WATER NEW ZEALAND COMPETENCY FRAMEWORK

Drinking Water Distribution Operator

water NEW ZEALAND
The New Zealand Water & Wastes Association Wainui Aotearoa

Water New Zealand Competency Framework Drinking Water Distribution Operator

ABOUT WATER NEW ZEALAND

Water New Zealand is a national not-for-profit sector organisation comprising approximately 1900 corporate and individual members in New Zealand and overseas.

Water New Zealand is the principal voice for the water sector, focusing on the sustainable management and promotion of the water environment and encompassing the three waters: drinking water, wastewater, and storm waters.

www.waternz.org.nz

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The Water New Zealand Competency Framework is still in the development stage and we are interested in your feedback as we develop it further. If you have any questions, queries, or comments, please contact training@waternz.org.nz

Further refinements of this framework will be issued on the Water New Zealand website.

www.waternz.org.nz/competence

Executive Summary

A workforce with the right skills and capabilities is key to developing an effective, efficient, accountable, and resilient three waters sector in New Zealand.

This document forms part of Water New Zealand's Competences Framework (the Framework) and should be read in conjunction with the Water New Zealand Competences Framework Overview document.

The framework is intended to help the water industry to identify the knowledge and skills required by their workforce, to help assess levels of staff training that may be required and to develop training programmes.

The framework has been developed on a role-by-role basis, this document describes what ***Drinking Water Distribution Operators*** should be **able to do** and what they **need to know** to competently undertake their work.

***Drinking Water Distribution Operators*.**

These are the people who **operate, monitor** and **maintain** drinking water distribution system. They look after the pipes, mains, service reservoirs and pumping stations that supply the community with water. They carry out planned, preventive maintenance as well as respond to incidents such as burst pipes and major leaks.

Contents

What is the Water New Zealand Competency Framework?

The Water New Zealand Competency Framework (the Framework) identifies what the workforce:

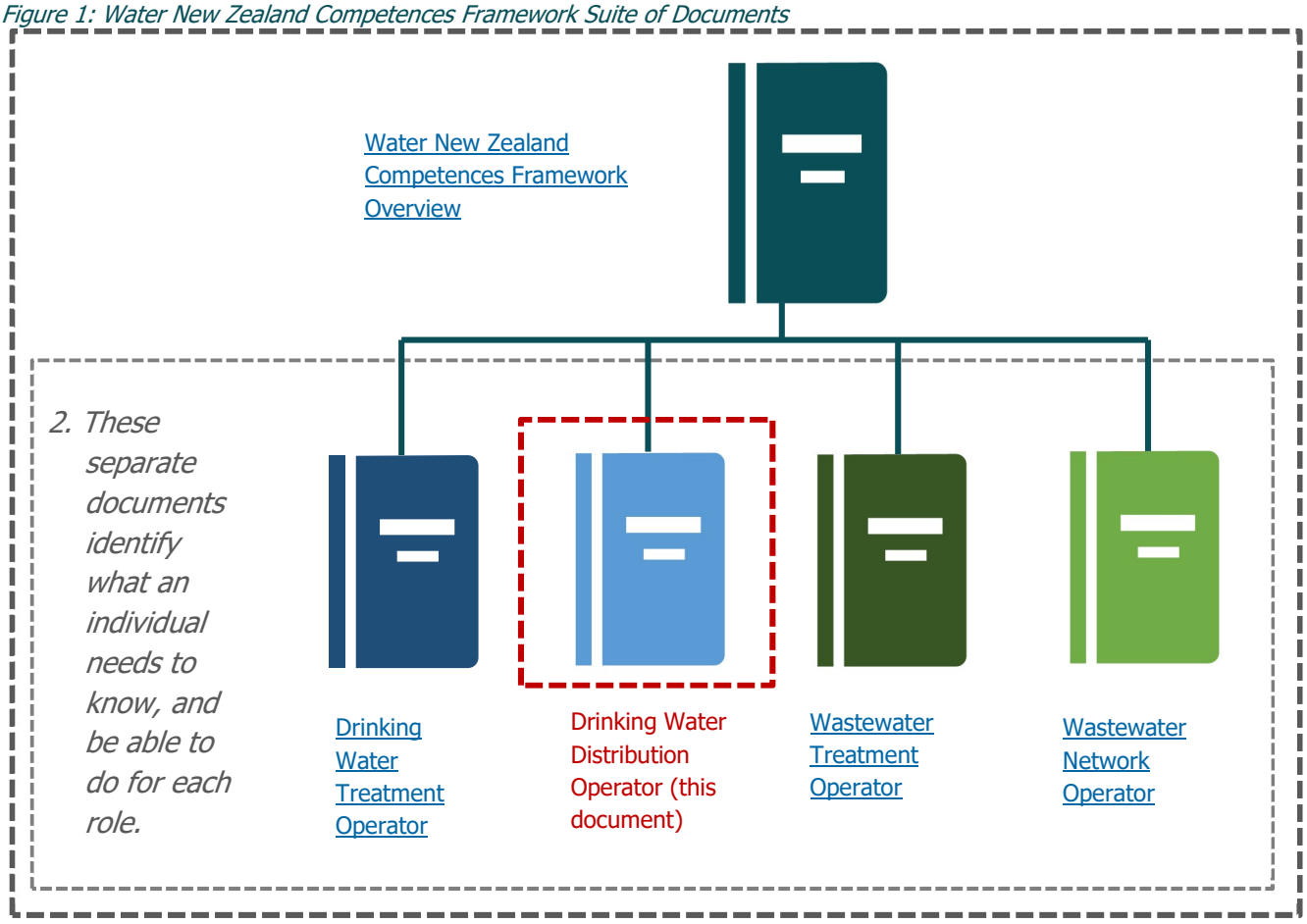
- Needs to be able to do, and
- Needs to know

In order to protect the health of the public by safely and effectively delivering three waters services to the community. While the Framework describes what people working in the three waters industry in New Zealand should be able to do and indicates what they ought to know and understand, it does not define how well they should be able to perform or how this should be assessed.

How does this document fit into the Water New Zealand Competence Framework?

The Framework has been structured into a suite of documents, as shown in Figure 1. This document details what it is that **Drinking Water Distribution Operators** need to know and be able to do. It should be read in conjunction with the Water New Zealand Competences Framework Overview document.

Figure 1: Water New Zealand Competences Framework Suite of Documents



Drinking Water Distribution Operator Profile

Drinking Water Distribution Operators take a risk management approach to protect the health of the public. They fulfil a crucial role in ensuring that water distribution networks, including pipes, service reservoirs and pump stations are operating properly to ensure that New Zealand communities are supplied with safe and sufficient water.

They need to have a full understanding of risk assessments and incident and emergency procedures that are documented within the Water Safety Plans that they are responsible for implementing.

To competently carry out their role, Drinking Water Distribution Operators need to understand hydraulics, pressures, and flows in a network in order to detect leakage. They need to have a full understanding of risk assessments and emergency procedures such as those identified in the Water Safety Plan. When a fault occurs, they find the root cause and utilise hydraulic theories and practices to ensure it is resolved as quickly and hygienically as possible. As water distribution assets are typically located underground in the roading corridor they need to safely manage traffic, use asset locating equipment and excavation support to safely complete their work.

Drinking Water Distribution Operator Elements of Competence

The table on the following page lists the elements of competence that are relevant to those roles that **Control Operations** and **Maintain Assets** in the context of operating and maintaining a water distribution network.

Each element of competence is further drilled down into to give context in a Water Treatment environment, and to identify what it is a Drinking Water Distribution operator needs to know and be able to do.

No one person at an organisation will be expected to be competent in all of the elements that this Framework details. The entire breadth of which knowledge and skills will be required by any operator will depend on the type of technology used by each Water Supplier. It will also depend on the depth of experience held within the team that the operator works within; some of the elements of competence will be appropriate for senior operators in a managerial role with other elements appropriate for new entrants to the industry.

What does someone who operates, monitors, and maintains a drinking water distribution network need to know and be able to do?

	Water NZ Competency Framework Link & Context	Elements of Competence
Strategy & Planning	**Governance, Legislation and Regulatory Frameworks** Drinking Water Distribution Operators are typically employed by Local Government either directly or via an outsourcing contract. They need an understanding of the governance, legal and regulatory frameworks that they are expected to operate within. Everyone involved in the water industry also needs to understand the spiritual and cultural significance of water to Tangata Whenua.	▪ Governance, Legislation and Regulatory Frameworks ▪ The Principles of Safe Drinking Water ▪ Development of Water Safety Plans ▪ The Role of the Drinking-water Standards for New Zealand ▪ The Role of the Firefighting Code of Practice ▪ Te Mana o te Wai
Asset Management Decision Making	**Operations and Maintenance Decision Making** Decisions made by Drinking Water Distribution Operators must reflect and support the principles of delivering safe drinking water as well as the activities and processes involved in determining operations and maintenance requirements.	▪ Critical Control Points ▪ Operational Monitoring and Inspection for Process Control ▪ Apply a knowledge of Science to the Distribution Network
Lifecycle Delivery	**Technical Standards** The activities that Drinking Water Distribution Operators are responsible for must comply with relevant technical standards.	▪ Technical Standards Related to Water Distribution
	Maintenance Delivery Drinking Water Distribution Operators need to be able to safely maintain the different types of equipment used in the delivery of water treatment	▪ Safe Isolation of Assets, Plant and Equipment ▪ Drinking Water Hygiene Requirements ▪ Disinfection Procedures for Fittings and Materials ▪ Locating Underground Services ▪ Safe Working in Roads ▪ Excavation ▪ Install and Repair Water Distribution Pipelines ▪ Maintenance and Repair of Water Pumping Systems ▪ Maintenance and Repairs of Water Storage Assets ▪ Validation and Calibration of Monitoring Equipment ▪ Inventory Management ▪ Cranes and Lifting Equipment ▪ Awareness of Specified Building Systems
	Reliability Engineering & Root Cause Analysis Drinking Water Distribution Operators need to be able to ensure that potential problems are identified as early as possible in an assets' life cycle, identifying the root cause of any lack of reliability	▪ Root Cause Analysis
	Asset Operations and Optimisation Drinking Water Distribution Operators monitor, operate, control, and optimise water treatment assets to ensure they operate in a manner that meets their objectives, within appropriate design, maintenance, and operational parameters.	▪ Water Demand and Hydraulics ▪ Pressure Management ▪ Flushing Water Mains ▪ Boundary Backflow Prevention ▪ Maintaining Disinfectant ▪ Mixing Water Sources ▪ Operate Treated Water Storage Tanks/Service Reservoirs ▪ Leakage Detection and Management ▪ Connection of New Customers ▪ Flow and Water Meters ▪ Valve and Hydrant Operations ▪ Awareness of how the SCADA system is used to control the Distribution Network and collect Data ▪ Operate Pumping Systems ▪ Operate Emergency Power Systems
	Shutdown & Outage Management Drinking Water Distribution Operators need to be able to manage asset shutdowns and the restarting processes. These can occur in planned, or unplanned, and emergency situations.	▪ Water Distribution Network Isolation / Shutdown / Re-commissioning of Assets ▪ Awareness of Vulnerable Persons Notification
	Fault & Incident Response Responding to failures and incidents in a systematic manner, including incident detection and identification, fault analysis, use of standard responses, temporary and permanent repairs is the responsibility of Drinking Water Distribution Operators. This includes the need to develop plans to respond to unplanned events and managing the resources required for the response to the events, and escalation criteria.	▪ Incident and Emergency Response Plan
	Asset Decommissioning and Disposal The processes used to decommission and dispose of assets due to aging or changes in performance and capacity requirements.	▪ Assist with the Process to Decommission, Dispose or Abandon Assets
Asset Information	**Data and Information Management** Drinking Water Distribution Operators gather much of the data and information that is used in asset management data analysis or is supplied to regulators.	▪ Provide data to assist in Asset Management Decision Making
Risk & Review	**Risk Assessment and Management** Drinking Water Distribution Operators need to recognise, and be able to respond to, risks to the delivery of safe drinking water.	▪ Implementing the distribution aspects of the Water Safety Plan ▪ Health and Safety ▪ Hazardous Substances Management ▪ Working with Asbestos ▪ Asset Security and Protection
	Asset Performance and Health Monitoring Drinking Water Distribution Operators need to understand how to monitor the performance of the assets that they are responsible for, how to report on asset performance and how to escalate problems they identify.	▪ Verification Monitoring ▪ Resource Consent Compliance Monitoring and Reporting
	Stakeholder Engagement Drinking Water Distribution Operators need to be able to communicate with the community and they also need to engage with other stakeholders like Drinking Water Assessors.	▪ Engage with Stakeholders and the Community

Element of Competence:	Governance, Legislation and Regulatory Frameworks
Context	The work that Drinking Water Distribution Operators are responsible for is regulated by several different pieces of legislation. The key legislation that Water Treatment Operators need to be aware of includes: ▪ The Health Act, which covers drinking water quality. ▪ The Water Services Bill, which when passed by parliament will cover the provisions of safe drinking water. ▪ The Resource Management Act (RMA) which covers taking water and discharging wastes to the environment. ▪ The Local Government Act (LGA) which covers the broad management and governance obligations that Water Treatment Operators are required to work within, including the setting of any specific local bylaws. ▪ The Building Act which includes backflow requirements for water connections and also the compliance requirements of buildings with specified systems ▪ The Health and Safety at Work Act (HSWA) which covers health and safety requirements. ▪ Taumata Arowai – the Water Services Regulator Act which covers regulation of water services. ▪ The Water Services Bill, which when passed by parliament will cover the provisions of safe drinking water. ▪ The Utilities Access Act which requires Utility Operators, such as Water Suppliers, to comply with a national code of practice that regulates access to transport corridors where the majority of distribution assets are located. ▪ The Fire and Emergency New Zealand Act 2017 which allows the Fire and Emergency services to use the water supply for any emergency or training purposes along with the authority to check the adequacy of the water supply for firefighting.
Outcome	The work undertaken by Drinking Water Distribution Operators meets all legal and regulatory requirements.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Operate the water distribution network in a manner that follows the Water Safety Plan for the distribution aspects of the supply and meets the Drinking Water Standards for New Zealand. The requirements for Drinking Water Distribution Operators are detailed further in the competency framework within the elements for Implementing the distribution aspects of the Water Safety Plan, and, The Role of the Drinking-water Standards for New Zealand.
- Provide information to the appropriate people regarding the performance of the drinking water distribution network to facilitate asset management planning and Department of

Internal Affairs reporting as required under the Local Government Act. The requirements for Drinking Water Distribution Operators are detailed further in the competency framework within the element titled Provide data to assist in Asset Management Decision Making.

- Operate the water distribution network within the requirements set out in the local bylaws specific to their territorial authority.
- Operate the water distribution network within the conditions set in the Resource Consent(s) for the water take, and any discharges from the distribution network. The requirements for Drinking Water Distribution Operators are detailed further in the competency framework within the element titled Resource Consent Compliance Monitoring and Reporting.
- Safely operate the water distribution network in a manner that addresses health and safety risks, including backflow prevention and firefighting capacity requirements.

To do this, Drinking Water Distribution Operators ***need to know:***

- About the Health Act, which requires Drinking Water suppliers to meet the Drinking Water Standards for New Zealand, and to have and implement a Water Safety Plan for each supply.
- About the Resource Management Act which regulates the source of water and requires the taking of water and the discharge of treated water to conform to the requirements of a resource consent.
- About the Local Government Act which requires Councils to set local bylaws
- About the Local Government Act requirement for Councils to identify the level of service to be delivered by the Water Supply and to be prudent in the stewardship of critical assets like Water Distribution Networks.
- About the Building Act which requires backflow prevention at points of connection to the drinking water supply.
- About the Health and Safety at Work Act which is concerned with the Health and Safety of workers and visitors to site.
- About the Health and Safety at Work (Hazardous Substances) Regulations 2017 which set out the rules for work-related activities involving hazardous substances and replaces the HSNO (Hazardous Substances and New Organisms) regulations for the workplace. Note that in the absence of specific HSWA guidance existing HSNO codes of practice (HSNOCOP) still provide useful guidance.
- About the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999.

