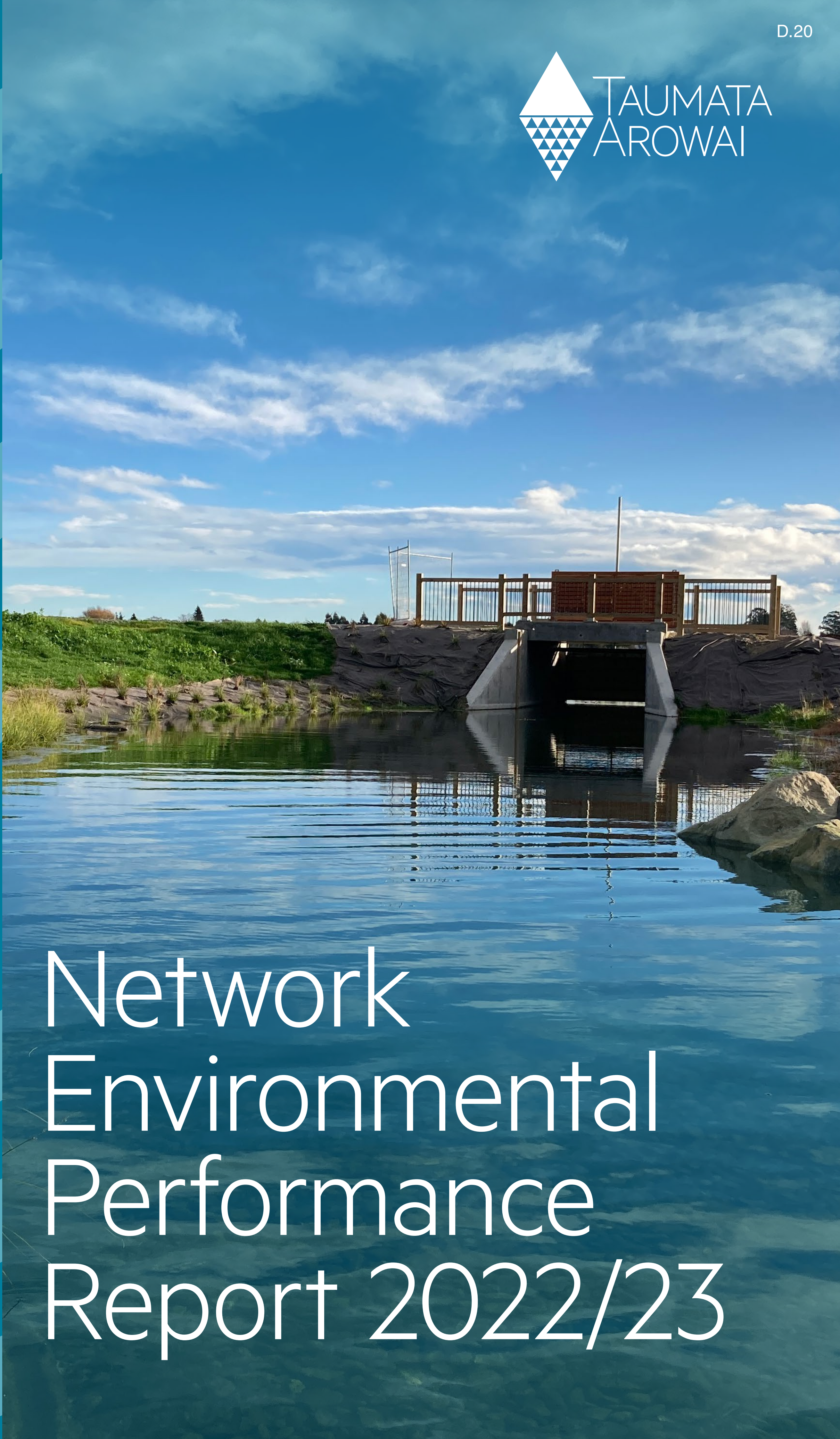
D.20

Taumata Arowai



Network Environmental Performance Report 2022/23

Published pursuant to sections 147(1) and 205(1)(e) of the Water Services Act 2021.

Email measures@taumataarowai.govt.nz

Call +64 4 889 8350

Mail Level 2, 10 Brandon Street, PO Box 628,
Wellington 6140, New Zealand

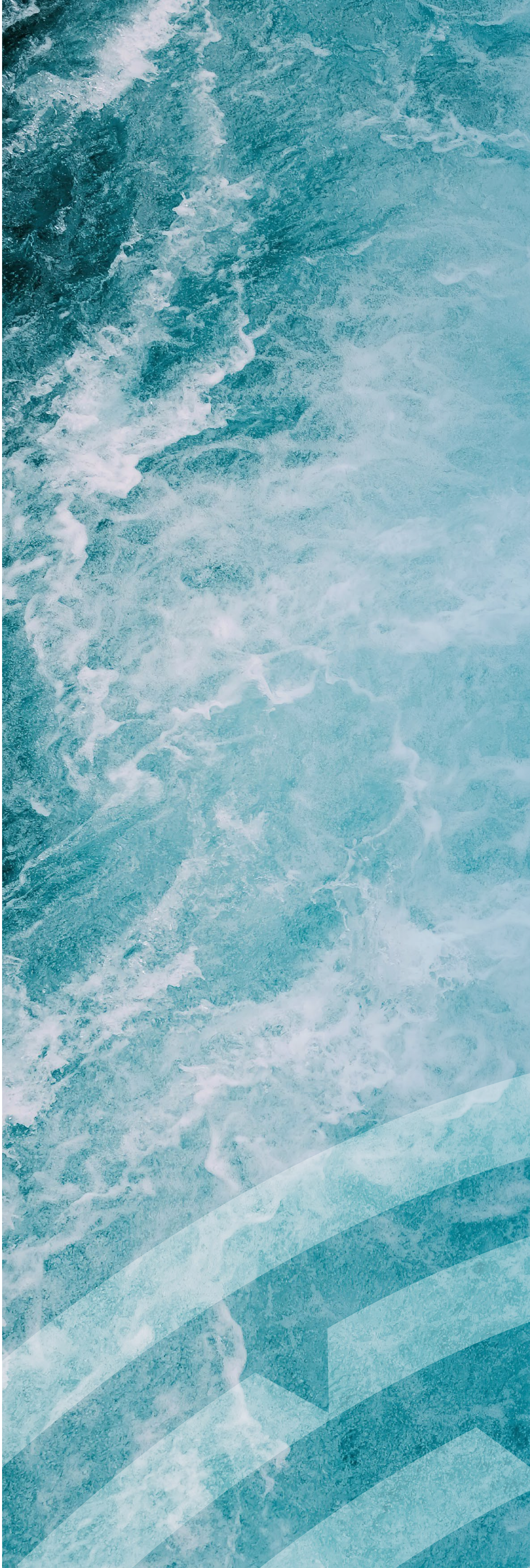
Network Environmental Performance Report 2022/23

Date: June 2024

ISSN: 3021-2081 (online)

ISSN: 3021-2073 (print)

Note: Further copies of this report can be downloaded from taumataarowai.govt.nz.



Te Whakatauākī a Taumata Arowai

Ko te wai ahau, ko ahau te wai
He whakaaturanga tātou nō te wai
Ko te ora te wai, ko te ora o te tangata
He taonga te wai me tiaki
Ko wai tātou
Ko wai tātou

I am water, water is me
We are reflections of our water
The health of the water is the health of the people
Water is a treasure that must be protected
We are water
Water is us

Executive Summary

About this report

Taumata Arowai is the water services regulator for Aotearoa New Zealand, established in 2021. We are responsible for regulating drinking water supplies and for providing national oversight of the environmental performance of public drinking water, wastewater, and stormwater networks.

This is our first Network Environmental Performance Report (NEPR) and mainly focuses on drinking water networks. It is the first time that a national picture of public drinking water networks, including all council networks, has been possible. Over time, we will refine our approach to build a comprehensive picture of environmental performance across all publicly owned water networks – drinking water, wastewater and stormwater networks.

This report complements the Drinking Water Regulation Report (DWRR), which we also publish annually. The DWRR addresses the safety of drinking water provided by drinking water suppliers. The NEPR focuses on the state of network infrastructure and its effects on the environment and on public health. The two reports intersect because the way our water networks are maintained and operated directly affects water suppliers' ability to provide safe drinking water.

We developed five outcomes that have guided our approach to this report and aid our understanding of the environmental performance of networks.

1. Environmental and public health is protected.
2. Services are reliable.
3. Resources are used efficiently.
4. Services are resilient.
5. Services are economically sustainable.

While there are clear links between the first outcome 'environmental and public health is protected' and environmental performance, the following aspects are also important components of environmental performance:

Efficient networks reduce water takes, which contributes to preserving, restoring and looking after water bodies.

Reliable networks support healthy communities and lessen the impacts on the natural environment. Poorly maintained networks that regularly fail are likely to result in higher water wastage and a higher risk of contaminants entering the network.

Resilient networks can withstand and recover quickly from adverse events such as extreme weather. Networks that perform poorly are likely to increase the risks to the environment and human health during these events.

Economically sustainable networks can balance revenue, expenditure and costs to those who use water services while ensuring community and environmental impacts are managed.

A note about the data

This report is based on infrastructure information provided by network operators. This information is similar to the voluntary reporting previously provided for Water New Zealand's National Performance Review.

In subsequent reports, we will build on this information to provide a clearer picture of how the state of our infrastructure impacts our environment. We will phase requirements to establish the system to enable comprehensive, mature data reporting. We will continue to support the sector with this. We will ensure that we consider the capacity of the sector before introducing any such requirements.

We expect the information contained in this and future reports will be invaluable for both network operators and the public. Strategic and effective management of networks will be supported by better understanding of the state of assets, and the ability to identify inefficiencies and potential environmental impacts. Strategic planning, informed by comprehensive data may enable efficiencies which could ultimately deliver cost savings for ratepayers. Future reports will enable benchmarking between network operators, enabling learnings from those operators performing well.

Key findings

Below is a summary of key findings from the data, as provided to us. More detail is in Part Six.

