remotely operated vehicles (ROVs) and other material used during inspection, maintenance or other activities within storage facility interiors must be made from materials acceptable for contact with drinking water and suitable for disinfection.
D3.17	All equipment and materials entering storage facilities must be disinfected immediately prior to entry according to industry best management practices.
Water Carrier Rules	
WC.2	The water carrier must only take water from a point in a distribution system prescribed by the drinking water supplier
WC.4	The operator of any vehicle used to transport water must ensure all tanks, and the equipment used for loading or unloading water, are only used for drinking water.
WC.5	The operator of any vehicle used to transport water must ensure all tanks, and the equipment used for loading or unloading water, are made from material that light cannot pass through, are always kept clean and clear of any possible contaminants, with all openings and connections sealed to protect them from possible contamination. The drinking water must be always protected from contamination during its loading, transit and delivery.
WC.6	If tanks and the equipment and fittings used for loading and unloading water are not used for the transport of drinking water for a period of 30 or more days, then before next used to transport drinking water: 1. The tank must be disinfected by filling with drinking water containing at least 5mg/l FAC for not less than 30 minutes before discharging safely to waste; and

Rule Number	Detailed requirement
	2. Equipment and fittings should be washed in water containing 5mg/l FAC.
WC.7	The water carrier must ensure there is backflow prevention or an adequate air gap in place when discharging drinking water from their tank.

4 Roles and Responsibilities

Authorised installers (https://ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/approved-contractors/Authorised-Water-Supply-Installers-Register.pdf) are individuals required to be approved by Council and are responsible for the following water supply related work:

- Council water mains contracts (asset renewals and new main assets)
- Council owned submain contracts (asset renewal and new submain assets)
- Installation of fire services and fire service connections
- New subdivision reticulation works with connection to the Council reticulation
- Connection of new pump station, treatment plants or reservoir to the Council reticulation

Chlorination Contractors

Chlorination work must be carried out by experienced personnel from the following companies who are Council approved for this work:

- City Care Water Limited
- Independent Pipeline Services Limited
- Trenching Dynamix Limited
- Maestros Water Solutions Ltd

4.1 Training and Competency

All water supply workers should have completed appropriate qualifications. Personnel records should document qualifications completed and also competency for the key activities that their roles require. This is also a requirement of the General Rules from the DWQAR G10.

5 Types of Contamination

Contamination of the water supply can occur at several points through source water, at treatment plants (including suction tanks) and within the distribution, including reservoirs.

Contamination can be from microbial hazards but also from chemical and physical hazards

5.1.1 Microbial hazards

Most microorganisms present in the drinking water are harmless. However infectious microorganisms can enter the distribution system and survive or in some cases continue to grow, increasing the potential for a waterborne disease. Faecal contamination is a common source of infectious organisms, these include bacteria, viruses and parasites that occur naturally in the guts of humans and other warm-blooded animals. Contamination can occur through a pathway such as broken mains, intrusion, cross-connections or openings in storage tanks.

5.1.2 Chemical hazards

Chemical contaminants may be present in source water (e.g. nitrates, arsenic), they may come from unwanted residues of the chemicals used in water treatment, released from materials used in the distribution (e.g. lead was a common component of pipes and fittings in the past) or may enter the distribution through breaks of faults if there is contamination in the surrounding soils.

Disinfection by products (DBPs) are produced when chemical disinfectants (typically chlorine based) react with organic matter which is usually present in surface water and not always well removed during treatment.

The Approved Materials List https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-materials/approved-materials-lists and the use of the *AS/NZ Standard 4020 Testing of Products for Use in Contact with Drinking Water* when, for example, choosing products to repair reservoirs help lower the risks associated with chemical contamination.

5.1.3 Physical hazards

Physical hazards refer to contamination affecting the physical properties of water such as colour, odour and turbidity, they are often related to the presence of chemicals or microbial contamination within the distribution system. With some exceptions, most chemicals are detectable by taste and odour at concentrations that are well below health-related guidelines.

The distribution system represents the final step in the delivery of water from source to consumer and so from many perspectives is the most vulnerable place for contamination. Distribution systems are an extensive network of interconnected pipes, valves and tanks, most of which are underground. Water quality generally can be expected to deteriorate as it passes through the distribution. The operation and maintenance of the water network has a large impact on the quality of water delivered to our customers. Any breaches, intentional or accidental, pressure transients or backflow/ cross connection events can allow for the introduction of pathogens and contaminant chemicals into the network, further compromising the water quality.

The public are often more concerned about chemicals in water, but most events associated with contamination of the water supply are due to microbial pathogens. Microbiological contaminants in drinking water are considered a greater threat to public health than chemical and radiological contamination, the reasons for this are detailed below:

Table 1: Comparison of Pathogens and Chemicals as Risk Factors for Waterborne Illness

Risk Factor	Microbial contamination	Chemicals

Time to effect	A small breach with pathogens(bugs) getting into a water supply can lead to illness.	In most cases chemicals in water don't cause significant harm unless consumed for many years
Detection	Pathogens can be difficult to detect, they have no taste, odour or colour and are too small to be seen. Results from monitoring are delayed (usually >12hrs) so water has often already been consumed	Chemicals are usually easier to detect
Harmful levels	Swallowing just a few pathogenic organisms can make someone ill. Low levels of pathogens can occur without any other signs	Often chemicals can be detected through taste, odour or appearance once harmful levels are reached.
Source	Pathogens come from natural sources and can be difficult to control (shallow groundwater, stormwater, grazing animals, wildlife, septic tanks)	Harmful chemicals generally arise from human activities. Their use is controlled to prevent discharge to water
Design	Pathogens have evolved to be transmitted via water, food, and direct contact from person to person	Most chemicals are not designed to cause harm in water

The DWSNZ stipulates the Maximum Acceptable Value (MAVs) of these contaminants including the bacteria *Escherichia coli* (*E. coli*) and protozoa such as Giardia and Cryptosporidium. E. coli is an indicator bacteria and not necessarily a pathogen itself. It's presence in water shows faecal contamination has occurred and this can increase the likelihood of pathogens including Campylobacter, Shigella, Salmonella and viruses. These can lead to major illness that can be fatal. Microbial contamination is usually the highest priority for responding to an event within a water supply. Pathogens are fast acting, capable of multiplying within a host, and are transmittable person to person.

Councils' obligation as a water supplier is to ensure safe drinking water. Potable water reticulation systems therefore must be treated similarly to a food grade factory and delivery system. Many recommendations for food safety can be applied to working on the water supply network.