Element of Competence:	The Principles of Safe Drinking Water
Context	There are six fundamental principles of safe drinking water in New Zealand [1] that are essential to the management of drinking water supply.
Outcome	The vulnerability of the drinking water supply to contamination is reduced by ingraining the Principles of Drinking Water Safety into operation of the entire drinking water supply.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Embrace a high standard of care in the work that they undertake. Vigilance, diligence, and competence are minimum requirements.
- Understand, manage, and address risks to source water.
- Understand how the treatment processes provide multiple barriers to contamination and the importance of maintaining these barriers against failure.
- Monitor the distribution network for any changes and respond accordingly.
- Maintain a personal sense of responsibility and dedication to providing consumers with safe drinking-water.
- Understand the risks to the water supply, how these risks are managed, and the control measures that are used to ensure that management is occurring properly. This includes the requirement for operators to monitoring the performance of each barrier.

To do this, Drinking Water Distribution Operators ***need to know:***

The six fundamental principles of drinking water safety:

- Principle 1: A high standard of care must be embraced
- Principle 2: Protection of source water is of paramount importance
- Principle 3: Maintain multiple barriers against contamination
- Principle 4: Change precedes contamination
- Principle 5: Suppliers must own the safety of drinking-water
- Principle 6: Apply a preventive risk management approach

Element of Competence:	Development of Water Safety Plans
Context	Water Safety Plans (WSPs) consider the potential risks to the water supply and identify ways to manage those risks. This essential tool promotes a multi-barrier approach to managing risks and articulates how the supply addresses the principles of drinking water safety in New Zealand. Given their knowledge of the water distribution network operation and maintenance requirements, Drinking Water Distribution Operators must have input into the development of the Water Safety Plan. They are also responsible for the implementation of the distribution elements of the Water Safety Plan.
Outcome	The publics' health is safeguarded through the development and implementation of the Water Safety Plan.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Assist with identifying the Critical Control Points (CCPs) within the distribution network for the supply.
- Assist with identifying and documenting the corrective actions which are required for the CCPs when defined action and critical limits are reached.
- Use their operational knowledge of the distribution network to help identify improvement items to include within the Water Safety Plan.
- Assist with reviewing customer complaints to help identify whether operational changes within the distribution network can be made to improve consumer satisfaction.
- Be involved in long-term engagement plans on the awareness and involvement in safe and secure drinking-water.

To do this, Drinking Water Distribution Operators ***need to know:***

- What their role is in the development of the Water Safety Plan (WSP).
- The requirements of the New Zealand Drinking-water Safety Plan Framework.
- The Principles of Safe Drinking Water in New Zealand.
- The characteristics of the drinking-water supply system, what hazards might arise, how these hazards arise and create risks, and the processes and practices that affect drinking-water quality.
- The available water quality information and be able to analyse and interpret this information which identifies actual and potential water quality issues.
- What the barriers to contamination are for the supply, so that the failure of a barrier linked to the distribution network will be compensated for by the effective operation of the remaining barriers. Possible barriers related to the distribution network might include maintaining residual disinfectant levels within the distribution system.
- What Critical Control Points are.

- How the Drinking-water Standards for New Zealand provide requirements for drinking-water safety by specifying the:
    - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water.
    - criteria for demonstrating compliance with the Standards.
    - remedial action to be taken in the event of non-compliance with the different aspects of the Standards.
- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information.
- The commitment to drinking-water quality management from their employer and the relationship of the Water Safety Plan to organisational policy and strategy.
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Element of Competence:	The Role of the Drinking-water Standards for New Zealand
Context	Drinking Water Distribution Operators are instrumental in ensuring that drinking water supplied to the community is safe to drink. They protect public health by ensuring that the distribution network elements within the supply system meet the Drinking-water Standards for New Zealand (DWSNZ).
Outcome	Safe drinking water is supplied to the community that, at a minimum, complies with the Drinking-water Standards for New Zealand.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Operate the water distribution network in a manner that ensures that each distribution zone within the network complies with the New Zealand Drinking-water Standards (DWSNZ).
- Monitor, both manually and continuously, the drinking-water within the distribution network for parameters to assess compliance with the DWSNZ in accordance with the supplier's monitoring programme.
- Verify the overall performance of the drinking water distribution network by confirming that the following has occurred:
  - The concentration of a determinant in a sample of the drinking-water does not exceed the MAV or GV more often than is permitted in the DWSNZ.
  - An operational requirement does not move outside its limit for more than its allowed frequency or duration of the compliance monitoring period.
  - The number of measurements made for each compliance criterion is equal to or greater than that specified in the DWSNZ.
  - Sampling, standardising, testing and reporting procedures meet the requirements of the DWSNZ.
  - The requirements of the compliance criteria have been met throughout the previous 12 months.
  - The escalation and remedial actions specified in the DWSNZ and the Water Safety Plan have been carried out when there has been a transgression or an excursion beyond an operational requirement.

To do this, Drinking Water Distribution Operators ***need to know:***

- How the New Zealand Drinking-Water Standards provide requirements for drinking-water safety by specifying the:
  - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water
  - criteria for demonstrating compliance with the Standards

- remedial action to be taken in the event of non-compliance with the different aspects of the Standards.

- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-Water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information. Note that Chapter 16 of the guidelines specifically relates to the distribution network element of the supply system.
- That the drinking water supply requires an approved Water Safety Plan(WSP) that considers the potential risks to the water supply and identifies ways to manage those risks. The WSP promotes a multi-barrier approach to managing risks and articulates how the supply addresses The Principles of Safe Drinking Water in New Zealand. Only the parts of the WSP that relate to the distribution network will be implemented by the Drinking Water Distribution Operators.
- The requirements for verification monitoring within the Drinking-water compliance monitoring plan that is referenced in the Water Safety Plan, including typical measured levels, trends and action levels for water quality parameters and the role of water quality alarms
- The actions to be taken in event of an exceedance of an operational target value.
- The implications and consequences of regulatory water quality sample failures, and actions to be taken as detailed in the Incident and Emergency Response Plans for the water supply.
- The importance of investigation process in the event of water quality incidents, and the regulatory requirements regarding the reporting of these.
- That the water supply they operate should be included on the Register of Drinking-Water Supplies in New Zealand which provides information on who is registered as a drinking-water supplier and gives information about their supplies or sources of water. Inclusion on the register is mandatory for all drinking-water supplies or suppliers serving more than 25 people.
- That the compliance monitoring data about the water supply must be uploaded to Drinking-Water Online, a reporting tool that helps suppliers report the results of their drinking-water supply compliance reporting to meet their obligations under the Health Act 1956.
- That the compliance of the water supply they operate will be reported to the public via the Annual Report on Drinking-Water Quality which is published each year and covers previous year's compliance for registered networked drinking-water supplies The report describes how drinking-water suppliers met the requirements of the Drinking-water Standards for NZ and how they met their statutory requirements of the Health Act.
- That the Health Act requires that only recognised laboratories may be used to carry out tests and analysis of raw water and drinking-water to demonstrate compliance with the Standards.
- What the roles and powers of Taumata Arowai - the water services regulator and Drinking Water Assessors are.

Element of Competence:	The Role of the Firefighting Code of Practice
Context	The New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008) provides direction on what constitutes a sufficient minimum supply of water pressure and volume for firefighting in urban fire districts. While it is not mandatory to meet this code of practice it is often referred to in relevant bylaws and district plans.
Outcome	A sufficient supply of water, both in terms of water pressure and flow, is always available within the distribution network to provide for firefighting requirements.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Monitor, water storage levels and pressures within the distribution network to ensure that the minimum pressure and volume of water storage required for firefighting purposes is maintained.
- Ensure that fire hydrants within the distribution network are maintained and kept fully charged.
- Ensure that markings and indicators that identify the position of fire hydrants are maintained so that they are always visible.
- Manage any discolouration and reduced pressures that may result from flow tests during fire service flow testing.
- Remove fire hydrant boxes, lids, marking and marker posts from abandoned water mains.

To do this, Drinking Water Distribution Operators ***need to know:***

- That the adequacy of a firefighting water supply involves having sufficient volume and pressure of water available. It also requires knowledge of the location, connections, marking and access to fire hydrants to enable the water supply to be used.
- That the Fire Service should be advised as soon as practicable when new water mains are charged and commissioned, or when existing water mains are decommissioned and when reinstated either temporarily or permanently.
- That fire hydrant boxes, lids, marking and marker posts must be removed from abandoned water mains.
- That the Fire and Emergency Act 2017 allows for the Fire Service to check the adequacy of firefighting water supplies, including the volume and pressure in any water mains and to also take water free of charge for both training and in emergency situations.
- That the New Zealand Fire Service Firefighting Water Supplies Code of Practice covers the inspection and testing requirements of hydrants.
- That the New Zealand Fire Service Firefighting Water Supplies code of Practice covers the markers and indicators required to identify hydrants.

Element of Competence:	Te Mana o te Wai
Context	Te Mana o Te Wai refers to the integrated and holistic wellbeing of a freshwater body. Each community decides what Te Mana o te Wai means to them, based on their own unique relationship with water in their area or rohe. Te Mana o te Wai is upheld by acknowledging the mana and mauri of the freshwater body which provides the source of water for the water treatment plant. The National Policy Statement for Freshwater Management (Freshwater NPS) recognises Te Mana o te Wai as an integral part of freshwater management.
Outcome	Protecting Te Mana o te Wai provides for the mauri of the water. This includes providing for: ▪ Te hauora o te taiao (health of the environment), ▪ Te hauora o te wai (health of the waterbody) and, ▪ Te hauora o te tangata (the health of the people).

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Te Hauora o te Taiao – Drinking Water Distribution Operators help to protect the health of the environment by ensuring that the conditions of any resource consent relating to the discharge of treated water from the distribution network are adhered to.
- Te Hauora o te Wai – Drinking Water Distribution Operators help to protect the health of waterbodies by ensuring that the conditions of any resource consent to discharge chlorinated water are adhered to. This also aligns with the Principle of Safe Drinking Water that identifies that protecting the water source is of paramount importance.
- Te Hauora o te Tangata – Drinking Water Distribution Operators protect the health of the people by operating the drinking water distribution network in a manner that reflects the Water Safety Plan for the supply.

To do this, Drinking Water Distribution Operators ***need to know:***

- What te Mana o te Wai means to their community. Under the Freshwater NPS it is up to the community and each Regional Council to consider and recognise Te Mana o te Wai in their regions.
- The conditions of all resource consents related to the operation of the drinking water distribution network.
- The elements of the Water Safety Plan that relate to the distribution network for the supply.

Element of Competence:	Critical Control Points
Context	A Critical Control Point (CCP) is a measure that can be operated as a process control for a water quality hazard. They are particularly important for managing microbiological hazards and being able to supply enough water. CCPs help to ensure the safety of drinking water from the source to the tap. A few of the parameters monitored by Drinking Water Distribution Operators may have been identified as CCPs within the Water Safety Plan. E.g. maintaining a residual disinfectant within the distribution system.
Outcome	CCPs are monitored regularly (ideally continuously) to ensure that barriers are effective. Appropriate actions to optimise the system, or to bring the system back into control, are undertaken when action limits are reached. Incident and emergency plans are activated when critical limits for individual parameters are reached.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Undertake operational monitoring and inspections of any Critical Control Points that relate to the distribution network.
- Undertake corrective actions when routine monitoring and inspections indicate that a CCP is deviating from its expected performance and is reaching its action limit. This may include:
  - adjustments or process control changes,
  - communicating and notifying others of the issue, including the relevant drinking water treatment operator for the supply.
  - additional monitoring and inspection to confirm that the corrective action has been effective.
- Activate incident and emergency response procedures when critical limits for a CCP is reached or because the corrective action at the trigger level has not improved the performance of the CCP.
- Have input into a review into the underlying cause of why the corrective action, or incident and emergency response procedures, were needed. This includes identifying:
  - how effective the monitoring and inspection plan was.
  - how effective the corrective action was.
  - whether the Water Safety Plan needs to be updated as a result.

To do this, Drinking Water Distribution Operators ***need to know:***

- What the Critical Control Points for the distribution element of the water supply are. CCPs are documented within the Water Safety Plan for each drinking water supply. For each of the Critical Control Points this will include:
  - Process control summary.

- A monitoring procedure for each control point
- Defined target, action, and critical limits
- Predefined corrective actions.

- The defined values documented in the CCP for target, action, and critical limits.
- The corrective actions listed in the Water Safety Plan which are considered to be necessary when the control limit is reached. Where the Water Safety Plan only lists the corrective actions, the Drinking Water Distribution Operator needs to know where to find the actual documented procedure, e.g. in the Operations and Maintenance Manual for the distribution network.
- The health-based targets, or maximum acceptable values (MAV), for any parameter being monitored. The CCP trigger and critical limits should always ensure that alarms and corrective actions are undertaken before MAVs are reached to ensure that the supply of non-compliant water is prevented.

Element of Competence:	Operational Monitoring and Inspection for Process Control
Context	Controlling the processes used to distribute water to the community is an important part of ensuring the safety of drinking water. The Operational Monitoring and Inspection requirements for each drinking water distribution zone is documented within the Water Safety Plan (WSP). Drinking Water Distribution Operators undertake the operational monitoring and inspection of processes within the distribution network. These typically relate to pressure control, water storage and pumping within the distribution network. They also instigate appropriate corrective actions to resolve potential problems before they escalate. This type of monitoring is additional to the Verification Monitoring required to comply with the Drinking-water Standards for New Zealand.
Outcome	Water distribution process are operating correctly and optimally. Appropriate actions to optimise the system, or to bring the system back into control, are undertaken when action limits for individual parameters is reached.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Obtain, review, and interpret trends on SCADA and telemetry systems.
- Identify target and action limits which identify when intervention may be required.
- Carry out key calibration or instrument checks of equipment using the results to identify issues with performance.
- Assess the condition of the instrument and any supply tubing. Cleaning may be required if a sensor is coated in chemical deposits.
- Identify whether equipment has deteriorated and whether it is no longer operating in accordance with its design.
- Take representative samples of water from key points within the distribution network, safely using appropriate sampling equipment
- Review and analyse the performance of the water distribution network by using laboratory, site, and network quality reports.

To do this, Drinking Water Distribution Operators ***need to know:***

- The monitoring and inspection plans identified within the Water Safety Plan that relate specifically to the distribution network element of the drinking water supply system including knowledge of:
  - The parameters to monitor / inspect
  - The purpose of each parameter

- The method of monitoring including instrument used, location, timing, frequency, by whom, and what needs to be recorded
- What actions to take in response to monitoring / inspection results
- Procedures for reporting anomalies
- The equipment that provides the process.

- The instruments used to monitor variables in the water distribution process and the basic scientific principles of these key analytical instruments. Chapter 17 of the Guidelines for Drinking-water Quality Management for New Zealand identifies common instruments used to monitor the drinking water supply system.
- The care and maintenance of monitoring equipment including instrument condition assessments and calibration records.
- The need for accurate and precise recording and reporting of process performance, in line with the Water Safety Plan requirements.
- Which of the parameters being monitored are Critical Control Points (CCPs).

Element of Competence:	Apply a knowledge of Science to the Distribution Network
Context	The science that underpins the water distribution network must be understood by those responsible for operating the system.
Outcome	Decisions made in the day-to-day operations and maintenance of the drinking water distribution network are made through an understanding of the scientific principles on which the distribution system is based.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Perform mathematical calculations used in the water industry, for example to calculate:
  - volumes,
  - levels,
  - flow rates; and
  - pressure
- Use their understanding of physics to operate and control the hydraulics through the distribution network.
- Use their understanding of microbiology to reduce the risk of contamination.
- Select and use appropriate equipment to measure performance of different parameters.
- Take water samples to monitor for the presence of indicator micro-organisms.

To do this, Drinking Water Distribution Operators ***need to know:***

- The principles of physics which impact on the water distribution network including understanding hydraulics, pressure and head, backflow, water hammer, surges, and head loss.
- The chemistry of drinking water supplies and chemicals of public health significance that may be found in drinking water supplies, including an understanding of chlorine demand, free available chlorine, disinfection by-products, and plumbosolvency.
- The microbiology of drinking water and the relationship between drinking water and public health. Operators need to understand the characteristics of microbiological risks such as bacteria, viruses, protozoa, cyanobacteria and cyanotoxins, how these microbiological risks are detected, and the processes are used to reduce microbiological risks to the drinking water supply.