- **Network operators hold a large number of drinking water network consents under the Resource Management Act 1991 (1,200+)**. Each consent includes multiple conditions that must be met. This provides an indication of the complexity and time involved in understanding consent compliance for the consent holder, regional councils and Taumata Arowai.
- **Reported water loss is high.** However, only just over half of network operators provided water loss data and their average confidence in the data was 'less reliable'. This indicates that most network operators do not understand their water loss.
- **The health of the water is not yet central to decision-making.** Initial data showing how networks are giving effect to Te Mana o te Wai, including information about the volume of water taken, used and lost, indicates that network operators frequently take and treat more water than consumers use. This suggests network operators have more work to do to ensure their actions are having the least possible effect on the waterbodies they are abstracting from.
- **There is limited understanding of the current state of water infrastructure.** There is a lack of information and low confidence in the data regarding the condition of drinking water infrastructure. All but one network operator was able to provide a percentage of pipes that have received a condition assessment. The data provided indicates that on average 59% of pipes have been assessed over the lifetime of the network and of those assessed 13% are in a poor or very poor condition. This indicates that the condition of drinking water pipe networks across New Zealand is not well known and it will be difficult for network operators to prioritise maintenance and renewals to where they are needed most.
- **Most network operators have undertaken an assessment of their critical assets.** We have not collected any data on how these assessments were undertaken, or how network operators identified which assets were 'critical', we plan to build on this information in future reports.

The information provided indicates network operators face challenges in ensuring their networks are managed efficiently and effectively and are likely taking more water than is needed for their communities. This puts pressure on the rivers, streams, lakes and aquifers that supply our drinking water.

High water loss rates and poor maintenance of assets can mean that our drinking water becomes contaminated from breaks or leaks in pipes. Exposure risk is generally correlated to the quality of the infrastructure as well as measures such as water loss and pipe age and condition (these are used globally as indicators of a network's condition).

The data quality issues identified in this report suggest network operators do not hold good information about their networks. This is likely to impact their ability to manage those networks effectively and efficiently and may increase their costs because operators are more likely to be undertaking reactive maintenance rather than planning strategically.

Recommendations

Data completeness and quality issues identified in this report have limited our ability to make recommendations related to specific aspects of environmental performance. However, we acknowledge the challenges within the sector and the significant capacity constraints that network operators face in providing good data. We reflect these in the following recommendations.

1. **Network operators prioritise resourcing the collection of necessary information.** This will help them understand the performance of their networks and identify potential risks to human health and the environment. Gaining a better understanding of the condition of assets and any inefficiencies and incorporating this understanding into strategic planning may enable cost savings. Good asset information is essential for informing effective and robust asset management processes and moving from reactive to proactive maintenance.

2. **Network operators prioritise identifying and managing water loss across their networks.** While the quality of the data we collected is affected by the issues identified, water loss issues are well documented and have been for some time. Managing water loss is critical to supplying safe drinking water and minimising environmental impacts.

3. **We (Taumata Arowai) review our data collection and reporting processes.** We recognise that we have a role to play in supporting the sector. By reviewing our data collecting and reporting processes, we can support network operators to provide more complete and accurate data.

Conclusion

Robust data collection and reporting is key to providing a clear, detailed picture of our networks, supporting operators to progressively improve the quality of their water services and deliver safe drinking water for New Zealanders.

This initial report is affected by data gaps and quality issues that will be addressed as we work with network operators to mature data quality assurance processes. Once further work to set up the system has been undertaken, we expect ongoing reviews to ensure our approach is still fit for purpose, while ensuring as far as practicable that there is consistency in what is being asked of network operators.

Many New Zealanders have a stake in water networks and the impact of those networks on their ability to access safe and sufficient drinking water. With this report, we aim to increase public understanding of network environmental performance and how this impacts their local environment so they can have confidence in the service provided by public operators. Greater understanding is also likely to support better engagement in local democratic processes and decision-making around water services network investment and management.

Ngā kaupapa
Table of contents

PART ONE: Introduction

> Everyone in Aotearoa New Zealand should be able to trust and rely on the performance of their public drinking water, wastewater and stormwater networks.

People should have confidence that these networks are being operated in a way that reduces negative impacts on the environment and people's health. That our waterways, coastal and marine areas are swimmable, that people can engage in and access mahinga kai, and communities can continue to enjoy the places they love.

Drinking water networks should have minimal leaks and planned maintenance and renewal programmes that provide our homes, businesses, and communities with a safe, sufficient and resilient supply of drinking water all year round. Ensuring minimal leaks respects and values the inherent mana and mauri of water.

Wastewater networks should safely remove waste from our homes and businesses in a way that protects receiving environments and the health of people.

Stormwater networks should be designed, maintained and upgraded to protect our homes, businesses, and communities from the effects of surface flooding whilst also protecting and enhancing receiving environments through effective management of contaminants and hydrology.

Having well-maintained and operated drinking water, wastewater, and stormwater networks throughout Aotearoa New Zealand contributes to protecting the health of water, people, and the environment.

We have defined environmental performance as follows:

Environmental Performance relates to the effects of water services networks – including the operation of infrastructure and associated processes – on the environment. In this context, 'environment' takes its meaning from the definition of that term in the Resource Management Act 1991. Environmental performance consequently includes consideration of a network's effects on:

(a) ecosystems

(b) natural and physical resources, including their innate mauri and mana

(c) people and communities, including the ability of mana whenua to exercise kaitiakitanga

(d) social, economic, aesthetic, and cultural conditions that affect (a) to (c), including mātauranga Māori and tikanga Māori.

Our role

Taumata Arowai was established in 2021 as the water services regulator for Aotearoa New Zealand. Our responsibilities include monitoring and reporting on the environmental performance of public drinking water, wastewater, and stormwater networks and their operators under the Water Services Act 2021 (the Act). We provide national oversight and promote public understanding of environmental performance of networks.

Monitoring and reporting will help:

- drive reliable, nationally consistent and comparable data
- provide transparency about how our public networks and network operators are performing
- enable comparisons between networks and network operators
- support network operators to better understand their networks
- raise awareness about the key issues
- provide an incentive for the water services sector to improve its performance
- provide insights to inform our potential interventions
- inform the decision-making processes of the water services sector, other regulatory agencies, and the government.

We develop measures that support the evaluation of the environmental performance of public drinking water, wastewater and stormwater networks. Network operators are required to collect information related to the measures and regularly report that to us.

We expect the information contained in this report and future reports will be valuable to network operators as well as the public.

Strategic and effective management of networks will be supported by better understanding of the state of assets, and the ability to identify inefficiencies and potential environmental impacts. Strategic planning, informed by comprehensive data may enable efficiencies that could ultimately deliver cost savings for ratepayers. Future reports will also enable benchmarking between network operators, enabling learnings from those operators that are performing well.

Public networks and their operators

A public network means the infrastructure and processes used to supply drinking water, wastewater, or stormwater services, where those services are provided by:

- local councils, or council-controlled organisations (CCO) such as Watercare and Wellington Water
- government departments such as the Department of Conservation | Te Papa Atawhai, the Ministry of Education | Te Tāhuhu o te Mātauranga, and the Ministry of Corrections | Ara Poutama Aotearoa
- the New Zealand Defence Force | Te Ope Kātua o Aotearoa.

For stormwater networks, this is limited to public networks in urban areas.

Our environmental performance oversight role is limited to these public networks. We do not have an oversight role for the environmental performance of private and community drinking water and wastewater systems.

The role of regional councils

Regional councils are the primary regulator for the environmental performance of water services networks. Our oversight role complements their functions.

Regional councils regulate activities that affect the environment under the Resource Management Act 1991 (RMA). Regional councils use planning frameworks including policy statements, objectives, policies, and rules in plans and resource consents, for:

- taking and using water from freshwater sources
- discharging water or contaminants, including to land, water, and air
- structures in the beds of water bodies.

The RMA requires that adverse effects on the environment are avoided, remedied, or minimised, as part of the promotion of the sustainable management of natural and physical resources.

The implementation, compliance, and enforcement of the RMA rules and consent requirements vary regionally, and even between networks within a region.

Public reporting on compliance with resource management plan and consent requirements and the effectiveness of regional council regulation varies. There is no requirement for a particular focus on three waters network performance, and there is generally no ability to make reliable comparisons between regions or networks.

This report will play a role in developing a national picture and enabling comparison between networks and network operators.

Te Mana o te Wai

Te Mana o te Wai is a te ao Māori concept that recognises the relationship between protection of water and the health of the wider environment and people. At its core, Te Mana o te Wai is about restoring and preserving the balance between the wellbeing of water, the environment and communities by recognising a more holistic approach to water is beneficial in achieving environmental outcomes.

The National Policy Statement for Freshwater Management (NPS-FM) incorporates Te Mana o te Wai as a fundamental concept relevant to improving outcomes in freshwater management and objectives under the RMA. Te Mana o te Wai in this context encompasses six principles and a hierarchy of obligations.

Under existing resource management processes, regional councils are working with their local communities, including iwi and hapū, to develop their approach to implementing the NPS-FM. There is signalled policy work to review the existing NPS-FM settings that may result in changes to certain requirements.

One of our current statutory objectives is to give effect to Te Mana o te Wai,[1] to the extent it applies to our functions and duties. This is reinforced through the Act, which requires every person – including us – exercising powers or fulfilling duties under it to give effect to Te Mana o te Wai when doing so, to the extent it applies[2]. Section 14 of the Act sets out the meaning, application and effect of Te Mana o te Wai and states that Te Mana o te Wai has the meaning set out in the NPS-FM.

This report includes commentary on Te Mana o te Wai by providing the public with information on the broader environmental performance of networks, with the goal of lifting performance and reducing or mitigating environmental impacts for the benefit of all people in Aotearoa New Zealand.

Initial data that can show how networks are giving effect to Te Mana o te Wai and its principles, including information about the volume of water supplied and used, indicates that many network operators frequently take and treat more water than consumers need.

Network leakage data also indicates that the water being abstracted is not being valued as appropriately as it could be, as poor infrastructure and leaky pipes result in significant water wastage in some networks. Future drinking water measures will build on this initial commentary through understanding how networks are:

- avoiding or minimising the discharge of contaminants to water
- ensuring abstraction points have controls in place to limit fish ingress
- taking account of minimum flows that are able to sustain mahinga kai.