5.2 Risk Assessment

Quantification of risks in the water supply requires knowledge of:

- Hazard – biological (microbial), chemical, radiological or physical cause of harm
- Hazardous event – incident or situation that can lead to presence of hazard in water.
- Likelihood (how often) & Consequence (what happens/severity)

DWQAR Rule D3.7 (***Before carrying out or commissioning repairs to pipes in a water distribution system, a drinking water supplier must undertake and keep records of a risk assessment to determine the risk of contamination of the network and the procedures required to minimise that risk***) requires that repairs to the network are undertaken within a risk-based framework. The risk assessment results must be recorded prior to carrying out any physical works and be maintained and available for audit when required.

Information recorded should include location, risk level assessed, person(s) completing the risk assessment and the reasons/justification for the risk level assessed.

In the field, risk assessment is necessary as different procedures are required depending on the likelihood of, and the potential impact on public health that contamination could have. Risk level is determined by the person working on the network who identifies a potential hazard and categorises it based on the two aspects of **Likelihood** and **Consequence**.

Hazardous events can arise during the construction and repair of the distribution as well as during routine system operation and can occur when the integrity of the system is compromised, either the **physical integrity** of the system, the **hydraulic integrity** or the **water quality integrity**. Actions taken while managing the distribution can be seen as preventative measures that will have an impact on either the likelihood or consequence of a hazard occurring. For example, being able to maintain positive pressure during a repair lessens the **likelihood** of contamination being able to enter the system. The routine inspections of reservoirs and suction tanks helps to ensure that conditions that may allow for contamination such as overhanging vegetation, defective mesh on the end of overflows are addressed and so reduces the **likelihood** of contamination occurring. The presence of free available chlorine (FAC) in the network means that the **consequence** of a low-level bacterial contamination can be addressed.

Examples of potential contributors to Hazardous Events included:

Table 2: Hazardous Events

Type of integrity loss	Hazardous event
Physical Integrity (Maintenance of the physical barrier against external contamination)	• Construction of new mains and new installs (including water meters, pumps, valves, hydrants): • Microbial or chemical contamination due to entry into an open pipe of debris, vermin, soil, groundwater or stormwater • Open main (not capped) in repair trench could allow contamination including petroleum products from pumps used to dewater • Corrosion leading to loss of physical integrity • Backflow from residential/industrial/commercial connections due to failure of or lack of adequate prevention devices • Accidental cross connections between potable and non-potable lines (likely increase during low pressure events)
Hydraulic integrity (The capacity to provide reliable quantities of water at acceptable pressures)	• Sediment resuspension • Sloughing of biofilms • Pipe breakages • Backflow through leaking joints, air valves, hydrants • Accumulation of biofilms, particles and sediment in areas of low flow and resuspension during high flows
Water quality integrity (Maintaining quality by minimising impacts caused by internal processes during delivery)	• Impurities in materials used in construction and maintenance • Use of inappropriate materials (incompatible with existing materials leading to increased corrosion • Discoloured water from corrosion (mild steel, cast or ductile iron) • Accumulation of sediment, manganese deposits particularly at dead ends • Survival of pathogens, growth of opportunistic pathogen and nuisance organisms in biofilms

	• Low levels or excessive levels of chlorine (under or overdosing) • Elevated disinfection byproducts (DBPs) due to high organics • pH increases in concrete tanks with high detention times • Corrosion of internal fittings and surfaces

The following matrix shows how the risk level changes with increases to likelihood and impact of consequence:

Table 3: Risk Matrix to determine the actions required to prevent contamination.

Likelihood	Consequence				
	Minor	Moderate	Significant	Major	Severe
Almost Certain Is expected to occur	Low	Medium	High	Very High	Very High
Likely Will probably occur in most circumstances	Low	Medium	High	Very High	Very High
Possible Could occur at sometime	Low	Medium	Medium	High	Very High
Unlikely Event hasn't occurred but it could in some circumstances	Low	Low	Medium	Medium	High
Rare Exceptional circumstances only	Low	Low	Low	Medium	Medium

Compliance in maintaining the Chain of Cleanliness and Worker Hygiene procedures and protocols found in this document, the Christchurch City Council Civil Engineering Construction Standard Specification (CSS) and the "Terms and Conditions for Christchurch City Council Authorised Water Installers to Carry Out Authorised Work" is necessary to prevent contamination occurring through the various pathways at different risk levels. The type of event can impact the risk level as there is more likelihood of increased contamination pathways with unplanned and emergency work.

Councils' water supply maintenance contractor and anyone else authorised to be working within treatment plants, pump stations or the network must be suitably trained or experienced (DWQAR - Rule G10), have Standard Operating Procedures (SOPs) for any work on the water supply (DWQAR – Rule D3.11) with specify hygiene procedures, including how a risk assessment is completed to determine the risk of contamination of the network, what procedures are required to minimise that risk, and how this is recorded (DWQAR – Rule D3.7). They must show procedures for how risk is managed for planned, unplanned and emergency repairs (DWQAR – Rule D3.11). This is to ensure consistency and quality of outcome in each type of event. SOPs are required to provide detailed instruction on how a person should perform a routine or technical task. Some examples of what procedures need to have included in water supply network installs and repair are:

- Who is responsible for what, i.e. All staff must report any gastro-intestinal illness to their supervisor at the onset of symptoms. Supervisor puts affected staff on non-contact work to prevent any contamination and determines whether medical clearance is needed before the staff member returns to work. 24hrs symptom free

- How all materials used are protected from contamination, i.e. keeping all materials wrapped, dry and clean until needed and use of a clean plastic drop sheet on the ground to prevent contamination from soil while work is undertaken.
- What additional procedures are required for unplanned and emergency procedures, i.e. for unplanned reactive repairs a Bacteriological test (Bug test) may need be conducted as required to comply with Council standards.

Lack of good hygiene is a risk requiring specific management by Council and its approved contractors, as the people working on the water supply network can contaminate the water supply and transmit illness, therefore they are an important barrier to contamination.

Awareness of the potential hazards and risks, making good assessments of these risks and following best practice will enable actions that will safeguard the network against contamination. Hazards can have many forms and relevant training, and previous experience are crucial in the identification and management of these hazards to prevent contamination.

Ensuring that there is a multi-barrier approach to prevent contamination pathways is the responsibility of all persons who work on the water supply. Personal hygiene, and general cleanliness applied to work clothing, equipment including vehicles, tools and materials should be treated as stringently as a food grade factory (Water New Zealand, 2019).