Element of Competence:	Technical Standards Related to Water Distribution
Context	There is a wide range of technical standards available that can be used to help operate and maintain a water distribution network.
Outcome	Water distribution networks are operated and maintained following best practice that has been documented within technical standards and guidelines.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the appropriate technical standards that relate to the operation and maintenance of the water distribution network. This might include a mix of:
  - Internal standards developed by the Water Supplier
  - The Drinking Water standards, guidelines and publications produced by the Ministry of Health relating to drinking water.
  - Technical documents, guidelines and publications developed by industry groups like Water New Zealand
  - New Zealand Standards and Guidelines published by NZ Standards, or by government organisations like Worksafe.
  - International standards and guidelines e.g. those published by International Organisation for Standardization (ISO), the World Health Organisation, or the American Water Works Association (AWA)

To do this, Drinking Water Distribution Operators ***need to know:***

- Which technical standards relate to the work that they are responsible for. These should be identified on applicable operational and maintenance procedure documentation.
- Where to find the technical standards, e.g. through a subscription to NZ Standards.
- There are many standards that cover the design and installation of drinking water distribution network assets. Some of the more commonly used standards which are applicable to the work undertaken by Drinking Water Distribution Operators include:
  - NZS 4404:2010 Land development and subdivision infrastructure which provides criteria for the design and construction of subdivision infrastructure including water distribution assets.
  - AS/NZS 2566.2:2002 Buried flexible pipelines – installation specifies requirements for the installation, field testing and commissioning of buried flexible pipelines with structural design in accordance with AS/NZS 2566.1.
  - AS/NZS 4793:2009 Mechanical Tapping Bands for Waterworks Purposes specifies the requirements for connecting property service pipes to reticulation watermains.
  - NZS 4522:2010 Underground Fire Hydrants provides guidance on the installation of fire hydrants

- NZS/AS 4020:2018 Testing of Products for Use in Contact with Drinking Water identifies what products that are suitable for use if they are to come into contact with drinking water.
- The Australasian Society for Trenchless Technology guidelines for horizontal directional drilling, pipe bursting, micro-tunnelling and pipe jacking.
- AS/NZS 2033:2008 Installation of Polyethylene Pipe Systems specifies methods for handling, storage, installation, testing and commissioning of polyethylene (PE) pipelines.
- AS/NZS 4129:2020 Fittings for polyethylene (PE) pipes for pressure applications standard specifies requirements for fittings to be used with polyethylene pipe and is applicable to fittings manufactured for the conveyance of water. Also includes the requirements for connecting property service pipes to polyethylene water mains.
- AS/NZS 2032:2006 Installation of PVC pipe systems includes methods for handling, storage, installation, testing and commissioning of polyvinyl chloride (PVC) pipelines, above or below ground, for pressure and non-pressure applications conveying liquids.
- AS/NZS 1477:2017 PVC pipes and fittings for pressure applications provides a standard specifies requirements of PVC pipe and fittings for pressure applications.
- AS/NZS 2280:2020 Ductile iron pipes and fittings provides a standard specification for ductile iron pressure pipes and fittings.
- AS/NZS 4998:2009 Bolted unrestrained mechanical couplings for waterworks purposes specifies requirements for unrestrained mechanical couplings for joining above or below ground water.
- AS/NZS 1516:1994 The cement mortar lining of pipelines in situ specifies the requirements for the cement mortar lining of pipelines in situ, by spray application. The lined pipelines are intended for the conveyance of wastewater or water intended for human consumption.

Element of Competence:	Safe Isolation of Assets, Plant and Equipment
Context	To undertake maintenance on water distribution assets Water Distribution Operators, need to be able to safely isolate and "lock out" the asset, plant and equipment that they are to work on. This would usually form part of a permit-to-work system.
Outcome	Plant and equipment are safely isolated before undertaking any maintenance in a manner that: ▪ Avoids the possibility of injury to workers. ▪ Maintains the safety of water being supplied to the community.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify the asset or equipment that is to be worked on, including the point of isolation. There are occasions where this is not clear, e.g. a switchboard may not isolate all equipment in the vicinity, and some plant, e.g. actuators, may require isolating elsewhere.
- Identify whether the isolation of the asset will interrupt the supply of drinking water to any point of supply. Refer to the element of competence around Water Distribution Network Isolation / Shutdown / Re-commissioning of Assets.
- Identify the hazards that might need to be controlled to isolate the asset. This might include hazards from the likes of:
  - Confined Spaces
  - Falling from heights
  - Mechanical equipment with moving parts
  - Electricity
  - Pressure
  - Chemical hazards
- Identify any other areas that might be affected by the isolation. The Drinking Water Distribution Operator must be able to clearly understand and communicate the effects of the isolation.
- Be able to select and use the correct equipment to safely isolate the plant to be worked on e.g. valves, isolating locks, and tags, locking pins etc
- Safely remove substances from the system by draining, venting, purging, or flushing the isolation.
- Follow approved procedures to confirm that the isolation has been successful to ensure that the isolated equipment is safe to work on.
- Undertake the safe removal of isolation equipment to return the assets into service.

To do this, Drinking Water Distribution Operators ***need to know:***

- The permit-to-work system in use.
- The procedures for installing isolations including:
  - Electrical isolation and tagging/locking out

- Proving electrical equipment is dead to ensure the correct piece of equipment has been isolated.
- Immobilisation techniques such as valves, chains, locking pin etc
- Bleeding off pressure, isolating and bypassing process equipment
- Cooling requirements, e.g. the time electric motors take to cool
- Neutralisation of chemicals (e.g. chlorine and caustic soda)

- How to adequately identify, test and confirm that the isolation has made the plant or equipment safe.
- The procedures for draining, venting, purging, and flushing.
- The procedures for removing isolations and returning plant and equipment.
- The risks associated with isolating a piece of plant or equipment and how to minimise the impacts associated with these and as documented within operational procedures.
- Communication, reporting, and record keeping requirements associated with isolating a piece of plant and equipment. This includes ensuring the work meets the requirements of the Health and Safety at Work Act.

Element of Competence:	Drinking Water Hygiene Requirements
Context	Drinking Water Distribution Operators need to understand potential sources of contamination and the steps that they are required to take to ensure that the water supply does not become contaminated.
Outcome	Contamination of the water supply is prevented by requiring hygienic work practices for workers and materials that come into contact with water.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Prevent the pollution or contamination of drinking water by following hygiene procedures.
- Follow the Disinfection Procedures for tools and equipment used in maintenance of the distribution network with chlorine. This also requires the correct disposal of the chlorine solution.
- Keep Personal Protective Equipment (PPE) and boots clean.
- Keep all fittings carried in vehicles or stored at site boxed, capped, or sealed with plastic wrapping. These items should not be uncovered until immediately before use.
- Have current inoculations and pass health screening requirements for waterborne illnesses.
- Follow the Incident and Emergency Response Plan associated with the distribution system after any contamination incidents.

To do this, Drinking Water Distribution Operators ***need to know:***

- How to identify potential sources of contamination.
- The importance of personal hygiene.
- About the potential for contamination from workers Personal Protective Equipment (PPE) and the need for clean equipment and boots.
- Chlorine/disinfection procedures, both for the water itself and other hygiene purposes i.e. how chlorine is used to wash boots, clean tools and in repairs, and the correct disposal of chlorine solution.
- The risks of multi-functional working between water and wastewater assets, including the need to have separate tools and equipment for water and wastewater works. Separate vehicles must be used for water and wastewater maintenance works. Drinking Water Distribution Operators must be mindful of where their vehicle has been e.g. wastewater treatment plants.
- The potential for, and implications of, contamination of the water supply from items such as fuel and chemical contamination. Drinking Water Distribution Operators need to know what procedures to follow, after a contamination incident.
- The potential for, and implications of, contamination of the water supply from waterborne microorganisms.
- Sampling and audit processes for the work that they are undertaking.

- That the Water New Zealand Good Practice Guide – Hygiene Practices to Prevent Water Supply Contamination [2] provides best practice guidance.

Element of Competence:	Disinfection Procedures for Fittings and Materials
Context	To ensure the ongoing safety of the water distribution system. Water Distribution Operators disinfect fitting and materials: ▪ before connecting new watermains to the distribution network, ▪ following repairs, ▪ as part of an emergency response procedure.
Outcome	Fittings and materials are disinfected and tested for bacteriological compliance: ▪ before being connected to the existing water distribution system for the first time. ▪ as part of repair procedures. ▪ as part of an emergency response procedure following a contamination incident.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedure for disinfecting fittings and materials. Depending on the circumstances this may include different procedures for:
  - connecting new watermains to the distribution system.
  - planned repairs of watermains where pressure is maintained while carryout the work,
  - planned or emergency repairs where the pipe has been depressurised and is open
  - emergency repairs
- Swab (clean) all fitting and exterior surfaces of the watermain with the approved disinfectant when carrying out under pressure planned repairs that do not involve cutting pipe open.
- The water main will need to be excavated, drained, with the surrounding ground water drained/dewatered to ensure it remains below the invert of the pipe. Any known contaminates should be removed, the pipe cleaned with the approved disinfectant.
- Isolations of watermains and affected connections in the event of an emergency repair. All connecting valves used to isolate the reticulated water from a main being disinfected should be tagged and opened once the disinfection procedure has been sign-off as completed.
- Flushing watermains following cleaning, until the residual disinfectant is within the required concentration range, using metered standpipes.
- Take water samples for bacteriological testing for Verification that the watermain is safe to return to service.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the water sampling test results are noted along with the volume of water discharged.

To do this, Drinking Water Distribution Operators ***need to know:***

- The objective of the disinfection process and the potential consequences of failing to disinfect.
- That there is a requirement to remove debris, sediments and to clean (swab) the pipe before flushing and disinfecting the main.
- That an open pipe, that isn't capped, can allow contamination to enter.
- Isolation requirements to safely dewater and recharge watermains.
- That the pumps used to dewater an excavation are a risk to the contamination of the water distribution system from petroleum products.
- That all tools and materials that will come into contact with treated water need to be disinfected first.
- What chemicals can be used to disinfect water mains e.g.0.1% chlorine solution, and how to calculate the required amount of dilution from commercially available Sodium hypochlorite concentrate.
- That fresh disinfectant is required to be used.
- How to safely dispose of old disinfectant.
- The water quality and sampling requirements for the disinfection process.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the water sampling test results and water discharge volumes are noted.

Element of Competence:	Locating Underground Services
Context	Most drinking water distribution assets are located underground. Drinking Water Distribution Operators need be able to safely locate distribution assets whilst avoiding other buried utilities assets. Knowing where underground assets are buried before digging helps to protect water distribution operators from injury and minimises the risk of asset damage and service interruption.
Outcome	Drinking water distribution assets are safely located using plans and electronic locating equipment.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Use service plans, GPS, and Geographic Information Systems (GIS) to determine the location of both underground drinking water distribution assets and also assets belonging to other utility services.
- Request a locate service using a range of internet based services such as Before U Dig.
- Follow Safe Working in Roads procedures for assets located in the road reserve.
- Visually inspect the work area surface to identify evidence of any drinking water distribution assets along with evidence of other utility assets.
- Use electronic locating equipment to determine the location of buried utility assets.
- Mark and record the position of services and sub-structures on the work site.
- Communicate to others the details of the position and type of services and sub-structures.
- Report deviations in the expected position of assets to the appropriate people.
- Excavate trial pits to expose the exact location of utility assets.
- Store tools and equipment safely and securely and leave the work area work in a safe condition.

To do this, Drinking Water Distribution Operators ***need to know:***

- The Health and Safety hazards associated with working on or near underground services relating to including hazards related to the following utility types:
  - Wastewater / Stormwater
  - Gas
  - Electricity
  - Telecommunications / Fibre optic
  - Oil / Petroleum
  - Traffic signal cables and detector loops
  - Working in the roading corridor
- The requirements of any Traffic Management Plan (TMP) which relate to the site in question.
- How to interpret GIS, utility drawings and line search documents to identify underground utilities assets.
- Methods of visually locating and identifying underground services including typical markers and signs.

- The typical locations and depths of underground utilities.
- Methods of accurately marking out services
- Methods for undertaking test pit excavations.
- That plans may not be accurate and the potential outcomes of incorrect marking out of services and excavations including injury, costs, loss of time, and material wastage.
- How to use, and interpret the results, of electronic locating equipment.
- The possible effects of external influences on electronic locating equipment readings and reduce the effects e.g. metal fencing, reinforced concrete.
- The procedures for reporting and recording work problems including who to inform when assets on site deviate from their position marked out on plans.

Element of Competence:	Safe Working in Roads
Context	Most drinking water distribution assets are located in the transport corridor. To safely work in the transport corridor, Drinking Water Distribution Operators need to have made a Corridor Access Request (CAR) to obtain a Work Access Permit (WAP) from the Corridor Manager. They must also implement the approved Traffic Management Plant for the site.
Outcome	Work undertaken by Drinking Water Distribution Operators in the transport corridor minimises the disruptions to other road users whilst maintaining safe working conditions for both the operators and the public.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Apply for a Corridor Access Request (CAR) to obtain a Work Access Permit (WAP) from the Corridor Manager.
- Implement the Traffic Management Plan (TMP) for the work.
- Ensure that a copy of the Corridor Access Request (CAR), including global CARs, and Work Access Permits (WAP) are held at all work sites along with a copy of the Traffic Management Plan (TMP).

To do this, Drinking Water Distribution Operators ***need to know:***

- That the National Code of Practice for Utility Operators' Access to Transport Corridors produced by the New Zealand Utilities Advisory Group [3] is a requirement under the Utilities Access Act 2010 and provides a framework for the access rights to the transport corridor for utility operators like water suppliers.
- That a Corridor Access Request (CAR) must by lodged with the Corridor Manager before any work can be carried out in Transport Corridors. Utilities such as water supplies can operate under a global CAR however each individual site will require an appropriate Traffic Management Plan (TMP).
- That the New Zealand Transport Agency Code of Practice for Temporary Traffic Management (NZTA COP/TTM) requires that appropriately trained and qualified personnel must carry out and supervise Temporary Traffic Management duties on all roadwork sites.
- That the Site Traffic Management Supervisor (STMS) has specific duties and has ultimate responsibility for overall traffic management at the site.

Element of Competence:	Excavation
Context	The installation or repair of drinking water distribution assets requires excavation, this can include: ▪ Open excavation ▪ Pot holing ▪ Pit excavations ▪ Trenches
Outcome	Excavations undertaken to repair or install drinking water assets follows safe working procedures for both operators and the general public, complying with the Health and Safety at Work Act 2015. The work should provide safe working conditions for both the operators and the public.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Safely use tools and large earthmoving equipment to excavate the ground to provide access to underground services, or to install new assets.
- Load excavated materials onto the trucks, using attachments if necessary.
- Backfill, compact, and reinstate the surface of excavated area with suitable materials.
- Avoid underground services when excavating, making sure not to undermine nearby structures by digging away from them and by hand digging when close to services.
- Prevent excavation collapse by shoring, benching, or battering back.
- Provide safe access to get in and out of the trench.
- Prevent people and materials falling into the excavated area. This will require Drinking Water Distribution Operators to install barriers strong enough not to collapse if someone falls against them.
- Check the excavation each day before starting work and after any event that may affect its stability.
- Where applicable Drinking Water Distribution Operators need to hold a special license e.g. Class 2 licence with a roller, tracks, and wheels (R, T and W) endorsement.

To do this, Drinking Water Distribution Operators ***need to know:***

- That the Good Practice Guide: Excavation Safety [4] produced by Worksafe New Zealand provides practical guidance for how to manage the health and safety risks associated with excavation work.
- That the Guide for Safety with Underground Services [5] sets out the work methods and preferred work practices for the location and excavation of underground services.
- That activities like concrete cutting, which can be used to cut through pavements prior to excavation, produces a wastewater which cannot be discharged to the environment, or the stormwater network.
- That they should not start excavations until they have Locating Underground Services.