Our understanding will also increase as we develop and introduce wastewater and stormwater measures and improve our understanding of the environmental impacts of these networks.

While more data will become available in coming years, early information indicates network operators have more work to do around how to embed the principle of putting the health of water at the heart of decision-making.

1 Taumata Arowai–the Water Services Regulator Act 2020, s 10(d).
2 Water Services Act 2021, s 14.

About this report

This report makes a comparative assessment of network performance, enabling transparency and comparisons to be made between networks and network operators. It mainly focuses on drinking water networks.

Based on our definition of environmental performance we developed five outcomes to guide our analysis of environmental performance.

1. Environmental and public health is protected.
2. Services are reliable.
3. Resources are used efficiently.
4. Services are resilient.
5. Services are economically sustainable.

While these outcomes do not explicitly refer to Te Mana o te Wai, the concepts that underpin it are relevant to many of these outcomes. Commentary is provided throughout this report where measures allow us to begin to build an understanding of how network operators are giving effect to Te Mana o te Wai.

We developed a staged approach in building a national picture to reflect the capacity and capability of the sector and reducing the challenges of regulatory compliance. This approach recognises the time needed for the sector to build the systems, processes and capabilities required to provide a more comprehensive picture of environmental performance.

We also need to take the time to make sure the way we collect and analyse data is robust and fit for purpose. We have focused on drinking water initially and the data that much of the sector was already familiar with recording and reporting. Network operators were required to collect data against the first set of drinking water environmental performance measures from 1 July 2022 to 30 June 2023. This data is summarised in this report.

Appendix 1 provides more detail on the potential environmental effects of networks, summarises the measures that form part of this report and the development of our approach. It also describes the additional measures that will be included in next year's report.

Over time we will refine our approach to build a comprehensive picture of the environmental performance across all water networks – public drinking water, wastewater and stormwater networks.

Our future reports will include more detail about how Te Mana o te Wai is being given effect to, along with more information about other matters the Act specifically requires us to consider, including:

- the extent to which networks are complying with applicable targets, standards, conditions, or requirements, including resource consents
- the extent to which network operators are avoiding, remedying, or mitigating adverse effects on the environment
- best practices for networks.

This report is affected by data gaps and quality issues that will be addressed as we work with network operators to mature data quality assurance processes. This report provides a baseline on which future reports will build. In the future we will be able to show year-on-year comparisons and trends that will help highlight environmental performance.

We expect to see significant improvements in the depth and quality of environmental performance information for drinking water, wastewater and stormwater networks in the years ahead. Better quality data will enable us to provide a more complete picture of national performance and ultimately is expected to drive improvements through greater public awareness and operator understanding of the networks.

Relationship to the National Performance Review

From 2008 to 2022, Water New Zealand published an annual National Performance Review (NPR) of drinking water, wastewater and stormwater services.[3]

The principal purpose of the NPR was to equip service providers and their stakeholders with accessible and comparable data to identify improvement opportunities. All but four territorial authorities have voluntarily reported in one or more NPRs since 2008.

3 Water New Zealand – National Performance Review Publication 2021/2022

We acknowledge the significant work undertaken by Water New Zealand and we commend them for establishing this important initiative, identifying the need for evaluation and ongoing improvement, and leading the discussion. We also acknowledge the councils that have voluntarily dedicated time and resources to participate in the NPR.

The Act requires us to report annually on the environmental performance of networks and network operators, which replaces the need for the NPR. We acknowledge that moving from a voluntary initiative to a statutory requirement is a change in approach and focus, and it will take time for the water sector to adapt.

Like the NPR, our report makes a comparative assessment of system performance thereby enabling transparency. In the future, our report will have a much greater focus on environmental performance than the NPR. Our audience is potentially wider than that for the NPR, as we aim to increase public understanding of network environmental performance.

‘Non-financial performance measures’ reporting

Since 2014, council network operators have been required to report on mandatory ‘non-financial performance measures’ through rules made under section 261B of the Local Government Act 2002.[4] This has been reported through councils’ Long-term plans and annual reports.

Reporting includes a suite of basic performance measures for water supply, wastewater, and stormwater networks. Councils must report against intended levels of service in their annual plans.

Some of the data we collect currently overlaps with the data required to be reported under the non-financial performance measures. We will continue to work with DIA towards minimising duplication in reporting requirements.

4 Non-Financial Performance Measures Rules 2013 (effective 30 July 2014)

About the data provided by network operators

We engaged with network operators regarding data requirements and allowed time extensions for data submission as requested. We selected a sub-set of the data to assess and for those data points contacted the 40 network operators we identified as reporting data outside of the expected ranges. Of these network operators, 21 came back with self-corrections.

We have developed an approach to undertake more rigorous data validation and correction processes for the next report. We will continue to refine our approach taking into account feedback from network operators.

The Department of Conservation | Te Papa Atawhai, the Department of Corrections | Ara Poutama Aotearoa, and the New Zealand Defence Force | Te Ope Kātua o Aotearoa all provided data.

The Ministry of Education | Te Tāhuhu o te Mātauranga (the Ministry) provided a broad commentary highlighting various challenges related to school drinking water supplies, but did not provide the mandatory data. We have since written to the Ministry to remind them of their obligations as a network operator. We recognise the Ministry faces unique challenges, given the characteristics of the school property portfolio and the role of Boards of Trustees and other school governors, however under the Act the Ministry is required to provide this information as a network operator.

Government operators have not previously been required to provide performance data on their networks, so the process of data collection and reporting is entirely new to them. We acknowledge the challenges in establishing processes to ensure the consistent collection of good data, for their various facilities across the country.

Table 1 shows the number of network operators who reported against the required drinking water network environmental performance measures. A full list of agencies required to submit drinking water data is given in **Appendix 2**.

Table 1: Network operators who provided drinking water data

Network operators who provided drinking water data

Class of network operator	Total number of operators required to report data	Total number of operators whose data was included in the analysis for this report
Territorial authorities and council-controlled organisations (CCO) [1]	64	63 [2]
Regional councils	3	3
Government departments	3	2
New Zealand Defence Force | Te Ope Kātua o Aotearoa	1	1
TOTAL	71	69

5 While there are 67 territorial authorities in New Zealand, several different arrangements for how the networks are managed mean that this year we have a total of 64 records that are considered to fall into the territorial authority and CCOs category. These 64 records encompass all 67 territorial authorities.

6 Masterton District Council provided the data after the cut-off period and therefore this data was not able to be included in our analysis. This data will be included in our database to be used in future years for trend analysis.


POTABLE DRINKING
WATER

PART TWO:
Drinking water networks

> In this part, we profile Aotearoa New Zealand's public drinking water networks based on data reported by network operators against our first set of network environmental performance measures.

Good environmental management of drinking water networks ensures the volume of water taken from a freshwater body is no more than required and can be supported by the water body. This includes instream structures like weirs or intakes have addressed any fish passage and ingress concerns, any wastes generated like backwash water are safely disposed of, and energy use is minimised where possible.

Through a Te Mana o te Wai lens, the outcome of these environmental management practices may include the ability of tuna to thrive and be a food source, or the ability of local children to swim and play in a freshwater body without getting sick.

To effectively maintain and improve environmental performance, drinking water networks must be resource efficient, resilient and reliable. They need sufficient financial planning to ensure all necessary improvements are affordable.

A note on drinking water measures

Some environmental performance measures are required to be reported at a district or departmental level, while others are reported at a network level.

- **District level**[7]: data is collected at a district level across all unitary, regional and territorial authority councils and council-controlled network operators.
- **Department level**[7]: data is collected at the department level for government network operators. For example, the Department of Corrections | Ara Poutama Aotearoa has three facilities that each have their own network. This is reported as one 'department' with three separate networks.
- **Network level**: a separate drinking water network operated by a network operator. For example, Gisborne District Council has three networks: Whatatutu, Te Karaka and Gisborne.

7 Note this is a term set up for this report to define how data should be summarised. We note that this term may have caused confusion and in future years we will use the organisational level to indicate how this data should be reported.

Completeness and quality of data provided by network operators

The raw data provided by network operators is available at taumataarowai.govt.nz/water-services-insights-and-performance/.

We received 70 out of 71 expected data submissions from territorial authorities, regional councils, and government operators. One submission was received too late to include in this analysis and therefore this section covers data from 69 submissions.

For the purposes of data collection in this report, network operators were able to exclude any drinking water network with a peak population of less than 100 people or any network that sources drinking water solely from rainwater collection tanks[8]. The data collected indicates some network operators did include networks below this threshold. Where we have been provided data for these networks it has been included in our analysis.

Across the 69 submissions received and analysed, network operators stated they manage 493 networks. When reviewing the submissions, we only had data for 393 networks. A review of our register in Hinekōrako showed 481 networks met the criteria set out in the guidance documentation. In future years we would expect these different sources to record the same number of networks. The difference is likely due in part to the following three factors.

- Some network operators reported networks with peak population of less than 100 people (including usual consumer numbers) in the total number of networks but did not provide data for these networks.
- Some network operators reported networks that only source water from rainwater collection tanks in the total number of networks and did not provide data.
- When compared to networks registered in Hinekōrako it appears that some network operators did not provide data for networks that serve more than 100 people as required.

Several data fields in every measure were also left blank. This resulted in network operators responding to an average of 72% of the required data points. **Appendix 3** details the range of responses across each data point of the performance measures. The following is a breakdown of the response rates for each measure at both the district and network level[9].

Table 2: Network operator data response for district and network level measures

	Percent response	
Performance measures	District level	Network level
Drinking water network information	97%	78%
Drinking water network connections	–	68%
Volumes of water abstracted (m^3/year)	97%	78%
Resource consent compliance	97%	62%
Fault attendance and resolution	96%	–
Asset condition	81%	–
Water pressure	96%	62%
Water restrictions	94%	–
Sufficient firefighting water available	73%	–
Water use	97%	55%
Energy efficiency	88%	–
Critical assets	93%	–
Overall	92%	65%

8 This assumes that these networks are likely to have less environmental impact than networks that serve larger populations. We acknowledge that this does not take into account cumulative impacts or the specific details of the relevant waterbody. At this time, we are focussing on larger networks that are likely to have a greater impact, this could be reconsidered once the processes for data collection and reporting are well established.