6 Hygiene Practices

6.1 Chain of Cleanliness

The production and distribution of drinking water is analogous to food processing and distribution; therefore, it is of the utmost importance that a high standard of personal hygiene is maintained at all times by personnel when working on potable water networks. Water treatment facilities and reticulation networks must be treated as food grade factories and delivery systems by all personnel working on the site

The 'Chain of Cleanliness' is to be established for all equipment and fittings prior to use on all works. The Chain of Cleanliness requires that all pipes and fittings used in the construction or maintenance that could potentially come into direct contact with potable water, will be kept free of potential contamination.

The 'Chain of Cleanliness' includes all processes involved in ensuring that water is not contaminated through all stages from the water source to consumption. Key stages in the safe water chain include water collection, handling, transportation, storage and treatment, and consumption. The safe water chain encompasses all practices that aim at ensuring that water remains safe between the water source and point of human consumption

6.2 Hygiene Practices for Vehicles, Tools and Equipment

Tools and equipment used across the water supply and how materials are stored prior to installation all have the potential to introduce sources of contamination. The following practices are required to be followed to minimise the risks and ensure a comprehensive chain of cleanliness:

- All materials used in construction and repairs must be free of visible contamination and must remain protected from contamination until installation. Consideration should be given to bagging all fittings and pipe ends, which could have contact with water.
- All tools contacting the water supply or its parts, particularly cutting surfaces must be adequately cleaned and disinfected prior to commencing work and subsequently as necessary when tools contact soil or backfill material.
- Where necessary, all equipment that can may contact water but has also had contact with dirt and debris, is to be cleaned of the dirt and debris and disinfected (using 100 mg/L chlorine solution) before use.
- Ensure that all sealing materials and lubricants are clean and certified as suitable for contact with potable water.
- Pipe sections should not be placed directly on the ground but supported off the ground (or at the very least ends should remain sealed until they are required)
- At the work site all tools and fittings should be placed on a mat, plastic sheet or in a bucket
- Water supply equipment should as far as practicably be dedicated to water supply only and stored away from other equipment used for wastewater and stormwater to avoid any contamination. All materials should be stored and handled in a manner that minimises contact with foreign materials.
- Where a reservoir or tank is inspected and/ or cleaned while still in operation using divers or Drones/Remote Operated Vehicles. Prior to any in situ cleaning or inspection an access, cleaning, hygiene and disinfection methodology specific to each reservoir / tank shall be presented as part of the Permit to Work.
- Vehicles, tools and maintenance equipment and clothing used for water supplies and waste / storm water operations should as far as practicably be segregated
- All vehicles must have provisions such as dedicated cleaning water supply, sanitary wipes, and antibacterial liquid soap available for workers to cleanse and sanitise their hands in the field.
- If personnel are required to work on a potable water system after working on a wastewater system, they should have separate protective clothing and tools for each system and should shower and change into clean overalls and boots between jobs.
- If the same vehicle is used to travel between potable water and wastewater sites, the potable water tools, and personal protective equipment (PPE) must be stored separately from, and not have contact with, wastewater tools and PPE
- Vehicles used for carrying or handling sewage or sludge or that have been used to transport contaminated equipment shall not enter a water treatment plant compound without the specific authorisation of water treatment staff and only following acceptance of the hygiene control methodology

6.3 Hygiene Practices for Individuals

The following steps should be used to minimise the potential for personnel to be a source of contamination.

Wherever practical personnel should be dedicated to working on the water supply system and not alternate between water and wastewater stormwater supplies. A clear hygiene control methodology must be approved and followed under circumstances where movement between water/wastewater sites is undertaken.

Those working on both potable water systems and wastewater systems pose a high risk of being the conduit for contamination of the potable water system. Workers are not to be employed on both sewer and water supply work in an alternating manner. A stand down period (overnight) must occur when someone is to be transferred from working on wastewater equipment to water supply equipment. Those must be accompanied by showering and a complete change of clothing, including boots.

The importance of all personnel maintaining a high standard of personal hygiene cannot be overstressed. An effective hand washing technique should not be assumed –

1. Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
2. Lather your hands by rubbing them together with the soap. ...
3. Scrub your hands for at least 20 seconds. ...
4. Rinse your hands well under clean, running water.
5. Dry your hands using a clean towel or an air dryer.

Warm, soapy water is the best option for washing your hands when they are visibly dirty. Hand sanitiser is only effective if your hands have no visible dirt on them.

Water supply workers with open wounds or septic skin infections should not work on the water supply network unless the infection or wound is effectively dressed and then covered in a waterproof dressing and/or gloved (if on the hand).

Workers should immediately report the onset of any gastrointestinal illness. Such workers, if possible, may be placed immediately on work not involving the handlings of water components until free of diarrhoea for 48 hrs. With some diseases, such as those notifiable to the medical officer of health (including Hepatitis A, Shigella, Typhoid and Cholera) a medical certificate of clearance will need to be obtained.

Councils Vaccinations Policy for anyone working in or around wastewater is that the following vaccinations are required: Hepatitis A, Hepatitis B, Tetanus, Polio, and Diphtheria.

Hepatitis A and B are the minimum requirements for those working solely on water supply.

6.4 Contractors Completion Certificate

Before a Certificate of Practical Completion for contracts is issued or before the release of the 224 Certificate for subdivision work, the Authorised Installer will complete, sign and return to Council, as part of the documentation required under the Contract Quality Plan, a Hygiene Certificate confirming that during the term of this contract the Authorised Installer and all people directly involved with the work have adhered to and complied with the provisions of this Code.

Where the Authorised Installer is a subcontractor, this certificate shall be provided by the subcontractor to support the main contractor's Contract Completion Certificate. (Refer to Appendix VIII of the Infrastructure Design Standards Part 3 – Quality Assurance for the Contractor's Completion certificate template).

7 Councils' authorisations, permits and standards

The main mechanism that ensures the expectations of Council regarding hygienic procedures is the Authorised Water Installer scheme. In addition, the Permit to Work requirements and the specific Infrastructure Design Standards (IDS) contribute towards insuring that appropriate hygienic procedures are always followed.