- Safe Working in Roads procedures.
- How to operate different types of digger attachments.
- What different support systems available and the hazards to be aware of when on sites e.g. ground water, soil type, sloping ground, surcharges such as vehicles, structures, or stockpiled materials.
- The safe working methods and construction methodologies for different types of excavation support systems including:

  a) Proprietary support systems
  b) Steel sheet support systems
  c) Timber support systems.
- The availability and capacity of excavation equipment and temporary works.
- The duties of a banksperson and slinger / signaller when working with excavation support systems.
- How to interpret a trench support system design.
- How to provide support to protect exposed services.
- How to recognise situations that could be, or become, a confined space and report in accordance with the Water Suppliers procedures.
- How to monitor excavation conditions for stability and atmospheric gasses.
- The causes of instability in excavated areas, including soil types, moisture content, presence of surface water and ground water.
- How to exclude and remove water from excavations.
- The environmental considerations to be taken into account when disposing of trench water and contaminated ground.
- The emergency and rescue procedures in the event of a collapse.
- The Health and Safety hazards and risks that can occur with the use of incorrect trench support practices.
- The organisations notification and reporting processes following the detection of any issue.
- How to backfill and reinstate surfaces.

Element of Competence:	Install and Repair Water Distribution Pipelines
Context	Water distribution pipeline assets are installed either as: ▪ a planned extension to the network, ▪ as part of a reactive repair; or ▪ as part of a planned renewal or maintenance work.
Outcome	Installation and repair of new water distribution assets is safely completed, using suitable material, in accordance with the standard operating procedures that are referenced in the Water Safety Plan. The material installed, their location and costs are recorded so that so that asset management decisions can be made in the future.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Respond to water distribution system maintenance / repair emergencies.
- Perform planned and unplanned maintenance / repairs, or installation, of new assets in accordance with job instructions detailed in operations and maintenance procedures that are referenced in the Water Safety Plan. This will require Drinking Water Distribution Operators to:
  - Complete the instructions/organisational procedures for the installation or repair task in question e.g. as recorded in maintenance procedures, or contract specifications.
  - Identify any environmental, Health and Safety and water quality hazards and how they are to be mitigated. Obtain a permit to work, and where this is required for the procedure.
  - Follow Safe Working in Roads procedures for assets located in the road reserve.
  - Identify any distribution network impacts on the work and inform the appropriate people e.g. if there is to be a supply interruption.
  - Undertake Excavation to allow construction, or repair, to proceed, providing suitable excavation support.
  - Determine what methods and materials are suitable to repair broken water distribution assets for different types of asset failures e.g. split pipe may require a pipe replacement whereas a repair clamp, or patch may be suitable for a hole.
  - Ensure the safe Isolation of assets where this is required.
  - Install a temporary overland supply between fire hydrants to provide continuity of supply.
  - Ensure materials, pipes and fittings are suitable for use in the water distribution system, are clear of any contaminants and that appropriate Disinfection Procedures for Fittings and Materials are followed.
  - Install, or repair, pipe, and fittings.

- Check that the completed installation maintenance and repairs meets the specification detailed in the maintenance procedure before returning the equipment to service.
- Document what work has been undertaken, including identifying any costs (including time) and inventory items used.

To do this, Drinking Water Distribution Operators ***need to know:***

- How to identify any environmental, Health and Safety, and water quality hazards, and appropriate mitigation methods.
- About Safe Working in Roads.
- How to safely Safe Isolation of Assets, Plant and Equipment.
- The Isolation procedures for distribution assets.
- The procedures to follow when Locating Underground Services.
- How to safely excavate, support/shore, backfill and reinstate holes and trenches needed for construction.
- How to safely operate tools, machinery, and equipment e.g. excavators and pipe cutters.
- How to install pipe including understanding:
  - position tolerances
  - appropriate bedding materials, pipe surround and compaction requirements
  - the need for vertical and horizontal separation from other services
  - how to install a trace wire
- The different rehabilitation and repair techniques associated with different material types including, but not limited to:
  - the use of structural liners
  - the use of non-structural liners
  - pipe bursting
  - direction drilling and tunnelling
  - hydro-excavation
  - air scoring
  - pigging
  - swabbing
- The procedures associated with the handling, storage, installation, repair, testing and commissioning of different pipe material types including:
  - polyethylene pipe
  - ductile iron
  - PVC
- How to join pipe materials by:
  - electrofusion processes
  - butt fusion processes
  - mechanical joints
- How to undertake pressure and leakage testing.
- The Drinking Water Hygiene Requirements and Disinfection Procedures for fittings and materials when commissioning the new pipework. This includes the requirement to

ensure that pipes are cleaned, and the ends are covered whilst in storage and being laid.

- How to dewater and recharge distribution mains.
- The requirements for documenting what work has been completed.
- That there are technical standards that cover the installation and repair of water distribution main. Refer to the Technical Standards Related to Water Distribution element of competence for a list of common standards.

Element of Competence:	Maintenance and Repair of Water Pumping Systems
Context	Water distribution pumping assets need to be maintained so that the water supply system works reliably and continues to supply the community with safe drinking water. A lack of pump maintenance can lead to increased risk of failure. Maintenance can either be planned (routine or scheduled) or unplanned (reactive).
Outcome	Maintenance of water distribution pumping systems is safely completed, at the correct frequency, in accordance with the Maintenance procedures that are documented within operational manuals and procedures referenced in Water Safety Plan for the supply in question. Maintenance tasks and costs are recorded so that better decisions can be made about maintaining each item and identifying when they need to be replaced.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Respond to water distribution pumping system repair emergencies.
- Perform planned and unplanned maintenance on assets in accordance with job instructions detailed in operations and maintenance procedures that are referenced in the Water Safety Plan. This will require Drinking Water Distribution Operators to:
  - Complete the instructions/organisational procedures for the maintenance task in question e.g. as recorded in maintenance procedures.
  - Identify any environmental, Health and Safety, and water quality hazards and how they are to be mitigated. Obtain a permit to work, where this is required for the procedure.
  - Identify any distribution network impacts on the work and inform the appropriate people e.g. if there is to be a supply interruption.
  - Undertake safe Isolation of assets, plant, and equipment.
  - Make sure materials, pipes and fittings are suitable for use in the water distribution system and are clear of any contaminants before installing.
  - Disinfection Procedures for Fittings and Materials.
  - Check that the completed maintenance and repairs meets the specification detailed in the maintenance procedure before returning the equipment to service.
  - Document what work has been undertaken, including identifying any costs (including time) and spare parts used.

To do this, Drinking Water Distribution Operators ***need to know:***

- The required planned, scheduled, and reactive maintenance tasks and procedures for the drinking water distribution pumping assets.
- How the equipment typically operates. Drinking Water Distribution Operators need to observe the equipment while it is in use so that they can recognize unusual sounds, vibrations or leaks that indicate that reactive maintenance is necessary.
- What maintenance frequency is required for each task. This will be based on the suggestions of the asset manufacturer but may also be a factor of the reliability and criticality of the asset.
- How to identify any environmental, Health and Safety and water quality hazards, and appropriate mitigation methods.
- Safe shut down and Isolation procedures before performing maintenance.
- The Hygiene Requirements and Disinfection Procedures needed to work on these assets.
- The requirements for documenting what work has been completed.
- The maintenance and asset replacement strategies for the water distribution assets that are recorded in the Asset Management Plan, so that Operators are aware of what should be maintained and what should be replaced.
- That differentiating between planned and unplanned maintenance is important because an increasing incidence of unplanned maintenance might indicate that the distribution system is deteriorating and becoming unreliable.
- That routine (planned) maintenance comprises the periodic inspections and tests performed on equipment at regular intervals. Included are daily, weekly, monthly, quarterly etc., inspections during which minor routine maintenance tasks are carried out, e.g. cleaning, lubrication, vibration tests, adjustments replacements and calibrations.
- That scheduled (planned) maintenance is also carried out on a time basis but is based on wear and the expected life cycle of the equipment's individual components. It involves the systematic and periodic removal from service of a piece of equipment for the replacement of parts, reconditioning or overhaul.
- That reactive (unplanned) maintenance amounts to repairing equipment that has broken down or abandoning it and replacing it with new equipment.
- That communication around water distribution asset maintenance is particularly important for where the maintenance activity might lead to:
  - pressure loss,
  - interruption to supply, or
  - the possibility of discoloured water (e.g. where changing flow patterns re-suspend sediments).

Element of Competence:	Maintenance and Repairs of Water Storage Assets
Context	Water distribution service reservoirs, or treated water storage tanks, need to be inspected for structural and functional deficiencies on a routine basis. They need to be maintained to ensure that they are clean and secure.
Outcome	Water service reservoirs, or treated water storage tanks are: ▪ Inspected for structural and functional deficiencies. ▪ Maintained to ensure that they are clean and secure.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Perform planned and unplanned maintenance on assets in accordance with Standard Operating Procedures that are referenced in the Water Safety Plan for the water storage tanks / service reservoir including:
  - inspecting the hydraulic controls
  - confirming the security of the vent screens and access covers
  - inspecting the cleanliness of the tank, including checking for accumulation of sediment, slime and chemical deposits
  - safely entering Confined Spaces.
  - removing accumulated sediments and Disinfection Procedures for Fittings and Materials the tanks.
  - inspect the condition of the water storage tanks / service reservoir roof, walls and foundations by looking for cracks or leaks. If cracks and leaks are noted the Drinking Water Distribution Operator needs to escalate these condition issues to the appropriate authority to flag that a structural integrity inspection is required.
  - Safely isolating and draining the reservoir
- Respond to reports of reservoir leakage and escalate these where required.
- Perform planned and unplanned maintenance on assets in accordance with Standard Operating Procedures that are identified in the Water Safety Plan. This may require Drinking Water Distribution Operators to complete the instructions/organisational procedures to:
  - Safely follow Reservoir Isolation procedures and drain the reservoir
  - Safely enter Confined Spaces
  - Inspect the cleanliness and security of the reservoir
  - Remove accumulated sediments
  - Follow the required Disinfection Procedures for the Reservoir as part of a recommissioning procedure.
- Identify any environmental, Health and Safety and water quality hazards and how they are to be mitigated. Obtain a permit to work, where this is required for the procedure.
- Identify any distribution network impacts on the work and inform the appropriate people e.g. if there is to be a supply interruption.

- Check that the completed maintenance and repairs meets the specification detailed in the maintenance procedure before returning the reservoir to service.
- Document what work has been undertaken, including identifying any costs (including time).

To do this, Drinking Water Distribution Operators ***need to know:***

- The operating and maintenance cycles for water storage tank / service reservoir including routine inspections.
- The need to maintain reservoir integrity and how this can be compromised, including inspection requirements following a seismic event.
- The security requirements for treated water storage tank / service reservoir.
- Disinfection Procedures for the reservoir and the requirements for removing sediments, including safe entry procedures.

Element of Competence:	Validation and Calibration of Monitoring Equipment
Context	The water distribution network must be monitored to ensure that the network is correctly functioning. Typically, instruments are used within a distribution network to monitor parameters such as: ▪ flow ▪ pressure ▪ levels; and ▪ free available chlorine (FAC). These instruments must be validated and calibrated to confirm the accuracy of their measurements. This also ensures that barriers to contamination within the distribution network, such as FAC, are being maintained at the correct level.
Outcome	The instruments used to monitor the water distribution system are validated and calibrated to ensure that the water supply system remains functional and all measures to prevent contamination are effective.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Carry out key calibration or instrument checks of online equipment and identify issues with their performance.
- Understand the operation of control systems and how to operate each instrument in various control states.
- Carry out the practice of maintaining online instruments in line with supplier recommendations, standard operating procedures and record keeping as detailed in the Water Safety Plan for the supply.
- Review and analyse the performance of the water instruments by reviewing site and telemetry data to ensure the results are correct and accurate.

To do this, Drinking Water Distribution Operators ***need to know:***

- The validation and calibration procedures documented within the Water Safety Plan for the supply.
- What the critical control points for the water supply are.
- The correct type and use of various analytical equipment for water quality measurement, including the levels at which the instruments operate, and their limitations are understood e.g. the accuracy and sensitivity of the equipment.
- The requirement and need for online monitoring of water processes, including the key performance criteria for the supply.
- The use and care of online equipment, including record keeping.
- The equipment required to maintain the instrument and its use.
- The calibration of the instruments including understanding the expected results.

- Communications, reporting, and record keeping requirements, associated with maintenance of monitoring equipment. These will be detailed in operations manuals referenced in the Water Safety Plan.
- Monitoring requirements and how to identify and troubleshoot instrument performance problems, such as flat lining.
- The need for accurate and precise analysis and risks associated with incomplete or inaccurate analysis or results.
- Contingency plans associated with the distribution network when monitoring equipment is unavailable or incorrect.
- The requirements for validation and monitoring within the distribution network within the New Zealand Drinking Water Standards.
- How the Guidelines for Drinking-water Quality Management for New Zealand relate to distribution networks, particularly with respect to online water quality reporting, and control systems.

Element of Competence:	Inventory Management
Context	Water distribution systems can fail if there are no spare parts available to undertake required maintenance or to repair equipment. Holding spare parts for items that fail frequently has the benefit of allowing repairs to be undertaken immediately, instead of time being spent going to the market to search for the appropriate part. Spare parts need to be delivered to the site at the right time, and consumed on a "first in, first out" basis.
Outcome	The spare parts required to maintain, and repair equipment is known, along with where to source these parts. The quantity of parts stock held in storage is monitored, with replacement stock ordered in time. Spare parts are used on a "first in, first out" basis.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Proactively identify what spare parts are needed to maintain and repair equipment.
- Monitor the level of parts that are held in stock.
- Identify which parts are to be used first (i.e. the oldest)
- Proactively order adequate quantities of parts and consumables from the supplier, in accordance with the Procurement policies of the water supplier.

To do this, Drinking Water Distribution Operators ***need to know:***

- What spares are held in storage.
- How to store parts correctly.
- That spares should be used on a "first in, first out" basis.
- What supplier provides spare parts and how to follow the organisations procurement procedures to obtain them.
- That standardisation of equipment and parts reduces the level of risk of equipment failure, because fewer types of each part need to be stocked which makes stock management easier and because it reduces the number of skills which need to be learnt to correctly install each part by the operators.
- That only materials which are suitable for contact with drinking water are used.

Element of Competence:	Cranes and Lifting Equipment
Context	Cranes are often installed at Water Pumping Stations, or mounted on the back of trucks, to lift heavy equipment. Unsafe use of crane equipment presents significant risk potential for people and property. Crane collapse or falling loads can cause serious injuries, fatalities as well as damage to property on and off site. The controller of the crane is responsible for the safe testing, operation, inspection, repair, and maintenance of that crane.
Outcome	Cranes are operated within their loading limits and are maintained in a safe condition with a current certificate of inspection.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Understand and comply with the written instructions relating to the safe operation of the crane.
- Calculate the load to be lifted and confirm that this is within the safe loading limit of the crane.
- Use, and understand, hand signals for the operation of the crane.
- Exercise the required level of care when operating the crane, including wearing the correct Personal Protective Equipment (PPE).
- Notify the controller of any unsafe equipment or process as soon as practicable.
- Readily locate all documentation and information related to the crane.
- Engage an Inspector to certify that the crane is safe.

To do this, Drinking Water Distribution Operators ***need to know:***

- That they cannot operate the crane until they have been trained in its safe use.
- That the crane cannot be used unless it has a certification of inspection.
- The design loading limits of the crane.
- That the Approved Code of Practice for Cranes [6] covers the operation, maintenance and inspection requirements of any crane.
- That a general guide to the health and safety in employment (pressure equipment, cranes and passenger ropeways) Regulations 1999 provides guidance on regulations around the duties of equipment controllers, designers, manufacturers and suppliers, as well as workers.

Element of Competence:	Awareness of Specified Building Systems
Context	Under the Building Act [7], buildings that contain safety and essential systems, known as specified systems, need a compliance schedule. Water distribution networks can potentially include buildings which require a compliance schedule. Where this is the case Drinking Water Distribution Operators will need to be aware that the specified systems require ongoing inspection and maintenance to ensure that they function as required.
Outcome	The buildings warrant of fitness (BWoF) is renewed every 12 months, and is signed, issued, and publicly displayed to prove the building's specified systems have been maintained and inspected.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Ensure that the current version of the BWoF is publicly displayed.
- Inform the appropriate people have been informed if the displayed BWoF is out-of-date.
- Induct the Independent Qualified Person (IQP) engaged to undertake inspections and maintenance of the specified systems onto the site in question.