9 Note each measure has multiple associated data points. In some cases, measures have data points that are reported at both a district and network level, other networks only have data points for one or the other.

The response rate for the district level measures (92%) was higher than the network level measures (65%), indicating that network operators across the country have less information at the network level than they do broadly across the district.

Key factors that reflect the size and scale of networks are population and distribution area. For example, it is more meaningful to compare performance between Auckland and Wellington, than it is to compare performance between Auckland and a small council rural water supply.

To enable comparisons between similar operators and networks we grouped the data submitted by network operators using the following categories of population density:

- Rural: less than 10 people per km^2
- Mixed rural and urban: Between 10 and 200 people per km^2
- Urban: More than 200 people/km^2.

These categories are sourced from Statistics New Zealand[10], which uses them to differentiate rural and urban populations.

Government and regional council operators have been classified as 'other' and have not been included in the population density-based statistics due to the characteristics of these networks. Where population density is used in the analysis below, these operators have been excluded.

Analysis of the data collected indicated that operators across the country can provide similar levels of information regarding the networks they operate, regardless of the population density of each network. When split by population density, operators still have a greater understanding of the district level measures when compared with the network level measures.

Network operators were required to provide a confidence level for the data entered in each measure of their submission. **Appendix 4** describes data confidence reported by network operators, and our quality assurance process.

The confidence intervals used are as follows:

- Highly reliable/audited.
- Reliable/verified.
- Less reliable.
- Uncertain.
- Very uncertain.

Comparing and contrasting types of operators and drinking water networks

Council operators generally operate drinking water networks that treat water at a centralised treatment plant and then distribute it through a piped network to multiple locations and properties. Council networks typically service cities, towns and small settlements across a range of urban and rural settings.

Networks in urban settings typically provide water to customers on demand. This means water pressure and availability is such that water can be used directly from the council network at any time. These networks are sometimes known as 'on demand' schemes. Many on demand networks also incorporate firefighting capacity, where flow rates, water pressure and the availability of hydrants are designed to meet the Fire and Emergency New Zealand Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008).

Water schemes in rural areas can be on demand, but it is more common to have a low-pressure network where purchased units of available water are delivered to tanks on a customer's property over a 24-hour period. These networks are sometimes known as 'restricted flow' or 'trickle feed' schemes. In addition to supplying rural households, they may be used for farming purposes, such as stock water, dairy shed supply or sometimes irrigation. Restricted flow water schemes generally do not provide water for firefighting purposes.

In comparison, government operators generally operate more localised drinking water networks. They may treat drinking water at a centralised treatment plant, but distribution is typically limited within a single property (although a wide array of people may use that supply). Examples of government networks are Department of

10 Stats NZ (2023). Statistical standard for geographic areas 2023 (updated December 2023). Retrieved from www.stats.govt.nz. ISBN 978-1-99-104961-2 (online)

Conservation | Te Papa Atawhai campgrounds, Ministry of Education | Te Tāhuhu o Te Mātauranga administered schools, Department of Corrections | Ara Poutama Aotearoa prisons, and New Zealand Defence Force | Te Ope Kātua o Aotearoa military camps and bases.

These different network operators create an opportunity to review water use across varying demographics. However, the diversity also creates a challenge when comparisons are made between them. To ensure that similar operators are compared, they were first divided into two categories: council operators and government operators.

Drinking water network information and data quality

Number and size of drinking water networks

Table 3 summarises 458 out of 474 council networks by population density. As mentioned previously, several councils reported additional networks in their total network count but did not provide data related to these networks; those networks where data was not provided have been excluded.

When reviewing the data, some network operators reported lengths of pipe that far exceeded the expected range. This may be due to some network operators using different units. Where values were outside the expected range, we have removed them from the analysis.

More than half of the networks reported in New Zealand sit within the rural category. With population densities of less than 10 people per km^2, managing rural networks presents different challenges to managing urban networks due to the long lengths of pipework between connections, less ratepayers to pay for asset management, and a smaller workforce to carry out the tasks.

In the Drinking Water Quality Assurance Rules (the Rules) the number of consumers served by a water supply (population size) is used to identify the appropriate rules for that supply. We asked network operators to use the same methodology to calculate population size when providing population numbers for this report.

Table 3: Number of rural, urban and mixed rural-urban networks

Population type	Number of networks	Number of water treatment plants	Number of reservoirs	Number of pump stations	Kilometres of pipe	Population
Rural	317	304	1679	362	18,260	588,957
Mixed	111	138	482	237	13,032	659,683
Urban	30	109	455	299	22,765	2,762,998
Total	458	551	2616	898	54,057	4,011,638
Data response rate	97%	97%	97%	97%	97%	80%
Median data confidence	Highly reliable/ auditable	Highly reliable/ auditable	Reliable	Reliable	Reliable	Reliable
Confidence response rate	90%	89%	92%	89%	92%	59%

Water suppliers are also required to include population size for their supply on the Public Register of Drinking Water Supplies. We would expect the population numbers in the register and this report to match. However, there are some differences between the information sources.

If the population data supplied by network operators in these performance measures is correct (and not out of date), then 17 networks have reported the incorrect population size in the Public Register of Drinking Water Supplies. This discrepancy would put them into a different category for application of the Rules. We will follow this up with the affected network operators to determine if this was an error in their reporting. There were also 42 networks for which no population size was provided.

The government operators that reported data manage 19 networks around the country.

Table 4: Number of government networks

Population type	Number of networks	Number of water treatment plants	Number of reservoirs	Number of pump stations	Kilometres of pipe
Government departments	7	7	18	5	55
New Zealand Defence Force | Te Ope Kātua o Aotearoa	12	8	14	7	188
Total	19	15	32	12	243
Data response rate	97%	97%	97%	97%	97%
Median data confidence	Highly reliable/ auditable	Highly reliable/ auditable	Reliable	Reliable	Reliable
Confidence response rate	90%	89%	92%	89%	92%

Sources of drinking water

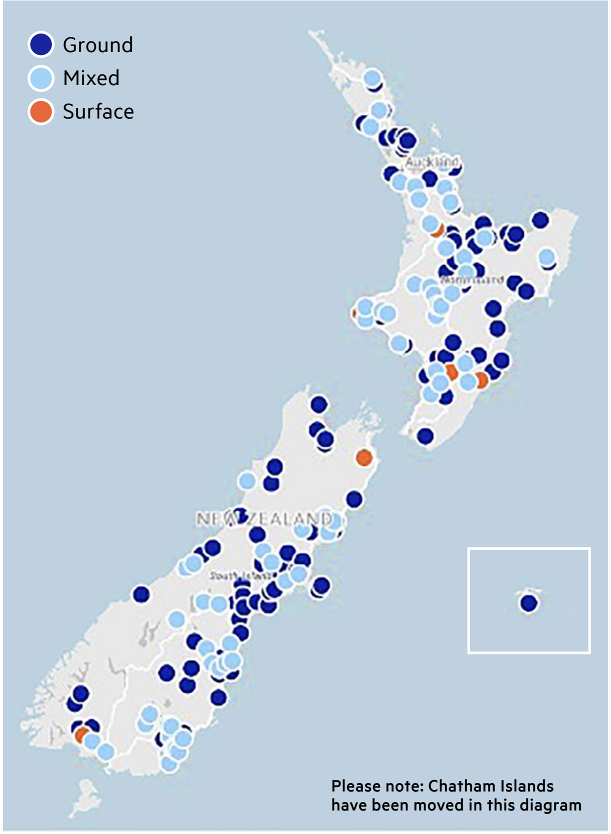
Few network operators rely solely on one source for drinking water to supply their network. Many use a mixture of sources within the same source type or use both groundwater and surface water to supply their consumers. Network operators that use a single source tend to be private operators or rural communities. Table 5 is a summary of the total volume of water use categorised by source type and includes all network operators who provided the data.

Table 5: Volume of water by source type

Source type	Number of network operators	Volume (m^3/year)	Population
Groundwater sources, from aquifers, bores and springs	208	156,519,596	872,887
Surface water sources, such as lakes, rivers, creeks streams, and infiltration galleries[11]	133	307,455,615	2,327,225
Mixed surface and groundwater sources	25	112,141,128	714,108
Data response rate	77%	80%	80%
Median data confidence	Highly reliable/ auditable	Reliable	Reliable
Confidence response rate	59%	5%	59%

11 Note infiltration galleries can be classified as surface water or groundwater. For the purpose of this report and because there were only two networks that source water from infiltration galleries we have grouped these networks in the surface water category.

Figure 1: Location of registered sources of drinking water



The following map shows the locations of the registered sources across New Zealand. The location of the sources was obtained from Hinekōrako. Only 379 of the 393 networks reported by operators had coordinates recorded in Hinekōrako.

From the data submitted, most of the network operators listed their source type as groundwater. However, the largest volume of water sourced for drinking water is surface waters. In particular, Auckland abstracts the largest volume of water of any network, which is sourced primarily from an assortment of dams and the Waikato River. While Auckland does source some of its drinking water from bores and springs, most of Auckland's network is supplied by surface water and therefore this supply has been categorised as a surface water supply in our analysis.

Te Mana o te Wai provides a framework for considering a holistic view of how and where water is sourced from and the impacts of this. Water bodies such as the Waikato River have significance to all New Zealanders, but also to iwi and hapū across the central North Island with specific rights and interests recognised in Treaty of Waitangi settlements. These considerations will continue to be relevant to our role moving forward.

Table 6: Water sources by population density

Population density	No. networks with groundwater source	Volume groundwater (m^3/year)	No. network with surface water source	Volume surface water (m^3/year)	No. networks with mixed source	Volume abstracted from mixed sources (m^3/year)
Rural	120	49,979,738	91	53,126,043	14	18,892,947
Mixed	59	53,218,778	27	51,589,126	7	19,130,771
Urban	9	51,905,475	10	201,593,649	4	74,117,410
Data response rate	77%	80%	77%	80%	77%	80%
Median data confidence	Highly reliable/ auditable	Reliable	Highly Reliable/ auditable	Reliable	Highly Reliable/ auditable	Reliable
Confidence response rate	59%	5%	59%	5%	59%	5%

Table 6 summarises the number of territorial authority networks and volume of water supplied for each source type by population density.