7.1 Authorised Water Supply Installers Register

Council's Authorised Water Supply Installers (AWSI) Register was established to reduce the potential for contamination of the water supply and the associated public health risks that exist if persons working on the supply do not follow procedures and work in a non-hygienic manner. Only water supply installers on the Council's Authorised Water Supply Installer Register are permitted to undertake water supply related work for Council. https://ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/approved-contractors/Authorised-Water-Supply-Installers-Register.pdf)

Applications to be on the Authorised Water Supply Installer Register are received electronically and are processed by Business Support Team who check that all supporting documentation is complete. This includes the Health & Safety Management Plan, Quality Assurance Plan, Public Liability Insurance and Traffic Management Plan up to date, documentation expires after 2 years except the Public Liability, which expires after 1 year. The applicant needs to provide copies of their qualifications/training and proof of payment for the application fee.

Once the application is processed the Council assessor from the Contracts Management Team is advised and arranges a time for the practical assessment. The practical assessment includes specific checks to confirm knowledge of shut off procedure, chlorination procedures, Chain of Cleanliness procedures, and prevention of cross contamination. On passing the assessment the Councils database is updated, and they are placed on the AWSI Register. Performance is managed through either a suspension of registration for any breaches in terms and conditions and there is three months to resolve the cause of suspension, or a cancellation that is based on 'three strikes' in 12 months. This can be appealed as specified in the terms and conditions.

The document "Terms and Conditions for Christchurch City Council Authorised Water Installers to Carry Out Authorised Work" (Published 2004, last Update April 2018) outlines the approval process, and the general responsibilities and conditions of registration. https://www.ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/Authorised-Water-Supply-Installer-Terms-and-Conditions.pdf .

Quality staff - Authorised Installers need to be suitably experienced individual workers who have relevant experience, skills and qualifications. Current qualifications for working on the reticulation are:

- New Zealand Apprenticeship in Pipeline Constructions and Maintenance L4
- New Zealand Certificate in Infrastructure Works – Pipeline Construction and Maintenance L3

Previous qualifications were:

- Level 4 NZC in Utilities Maintenance
- Level 4 NZC in Pipe Installation
- Level 3 National Certificate in Water Reticulation (Planned & Reactive Maintenance Technician)
- Level 4 National Certificate in Water Reticulation (Supervisor)
- Level 3 National Certificate in Infrastructure Works (Infrastructure Pipelaying Technician).

AWSI are responsible for notifying Council if they leave their present company and are working for another. Companies can also notify Council of any AWSI staff changes. Full requirements can be found in the Authorised Water Supply Installer Terms and Conditions: https://ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/Authorised-Water-Supply-Installer-Terms-and-Conditions.pdf

The latest Register of Authorised Water Supply Installers is found on the CCC Authorised water installers webpage:https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-water-supply-installers

7.2 Chlorination Contractors

Council requires all water supply mains and submains to be pressure tested, chlorinated and bacteriologically tested in accordance with the CSS. This applies to:

- Council projects: capital works renewals and net assets
- Subdivisions that are to be vested in Council
- Other private work to be vested in Council e.g. NZTA projects

Council requirements are:

- The pressure test must be witnessed by a representative of the CCC Technical Services & Design – Contract Management Team (CCC CMT Representative), with the water installer providing formal notice of at least 2 working days.
- Chlorination must be approved by a CCC CMT Representative once all pressure testing requirements are met to the CCC CMT Representative's satisfaction.
- Chlorination must be carried out by experienced personnel from one of the companies which are CCC approved for this work.
- The FAC level in the chlorinated main after 24 hrs contact time must also be witnessed by a CCC CMT Representative, with 24 hrs notice being provided.
- A sample of fresh water following post-chlorination flushing must be collected by the person undertaking the chlorination for bacteriological testing at the CCC laboratory.
- The CCC authorised water installer will then gain approval from a CCC CMT Representative to liven new pipework following clear bacteriological testing. Allow at least 2 working days from time of sampling for laboratory results to be available from a CCC CMT Representative.
- The contractor must also submit a Hygiene Certificate in accordance with CSS: Part 4 2015, Clause 4.

Suitably experienced and qualified individuals are invited to become Council Chlorination Contractors by staff of CCC Technical Services & Design – Contract Management Team.

The current list is available on the Council website: https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/chlorination-contractors

7.3 Permit to work: Water supply network.

Before working on Council water assets such as pump stations or water treatment plants or part of the network, contractors must also complete a Network Operations Three Waters Induction session. This two-hour session includes information regarding our water safety plans, risk management and the Six Principles and includes an online test upon completion of the presentation.

The Permit to Work (PtW) system allows contractors to apply to work on the water supply and wastewater networks.

The Permit to Enter (PtE) system is operated by the Council's maintenance contractor for people who require access to Council water, stormwater and wastewater sites.

The Permit to Work system only looks at whether the work impacts the correct and safe operation of the Three Waters networks and ensures that Council has:

- Visibility of what is happening in the networks that it is required to maintain.
- Can notify the principal maintenance contractor of work being carried out by others, in case an afterhours response is needed.
- Can notify the applicant for a permit to work of any special conditions and precautions they should take in doing the work and any contingencies and remedial actions required.

7.4 Christchurch City Council Civil Engineering Construction Standard Specification (CSS)

These specifications set out Council's technical requirements for the construction of land and asset developments. They cover:

- Work undertaken on behalf of Christchurch City Council
- Assets that are intended to be taken over or maintained by Council.

Currently, CSS Part 4 covers Water Supply with hygiene requirements in Section 4 – Prevention of Contamination of Christchurch's drinking water supply and refers to Schedule D of the Authorised Water Supply Installer conditions, specifying the following:

- The chain of cleanliness for equipment and fittings prior to use on all works.
- Worker hygiene and the steps necessary to minimise the potential for workers to be a source of contamination.
- Sterilisation procedure prior to the commissioning or re-commissioning of plant.
- Water testing required to establish compliance with Drinking Water Standards of New Zealand (DWSNZ), prior to plant commissioning or re-commissioning.
- Procedures to be followed when contamination of the system has occurred.
- The submitting of a Hygiene Certificate, prior to application for a Certificate of Practical Completion.

Requiring all work to be undertaken within these conditions ensures that:

- There is Compliance with the regulatory requirements.
- Affords a high level of confidence that when work is carried out on the water supply system, the water supply network is not put at unnecessary risk of contamination.

After this code is approved and released, a change request to the CSS Section 4 will be made to ensure that this Code is referred to instead of Schedule D.

Hygiene certificates are completed at the completion of the work to certify correct hygiene practices have been used throughout: The Clause following from the CSS CSS-2022-PART-4-WATER-SUPPLY.PDF (ccc.govt.nz) gives this requirement:

Hygiene Certificate: Before a Certificate of Practical Completion is issued, the Authorised Installer shall complete, sign and return to the Council, as part of the as built documentation required under the Contract Quality Plan, a Hygiene Certificate confirming that during the period of these works the authorised installer and all people directly involved with the work have adhered to and complied with the provisions of the Authorised Water Installer's Specification.