To do this, Drinking Water Distribution Operators ***need to know:***

- That buildings with specified systems need to have a compliance schedule where one is required under the Building Act [7].
- That inspections, maintenance and reporting procedures for the specified systems stated in the compliance schedule for the building in question will need to be carried out by an Independent Qualified Person (IQP) to confirm that those systems are performing, and will continue to perform, to the performance standards.
- That reports detailing inspections, maintenance, and repairs from IQP need to be kept with the compliance schedule for at least two years after they have been issued.
- That the Ministry of Building, Innovation and Employment has published a Compliance Schedule Handbook to provide guidance on the requirements of Compliance Schedules and Building Warrants of Fitness.

Element of Competence:	Root Cause Analysis
Context	When something goes wrong within the water distribution system, Drinking Water Distribution Operators help to answer the question of why the problem occurred in the first place by helping to: ▪ Determine what happened ▪ Determine why it happened ▪ Figure out what to do to reduce the likelihood that it will happen again.
Outcome	The root cause of a problem is identified, and steps are put in place to prevent it happening again.

To do this, Drinking Water Distribution Operators ***need to be able to***:

Be involved, with others where appropriate, in the Root Cause Analysis processes. This involves helping to:

- Define the problem:
  - what is happening?
  - what are the specific symptoms?
- Collect data:
  - how long has it been happening?
  - what is the impact of the problem?
- Identify possible causal factors:
  - what sequence of events led to the problem?
  - what conditions allows it to occur?
- Identify the Root Cause:
  - Why does the causal factor exist?
  - What is the real reason the problem occurred?
- Recommend and Implement Solutions
  - What can you do to prevent this happening again?
  - How do we implement the solution?
  - Who will be responsible for this?
  - What are the risks of implementing the solution?
- Update the Water Safety Plan

To do this, Drinking Water Distribution Operators ***need to know:***

The basic cause of the problem (there can be more than one). Usually either a:

1. Physical cause – a physical item failed in some way (for example a dose pump stopped working).
2. Human cause – somebody did something wrong or did not do something that was needed. Human causes typically lead to physical causes (for example nobody filled a dose tank, which led to the pump failing).

3. Organisational cause - a system, process, or policy that people use to make decisions or do their work is faulty (for example, no one person was responsible for maintaining the dose tank, and everyone assumed someone else had done this).

Element of Competence:	Water Demand and Hydraulics
Context	An understanding of current and forecast demand for water along with an understanding of hydraulics and design flows is needed by Drinking Water Distribution Operators. This includes understanding how diurnal and seasonal variations impact on water demand and the impact on water quality that can occur in areas of low demand, such as at the ends of mains.
Outcome	The drinking water distribution system can supply sufficient and safe water to all customers.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Monitor the flow through the water distribution network and use knowledge of daily and seasonal demand variations to forecast what the future demand for water will be.
- Perform calculations involving flow, pressure, velocities, and head loss from first principles.
- Review and analyse the performance of flow instruments.
- Carry out procedures for maintaining flow instruments in line with supplier recommendations, operational procedures including paperwork and records keeping requirements.
- Follow standard operating procedures to maintain adequate flows through the system, particularly at ends of mains, and during periods of low demand e.g. flushing end of mains.

To do this, Drinking Water Distribution Operators ***need to know:***

- Hydraulic principles and understanding of how flow and hydraulic conditions can influence the water distribution network.
- Factors which contribute to water demand including pressure, population, and environmental conditions.
- The different types of water distribution assets, why they are installed and how they impact on network hydraulics including:
  - Service reservoirs
  - Trunk mains
  - Distribution mains
  - Pumping stations / booster pumps
  - District metered areas and pressure managed areas
  - Compliance monitoring points
  - Valves, air valves, hydrants, and washouts
- Flow calculations and understand their significance for meeting customer demand.
- The requirements of flow monitoring and reporting requirements to meet Resource Consent conditions.

- The monitoring of hydraulic loading and control limitations.
- The significance of design capacity of the distribution network.
- That increased water age can lead to sub-optimal water quality including increased concentrations of DBPs, decreased disinfectant concentrations, unacceptable tastes, and odours due to biological growth, and low dissolved oxygen and increased pH in cement or cement-lined pipes.
- Sudden increases in flows or rapid flow reversals, can both dislodge accumulated sediments and biofilms, leading to increased turbidity and colour in drinking-water supplied to consumers.
- Key flow control systems and operation of these in automatic or manual.
- The risks associated with incomplete or inaccurate flow measurement.
- Contingency plans associated with the network when monitoring equipment is unavailable or incorrect.

Element of Competence:	Pressure Management
Context	Pressure within the drinking water distribution system needs to be maintained within a set range to avoid pipe bursts at high pressure yet maintaining sufficient pressure at the point of supply to meet the water supply's level of service. Seasonal and diurnal variations in water demand need to be considered, along with the impacts of activities like maintenance and firefighting which can cause sudden changes in water flows and pressures.
Outcome	Drinking water distribution system components such as pump station controls and pressure regulating valves are operated in a co-ordinated way to ensure that adequate pressure and flows are maintained, and pressure surges are avoided.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Undertake operational monitoring of pressures within the drinking water distribution systems using the SCADA system.
- Identify areas where the distribution pressure does not meet the required level of service.
- Investigate the loss of positive pressure, especially during system changes and repair work.

To do this, Drinking Water Distribution Operators ***need to know:***

- The principles behind pressure management on the drinking water distribution network and the many causes of sudden pressure reductions.
- Specific Health and Safety requirements relating to pressure management valves.
- Different types of pressure management valves used within the water industry.
- The different types of tools and equipment required when working on pressure management valves.
- Who may be affected by pressure management valve maintenance and how they are informed.
- How to repair, maintain and re-commission pressure management valves.
- Data collection and reporting requirements related to pressures within the drinking water distribution system.
- Sufficient pressure needs to be maintained within the drinking water distribution system to meet the Firefighting Code of Practice requirements.

Element of Competence:	Flushing Water Mains
Context	Water distribution systems require a programme of regular mains cleaning, particularly in those distribution networks that are prone to: ▪ collecting sediments; or ▪ growing biofilms; or ▪ have a history of dirty water complaints or off-odours due to long detention times and low flows. A range of methods can be used to clean mains. This element of competence covers unidirectional flushing which involves the discharge of water from pipes, generally through hydrants and washouts, in a manner that generates high enough velocities to remove accumulated material and biofilms inside the pipe. Flushing of mains is commonly required: ▪ as part of a systematic mains cleaning programme ▪ before connecting new water mains to the network ▪ following a planned repair ▪ in an emergency e.g. following a contamination incident.
Outcome	Sediment and biofilms build-ups within water mains are safely removed, resulting in: ▪ an increased hydraulic capacity ▪ a reduction in residual disinfectant demand ▪ a reduction in dirty water and odour complaints. ▪ mains being safe to return to service following installation, repair or in an emergency situation.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedure referenced in the Water Safety Plan for mains flushing.
- Identify the pipes to be flushed, the associated valves and hydrants required to cause unidirectional flow and determine the discharge location.
- Follow the sequence of operating the required valves and hydrants to flush the pipes for the required period of time, using metered standpipes.
- Safely work in the roading corridor, where applicable.
- Notify the appropriate people before undertaking the work e.g. the communications team so that affected customers are notified. Communicating with customers is an essential part of any mains cleaning programme because the process can:
  - stir-up sediments;
  - reduce pressure;
  - increase community concerns about wasting water and the discharge of sediments.
- For new mains that are to be connected to the distribution system, mains flushing represents the first step in the Disinfection Procedures for new watermains.

- Flushing water should be safely discharged, meeting any associated resource consent discharge requirements.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the volume of water discharged is recorded.

To do this, Drinking Water Distribution Operators ***need to know:***

- Reactive and preventative mains flushing and sediment removal procedures and frequencies.
- The required flushing flow rate to suspend and transport sediments along the pipeline and the number of hydrants required to be opened to achieve this flow.
- The time required to flush the main. In calculating flushing times Drinking Water Distribution Operators need to know that it is important to remove at least twice the nominal volume of each main, because the suspended particulate matter moves more slowly than the water.
- That the flow of water should be from one direction at a time. A systematic approach should be used to ensure that water enters from a previously cleaned main and approaches the discharge point from one direction only.
- When flushing of mains is required e.g. following the repair of pipes or as part of a systematic maintenance programme.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the residual disinfectant levels are tested and noted.
- Where flushing operations that place in the roading corridor the Drinking Water Distribution Operator needs to know how to safely work in roads.
- How to safely use all tools and equipment required to undertake the work.

Element of Competence:	Air Scouring Water Mains
Context	Water distribution systems require a programme of regular mains cleaning. Air scouring is one method that can be used to clean smaller diameter pipes and pipes in low pressure areas. Air scouring involves the controlled injection of filtered compressed air into pipes, usually via a hydrant. The high velocity compressed air drives "slugs" of water along the pipe, lifting silts and sediments. Air scouring uses significantly less water than other cleaning methods and removes more deposits from pipes than flushing. However, it is not as effective as removing biofilms and is usually used on smaller diameter pipes.
Outcome	Sediment build-ups within water mains are safely removed, resulting in: ▪ an increased hydraulic capacity ▪ a reduction in residual disinfectant demand ▪ a reduction in dirty water and odour complaints. ▪ mains being safe to return to service following installation, repair or in an emergency situation.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedure referenced in the Water Safety Plan for air scouring of mains.
- Prior to starting air scouring operations, Drinking Water Distribution Operators need to check the air scour equipment to check that there is no debris in the air cooler tube or hoses and that the air compressor is not generating large quantities of oil.
- Fit a tee piece with a ball valve on the hydrant connection to enable the main to be depressurised of air and make it safe for the operator to disconnect the hose connection either from the main, compressor or air scouring unit.
- Identify the pipes to be scoured, the associated isolation valves, hydrant/air injection point and the discharge location.
- Safely work in the roading corridor, where applicable for the main in question.
- Follow the sequence of operating the required valves to isolate the main to be scoured.
- Ensure that the air compressor pressure is less than the mains pressure to eliminate the risk of backflow.
- The materials and fixtures used to air scour pipes are potential sources of contamination to the network and therefore Disinfection Procedures need to be followed.
- Take precautions to prevent air contaminated with pathogens and chemicals (such as compressor oil) entering the pipework. As air compressors can release oil into the air stream, Drinking Water Distribution Operators need to ensure that the compressed air is passed through suitable filters to remove oil droplets and vapors.
- Purge the air and scour water, and on completion, ensuring that the discharge to the environment meets any resource consent requirements.

- Notify the appropriate people before undertaking the work e.g. the communications team so that affected customers are notified. Communicating with customers is an essential part of any mains cleaning programme because the process can:
  - stir-up sediments;
  - reduce pressure;
  - increase community concerns about wasting water and the discharge of sediments.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the volume of any water discharged is recorded.

To do this, Drinking Water Distribution Operators ***need to know:***

- The circumstances in which the air scoring technique is best suited for mains cleaning e.g. its suitability for low pressure areas, and its pipe diameter limitations.
- Reactive and preventative air scouring and sediment removal procedures and frequencies.
- How to determine what valves to operate to isolate the section of main to be scoured.
- The required pressure to scour sediments whilst ensuring that there is no resulting backflow from the network.
- The requirements to keep records about what work they have undertaken has been recorded. This should include ensuring that that the water sampling test results are noted.
- Where flushing operations take place in the roading corridor the Drinking Water Distribution Operator needs to know about Working in Roads.
- How to safely use all tools and equipment required to undertake the work.

Element of Competence:	Swabbing/Pigging Water Mains
Context	Water distribution systems require a programme of regular mains cleaning, particularly in those distribution networks that are prone to: ▪ collecting sediments; or ▪ growing biofilms; or ▪ have a history of dirty water complaints or off-odours due to long detention times and low flows. A range of methods can be used to clean mains. This element of competence covers swabbing/pigging which involves driving a swab, or pig, through pipes. Different grades of swab are available with the term "swab" used for light flexible polyurethane foam cylinders, with tapered noses, and the term "pig" for heavier, less flexible devices, often incorporating hard or abrasive coatings. As the swab/pig travels through the pipeline it loosens deposits within the pipe. It is usual to need to send multiple swab/pigs through a pipe to achieve adequate cleaning. They typically clean more effectively than flushing or air scouring and are commonly used as part of a systematic mains cleaning programme.
Outcome	Sediment and biofilms build-ups within water mains are safely removed, resulting in: ▪ an increased hydraulic capacity ▪ a reduction in residual disinfectant demand ▪ a reduction in dirty water and odour complaints. ▪ mains being safe to return to service following installation, repair or, in an emergency situation.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedure referenced in the Water Safety Plan for swabbing/pigging.
- Identify the pipes to be cleaned, and how the pipe will be accessed. Swabs/pigs are normally launched and exited from existing fixtures, or where there are connections specifically installed for swabbing.
- Isolate the line to be cleaned.
- Install and run a "line swab/pig" as a first stage through the pipe to prove flow conditions and the actual pipe diameter.
- Because the swab/pig is introduced into the distribution network it is a potential source of contamination, therefore is important to follow the Disinfection Procedures before inserting the swab/pig.
- Launch the swab/pig and, by controlling the rate of flow through upstream fixtures, it can be guided to the exit point. Blockages within the line can usually be rectified by backflushing the swab out the inlet point.

- Safely work in the roading corridor, where applicable.
- Notify the appropriate people before undertaking the work e.g. the communications team so that affected customers are notified. Communicating with customers is an essential part of any mains cleaning programme because the process can:
  - stir-up sediments;
  - reduce pressure;
  - increase community concerns about wasting water and the discharge of sediments.
- Swabbing water should be safely discharged, meeting any associated resource consent discharge requirements.
- Ensure that the work undertaken has been recorded. This should include ensuring that that the volume of water discharged is recorded.

To do this, Drinking Water Distribution Operators ***need to know:***

- Reactive and preventative mains swabbing/pigging and sediment removal procedures and frequencies.
- The required flow rate to guide the swab along the pipeline.
- Where operations that place in the roading corridor the Drinking Water Distribution Operator needs to know how to safely work in roads.
- How to safely use all tools and equipment required to undertake the work.

Element of Competence:	Boundary Backflow Prevention
Context	Backflow, from a customer's property back into public drinking water distribution system, is a public health risk. It can occur when the pressure in the drinking water distribution system drops below the pressure in the supplied property. Backflow prevention devices help to prevent backflow from occurring. They must be appropriately selected, installed and tested to successfully protect the drinking-water distribution system from backflow contamination. Testable backflow devices are usually installed on higher risk connections, with untestable backflow devices usually installed on lower risk residential connections.
Outcome	The risk of contaminants and pollutants entering the drinking water via backflow is reduced by installing and testing appropriate backflow prevention devices at the point of supply. These devices are regularly inspected and tested to confirm that they are correctly operating.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Maintain positive pressure within the drinking water distribution system to reduce the likelihood of backflow occurring.
- Install appropriate backflow prevention devices at new connections based on level of risk (low, medium and high). The Water Suppliers backflow policy, referenced in the Water Safety Plan, will identify how to assess the level of risk for the network e.g. water meters with built-in dual check valves may be used for residential customers, whereas testable backflow prevention devices may be required for high-risk industrial customers.
- Update the Water Suppliers register of backflow prevention devices for each new installation.
- Undertake the ongoing annual testing programme to evaluate the effectiveness of the testable backflow prevention devices and keep quality assurance records of these – e.g. by recording results in the water supplier's backflow prevention devices register database.
- Undertake field tests of backflow prevention devices in accordance with Part 3 of AS/NZS 2845.1:2010.
- Maintain and re-test backflow prevention devices in accordance with Part 3 of AS/NZS 2845.1:2010.
- Ensure that the equipment used to undertake field testing of backflow prevention devices is calibrated and certified annually.
- Demonstrate that they have attended and passed approved backflow testing courses.