Rural communities have a relatively even distribution between sourcing drinking water from ground and surface water. In mixed population areas, most of the drinking water is from groundwater sources. Although urban areas have more networks operating from groundwater sources, the largest volume of urban drinking water comes from surface water sources.

Outcome: Environmental and public health is protected

To gain an insight into how network operators are protecting the environment and public health, we established the following measures.

- **The number of drinking water connections** this tells us the size of the network, the proportion of residential and non-residential customers and, in time, the growth.
- **The volume of water supplied to the network** this indicates how much water is being taken from our rivers, lakes, and aquifers, that is treated and transported to our homes and businesses. It also directly relates to how network operators are giving effect to Te Mana o te Wai.
- **Resource consent information** resource consents are key for enabling activities while avoiding, remedying and mitigating the adverse environmental effects.

In addition to these measures, we publish a Drinking Water Regulation Report that focuses on the safety of drinking water being provided to communities by suppliers across the country.

Drinking water network connections

Comparisons between network operators are difficult due to different population sizes and distribution areas. To normalise the data for a more accurate comparison, the drinking water network connections can be compared with population densities and length of pipe. The data has also been separated into residential and non-residential connections. Table 7 provides a summary of the number of connections based on population density.

Table 7: Connections by population density

Population density	Residential connections	Non-residential connections	Connections per kilometre of pipe[12]
Rural	212,231	41,819	14
Mixed (between 10 and 200 people/ km2)	251,423	25,072	21
Urban (>200 people/ km2)	934,706	83,561	45
Data response rate	66%	60%	97%
Median data confidence	Reliable	Less reliable	Reliable
Confidence response rate	54%	54%	92%

The data quality demonstrates that many network operators were unable to provide robust information about the number of connections in their networks – data we consider forms basic information needed to understand the network.

Only 66% of network operators provided a response regarding the number of residential connections and 60% provided the number of non-residential connections. The dataset shows there are more residential connections in urban networks than those with lower population densities (i.e. rural and mixed networks). Urban regions tend to have a higher density of buildings and associated water connections than rural areas.

Resource consent information

To ensure adverse effects on the environment are avoided, remedied, or mitigated, regional councils may grant resource consents and undertake associated compliance, monitoring, and enforcement activities for the various aspects of drinking water networks, including:

- taking and using source water
- discharging water or contaminants, such as backwash water
- construction and maintenance of structures in the beds of water bodies.

Both the scope of the resource consent granted and the network operator's compliance with its conditions are key factors in ensuring good environmental performance of networks.

For 2022/23, network operators were only asked to identify the types of resource consent they hold, the consent reference number and the expiry date of the consent. The data provided identified 1,268 resource consents held by operators across the country for their drinking water networks. Unfortunately, we were unable to extract reliable information regarding the types of consent or their expiry dates. The approach to collecting this data will be improved next year and additional measures will enable us to start to build a picture of consent compliance.

Outcome: Resources are used efficiently

In evaluating drinking water network environmental performance, we want to understand if network operators are using resources efficiently. Preserving, restoring, and looking after waterbodies and minimising water use and water take are particularly important for Māori. It is also part of taking a holistic view from the protection and restoration of source water to the quality and quantity of drinking water.

12 Calculated by dividing the total number of connections by the total kms of pipes in the network.

Current measures to help us determine resource use include:

- **Water use by customers on the network and the amount of water lost from the network** – minimising water use and losses can help reduce the total amount of water taken from the river, lake or aquifer, and helps to give effect to Te Mana o te Wai. Ensuring we take no more water than is necessary reduces the cost associated with maintaining and operating the network. This also reduces the need for new expenditure and reduces the impact on the environment.
- **Energy efficiency** – energy use from electricity and fuels, and any energy generation associated with the network, enables us to consider greenhouse gas emissions and contribution to New Zealand's energy needs. The amount of energy used in the water treatment process can also provide information about how efficiently equipment is running and provide an indication of maintenance and renewal needs.

Water use

Water metering

Water meters are a useful tool when managing a network. By providing an accurate measure of the water consumption, network operators can better manage demand and monitor network performance.

The accuracy of a water meter is integral to its operation. As water meters age, the measurements will start to drift causing inaccurate readings. Network operators must ensure that flow meters are recalibrated or replaced at regular intervals.

Consumer water meters measure actual customer use and help network operators pinpoint areas of high demand and water loss. We asked network operators to provide the number of residential and non-residential connections with water meters. Table 8 summarises this data.

Table 8: Number of consumer water meters by population density

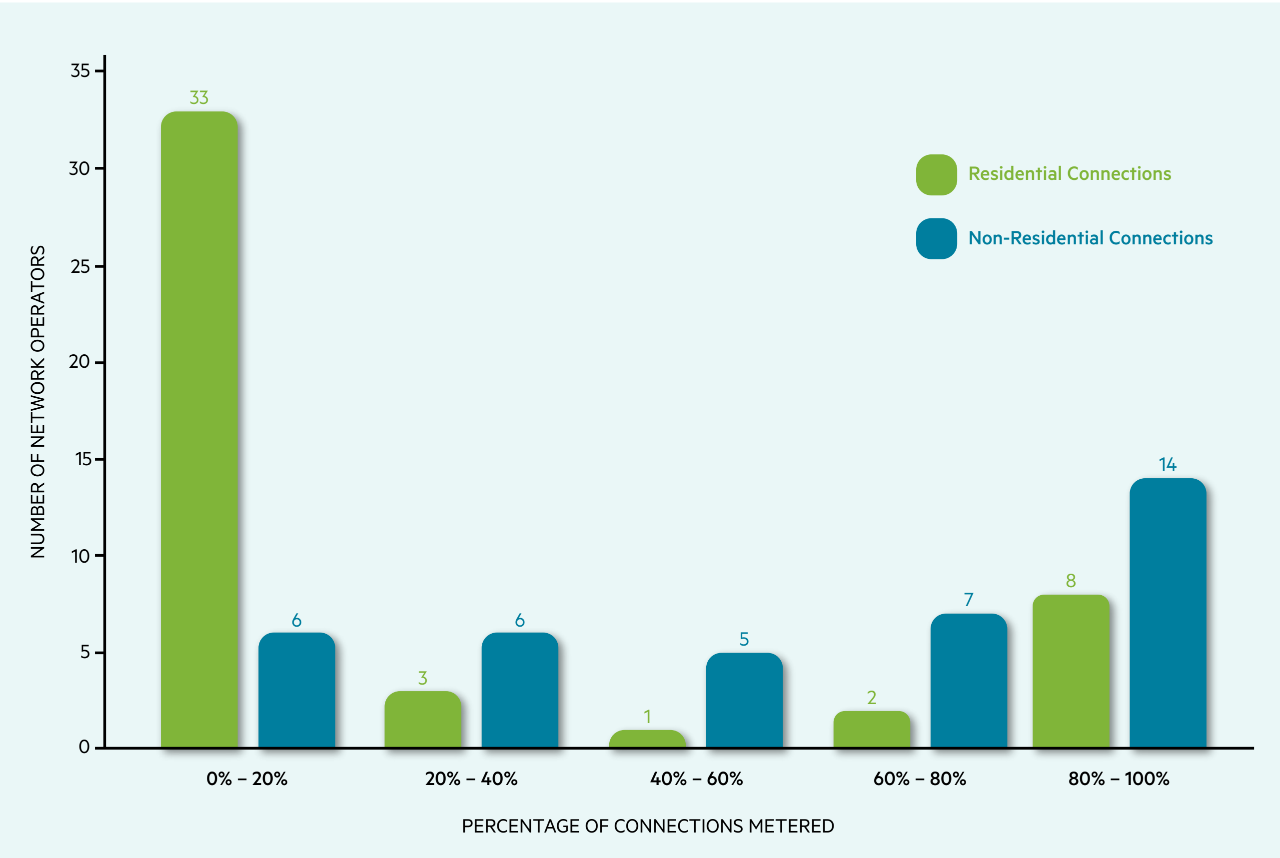
Population density	Residential meters	Non-residential consumer meters
Rural	105,400	22,677
Mixed	120,656	24,223
Urban	643,883	72,034
Data response rate	97%	97%
Median data confidence	Reliable	Reliable
Confidence response rate	77%	79%

Most residential consumer water meters are in urban population areas. This is because more than half of the residential flow meters installed in the country are in Auckland with 433,170. Christchurch City Council had the second highest number of residential water meters installed with 128,116. In comparison, Wellington Water has a total of 1,081 residential water meters. There are 15 network operators that report not using any water meters.

With a total of 934,706 residential connections in urban areas, around a third of connections are without water meters. For rural and mixed population areas, roughly half the connections are metered. As shown in Figure 2 only eight network operators have water meters installed on 80% or more of their residential connections.

For non-residential meters, most of the mixed population areas have meters installed on their connections. For urban areas, about 80% of the connections have meters installed. Rural populations are at the lowest with only 54% of the connections metered.

Figure 2: Percentage of connections metered for each network operator



	Residential connections	Metered residential connections	Non-residential connections	Metered non-residential connections
Data response rate	66%	97%	60%	97%
Median data confidence	Reliable	Reliable	Less reliable	Reliable
Confidence response rate	54%	77%	54%	79%

The analysis includes 47 of the 69 network operators. There were 11 operators where the number of metered connections exceeded the number of connections in the network and 11 operators that did not provide sufficient information to determine the percentage of connections metered. These 22 operators were therefore removed from the analysis. 33 out of the 47 operators (70%) reported that less than 20% of the residential connections in their networks were metered. A much higher proportion of non-residential connections are metered, which is likely to be because these meters are used to determine water use charges.

Water efficiency

Total water use is highest in urban population areas, with mixed and rural areas reporting similar total water use volumes.[13] The volume of water use is more indicative of the actual demand in a network than the water supplied to the network. When comparing water use to the water supplied to the network, water loss accounted for a substantial portion of the total volume. Water loss will be discussed in another section of this report.

This indicates the demand from consumers is lower than the volume of water being supplied to the networks. This is inefficient and expensive because network operators are generally abstracting, treating and transporting more water than consumers need. It's unlikely to demonstrate effective application of Te Mana o Te Wai because a large proportion of the water abstracted is wasted and therefore not available to provide for the health of the water body.