8 Methods of Working, Cleaning and Disinfection – Good Practice

The following sections concentrate on particular activities and detail the expected hygiene steps that should be included when this work is completed.

8.1 Network repairs – Planned and Emergency

8.1.1 Pipe Mains Repair Procedure

There are generally three types of mains repair situations:

1. Mains repairs where positive pressure is maintained
2. Where there is loss of pressure but without contamination from other sources
3. Mains repairs where there is loss of pressure with contamination from other sources

Summary actions considered to be good practice for each situation are included below:

Pipe Mains Repairs where Positive Pressure is maintained - no opportunity for contaminated ground or surface water to enter the network (generally a small leak where there is no possibility for the flow from the leak causing suction elsewhere in the network).

- Excavate below the leak
- Ensure trench water is kept below this level prior to completely cutting off the leakage flow
- Any draining of the line should occur through the break while still maintaining the trench water below the pipe invert level
- Repair main leak using approved material/procedure for pipe wrapping, ensure no contamination can occur
- Complete the repair using chlorine solution on the exposed pipe, new fittings and tools
- Return to service

Pipe Mains Repairs where there is loss of pressure without contamination from other sources

- Expose the pipe at the break position and excavate to below invert to allow trench water to be pumped and maintained below the pipe invert
- Maintain air gap between invert and excavated level
- Remove damaged pipe section with care to ensure no foreign material enters the exposed water pipe
- All exposed sections of the water pipe, the repair materials and tools shall be spot treated with the chlorine disinfection solution.
- Place disinfected materials onto clean surface (eg impervious plastic sheet or tray, not directly onto the ground
- Repair leak using approved material/procedure for pipe wrapping, ensure no contamination can occur
- Cut pipe work and install tapping bands if required.
- Replace pipe section ensuring you have gone along pipe to find sound pipe sections to install new section onto.
- Remove damaged section and bag sample for potential condition assessment. Cut pipe work and install repair band.
- On completion of the repair the main the required service connections affected by the shutdown shall be thoroughly flushed in line

- Ensure appropriate flushed water containment is in place and potential environmental impacts are mitigated prior to taking repair actions

Mains repairs where there is <u>loss of pressure with suspected or confirmed contamination</u> during repair/damage (e.g sewage, stormwater, chemicals, hydrocarbons)

- Endeavour to maintain positive water pressure in pipeline until contamination source has been removed or the section of watermain affected must be immediately isolated by the closing of appropriate valving, including house connections attached to that length of pipeline.
- Dig sump 400mm beneath open pipe and drain/pump to ensure groundwater/surface water always remains below invert of open pipe
- Isolate and/or remove the contamination
- Thoroughly clean exterior of pipe, open ends, fittings and tools
- Place disinfected materials onto clean surface (e.g. impervious plastic sheet or tray, not directly onto the ground).
- Repair completed
- Once repair completed thorough flushing of the main shall occur including any rider mains.
- Mains shall be thoroughly flushed in sections through remote hydrants or water tankers (which must be fitted non-return valves or configured to prevent backflow), producing sufficient flow velocity to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes.
- A similar disinfection process as for new mains should be undertaken
- Take sample for laboratory analysis (field tests may be acceptable for return to service)

Flushing

Following reticulation repairs, the mains should be flushed thoroughly in sections, using potable water from the network. Hydrants should be used to produce sufficient flow velocities to remove any foreign matter that may have entered the network from the break of subsequent repair. The volume of water used for flushing should be equivalent to at least three times the pipe volume in the section being flushed. Flushing should continue until the discharged water is visually clean and has the same FAC as expected in the adjacent network. Refer to section 8.5 for disposal of chlorinated water.

Flushing may also be carried out reactively in response to complaints of dirty water.

8.2 New Pipe Installations

Good practice includes the following:

- An assessment should be made of the ground conditions and any other potential risks to water quality during the laying and commissioning of pipes. For example, the use of metal or barrier pipes in brown field sites where there is risk of hydrocarbon contamination.
- Pipes and fittings are transported and carefully stored on site, off the ground, to avoid entry or dirt or vermin. Pipes should be supplies with close fitting end caps where feasible and these should remain in place until the pipe is laid. Care should be taken that particularly plastic pipes are kept clear of fuel oils.
- All fittings and end pipes are sprayed with 100mg/l chlorine solution as they are laid.
- Chambers for hydrants and air valves should be located away from areas where there is risk of flooding or spillages.

Typically, upon completion of laying new pipe the work is inspected prior to flushing. Following flushing the pipeline is pressure tested to confirm there are no leaks. Following pressure testing and prior to commissioning, sterilisation shall be undertaken by the Council's approved Chlorination Contractor:

- The system will be filled with water containing a free available chlorine (FAC) concentration of 15g/m^3 (mg/l) +/- 5g/m^3 (mg/l) (see details below)
- It will be allowed to stand for a minimum of 24hrs for all new systems
- At the end of the 24hr period the FAC concentration must be at least 10g/m^3 (mg/l).
- If the FAC is less than 10g/m^3 then the sterilisation must be repeated until a satisfactory result is obtained (investigate the cause of the failed test)
- Flush and dispose of sterilisation solution (see section 8.5 for disposal of chlorinated water)
- Bacteriological testing to be completed (E.coli and total coliforms) and result confirmed prior to commissioning
- If a newly tested main is not connected to the existing reticulation within 10 days of chlorination/testing then the main shall be retested for E.coli as per the initial testing.

8.2.1 Method of introducing Sterilising Solution

The sterilising solution will be injected into the system using a portable chlorinator. If pre-mixed chlorinated water is not used, the chlorine solution must be injected at a continuous rate to ensure a concentration of 15g/m^3 (mg/l) +/- 5g/m^3 (mg/l) is in contact with every part of the main (achieved by pumping or injection while mains is filling). Use of powder, granules or tablets dumped into pipe or through hydrants is not permitted.

- Fill from lowest section of pipe to ensure air is not trapped.
- Record FAC at minimum of 150m intervals along main.
- After 24hours, record FAC and pH. If FAC >= 10mg/l and pH < 9 then acceptable, if not repeat chlorination process.
- Flush main and service connection pipe(s), as detailed above, until FAC between 0.5 and 1.0mg/l. (See 8.5 re disposal of chlorinated water). The sterilising solution shall be fed by gravity or pumped into one end of a stem if possible and the 'flushing' water in the system displaced out of the other end of the system to be disinfected until the tests carried out show that the water being displaced contains the full FAC concentration.