To do this, Drinking Water Distribution Operators ***need to know:***

- The loss of pressure during interruptions to supply exacerbates the impact of backflow on the drinking water distribution system. The lower the system pressure and/or the increased instances of leakage in the piping network, the greater the probability of contaminant ingress.
- That the Health (Drinking Water) Amendment Act:
  - identifiers that back-flow prevention devices can be used to protect the drinking water distribution system from public health risks related to back-flow.
  - recognises that some back-flow prevention devices are installed and owned by the water supplier and some are installed and owned by the property owner.
  - requires a water supplier to maintain a register of all boundary backflow devices, including (non-testable) dual check valves. The register should include both water supplier and privately owned boundary devices.
  - requires, irrespective of ownership, that all boundary backflow devices shall be tested at least annually.
- That each Water Suppliers backflow prevention policy will identify who owns and maintains the boundary backflow devices – e.g. whether it is the water supplier, the property owner, or a combined ownership.
- That the Water Safety Plan for the supply will:
  - include a risk assessment of backflow to the water distribution system.
  - identify how this risk is to be reduced, e.g. via a backflow prevention programme of works.
- That each Water Supplier will have a backflow prevention programme that:
  - includes an ongoing annual inspection/testing programme to evaluate the effectiveness of the backflow prevention of all testable boundary devices.
  - covers installation and replacement programme for non-testable backflow devices.
  - covers situations where water is extracted from bores or taken from water mains by water carriers.
- The Incident and Emergency Response Plan for the water supply in the event of:
  - a backflow event
  - a failed backflow prevention device
- That the Water Safety Plan Guide: Distribution System – Backflow Prevention provides details on backflow risks to the drinking water distribution system.
- That the Water New Zealand guidance document Boundary Backflow Prevention for Drinking Water Supplies [8] provides water suppliers with backflow prevention guidelines.
- That Part 1 of the Standard AS/NZS 2845.1:2010 Water Supply – Backflow Prevention Devices [9] specifies requirements for the materials, design and performance testing of backflow devices used to prevent contamination of drinking water supplies.
- That Part 3 of the Standard AS/NZ 2845.3:2020 Water Supply – Backflow Prevention Devices outlines the minimum requirements for the testing and maintenance of testable backflow prevention devices in the field.

Element of Competence:	Maintaining Disinfectant Residuals
Context	Maintaining minimum disinfectant residuals within the drinking water distribution system is used as a barrier for any bacterial and viral pathogens that may enter the distribution system post-treatment. Disinfectant residuals also act to reduce the formation of biofilms and the growth and persistence of some pathogens. Ensuring that minimum disinfectant residuals are maintained within the distribution system may require the operation of a secondary booster chlorination station, these help to avoid excessive does at the start of the distribution system while ensuring a residual is achieved at the extremities of the network.
Outcome	A disinfection residual is maintained in the drinking water distribution system. This requires a balance between avoiding excessive concentrations in water delivered to customers at the start of distribution systems and yet maintaining detectable concentrations near the extremities of distribution system.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedures, which will be referenced in the Water Safety Plan, for disinfection residuals. This may include:
  - operating secondary booster chlorination stations to ensure that the disinfection targets are achieved.
  - maintaining secondary booster chlorination stations assets.
  - collecting water samples to test for Free Available Chlorine equivalent (FACe) and disinfection by-products (DBP).
- Respond to the effects of Mixing Water Sources within the distribution system on the resulting residuals.
- Escalate issues around DBP's and FACe to others e.g. the Drinking-water Treatment Operator, who may be responsible for some of the procedures related to maintaining disinfectant residuals, or disinfection by-product reduction.

To do this, Drinking Water Distribution Operators ***need to know:***

- What the disinfection target criteria are, such as minimum and maximum residuals at:
  - the head of distribution system
  - immediately after booster stations
  - target residuals within the distribution system.
- How to operate primary and secondary disinfection stations, including operational monitoring requirements.

- How to respond to sudden drops in disinfectant residuals that could indicate a contamination event, including escalation requirements.
- That the booster stations should be operated in a manner that reduces the formation of the health-significant disinfection by-products. However, operators need to be mindful that microbiological quality of the water should not be sacrificed just to minimise disinfection by-product formation.
- That the presence of high levels of DBP should be escalated to the appropriate people e.g. the drinking water treatment operator.
- That the rate of loss of the disinfection residual is multi-factorial and can be impacted by:
  - the retention time in the distribution system
  - the percent of compounds that react slowly with chlorine remaining in water after treatment.
  - contaminates entering the distribution system
  - the state of the water mains
  - water temperature
- More useful information found in the Water New Zealand Good Practice Guidance Note on the Supply of Chlorine for use in Drinking-water treatment. [10] and within Chapter 15 of the Ministry of Health Guidelines for Drinking-Water Quality Management for New Zealand [11].

Element of Competence:	Mixing Water Sources
Context	Some drinking-water supplies can receive water from more than one source, including different water treatment plants. In most cases this has no detrimental effect on the distribution system however, in some distribution systems it can lead to a range of issues, which primarily affect the aesthetic and chemical quality of water, including ▪ changes in flow direction within the distribution system, leading to re-suspension of sediments or dislodging of biofilms ▪ loss of disinfectant residuals ▪ change in taste ▪ reduced effectiveness of disinfectants due to pH and temperature changes
Outcome	Potential changes to the aesthetic and chemical quality of water caused by changing or mixing water sources are mitigated. Where aesthetic changes or impacts on sensitive users are likely, these should be communicated with consumers.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the standard operating procedure, which will be referenced in the Water Safety Plan, for dealing with the mixing of sources, and in particular with changing the usual mix of sources. Depending on the circumstances these procedures may include:
  - increasing disinfectant doses,
  - Maintaining Disinfectant within the drinking water distribution system,
  - changes in operation of the drinking water distribution system, and
  - water main cleaning.

  Note that not all these procedures are necessarily the responsibility of the Drinking-water Distribution Operator, who may need to escalate the requirement of some procedures to others e.g. the Drinking-water Treatment Operator.
- Identify the range of alarms associated with changing water quality in the network.
- Monitor and check water samples within the distribution system for changes in pH and FACe.
- Evaluate trend data from SCADA and / or test results to identify:
  a) Normal trends when the supply is being operated in its standard manner
  b) Atypical trends when mix of water sources changes from usual
- Instigate corrective action to ensure residual disinfectant levels are maintained.
- Instigate water main flushing to remove dislodged sediments or biofilms.
- Investigate the cause of taste complaints.

To do this, Drinking Water Distribution Operators ***need to know:***

- The potential sub-optimal consequences of mixing water sources.
- Water quality and sampling requirements throughout the distribution system.
- How to interrogate SCADA to:
  a) Evaluate trend data differentiating normal operational conditions from conditions when there is a change in the usual mix of water sources.
- The range of instrumentation plant used to monitor water quality within the distribution system and their calibration requirements.
- Disinfection Procedures for Fittings and Materials standards and requirements for removing sediments.
- Alarms, action levels, authorization levels and consequences associated with deteriorating water quality within the distribution system.
- How to identify the root cause of problems and the sequence of actions required to restore the distribution
- Reactive and preventative mains flushing and sediment removal procedures and frequencies.

Element of Competence:	Operate Treated Water Storage Tanks/Service Reservoirs
Context	Water storage assets are used to buffer demand between customers and the Water Treatment Plant.
Outcome	Water storage assets are: ▪ Controlled to ensure an adequate supply of water ▪ Optimised to ensure that the volume of water meets efficiency and resilience targets based on the analysis of trends. ▪ Inspected for structural and functional deficiencies. ▪ Maintained to ensure that they are clean and secure ▪ Are restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the operational procedures and first line maintenance tasks relating to the water storage asset that are documented in the operational manuals and procedures that are referenced in the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the water storage tank / service reservoir asset on SCADA and on site.
- Monitor and check reservoir storage volumes, completing associated calculations e.g. to determine disinfection contact times, retention and turnover.
- Undertake water quality testing at the water storage tanks.
- Identify set-points (e.g. pump start and stop levels) applicable to the operation of the water storage tank / service reservoir.
- Identify the range of alarms associated with the water storage tank / service reservoir (e.g. low level, high level and hatch alarms).
- Control the water storage tank / service reservoir to meet energy efficiency targets.
- Evaluate trend data from SCADA and / or test results to identify:
  a) Normal trends or cycles for the works, and
  b) Atypical trends or changes and the underlying or root causes for the change
- Instigate corrective action to return the water storage tank / service reservoir to normal operation.

To do this, Drinking Water Distribution Operators ***need to know:***

- The objective of the water storage operations and consequence of sub-optimal operation.
- Key process parameters and variables associated with the water storage asset, including the influence of variable water quality and design limitations of the set-up.

- The operating and maintenance cycles for water storage tank / service reservoir including routine inspections.
- The operation and control of associated pumping regimes.
- Water quality and sampling requirements at the water storage tank / service reservoir.
- The need to maintain reservoir integrity and how this can be compromised, including inspection requirements following a seismic event.
- The consequences of sub-optimal treat storage water asset performance on the Distribution network and customers.
- How to interrogate SCADA to:
  b) Identify and control items of mechanical, electrical and instrumentation equipment.
  c) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
  d) How to confirm the configuration, operation and performance of the actual water storage asset corresponds to the information system.
- Security requirements for treated water storage tank / service reservoir.
- The range of instrumentation plant used to monitor and control the water storage tank / service reservoir and their calibration requirements.
- How levels and flows are controlled to maximize energy efficiency.
- Disinfection Procedures for Fittings and Materials standards and requirements for removing sediments.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of problems and the sequence of actions required to restore water storage to optimal volumes, taking account of all demand and process lag times.
- Reactive and preventative maintenance requirements and frequencies for the water storage tank / service reservoir, including safe entry procedures, as detailed further in the Maintenance and Repairs of Water Storage Assets element.

Element of Competence:	Leakage Detection and Management
Context	Water lost through leaks from the drinking water distribution system represents: ▪ An opportunity for contaminants to enter the supply, creating a public health risk. ▪ A financial loss due to increased treatment and pumping costs along with the additional repair costs. ▪ A risk of damage to other infrastructure by creating voids and damaging paving. ▪ A negative environmental impact due to increased energy use and chemical consumption within the supply. ▪ An inconvenience to customers, by reducing their water pressure.
Outcome	Water losses due to leakage from the drinking water distribution system is kept within the Water Suppliers set leakage target.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Investigate customer complaints about leakage or seepage.
- Sample and test leaks to confirm its source e.g. check for the presence of fluoride or FAC.
- Repair burst/leaking pipes.
- Ensure that the location of, and repair of, leaks are recorded. This should include the response time to fix from any complaints, the date of repair, the exact position of the leak, the pipe material and size and whether pipe replacement was necessary.
- Identify District Metered Areas (DMAs) and the location of DMA boundary valves. Drinking water distribution operators need to ensure that the DMA boundary valves are kept closed and routinely check on their status.
- Retrieve logging data that is used to calculate leakage rates within District Meter Areas.
- Maintain flow meters and data capture / logging test equipment in line with manufacturers' recommendations e.g. undertake calibrations.

To do this, Drinking Water Distribution Operators ***need to know:***

- How the drinking water distribution network operates at a strategic level including understanding reservoir zones, district metered areas (DMAs) and key account user monitoring.
- What the Water Supplier's expected response time to leakage complaints is.
- The regulatory reporting requirements; the Department of Internal Affairs requires water loss, complaints and their fault response times to be provided as part of Councils non-financial performance measures under the Local Government Act 2002.

- That the water-take resource consents may have water conservation requirements that suppliers must meet related to reducing water losses from the distribution system.
- How various water metering and data collection technologies are used in leakage reduction programmes, including data loggers, pressure sensors, flow meters and customer water meters.
- That the Water NZ Water Loss Guidelines provides information on how to assess water losses, and recommendations around developing a water loss strategy.
- How to undertake repairs on drinking water assets to stop leaks.

Element of Competence:	Connection of New Customers
Context	As the community grows, new customers need to be connected to the drinking water distribution system, these can either be residential customers or commercial/industrial customers.
Outcome	New customers are safely connected to the drinking water distribution system in a manner that mitigates potential contamination entering the distribution network.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the construction standards, which will be referenced in the Water Safety Plan, for the connection of new customers. Information on new connection requirements will likely be detailed in the District Plan and/or the Land Development and Subdivision Infrastructure Code of Practice. This may include:
  - Excavating and installing new service connection pipework and fittings.
  - Install pipe restraint and anchorage.
  - Install a backflow preventer and test that it is working.
  - Install a water meter and test that it is working.
  - Ensuring that Disinfection Procedures for Fittings and Materials and flushing procedures are followed prior to commissioning.
  - Connecting the new pipework to the distribution network. Depending on the materials used this might require the drinking water distribution operator to connect the pipes use a tapping saddle or by electrofusion fitting.
  - Keeping records of installation including marking up as-built plans to show the location, materials used, costs and date of installation.
  - Prevent contamination of the distribution system during the installation of new connection by following the Water Suppliers construction standards and procedures, which will be referenced in the Water Safety Plan.

To do this, Drinking Water Distribution Operators ***need to know:***

- The extent of their responsibilities for installing new connections as defined in the Water Suppliers standard operational procedures, as referenced in the Water Safety Plan. Including understanding how the Water Supplier defines the point of supply, where private assets are differentiated from assets belonging to the water supplier.
- Which connections require backflow prevention and how to install it.
- That NZS4404:2010 Land Development and Subdivision Infrastructure details requirements for the design and construction of water distribution infrastructure.
- Construction standards and specifications including for material storage, handling, transport, flushing, swabbing, Disinfection Procedures for Fittings and Materials, contact tome and water quality testing.

- That the method of connection (including tapping) will be dependent on both the reticulation main and service connection pipe materials.
- What to do where existing cathodic protection systems are in place on the pipeline being connected to.
- The as-builting and quality record requirements.

Element of Competence:	Flow and Water Meters
Context	Volumetric water measurement devices called "flow meters" when they are used to measure flow within the water distribution network and "water meters" when they are installed on individual service connections. Water and flow meters measure water usage on a volumetric basis and enable: ▪ Customers to become more aware of their water usage and identify customer-side leakage. ▪ Water suppliers to better understand water balance and target distribution system water loss. ▪ Water suppliers to charge customers on a volumetric basis. Not all drinking water distribution systems in New Zealand have universal water meters for every customer, however water meters are widely used to measure the usage of extraordinary users, such as commercial and industrial customers.
Outcome	Flow and Water meters are: ▪ Installed at locations identified in the Asset Management Plan ▪ Calibrated to ensure that they meet required levels of accuracy. ▪ Read for usage data with this information being used for volumetric charging where applicable. ▪ Maintained to ensure that they are not leaking. ▪ Replaced as required by the water meter renewal programme.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow standard operating procedures, which will be referenced in the Water Safety Plan, for:
  - installing meters
  - calibrating meters
  - reading meters
- Determine what type of meter to install based on expected flows.
- Document the calibration and certification records
- Install data loggers on the water meter e.g. when there is a requirement to understand instantaneous peak flows and pressures.
- Read a water meter and provide this data to the appropriate people, within identified time frames, to allow the water suppliers to invoice volumetric usage.
- Implement the water meter renewal programme.

To do this, Drinking Water Distribution Operators ***need to know:***

- The applicable policies or bylaws that cover the approach to water metering for their supply.
- In what circumstances flow meters are installed within the drinking water distribution system and their types (e.g. magflows to measure bulk water produced) and what type of water meters (e.g. differing mechanical meters) suit different customers.
- That the Water New Zealand Good Practice Guide Water Metering of Customers on Reticulated Supplies [10] prescribes industry good practice for the supply, use, and operation of water meters.
- How to install, calibrate and read flow and water meters.
- The as-builting and quality record requirements relating to meters.

Element of Competence:	Valve and Hydrant Operations
Context	Valves are used to either isolate assets or to regulate or modulate flow in the drinking water distribution system. The most common use for valves is to isolate sections of pipe so that repairs can be made, or so pipes can be cleaned. Hydrants, pressure-reducing valves, and air valves are all special types of valves that form part of the water distribution system. Most valves in the drinking water distribution system are generally operated in exceptional circumstances, as a result they are prone to corrosion and problems stemming from their disuse. Valves and hydrants should be regularly exercised to ensure that when they are required, they can still operate.
Outcome	Valves and hydrants should be inspected and maintained on a regular basis following a valve exercise programme. Inspection should include checking that the valve still functions as designed.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the Water Suppliers standard operating procedures, along with the maintenance programme which referenced in the Water Safety Plan for exercising valves.
- Locate the position of valves using plans and Geographic Information Systems (GIS).
- Confirm that valves can still accessible (i.e. that they have not been covered by earthworks or sealed over during road works). Where valves are not visible Drinking Water Distribution Operators need to be able to use locating equipment to detect valve locations and organise for them to be exposed in those instances where they are inaccessible.
- Undertake sounding of valves and hydrants to confirm isolation.
- Following cleaning/flushing or maintenance works, Drinking Water Distribution Operators need to confirm that the valves have been restored to expected operation.