Network operators were asked to report median residential water consumption. There is no accepted value for a reasonable amount of water for a household to use. A 2022 BRANZ study on water use in New Zealand homes found the median daily water use across 66 households in the study was 397 litres per day[14]. The European Environment Agency states on average 144 litres of water per person per day is supplied to households in Europe[15]. For a household of three people this would equate to 432 litres per connection per day.

Table 9 provides the average volume of residential water supplied per property (that is similar to connection) per day for the major centres in Australia in 2022/23.

Table 9: Average residential water use in Australia[16]

Major urban centre	Volume L/property/day
Melbourne	384
Canberra	436
Sydney	482
Adelaide	490
Perth	600
Darwin	956

The data provided by network operators indicates the median water use per residential connection per day is 404 litres, which appears to be equivalent to water use reported in the examples identified early in this section. However, it is likely this figure is impacted by poor data quality with significant outliers – as outlined in Table 10.

Table 10: Median water use in New Zealand

Median residential water use	L/connection/day
Maximum	9,784
95^{th} percentile	4,064
Average	992
Median	404
5^{th} percentile	141
Minimum	5
Parameters	**Median water use**
Data response rate	52%
Median data confidence	Less reliable
Confidence response rate	66%

13 There was an 80% response rate for the total volume of water used. Operators had an average confidence rating of "Reliable" with a response rate of only 5%.
14 Residential water use in New Zealand: Water New Zealand (waternz.org.nz)
15 Water use in Europe — Quantity and quality face big challenges — European Environment Agency (europa.eu)
16 National performance reports: Water Information: Bureau of Meteorology (bom.gov.au) 2022-23 report, page 20, table 2.3 average volume supplied in kL per year, converted to L per day.

To remove the outliers, all data points outside of the 5th to 95th percentile range were omitted from the analysis. Table 11 summarises the resulting median water use by population density.

Table 11: Water use in New Zealand by population density

Population type	Median L/connection/day
Rural	627
Mixed	521
Urban	586

Parameters	Median water use
Data response rate	46%
Median data confidence	Less reliable
Confidence response rate	28%

The data indicates that the highest median water use is found in rural areas, while urban populations reported the lowest median water use. The response rate for this measure was low and network operators considered this data 'less reliable'. These numbers should therefore be considered with caution.

Network losses

Water loss accounts for a substantial portion of the difference between water supplied to the network and water used by consumers. Water loss management across a network is important because population growth increases the demand for water and climate change may decrease the amount of water available. Water contamination can also occur from breaks or leaks in pipes if pressure is lost.

Reducing water loss can ensure networks are more resilient. Water loss also results in higher treatment and conveyance costs because a greater volume of water must be treated and transported than is needed for the community. As previously discussed, high network losses are inconsistent with recognising the inherent value and mana of water.

One way to measure water loss is using the '**Current Annual Real Loss**' (CARL) that is the actual amount of water lost from all leaks, bursts and overflows per year. Table 12 shows the current loss (CARL) in volume loss per connection per day against population density, as reported by network operators.

Table 12: Current Annual Real Loss (CARL) in volume loss per connection per day by population density, as reported by network operators

CARL (L/connection/day)	Average	Median	5th percentile	95th percentile
Rural	14,984	25	0	53,837
Mixed	63,420	204	0	62,678
Urban	628,429	233	52	116,027

Parameters	CARL
Data response rate	58%
Median data confidence	Less reliable
Confidence response rate	55%

In general, the higher the current loss (CARL) the greater the leakage in the network. The data provided was summarised by population density brackets. Many of the numbers provided by network operators were well outside the expected range and are unlikely to be accurate.

As a comparison to the current loss (CARL) data provided by network operators, the operators also provided enough information to calculate the current loss (CARL) for each network. To calculate the current loss (CARL), RE1 - estimated total drinking water network water loss (m^3/year) was divided by the sum of EH1 - number of residential connections in network and EH2 - number of non-residential connections in network. Then the value was converted to litres by multiplying by 1,000. The value was also converted to days by dividing by 366 (since 2024 was a leap year). The following table summarises the results.

Table 13: Taumata Arowai calculated Current Annual Real Loss (CARL) in volume loss per connection per day by population density

CARL (L/connection/day)	Average	Median	5th percentile	95th percentile
Rural	6,677	386	3	12,035
Mixed	5,110	234	0	25,327
Urban	17,249	142	52	116,027

Parameters	Estimated total drinking water network water loss	Number of residential connections in network	Number of non-residential connections in network
Data response rate	75%	66%	60%
Median data confidence	Reliable	Reliable	Less reliable
Confidence response rate	56%	54%	54%

We also use the '**Infrastructure Leakage Index**' (ILI) developed by the International Water Association (IWA) to understand water loss. The methodology ensures different infrastructure characteristics are taken into consideration, such as the number of connections, the length of pipeline, and operating pressures, enabling comparisons to be made between networks.

The ILI compares the current loss (CARL) with the '**Unavoidable Annual Real Loss**' (UARL). UARL is the proportion of the loss considered to be unavoidable. Water loss considered unavoidable is included in the calculation because it recognises there will always be some level of loss due to water moving through the network under pressure, even in a well-maintained and good quality network. The ratio of the current loss (CARL) to unavoidable loss (UARL) is used to calculate the infrastructure leakage index (ILI) which can be used to present a range of performance bands to denote the water loss performance of the network as shown in Table 14.

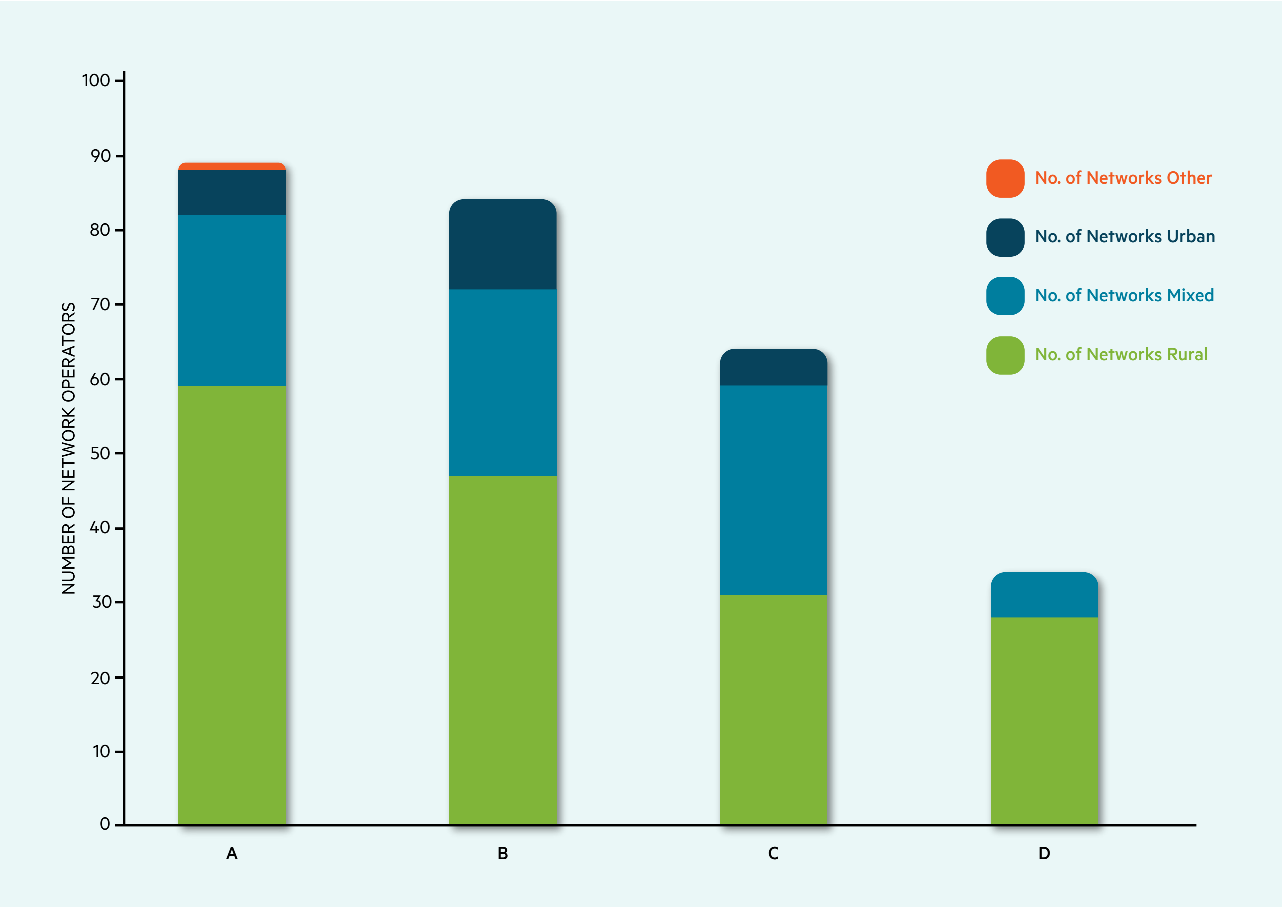
Table 14: Water loss bands in the Infrastructure Leakage Index (ILI)[17]

Band	ILI range	Guideline description of real loss management performance categories for developed countries
A	< 2.0	Further loss reduction may be uneconomic unless there are shortages. Careful analysis is needed to identify cost-effective leakage management
B	Between 2.0 and 4.0	Possibilities for further improvement: Consider pressure management, better active leakage control and better maintenance.
C	Between 4.0 and 8.0	Poor leakage management, tolerable only if plentiful cheap resources – even then, analyse level and nature of leakage and intensify reduction efforts.
D	>8.0	Very inefficient use of resources, indicative of poor maintenance and system condition in general. Leakage reduction programmes imperative and high priority.

We provided guidance regarding how to complete the ILI calculation by directing network operators to the Water New Zealand Water Loss Guidelines, which base calculations on the IWA. Figure 3 shows the number of networks in each of the ILI bands.