8.2.2 Sterilising Process

1) Determine the volume of water to be treated based on lengths of pipes[1]:

$$\text{Volume} = \text{Area} \times \text{Length}$$

$$\text{Area} = \pi \times r^2 = \pi \times \left(\frac{D}{2}\right)^2 = 0.25 \times \pi \times D^2$$

Length of main to be chlorinated (m)	Volume of main to be chlorinated(m^3)
Ø100mm =	**X** Sectional area 0.0078m^2 =
Ø150mm =	**X** Sectional area 0.0177 m^2 =
Ø200mm =	**X** Sectional area 0.0314 m^2 =

[1] r: radius
D: diameter

Ø300mm =	**X** Sectional area 0.0707 m^2 =
Ø xx mm =	**X** 0.25πD^2 =
Total length of main to be chlorinated =	Total volume (m^3) =

2) Determine the period of time that must elapse from the beginning of sterilisation of the water main(s) until the test can begin (i.e. the time taken for chlorinated water to travel from the injection point to the testing point):

$$\text{Time (min)} = \frac{\text{Volume (m}^3\text{)}}{\text{Flow (m}^3\text{/min)}} = \frac{\text{Volume (m}^3\text{)}}{0.5\ \text{m}^3\text{/min}}$$

3) Connect the dosing system to the new reticulation through the chlorination point. Ideally, the main should be charged from the lowest point to ensure that air is not trapped. Ensure a backflow prevention device is used to protect the existing reticulation.
4) Adjust the flow rate using the flow meter on the terminal fire hydrant on the water main to obtain the required flow rate of 0.5m^3/min (8.33l/s)
5) Allow the chlorinated water to flow for at least the travel time before carrying out the initial total residual chlorination test: 15mg/l (+/_ 5mg/l).
6) If the initial test complies, close off the main and leave the chlorinated water for 24hrs. After 24hrs carry out the FAC residual test. If the FAC is not at least 10mg/l then the sterilisation must be repeated.
7) Once the sterilisation has passed flush the main(s), disposing of the chlorinated solution as detailed in Section 8.5. Test the water to confirm that the FAC is at the level expected in the network. Take a sample for bacteriological testing, if it fails the sterilisation process must be completed.
8) The main(s) can be commissioned once a clear bacteriological test is received (<1/100ml E.coli and total coliforms)

8.3 Well and Surface Pump Maintenance and Pump Replacement

- All riser pipe removed is stored securely with ends of pipework and fittings protected from both organic matter and potential against vermin entering
- Ensure all cables are stored securely, coiled up and protected from any potential contamination sources or damage.
- All riser pipe, cables, pumps and any other equipment to be reinstalled into the well shall be treated with 100mg/l chlorine solution.
- For pump replacement all pipework/manifolds/ gaskets, pumps and any other equipment to be reinstalled is stored securely on site with ends of pipework, fittings and pump protected from any foreign material entering the pipe and then are treated thoroughly with 100mg/l chlorine solution prior to being reinstalled.
- Once work is completed, bore should be flushed to waste and bacteriological testing (E.Coli and total coliforms) completed, with results confirmed before returning to service.

8.4 Reservoirs and Suction tanks

Personnel working with reservoirs and suction tanks, including Inspections, both external and internal and maintenance need to follow the good hygiene practices outlined in this Code.

Refer to the CCC Water Storage Management Plan (TRIM 23/1929712) for detail regarding the cleaning of tanks removed for inspection and returning them to service.

Disinfection is required of all equipment that will enter an operating reservoir (e.g. Remotely Operated Vehicles (ROVs), etc). Immediately prior to its use, all equipment should be disinfected via submersion in, spraying or sponging with disinfectant solution (minimum 1% chlorine). Any person entering a reservoir should wear appropriate footwear dedicated solely to potable water work, and a footbath of disinfectant solution should be stepped through immediately prior to entering the reservoir.

Most of the source water in Christchurch is considered to be Class 1 under the DWQAR, this means a protozoa treatment barrier is not needed to be installed, a poorly maintained suction tank has the potential to contaminate our source water.

Reservoirs, both at treatment plants and those within our networks are vulnerable to contamination from a variety of potential sources – backflow, vermin entering the reservoir, roof contamination (birds, vermin, organic matter) being washed into the reservoir through leaky/damaged roofs, poorly fitting hatch seals etc.

It is therefore crucial that any work undertaken on these storage tanks is done with the utmost care and attention to hygienic practices. Routine security and contamination inspections are also crucial for identifying and remedying potential pathways where contamination could occur.

8.4.1 Internal tank surface spraying following tank emptying / inspection/ repair (Also applicable for New Tanks)

- Ensure any rubbish from any work undertaken and scrap metal is removed. Using a hose, carry out final wash-down of ceiling, walls and floor and have sucker tank on site to remove excess water and any remaining sand.
- Note that strict hygiene controls are required from this point: entry into the tank should be through a chlorinated footbath and plastic laydown area.
- Spray down walls and floor with 1% chlorine solution. A jet nozzle adapter for the spraying may be needed to reach the top of walls from the floor (ensure appropriate health & safety measures are taken, full protective clothing and mask must be worn).
- Wait 30 minutes after spraying all surfaces, then fill the tank to normal operation level.
- Wait a further 30 minutes after filling the tank and then discharge. This discharge is an ideal time to bleed the disinfection sampling points and also flush the network pipe.
- Refill the tank, full testing (E. coli, total coliforms (both 0 cfu/100ml), turbidity (<1NTU) and pH (between 7.0 and 8.5) can begin. FAC analysis should also be undertaken (to confirm the FAC in chlorinated reservoir/check any residual from cleaning in a suction tank).
- The testing to be completed on three consecutive days with clear results before tank is returned / introduced into service.
- Note that an alternative of chlorinating a full tank if spraying internal walls is not possible is also outlined in memo TRIM 22/1821319

8.4.2 Preparing Chlorine Solutions for Use

Equations and equivalences:

- $\frac{\%\ \text{chlorine in hypochlorite solution}}{\%\text{chlorine desired}} - 1 =$ Total parts of water for each part hypochlorite solution

1 % chlorine in hypochlorite solution = 10g/l = 10,000mg/l = 10,000ppm

  - g/l: grams of chlorine per litre of solution
  - mg/l: milligrams of chlorine per litre of solution
  - ppm: parts of chlorine per million parts of solution

Examples:

Using a 1% stock solution (10g/l or 10,000mg/l) to make a 0.1% solution:
$\frac{1\%}{0.1\%} - 1 = 9$, so nine parts of water to one part 1% stock solution will give a 0.1% solution.