To do this, Drinking Water Distribution Operators ***need to know:***

- Specific Health and Safety requirements relating to valve and hydrant operations. This work may involve working in roads and heavy lifting.
- The different types of valves used within the drinking water distribution system and their purpose. Including gate valves, sluice valves, globe valves, butterfly valves, fire hydrants, pressure-reducing valves, scour valves and air relief valves.
- How to identify valve size e.g. from number of turns.
- The different types of tools required to access and clean the valve and hydrant chambers e.g. lifting key.
- The impact of valve and hydrant operations on the distribution network e.g. poor pressure and discolouration.

- Potential ingress and contamination issues from leaking valves.
- The notification processes to follow when valves are operated e.g. informing customer service staff and recording current valve position and status on company systems.
- Different types of monitoring equipment fitted to valves and the procedures to follow upon discovery of monitoring equipment.
- That when closing valves to isolate section of mains the downstream valve should be closed first to maintain positive pressure along the line and prevent backflow.
- Data collection, recording, reporting and maintenance requirements.
- That the New Zealand Fire Service Firefighting Water Supplies Code of Practice covers the inspection and testing requirements of hydrants.

Element of Competence:	Awareness of how the SCADA system is used to control the Distribution Network and collect Data
Context	Remote automation systems, such as SCADA (Supervisory, Control and Data Acquisition) systems are used to monitor and control the water distribution network. Depending on the water supply system, most of the control relating to the distribution network will be automated or controlled by others e.g. Drinking Water Treatment Operators. The typical parameters that Drinking Water Distribution Operators may need to monitor using SCADA include: - reservoir levels - pump status - flows - pressures - free available chlorine equivalent (FACe)
Outcome	The water distribution network is monitored controlled using the SCADA system. Data collected by the SCADA system is analysed and used to comply with the Drinking-water Standards of New Zealand.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- For the distribution network aspects of the water supply system the Drinking Water Distribution Operators need to be able to use the SCADA system, including:
  - Logging into and navigating around the SCADA system.
  - Adjusting control set points and alarm levels for the different types of equipment used to control process operations.
  - Interpreting alarms.
  - Accepting, or overriding, alarms.
  - Viewing and understanding trend data and reporting any unusual trends.
  - Setting up ad-hoc records.
  - Interpreting mimic pages.
  - Undertaking basic maintenance of the SCADA system i.e. shutting down and restarting nodes.
- Interrogate the SCADA system to:
  - Identify and control items of mechanical, electrical and instrumentation equipment.
  - Evaluate trend data differentiating normal operational cycles from developing fault conditions or emerging risks.

To do this, Drinking Water Distribution Operators ***need to know:***

- The control philosophy for the water distribution system.
- How to use the SCADA system to assess the status of the distribution network and escalate issues to the appropriate people when SCADA data highlights fault conditions or emerging risks.

Element of Competence:	Operate Pumping Systems
Context	Pumps are used in several ways in a water distribution network, the main types in use include: ▪ Transmission pumps which move water from the Water Treatment Plant into tFhe supply system. ▪ Booster pumps which lift water in the distribution network to a service reservoir or pressure zone. ▪ Dose pumps at chlorination booster stations.
Outcome	Pumps used within the distribution network are: ▪ Controlled to ensure an adequate supply of water ▪ Optimized to ensure that the volume of water meets efficiency and resilience targets based on the analysis of trends. ▪ Restored to normal operation through the identification of the root cause of any faults identified with the process.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the operational procedures and first line maintenance tasks for the pumps that are documented in the Water Suppliers operational manuals, which will be referenced in the Water Safety Plan.
- Identify all mechanical, electrical and instrumentation assets associated with the pumps on SCADA and on site.
- Monitor and check flows and system pressures.
- Identify and adjust set-points (e.g. pump start and stop levels) applicable to the pumping operations
- Identify the range of alarms associated with the pumps
- Control pumping operations to meet energy efficiency targets
- Evaluate trend data from SCADA and / or test results to identify:
  a) Normal trends or cycles for the works, and
  b) Atypical trends or changes and the underlying or root causes for the change
- Inspect pump components and identify maintenance needs, as per the manufacturer's recommendations e.g. to repair leaks and replace corroded parts.
- Schedule preventive maintenance, particularly lubrication and replacement of seals, diaphragms, tubing etc as per manufacturers recommendation.
- Instigate corrective action to return the pumps to normal operation.

To do this, Drinking Water Distribution Operators ***need to know:***

- Principle and purpose of the pump operation, the types of pumps and their operational function.
- Key process parameters and variables associated with the pumps and design limitations of the set-up.
- Design considerations for pumps including:
  - Pump delivery head and suction
  - Impact of friction losses, pipe sizes and materials.
- The system hydraulics, including network layout and reservoir operation.
- The operating and maintenance cycles for the pumps including inspection requirements and how to safely isolate the pumps from both mechanical and electrical hazards.
- How to interrogate SCADA to:
  e) Identify and control items of mechanical, electrical and instrumentation equipment.
  f) Evaluate trend data differentiating normal operational cycles from developing fault conditions.
  g) How to confirm the configuration, operation and performance of the pumping system corresponds to the information system.
- The range of instrumentation used to monitor and control the pumps and their calibration requirements.
- How pumps are controlled to maximize energy efficiency.
- Alarms, action levels, authorization levels and consequences associated with the process or processes
- How to identify the root cause of problems and the sequence of actions required to restore water storage to optimal volumes, taking account of all demand and process lag times.
- Reactive and preventive maintenance procedures and frequencies.

Element of Competence:	Operate Emergency Power Systems
Context	In the event of a loss of mains power an alternative power supply, such as an emergency generator and/or an uninterrupted power system (UPS) are used to allow the communities supply to continue uninterrupted.
Outcome	Distribution assets that require electricity to operate e.g. pump stations, continue to operate during a loss of mains supply power.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the operational and first-line maintenance procedures relating to the emergency power system that are documented in operational manuals for the supply. These will also be referenced in the Water Safety Plan.
- Identify the voltage, load and phase of all electrical assets associated with the distribution system. Typically, these would be located at the pump stations within the distribution system.
- Ensure that the generator is regularly serviced by a qualified technician as specified by the supplier.
- Run the generator under full load for extended periods to test for any problems.
- Ensure that the UPS is regularly tested and serviced by a qualified technician as specified by the supplier.
- Arrange for fuel in storage tanks to be tested to ensure that it remains viable. Undertake fuel conditioning, or fuel replacement, on a regular basis to maintain the quality of the fuel in the tank.
- Implement the incident and emergency response plan for loss of power at the site, including informing their lines network provider of the loss of mains electricity supply.
- For sites which rely on portable emergency generators the drinking water distribution operator needs to be able to select a generator which is suitable for the site and be able to safely transfer the load from the mains to the generator.

To do this, Drinking Water Distribution Operators ***need to know:***

- The operating and maintenance cycles for the emergency power system components including inspection requirements.
- How much fuel is needed to operate the site for the period specified in the incident and emergency response plan, the on-site fuel capacity, and the procedures for re-fueling.
- If there is not a permanently installed generator the Drinking Water Distribution Operator needs to know what type of generator is needed and where this is to come from. The following variables will need to be known by the Drinking Water Distribution Operator to select an appropriate emergency generator:
  - Voltage – the generator must have the appropriate voltage to match the motors it will be powering
  - Load - the Full Load Amps of all motors that are to be run off the generator needs to be known.

- Phase (rotation) - Phase is a requirement for a single or multiphase generator based on what the generator will be powering.
- The power rating and load factor of the genset.
- Where the load transfer switch is located.

- Reactive and preventive maintenance procedures and frequencies.

Element of Competence:	Water Distribution Network Isolation / Shutdown / Re-commissioning of Assets
Context	Isolation, shutdown and the recommissioning of water distribution assets can occur in planned, or unplanned, and emergency situations.
Outcome	Water distribution assets are safely isolated, and then recommissioned, as required. This might involve: ▪ A complete shutdown and purging of all water from the asset for planned maintenance or improvement e.g. taking a Service Reservoir out of service to allow for repairs; or ▪ A short shutdown to allow minor work with minimal disruption to the network, e.g. isolation of a water main to allow for air scouring; or ▪ An emergency shutdown in response to an expected situation e.g. isolating a portion of the network to allow a burst main to be repaired.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify early warning signs that assets/equipment need attention.
- Identify the range of circumstances in which distribution assets will shut down automatically, including the range of failsafe criteria, and any associated critical control points.
- Carry out the planning and actions required for the following types of shutdowns:
  a) An automatic shutdown e.g. at a pump station.
  b) A controlled shutdown on discovery of issues
  c) A manual isolation e.g. within the pipe network
- Shutdown pumping stations, reservoirs and valves within the distribution system in line with standard operating procedures, including required communications, to manage shutdowns and re-starts within the distribution network effectively, reducing the impacts as far as practicable.
- Troubleshoot major components and their problems to identify the cause of an emergency shutdown.
- Re-start the previously isolated/closed assets within the distribution system in line with standard operating procedures, including:
  a) Reporting and recording
  b) Observing, sampling and testing
  c) Information systems and manual checks
- Inform the appropriate people of a shutdown.

To do this, Drinking Water Distribution Operators ***need to know:***

- The range of circumstances in which distribution assets may be shutdown.
- The correct methods of starting, stopping, operating and controlling each asset including understanding the impact of shutdown on distribution system.

- The architecture and layout of the distribution system including knowing control philosophies and isolation valves.
- How to identify the cause of asset shutdown including relevant alarms and actions, and escalations.
- Shut-down and start-up procedures including standard operating procedures.
- The range of water quality sampling and testing required in the event of a shutdown and re-start.
- Communications, reporting and record keeping requirements associated with a shutdown. Including ensuring the response meets the requirements of the Drinking Water Standards of New Zealand.
- The risks associated with works shutdown and re-start and how to minimise the impacts associated with these.
- Contingency plans associated with the works shutdown.
- How to respond in the event of an emergency situation in the workplace environment e.g. following an Incident and Emergency Response Plan.
- That the Health Act mandates that restrictions or interruptions to the supply of drinking water must not exceed 8 hours for planned works. The only exception to this is where prior approval has been given by the Medical Officer of Health and all practical steps have been taken to warn affected people before works started.
- That the Health Act requires water suppliers to notify the Medical Officer of Health of the reasons of the interruption to the supply as soon as possible and no later than 24hours after the event the event of an emergency any restriction or interruption to the provision of drinking water must not exceed.

Element of Competence:	Awareness of Vulnerable Persons Notification
Context	Vulnerable people in the community, such as dialysis patients, along with medical facilities, are particularly at risk from interruptions to the quality of the drinking water supply. Drinking Water Distribution Operators must be aware of the location of vulnerable people and facilities in the supply area and instigate the process which will notifying these people before making any changes in the level of their service.
Outcome	Vulnerable people and facilities in the supply area are protected in the event of a loss of supply, or a decrease in the level of service.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify the location of vulnerable persons and facilities.
- Instigate the notification process for the vulnerable people of planned works such as shut-downs, or operations that might decrease the level of their service, like mains flushing, in accordance with the communications plans for the supply area.

To do this, Drinking Water Distribution Operators ***need to know:***

- Where to find current up-to-date information about the location of vulnerable people.
- What communications protocols are in place to inform vulnerable people.
- What potential incidents and emergencies related to vulnerable people will require an operational response.
- The triggers for activating the incident and emergency response plan, for example when the supply of a vulnerable person has been disrupted without prior notification.

Element of Competence:	Incident and Emergency Response Plan
Context	Incidents or emergencies that might threaten the safety of the drinking water supply, can occur. Water Distribution Operators need to be able to provide input into the development of Incident and Emergency Response Plan and be able to implement the operational response to such incidents.
Outcome	During incidents or emergencies Water Distribution Operators implement the operational response in accordance with the Incident and Emergency Response Plan.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Provide input into the development of the Incident and Emergency Response Plan.
- Implement the operational corrective actions, which may include process control adjustments or an asset isolation and shutdown to ensure that the supply of non-compliant water is prevented.
- Demonstrate that they have been trained in emergency situations.
- Test response plans prior to an emergency arising.
- Make use of "lessons learned" information by contributing to the implementation and continuous improvement of quality systems in the water industry.

To do this, Drinking Water Distribution Operators ***need to know:***

- Where to find the documented Incident and Emergency Response Plan.
- What potential incidents and emergencies will require an operational response.
- The triggers for activating the incident and emergency response plan, for example when a critical control point level has been reached.
- Communications, reporting and record keeping requirements associated with emergencies, including ensuring the response meets the requirements of the Drinking Water Standards of New Zealand.
- What civil defense obligations they have during an emergency.

Element of Competence:	Assist with the Process to Decommission, Dispose or Abandon Assets
Context	Drinking Water Distribution Operators are involved in the decommissioning and removal of assets from service. They also need to manage the ongoing risks from any assets which have been abandoned but remain in place.
Outcome	Assets are safely decommissioned and either disposed of, or if they remain in place the ongoing risk of these assets is understood and managed by the Drinking Water Distribution Operator.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Organise a risk assessment, prior to starting the decommissioning process, that is reflective of the scope and complexity of the decommissioning process. The risk assessment may need to include the following items to provide assurance that all hazards are identified, understood, and eliminated:
  - An engineering assessment of the structural integrity of any associated building and structure carried out be a Chartered Structural Engineer.
  - A Health and Safety electrical assessment that identifies and marks out the power supply to, and the Distribution of power in the work area, to identify the isolation requirements or protection of the supply to other areas of plant or equipment carried out by an Electrical Engineer or Electrician.
  - A Health and Safety Fire Assessment if changes to fire protection systems might be required carried out by a Fire Engineer.
  - A Health and Safety Asbestos Assessment to establish if any asbestos is present and if so, how to deal with it.
  - Undertake the decommissioning process and dispose of water distribution assets at the end of their life once the risks above have been eliminated.

To do this, Drinking Water Distribution Operators ***need to know:***

- The Decontamination and Demolition of Plant and Assets Procedure outlined in the Guidelines for Occupational Health & Safety in the New Zealand Water Industry. [11]

Element of Competence:	Provide data to assist in Asset Management Decision Making
Context	Data that is collected by Drinking Water Distribution Operators supports effective decision making at various levels within an organisation, including operation staff and management, senior leadership and elected officials or boards of directors. The operation of the drinking water system leads to the generation of large amounts of data that needs to be recorded. Efficient record keeping is an essential tool for identifying potential problems, or as a means of providing evidence that the system is operating effectively.
Outcome	The relevant people within an organisation receive the information they need to be able to make informed decisions about the management of the drinking water supply. The organisations knowledge base is continuously developed with information provided by Drinking Water Distribution Operators.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Undertake a systematic approach to collecting, recording, and reporting data.
- Follow the reporting requirements and procedures that are either referenced or documented within the Water Safety Plan.
- Follow reporting requirements and procedures for the performance measures and targets that are either referenced or documented within the Asset Management Plan.

To do this, Drinking Water Distribution Operators ***need to know:***

- What mechanisms are in place for recording and reporting data to others within the organisation. This includes what reporting responsibilities and accountabilities the Drinking Water Distribution Operator will have.
- What higher level oversight, performance assessment against organisational goals and objectives is expected. This includes needing to know about:
  - The required level of service for the drinking water supply
  - The performance measures and targets that are to be used to assess compliance with the required level of service.
  - How performance is to be assessed and reported.