17 As outlined in the Water New Zealand Water Loss Guidelines, 2010

Figure 3: Number of networks in each of the Infrastructure Leakage Index (ILI) bands



Parameters	ILI
Data response rate	55%
Median data confidence	Less reliable
Confidence response rate	54%

Table 15: Infrastructure Leakage Index (ILI) against population density

Population density	Average (band)	Minimum	Maximum
Rural	5 (C)	0.3	40
Mixed	4 (B)	0.1	13
Urban	3 (B)	0.3	5

Parameters	ILI
Data response rate	55%
Median data confidence	Less reliable
Confidence response rate	54%

From the submitted data, ILI in rural areas is the highest and has the biggest range. ILI in urban areas is lowest out of the three population groups, with the Wellington Water network reporting the highest ILI of urban networks at a value of 5.2, putting them in water loss band C (poor leakage management). The second highest operator in an urban area was Christchurch with an ILI value of 2.8. This puts Christchurch into water loss band B.

High ILI indicates networks have high water loss beyond what would be expected to be reasonable in a well-maintained network. This is likely to be inconsistent with the concept of Te Mana o te Wai and may mean greater pressure is being placed on aquatic ecosystems and groundwater systems through high levels of water abstraction.

Current loss (CARL) and the ILI are two different ways of understanding how much water is lost from the network. Unavoidable loss (UARL) is incorporated into the ILI to account for the water losses considered inevitable in any significant network and are calculated based on the length of mains, the number of service connections and the network pressure.

Although unavoidable loss (UARL) is factored into the ILI calculations, we would expect both methods to provide a similar picture of water loss. We compared ILI and current loss (CARL) and found there are differences between network operators with the highest leakage across each measurement, with some network operators reporting a high current loss (CARL) but low ILI. This may indicate network operators used a different calculation rather than the one recommended in the guidelines.

Therefore, while Figure 3 appears to show a significant number of networks with low ILI values this does not correlate with other data we collected.

Energy efficiency

Energy is used for both water treatment and conveyance. Energy consumption for water treatment is dependent on the water source, with water sources of poorer quality generally requiring more energy to treat. Energy consumption for water conveyance through the network is dependent on topography as significant energy is used to pump water to the high points of the network. Larger or flatter distribution areas also require more energy to pump the water to consumers at the furthest reaches of the network.

When designing and operating a network, energy consumption for water conveyance needs to be balanced with the minimum pressure requirements for customers, as well as the code of practice design requirements for firefighting services. In the event of a power outage, many treatment plants and pump stations are equipped with diesel generators to continue operations.

The following parameters were recorded on a district level:

- grid electricity use
- total energy use (e.g. diesel and biogas) from other sources, including both the treatment plant and network, but not including fleet vehicles or offices
- energy generation.

Total energy use was determined by summing the grid electricity and energy use from other sources then subtracting the energy generation.

While reviewing the data, it was noted that two councils reported high energy generation values resulting in negative power consumption. This data suggests the water treatment plants operated by these councils generate significantly more energy than they consume. This is likely to be a data error as water treatment plants generally have limited opportunities to generate power. These values were therefore removed from the analysis.

Comparisons between energy consumption and population density are difficult due to the data quality. The energy efficiency measures did not breakdown the consumption between treatment and conveyance. In rural areas, the energy required for conveyance is elevated due to the longer distances between connections. In urban areas, the larger volume of water required increases the energy consumption of the treatment process. The only conclusion that can be made with the current data is that the highest energy consumption was reported in urban regions, while the lowest energy use was in rural areas.

Energy efficiency is determined by calculating how much water can be treated and conveyed by 1 kWh of energy. The total volume to the network was divided by the total energy use.

Table 16: Volume of water treated and delivered to the customer per 1kWh of energy

Population density	Average energy efficiency	Minimum energy efficiency	Maximum energy efficiency
Rural	3.3	0.46	18.6
Mixed	6.7	0.01	66.7
Urban	46.1	1.16	226.7

Parameters	Grid electricity use	Energy use	Energy generation	Water supplied to network
Data response rate	70%	97%	97%	80%
Median data confidence	Reliable	Reliable	Reliable	Reliable
Confidence response rate	63%	62%	66%	5%

From the data set it would appear drinking water networks in urban areas are more energy efficient than those in rural areas. As noted above, without the separation between water treatment and conveyance it is difficult to determine the cause of the efficiencies.

Outcome: Services are reliable

In evaluating drinking water network environmental performance, we want insight into the reliability of the service provided because this is a key contributor to healthy communities, natural environments and efficient resource use.

Poorly maintained networks that regularly fail are likely to result in more water being abstracted than required and may increase the risk of contaminants entering the network. Current measures used to help us examine this are below.

- **Asset condition** – is the physical state of the network. A network in good condition is more likely to perform well and less likely to fail.
- **Fault attendance and resolution** – this tells us how quickly urgent and non-urgent faults are responded to, thereby addressing risk to public and environmental health.
- **System interruptions** – the number of planned and unplanned (third party or natural event) disruptions to normal service levels.
- **Water pressure** – in addition to ensuring good pressure for customers, pressure management can improve network efficiency, lowering operating and maintenance costs by reducing the likelihood of pipe breakage and water leaks.
- **Firefighting capability** – not all drinking water networks provide firefighting capability, which includes fire hydrants and water at specified rates and pressures. This measure allows us to better understand those networks that provide water for firefighting, and how many hydrants have been tested.

Asset condition

Asset information was provided by network operators as the percentage of assets that had a condition assessment and the percentage of those that are in poor or very poor condition. This information is split into above-ground assets (e.g. water treatment plants, reservoirs and pump stations) and pipelines.[18]

A calculation was performed with this information to determine the percentage of Aotearoa New Zealand's drinking water assets with a known condition and percentage of these assets in poor condition, as summarised in Table 17.

Table 17: Percentage of assets with a known condition and percentage of those assets in poor condition[19]

Parameters	Average	Minimum	Maximum
Percentage of above-ground assets with a condition grading	72%	0%	100%
Percentage of above-ground assets in poor or very poor condition	13%	0%	95%
Percent of pipelines with a condition grading	59%	0%	100%
Percent of pipelines in poor or very poor condition	13%	0%	52%
Weighted average age of pipes	32 years	5 years	100 years

Parameters	% of pipelines that have received a condition grading	% of pipelines in poor or very poor condition	Average age of water pipelines	% of above ground assets that have received a condition grading	% of above ground assets in poor or very poor condition
Data response rate	97%	97%	92%	63%	56%
Median data confidence	Less reliable	Less reliable	Reliable	Less reliable	Less reliable
Confidence response rate	79%	79%	85%	79%	76%

18 It is acknowledged that some of the assets listed as 'above-ground' may also be found underground, for the purpose of this report we have only requested data on above ground assets.
19 Where we have provided the proportion of assets in poor or very poor condition, this is the proportion of those that have received a condition assessment.

There is a lack of information and low data confidence regarding the asset condition of water infrastructure. 24 network operators did not provide a percentage of above ground assets receiving a condition assessment and 29 network operators could not provide a percentage of above ground assets in poor or very poor condition.

All but one network operator was able to provide a percentage of pipes that have received a condition assessment. Of the network operators that did provide data, only 59% of pipes in the country have been assessed over the lifetime of the network and 13% of those pipes are in poor or very poor condition. We do not know the condition of the 41% of pipes that have not received a condition assessment, it is possible that a greater proportion of those pipes are in a poor or very poor condition.

There is also a significant range in the proportion of the network that has been assessed between operators, with some networks having assessed 100% of their pipes while others have assessed less than 1%. For the pipelines that have been assessed the highest proportion in poor or very poor condition in a network was Kawerau District Council. They assessed 50% of the pipes and all of them were in poor condition.

The council with the lowest proportion in poor or very poor condition was Waimate District Council with 93% of the pipes assessed and none in poor or very poor condition. There are a variety of different condition grading criteria and therefore any comparisons between network operators should be considered in this context.

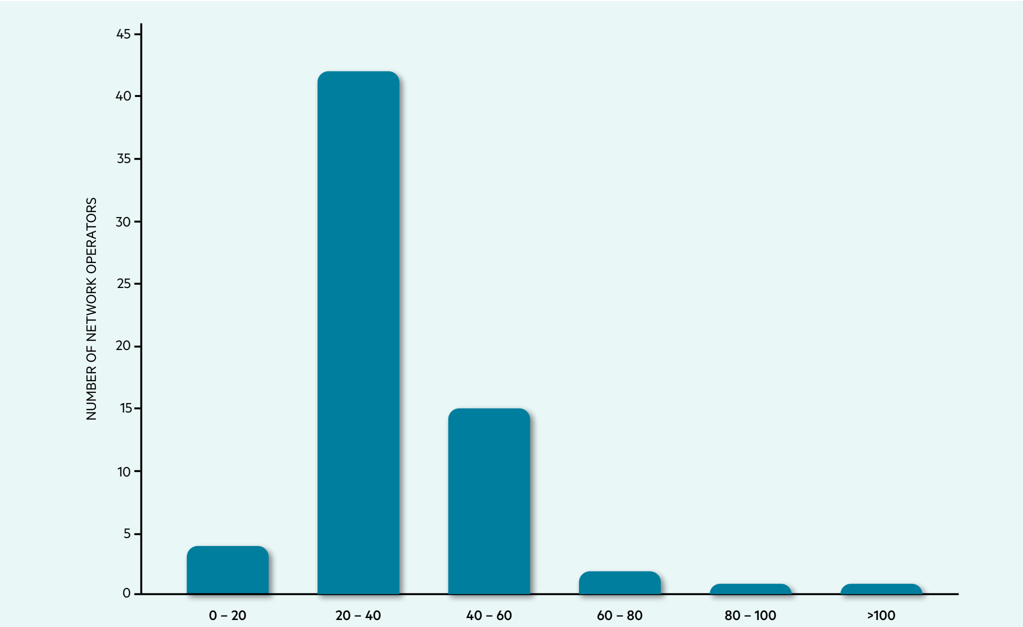
In the future, we would like to see network operators move to a consistent way of grading their assets and we may need to consider providing guidance on this.

A lack of asset information leads to issues with long term strategic planning for network operators. Without accurate condition data, the end-of-life for the asset cannot be accurately predicted. With undefined timeframes, additional contingencies may need to be added to Long Term Plans.

Asset age

Network operators also submitted the weighted average age of the network piping. Figure 4 summarises the pipe age range across the country.