Using a 12% stock solution (120g/l or 120,000mg/l) to make a 0.1% solution:
$\frac{12\%}{0.1\%} - 1 = 119$, so 119 parts of water to one part 12% stock solution will give a 0.1% solution.

Product	Disinfection of tools – 0.1% solution	Spraying of tank walls to return to service	Notes
Sodium hypochlorite solution at 12 – 15% active chlorine	7ml in 1 litre	70ml in 1 litre	Difficult to use concentrated solution to get small quantity of 0.1%
Sodium hypochlorite 1% solution	Dilute 1 part to 9 (e.g. 100ml and 900ml if want 1 litre of solution	Use directly	

1 teaspoon = approx. 5ml

1 Tablespoon = approx. 15ml

1 Cup = approx. 250ml

8.5 Disposal of chlorinated water

Installation of new pipework, returning reservoirs and suction tanks to service, use of temporary connections, discharge of treated water from continuous monitoring instruments and other specialised activities creates a need to dispose of chlorinated water. Even normal flushing of the network with potable water or mains bursts can pose a threat to ecologically sensitive environments as chlorine can be toxic to freshwater biota at a much lower level than is required to maintain a residual disinfection barrier within the network. Without adequate processes for identification, treatment and control, these discharges can feasibly result in high risk for the environment and for Council.

The allowable limit for discharge of chlorinated water in the Canterbury Land and Water Regional Plan (LWRP) varies depending on the receiving environment but can be as low as 0.4ppb or µg/l where a 99% level of

protection is required – this is equivalent to **0.0004mg/l**. The ANZECC (2000) Guidelines for Fresh and Marine Water Quality (FMWQ) have a trigger value of 3µg/l of total chlorine residual, equivalent to **0.0003mg/l**. See appendix B for extracts from the LWRP.

Levels of chlorine that have the potential to affect freshwater biota are therefore considerably less than the **0.2mg/l** required by the DWQAR to be achieved at the extremities of our distribution networks. Care needs to be taken with any discharge of chlorinated water to the environment including routine or reactive flushing within the network.

Broadly there are two main categories of dechlorination method: physical and chemical:

- Chemical involves dosing the discharge with a chemical which reacts with the chlorine, the commonly used examples are sodium thiosulphate or ascorbic acid. These are often deployed via dechlorination mats or strips (dechloromats), these must be placed such that the channelled water does not flow outside the span, or the mat and the channelled flow must be long enough to ensure proper mixing with the chemical.
- Physical methods make use of the relative ease with which chlorine is neutralised upon reaction with air, sunlight and contacting surfaces, reacting readily with organic and inorganic impurities in soil, paved surfaces, water and wastewater. Such methods include discharge to sewer, stormwater, overland flow and retention in tankers.

The following areas are the key factors influencing the possible harm of the discharge:

- Receiving water sensitivity
- Chlorine concentration in water
- Duration
- Dilution
- Volume
- Geography (distances, travel times, downstream confluences)

Flushing to the sewer system is usually the first option considered, the requirements for such a discharge from Councils Trade Waste bylaw are:

- Free chlorine – <3 g/m^3
- Hypo chlorine – <30 g/m^3

All requests to discharge to sewer do require a temporary Trade Waste consent or for small volumes an agreement under Council's bylaw and should be made through contacting TradeWaste@ccc.govt.nz

In general, if the location of where a discharge will enter into a waterway is unknown, assume a highly sensitive receiving environment (precautionary principle).

8.6 Temporary connections

Temporary connections are required to be applied for: https://ccc.govt.nz/services/water-and-drainage/water-supply/connections/connect. All temporary water supplies need to be installed, operated and removed by a Council authorised water installer.

The use of temporary connections can present additional risks that have the potential to affect the quality of the water supply. Temporary connections may be part of planned work or arise from an emergency situation.

Generally, their use should only be for a short period and only when there is no other satisfactory means of supply.

- All temporary connections of reticulated water to mains under construction and/or maintenance should incorporate as a minimum a testable double check backflow prevention device.
- Connections should be appropriately sized for the number of customers / expected demand.
- 1% chlorine solution should be used to disinfect all joints and fittings.
- Temporary connections (<50mm nominal diameter) do not normally require sampling, provided that appropriate disinfection and flushing has been carried out. Checking of FAC following flushing should confirm normal distribution levels of chlorine.
- If the temporary main is part of a preplanned project, then it should be disinfected, sampled and satisfactory results obtained prior to commissioning.
- Suitable protection should be provided where temporary piping crosses driveways, footpaths or roads.
- The potential for contamination by oil, petrol or solvents is assessed as these chemicals can quickly penetrate plastic pipes and so if crossing contaminated land then a barrier pipe should be employed.
- When in use a temporary connection should be regularly inspected to confirm its integrity and a sampling programme employed at a frequency determined by risk assessment.
- In warm weather consideration should be given to regular flushing to minimise the potential effects of raising water temperature.

8.7 Backflow Risks

Council's backflow prevention programme is outlined in TRIM23/1247034 and also Council's Water Supply and Wastewater Bylaw 2022 (TRIM 24/99565)

The risk of backflow through service pipe connections into a main directly is greatest when the main is depressurised, this may be from a burst or damage or from the subsequent isolation of the main for repair.

All temporary connections or reticulated water to pipes under construction and/or maintenance shall incorporate testable double check backflow devices to prevent contamination of the reticulation network. This includes water used for hydrostatic pressure testing, flushing and disinfection.

8.8 Use of Fire Hydrants

DWQAR Rule D3.6 prevents access to the water network through use of a standpipe except by FENZ, other emergency services and the drinking water supplier (and their contractors) where necessary for the operation of the drinking water supply. Until Council has dedicated tanker filling points the current procedure for standpipe hiring continues:

How to hire a Council standpipe?

- Applications for water connections are made by completing a WS3 form and e-mailing these through to the water connections mailbox - water.connections@ccc.govt.nz
- The customer will typically be given an order number within 2 business days. They take this to Humes, 30 Carmen Road, Hornby Christchurch 8441, or phone 03 349 4399 or 0800 101 999.

- The standpipes are fitted with a backflow prevention device and a water meter.