Element of Competence:	Implementing the distribution aspects of the Water Safety Plan
Context	Water Safety Plans consider the potential risks to the water supply and identify ways to manage those risks. This essential tool promotes a multi-barrier approach to managing risks and articulates how the supply addresses The Principles of Safe Drinking Water in New Zealand. Drinking Water Distribution Operators are instrumental in the implementation of the aspects of the Water Safety Plan that relate to the distribution network. This can often require distribution operators to provide feedback to others, such as the Drinking Water Treatment Operators.
Outcome	The publics' health is safeguarded through the implementation of the Water Safety Plan.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Operate the drinking water distribution network in a manner that aligns with the operational procedures that are identified in the Water Safety Plan.
- Undertake Operational Monitoring and Inspection for Process Control of the distribution assets, as documented in the Water Safety Plan. This includes undertaking corrective actions when monitoring and inspections indicate that a measure is deviating from expected performance and communicating this to the appropriate people.
- Monitor the Critical Control Points and undertake the corrective actions for the CCPs when the defined action and critical limits are reached.
- Verify the performance of the distribution network performance in accordance with the Drinking-water Quality Compliance Monitoring Plan referenced in the Water Safety Plan.
- Implement the procedures that are documented in the Water Safety Plan that detail how to respond to transgressions and non-compliances with the Drinking-water Standards for New Zealand where these relate to the distribution network.
- Assist with reviewing customer complaints to help identify whether operational changes within the distribution network can be made to improve consumer satisfaction.
- Communicate with the appropriate people when updates to the Water Safety Plan are identified.
- Undertake any improvement items identified in the Water Safety Plan for which the drinking water distribution operator has been given responsibility for.

To do this, Drinking Water Distribution Operators ***need to know:***

- The Principles of Safe Drinking Water in New Zealand
- The characteristics of the drinking-water supply system, what hazards might arise, how these hazards arise and create risks, and the processes and practices that affect drinking-water quality.

- The available water quality information and be able to analyse and interpret this information which identifies actual and potential water quality issues.
- What the barriers to contamination are, so that the failure of one barrier will be compensated for by the effective operation of the remaining barriers. Possible barriers might include:
  - killing, or inactivating pathogens by disinfection
  - maintaining the quality of the distribution system

- What the Critical Control Points are for the supply.

- How the The New Zealand Drinking-Water Standards provide requirements for drinking-water safety by specifying the:
  - maximum amounts of substances or organisms or contaminants or residues that may be present in drinking-water
  - criteria for demonstrating compliance with the Standards
  - remedial action to be taken in the event of non-compliance with the different aspects of the Standards.
- About the Guidelines for Drinking-Water Quality Management in New Zealand which complement the Drinking-Water Standards for New Zealand and provides advice for achieving high level of drinking-water quality management. The Guidelines will assist water suppliers to achieve the Standards and are updated on an ongoing basis with new information.

- The commitment to drinking-water quality management from their employer and the relationship of the WSP to organisational policy and strategy.

Element of Competence:	Health and Safety
Context	Drinking Water Distribution Operators work in an area with risks to their health and safety. They need to be able to work in a manner that mitigates the hazards and risks that they, and others, may be exposed to. The Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] provides guidance and model procedures for how mitigate common health and safety risks in the water industry in New Zealand.
Outcome	Drinking Water Distribution Operators work in a safe manner that mitigates the hazards and risks that they, and others, may be exposed to.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify hazards, risk assessment and control measures.
- Safely undertake their work and look after the health and safety of any other workers that they direct. To do this Water Distribution Operators need to be able to:
  - Work in the transport corridor
  - Conduct a health and safety induction for visitors to site
  - Safely enter confined spaces
  - Work alone, and in isolated areas
  - Work with hazardous substances
  - Work at heights
  - Work in, and above, water
- Control plant and equipment hazards by:
  - Following temporary traffic management plans
  - Safely operating machinery
  - Safely operating vehicles
  - Safely operating mobile plant
- Implement the Incident and Emergency Response Plan for the site.

To do this, Drinking Water Distribution Operators ***need to know:***

- That the Health and Safety at Work Act 2015 (HSWA) [12] is New Zealand's workplace health and safety legislation. Water Suppliers must look after the health and safety of their Drinking Water Distribution Operators and any other workers that they influence or direct.
- That the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] provides guidance and model procedures for how to comply with the Health and Safety at Work Act.

- What "permits to work" and operational procedures are in place within the distribution network that control the identified hazards.
- What Personal Protective Equipment (PPE) is required when operating and maintaining the Water Distribution System.

Element of Competence:	Confined Spaces
Context	Drinking Water Distribution Operators can be required to work in areas that have been defined as being a confined space, such as a treated water storage tank or service reservoir. They need to be able to identify what areas are deemed to be confined spaces and to plan an entry to, and work safely within, a confined space.
Outcome	Drinking Water Distribution Operators can enter, and work within, confined spaces without endangering the Health and Safety of themselves or others.

To do this, Drinking Water Distributions Operators ***need to be able to***:

- Identify confined space hazards, undertake risk assessments, and identify the control measures for confined space entry work.
- Select and safely use the correct PPE for a confined space entry. This may include the use of safety harnesses and lifelines, and respiratory protection.
- Ensure that communication between the person within the confined space and the confined space standby person is always maintained during any confined space entry.
- Secure confined space entry and exit points to allow for safe access, ensuring that appropriate danger signs are used.
- Isolate the confined space to prevent the inflow of hazardous substances.
- Ensure that the space is ventilated, either through forced, extraction, or natural ventilation.
- Undertake atmospheric testing prior to, and during a confined space entry.
- Clear atmospheric conditions in a confined space by purging.
- Implement the Incident and Emergency Response Plan for confined space entries and rescues.

To do this, Drinking Water Distributions Operators ***need to know:***

- That the Worksafe Quick Guide to Confined spaces: planning entry and working safely in a confined space gives a brief overview of the requirements and procedures required to plan an entry to and also to work safely within a confined space.
- That Worksafe New Zealand accepts the Standard AS/NZS 2865:2001 Safe working in a confined space as having the current state of knowledge on confined space entry work. It follows the approach of the Health and Safety at Work Act 2015 (HSWA) [5] in requiring that the hazards associated with working in confined spaces be identified and controlled either by elimination or minimisation.
- That the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [4] provides guidance and model procedures for planning an entry into a confined space.
- What "permits to work" and operational procedures are in place for the distribution system that control identified hazards like confined space.

- What Personal Protective Equipment (PPE) is required when entering, or working within, a confined space.
- What the atmospheric conditions within the confined space are.
- That the concentration of potential atmospheric contaminants will determine whether it is safe to be within the confined. The Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)] identify what the safe level of atmospheric contaminants that Drinking Water Distribution Operators can be exposed to.
- That the Standard AS/NZS 1891 Industrial fall-arrest systems and devices covers the selection, use and maintenance of harnesses and ancillary equipment commonly used in confined space entry work.

Element of Competence:	Hazardous Substances Management
Context	Drinking water distribution operators ensure that hazardous substances involved with the distribution network, e.g. at booster chlorination stations, are used and stored in a safe manner. The Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] provides guidance and model procedures for how to manage chemical and hazardous substances.
Outcome	Chemicals and hazardous substances are stored and used in a safe manner.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Manage an inventory of all hazardous substances used within the network, including booster chlorination stations and fuel for emergency generators. The inventory needs to be kept up-to-date, accurate and easily accessible to emergency workers.
- Ensure that Safety Data Sheets are available for all hazardous substances used in the water distribution network
- Safely work with chemicals and hazardous substances (both in terms of handling and storage requirements) including for:
  - Asbestos containing materials
  - Fuel
  - Chemicals
- Use the correct Personal Protective Equipment (PPE) and other appropriate controls (e.g. ventilation) as indicated on the Safety Data Sheet when handling chemicals and hazardous substances.
- Label containers containing hazardous substances correctly, including when they are decanted or transferred into smaller containers.
- Store hazardous substances safely
- Ensure that correct signage is in place for hazardous substances.
- Follow the procedures detailed in the Incident and Emergency Response Plan in the event of a spill.

To do this, Drinking Water Distribution Operators ***need to know:***

- What hazardous substances (i.e. any product or chemical that has explosive, flammable, oxidising, toxic, corrosive or ecotoxic properties) are stored or used within the water distribution network and the dangers that these substances pose.
- That they cannot work with or around hazardous substances until they have the knowledge and practical experience to do so safely.
- That the Incident and Emergency Response Plan for the supply details the procedures to follow in the event of a spill or work on asbestos containing materials.

- That the Health and Safety at Work (Hazardous Substances) Regulations [13] identifies how the chemicals and hazardous substances such as those used in Water Treatment and distribution processes need to be managed.
- That the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] provides guidance and model procedures for how to manage chemical and hazardous substances.
- That health and safety information is available for all chemicals on Safety Data Sheets (SDS) that must be provided at the time of supply.
- That the Water New Zealand National Asbestos Cement Pressure Pipe Manual [14] details the health and safety requirements when working with asbestos material containing pipes, i.e. for work involving cutting into, removal, storage or replacement of AC pipes Refer to the Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] for procedures for asbestos material not associated with pipes i.e. asbestos material present in switchboards or building materials.

Element of Competence:	Working with Asbestos
Context	Some drinking water distribution networks include pipes, and other asset types, made from asbestos, or asbestos containing material (ACM) such as asbestos cement pipes.
Outcome	Water Distribution Operators work in a safe manner that mitigates the hazards and risks that they, and others, may be exposed to.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify asbestos containing material.
- Following Standard Operating Procedures for working with asbestos containing material. This should include being able to:
  - Correctly use P3 Asbestos PPE.
  - Set up a decontamination area.
  - Set site up for work, including securely barricaded it and putting temporary traffic management measures in place.
  - Correctly use controlled equipment for working with AC pipes
  - Control the contamination of the asbestos work area and equipment.
  - Carry out personal decontamination in designated areas
  - Clear the site and correctly dispose of contaminated material and PPE.
- Implement Incident and Emergency response plans for incidents on asbestos containing assets.

To do this, Drinking Water Distribution Operators ***need to know:***

- That they must have had appropriate training before working with asbestos containing materials.
- What "permits to work" and operational procedures are in for working with asbestos containing material.
- What Personal Protective Equipment (PPE) is required when working with asbestos containing material.
- That the Health and Safety at Work Act 2015 (HSWA) [12] is New Zealand's workplace health and safety legislation. Water Suppliers must look after the health and safety of their Drinking Water Distribution Operators and any other workers that they influence or direct.
- That the Health and Safety at Work (Asbestos) Regulations 2016 [15] made under the Health and Safety at Work Act require asset owners to provide, and adhere to, an Asbestos Management Plan.

- That the Worksafe Approved Code of Practice for the Management and Removal of Asbestos [16] sets out expectations about how to comply with asbestos health and safety law, including the Health and Safety at Work (Asbestos) Regulations 2016.
- That the Water New Zealand Good Practice Guide: National Asbestos cement pressure pipe manual [17] provides examples of safe working practices when working with AC pipes.
- The Water New Zealand Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry [11] provides guidance and model procedures for how mitigate common health and safety risks in the water industry in New Zealand, including how to deal with non-pipe related asbestos.

Element of Competence:	Asset Security and Protection
Context	Delivering safe drinking water to the community includes ensuring that there are appropriate security measures in place to protect the security of the drinking water distribution network.
Outcome	Access to distribution network assets is restricted to authorised personnel. Contractors and temporary workers and visitors are inducted onto site and supervised.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Induct and supervise visitors to distribution asset locations (e.g. reservoir sites).
- Lock and alarm all points of entry, including hatches, vents, and gates.
- Maintain a key register of who holds keys for each site.
- Routinely perform visual examinations of the exterior of the drinking water distribution assets and remove objects that could be used to aid an intruder.
- Respond to security breaches at drinking water distribution assets in accordance with the requirements of the incident and emergency response plan for the site.

To do this, Drinking Water Distribution Operators ***need to know:***

- Who has access to drinking water distribution assets, and where the keys are kept.
- How to induct and supervise visitors to site.
- How to implement the incident and emergency response measures for security breaches.

Element of Competence:	Verification Monitoring
Context	Verification monitoring is the process of regularly checking the system to make sure everything is ok. It is the quality control check in the Water Safety Plan approach and includes: ▪ Drinking-water quality monitoring ▪ Consumer satisfaction ▪ Short-term evaluation of results
Outcome	The verification monitoring process confirms that the distribution network complies with the Drinking-water Standards for New Zealand.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Follow the drinking-water compliance monitoring plan, which will be referenced in the Water Safety Plan, for the distribution aspects of the supply. This plan will detail the supply-specific requirements for compliance monitoring to meet the Drinking-water Standards for New Zealand. This might include being able to:
    - Take representative samples of water from key points within the distribution network, safely using appropriate sampling equipment.
    - Review and analyse the performance of the distribution system by using laboratory, site, and network quality reports.
- Follow the procedures referenced in the Water Safety Plan for responding to transgressions and non-compliances with the Drinking-water Standards for New Zealand.
- Review customer complaints and use them to make improvements to the distribution system.
- Review the results of both the drinking-water quality monitoring and the Operational Monitoring and Inspection for Process Control and communicate to identify target and action limits when intervention may be required and communicate this to the appropriate people.

To do this, Drinking Water Distribution Operators ***need to know:***

- That the Drinking-water compliance monitoring plan, which will be referenced in Water Safety Plan, details how the supply meets the compliance monitoring requirements for the Drinking-water Standards for New Zealand.
- The procedures for responding to transgressions and non-compliance with the Drinking-water Standards for New Zealand.
- The customer complaint process and how complaints are to be reviewed and used with helping to make improvements
- What operational monitoring and inspection requirements are required, including knowing how to instigate the updating of the Water Safety Plan where necessary.

Element of Competence:	Resource Consent Compliance Monitoring and Reporting
Context	A resource consent provides permission to either take water, or to discharge wastes, that would otherwise contravene the Resource Management Act. When resource consents are issued, they include conditions intended to protect the environment. As a consent holder the water supplier has a legal obligation to comply with any conditions set out in the resource consent. Disinfection operations undertaken by Drinking Water Distribution Operators may need to discharge super-chlorinated water to the environment within the confines of a resource consent(s). This may include collecting and providing data to the Consent Authority on the operation of the discharge e.g. data on the amount of water discharged, including flow and chlorination concentration rates.
Outcome	All resource consent conditions related to the operation of the Drinking Water Distribution system are met.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Fulfil the resource consent conditions related to the operation and maintenance of the drinking water distribution network. For flushing operations this will likely require the drinking water distribution operator to dechlorinate water prior to discharge, or to collect flushed water within a tanker for later disposal into the wastewater network.
- Assist staff from the consent authority when they undertake site inspections, e.g. induct them onto the site.
- Provide operational data to the consent authority in accordance with the conditions of consent.
- Monitor the discharge, including trending data, and communicate with the appropriate people when conditions of consent are close to being breached so that action can be taken to prevent this before it occurs.
- Notify the appropriate people when the operation of the discharge fails to comply with the resource consent conditions and implement the operational response in accordance with the Incident and Emergency Response Plan

To do this, Drinking Water Distribution Operators ***need to know:***

- What resource consent conditions are in place for the operation of the distribution system and the limitations these apply to the operation of network (e.g. maximum discharge flow rates).
- What data needs to be collected and monitored to meet the conditions of the consent.
- What to do if the operation of the distribution network fails to comply with the resource consent conditions, as detailed in the Incident and Emergency Response Plan

Element of Competence:	Engage with Stakeholders and the Community
Context	Drinking Water Distribution Operators will at times need to be involved with proactively communicating to members of the public. They also need to engage with other stakeholders both external to an organisation, like Drinking Water Assessors and Consent Compliance Officers, and internal stakeholders including the Water Treatment Operators and Asset Managers.
Outcome	Effective communication is used by Drinking Water Distribution Operators to engage with stakeholders and the community.

To do this, Drinking Water Distribution Operators ***need to be able to***:

- Identify the stakeholders that they are required to engage with. This will include, but not be limited to, those identified in the Water Safety Plan.
- Identify the connections that will be impacted by maintenance operations or shutdowns.
- Engage with stakeholders by following the mechanisms and documentation within the Water Safety Plan for stakeholder engagement. Drinking Water Distribution Operators will need to follow the Water Suppliers Standard Operating Procedures for providing advance notice to those who will be impacted by planned maintenance works.
- Provide input into the long-term employee engagement plan (management and operational) on awareness and involvement in safe and secure drinking water.
- Identify the contact list and communication plan for incidents and emergencies.

To do this, Drinking Water Distribution Operators ***need to know:***

- That the stakeholders who could affect, or be affected by, decisions or activities to do with drinking water will have been identified either in the Water Safety Plan, or in other communications plans referenced by the WSP.
- That the Water Safety Plan and associated Standard Operating Procedures will also have documented the appropriate mechanisms that they should use to obtain input and involvement from the stakeholders.
- The long-term consumer engagement plan on awareness and involvement in safe drinking water.
- The Water Suppliers two-way communication programme to receive consumers' suggestions, complaints, and concerns.

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