9 Reporting and Audits

Taumata Arowai requires Council to report on compliance with assurance rules within 40 days of the end of the calendar year. Several of the Assurance Rules have a hygiene aspect to them. As well as having general procedures, authorisations, permits and standards in place it is important that these are regularly audited to ensure that there is good compliance. As well as compliance it is also important that there is an awareness and understanding of the importance of good hygiene in all aspects of managing a water supply and the vulnerability of the water supply to contamination.

Audits of work undertaken on the water supply are undertaken to ensure compliance with Councils authorisations, permits and standards as follows:

- Internal audits by the contractor
- Audits by Water and Wastewater Operations team of the contractor
- Initial assessment for Authorised Installers
- Audits of projects – new work / replacements / projects
- Audits of BP water treatment plants by Quality and Compliance Team
- Project managers

Appendix A REFERENCES

- Authorised Water Supply Installer: https://ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/Authorised-Water-Supply-Installer-Terms-and-Conditions.pdf
- Christchurch City Council Civil Engineering Construction Standard Specification: Download the CSS : Christchurch City Council (ccc.govt.nz)
- Health, Safety, and Wellbeing Guidebook: Record 22/1365948: 3WG001 3W HSW Guide Book Employees Version 1.0 Published
- Ministry of Business, Innovation and Employment (MBIE), 2010. A principal's guide to contracting to meet the Health and Safety in Employment Act 1992. Retrieved from https://healthandsafetybydesign.co.nz/wp-content/uploads/2019/02/a_principals_guide_to_contracting.pdf
- Taumata Arowai: Ministry-of-Health-Drinking-Water-Quality-Guidelines-for-New-Zealand.pdf (particularly chapter 16: The Distribution system)
- Permit to Work: https://ccc.govt.nz/consents-and-licences/construction-requirements/three-waters-contractor-portal/permit-to-work/
- Permit to Enter: https://ccc.govt.nz/consents-and-licences/construction-requirements/three-waters-contractor-portal/permit-to-enter/
- Returning Reservoirs and Suction Tanks to service after internal inspection cleaning and repairs TRIM 22/1821319
- Water NZ Good Practice Guide Hygiene Practices to Prevent Water Supply Contamination: https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=4203
- Code of Practice for Disinfection of Water Systems No. COP-04 Version 4 August 2022 TRIM 25/644127

Appendix B Extracts from Canterbury Land and Water Regional Plan

5.99 Any discharge of water or contaminants into surface water or onto or into land in circumstances where it may enter surface water that is not classified by any of the above rules, is a permitted activity, provided the following conditions are met:

1. The discharge is not from or into contaminated or potentially contaminated land; and
2. The discharge is not into a Natural State water body; and
3. The discharge meets the water quality standards in Schedule 5 after reasonable mixing with the receiving waters, in accordance with Schedule 5; and
4. The concentration of total suspended solids in the discharge shall not exceed:
   (a) 50 g/m^3, where the discharge is to any Spring-fed river, Banks Peninsula river, or to a lake; or
   (b) 100 g/m^3 where the discharge is to any other river or to an artificial watercourse; and
5. The discharge does not result in more than a 20% change in the rate of flow of the receiving surface water body; and
6. The discharge does not contain any hazardous substance, hazardous waste or added radioactive isotope.

Schedule 5 Mixing Zones and Receiving Water Standards

Mixing Zones

The area (and underlying volume) of a receiving water where the water quality standards specified for rivers, artificial watercourses and lakes do not have to be met is referred to as the Mixing Zone.

The Mixing Zone, as a result of a point source discharge of a contaminant, is:

1. For river and artificial watercourse locations with flowing water present at all times;
   (a) no longer than 200 m along the longest axis of the zone, and
   (b) occupies no greater than two-thirds of the wetted channel width[1] at the estimated 7DMALF[2] for that location; and
   (c) no longer than 10 times the wetted channel width[1] at the estimated 7DMALF[2] for that location.

2. For river and artificial watercourse locations, with intermittent flows, no longer than 20 m at times of flow and 0 m at no flow;

3. For lake locations:
   (a) if the discharge location is within 50 m of the lake water edge[3] at any time, a circle with a diameter of 50 m; or
   (b) if the discharge location is greater than 50 m from the lake water edge[3] at all times, a circle with a diameter of 100 m; and

4. When within a Community Drinking-water Protection Zone, as set out in Schedule 1, 0 m.

Notes:

1 The wetted channel width is estimated by a suitably experienced and qualified person for the proposed discharge location. For a braided river the wetted channel width is the width of water in the braid receiving the discharge.

2 The 7DMALF for a specific location is estimated using a generally accepted calculation method undertaken by a suitably experienced and qualified person.

3 The lake water edge is estimated by a suitably experienced and qualified person for the proposed discharge location at the lowest lake level with a ten year reoccurrence interval.

Table S5B

CHEMICAL	LEVEL OF PROTECTION (% species)		
	99%	95%	90%
	Narrative Standards		
	Adverse effects on aquatic organisms are less than negligible.	Adverse effects on aquatic organisms are less than minor.	Adverse effects on aquatic organisms are minor.
	Numerical standards		
	(µg/l)	(µg/l)	(µg/l)
METALS AND METALLOIDS			
Aluminium	27	55	80
Arsenic (As III)	1	24	94
Arsenic (AsV)	0.8	13	42
Boron	90	370	680
Cadmium	0.06	0.2	0.4
Chromium (CrVI)	0.01	1.0	6
Copper	1.0	1.4	1.8
Lead	1.0	3.4	5.6
Manganese	1200	1900	2500
Mercury (Inorganic)	0.06	0.06	1.9
Nickel	8	11	13
Selenium (Total)	5	11	18
Silver	0.02	0.05	0.1
Zinc	2.4	8.0	15
NON-METALLIC INORGANICS			
Ammonia (Total N)	320	For values see Table 5C	
Chlorine (Total Cl)	0.4	3	6
Cyanide (Unionised, as CN)	4	7	11
Hydrogen sulphide (Un-ionised as S)	0.5	1.0	1.5
AROMATIC HYDROCARBONS			
Benzene	600	950	1300
o-xylene	200	350	470
p-xylene	140	200	250
CHLOROETHANES			
1,1,2-TRICHLOROETHANE	5400	6500	
HEXACHLOROETHANE	290	290	
ANILINES			
ANILINE	8	8	
2,4-DICHLOROANILINE	0.6	7	
3,4-DICHLOROANILINE	1.3	3	
POLYCYCLIC AROMATIC HYDROCARBONS			
Naphthalene	2.5	16	37
NITROBENZENES			