Figure 4: Weighted average age of all pipelines in the network



Parameters	Average age of water pipelines
Data response rate	92%
Median data confidence	Reliable
Confidence response rate	85%

The weighted average age of pipework in Aotearoa New Zealand is currently reported at 32 years old and spans a range between five and 100 years. Four operators were also unable to provide information regarding the age of their pipes.

Pipe age does not necessarily provide a good understanding of when assets need to be replaced. The pipe material, size, location underground, operating pressures and the chemical properties of the water can all affect the lifespan of the network.

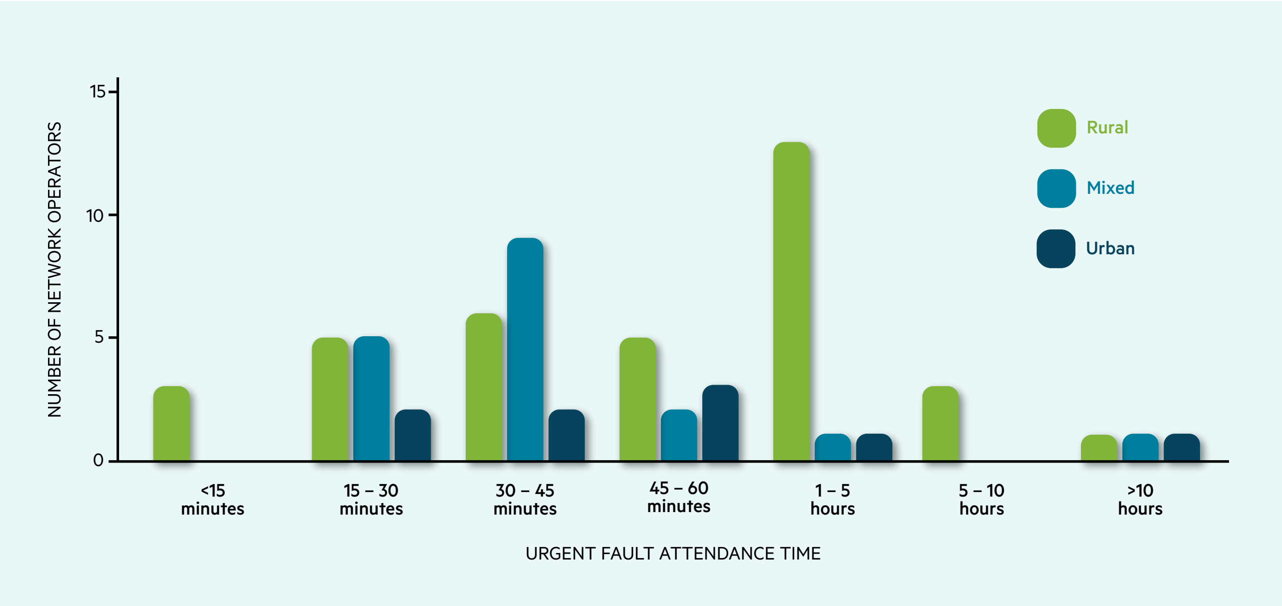
To ensure pipes are being replaced in a timely manner, comprehensive condition assessments that inform a maintenance program is required. To improve the insight of this data, we will consider a way to adapt the measures in future years to account for the variety of factors affecting pipe conditions.

Fault attendance and resolution

Data was requested for the median time to attend a fault and the median time until the fault was resolved. These were separated into urgent and non-urgent faults. For 2022/23 there was no requirement to submit the number of faults received or resolved, but this data is included in the 2023/24 measures and will therefore be included in the 2024 version of this report.

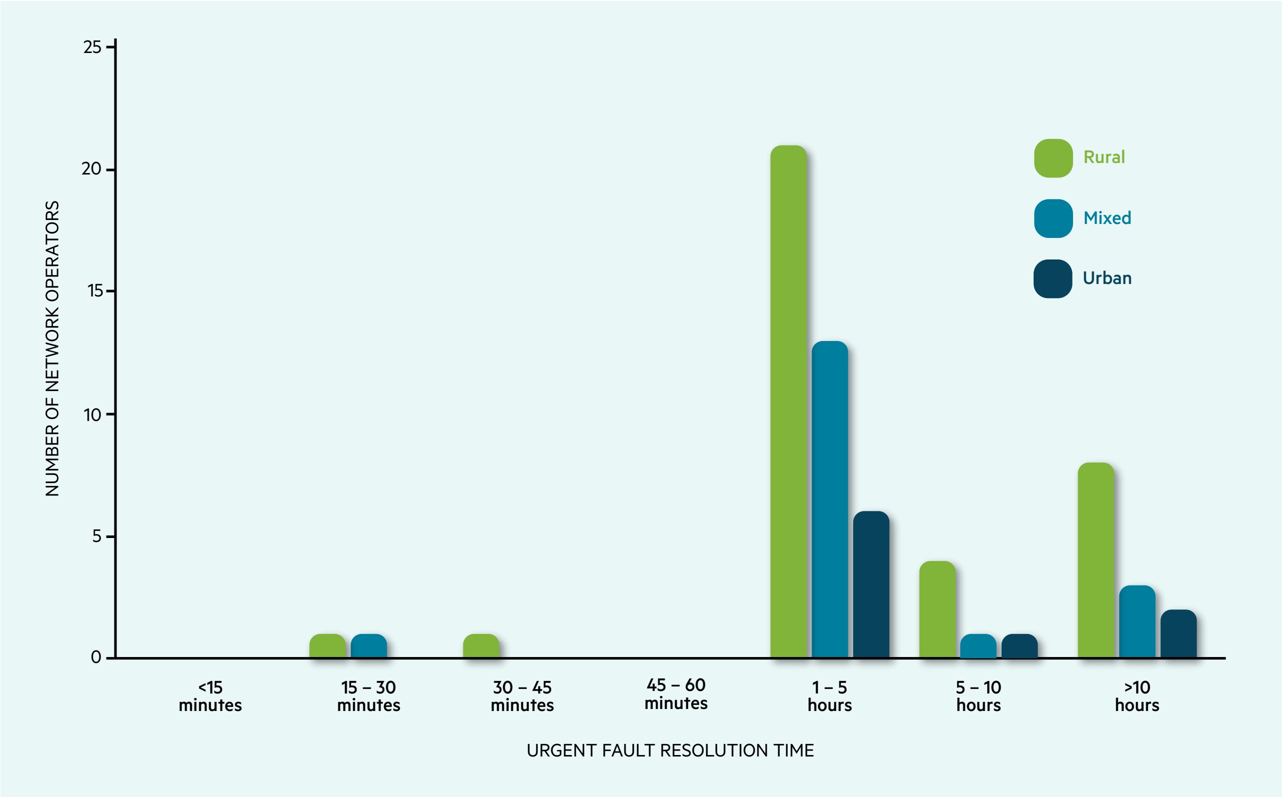
Figure 5 plots the attendance time for an urgent fault and Figure 6 plots the resolution time for urgent faults.

Figure 5: Median urgent fault attendance times vs number of network operators



Parameters	Median hours to attend an urgent fault
Data response rate	97%
Median data confidence	Reliable
Confidence response rate	92%

Figure 6: Median urgent fault resolution times vs number of network operators



Parameters	Median hours to attend an urgent fault
Data response rate	97%
Median data confidence	Highly reliable/audible
Confidence response rate	92%

There are significantly more rural and mixed networks than urban in Aotearoa New Zealand, which impacts the results. From this graph, it appears that network operators in rural areas attend to urgent faults quicker than urban operators. However, network operators from all three population areas resolve the urgent faults at a similar time.

The response rate for non-urgent fault attendance was 97% and 93% for non-urgent fault resolution. The average confidence rating was 'reliable' with a response rate of 94% for each. For non-urgent faults, rural operators are faster at attending, while urban operators do not attend to the fault until much later. However, network operators from all population areas take much longer to resolve the fault when compared to an urgent fault.

Table 18 provides a summary of the statistics for each measure.

Table 18: Statistics for fault attendance

Parameters	Average	Minimum	Maximum
Median hours to attend an urgent fault	5	0.02	206
Median hours to attend a non-urgent fault	32	0.38	552
Median hours to resolve an urgent fault	11	0.30	168
Median hours to resolve a non-urgent fault	69	0.57	1,227

Planned system interruptions

Planned system interruptions occur when there is scheduled maintenance or renewal activities being performed on the network. Network operators submitted the number of planned interruptions in the network in a year.

The response rate for planned interruptions was 97%, with an average confidence level of 'Reliable' and a confidence response rate of 90%. The data indicates that rural operators seem to have fewer planned interruptions, whereas urban operators tended to have more.

It is challenging to draw conclusions from this data – more planned system interruptions may reflect normal ongoing maintenance or a pulse of delayed maintenance, while less interruptions may reflect a well-maintained network or a network that requires maintenance but for which no maintenance is occurring. The next report will include data on unplanned interruptions that will assist in providing a more in-depth analysis.

Water pressure

Sufficient pressure must be maintained in the network to ensure that water can be supplied to the consumer. Some network operators also need to demonstrate compliance with the Fire and Emergency New Zealand Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008), which identifies the minimum pressure and flow rates in the network to support effective fire suppression.

The following table summarises the variation in the operating pressure reported across the various networks:

Water pressure	kPa
Maximum	1,100
95th percentile	735
Average	237
Median	65
5th percentile	25
Minimum	0.2

One network operator entered a pressure value of 1,100kPa. This is 100 times greater than the minimum pressure requirement from Fire and Emergency New Zealand (100kPa). To put this into context, this pressure is equivalent to the output of an electric pressure washer. If pressures in networks were this high, it would cause damage to the water infrastructure.

There are also some networks reporting operating at very low pressure. Low pressure can cause supply issues resulting in complaints from consumers and causing backflow, resulting in contamination of the network.

Typically network pressure ranges between 147kPa and 588kPa. It appears many network operators did not follow the correct methodology when calculating pressure. The following analysis will omit all data outside of the 5th and 95th percentile range. We have clarified our guidance for this performance measure for future reporting rounds.

Table 19 shows key aspects of the reported average network pressures across different population densities.

Table 19: Range of reported average network pressures in kPa

Population density	Average	Minimum	Maximum
Rural	182	25	700
Mixed	338	35	700
Urban	88	38	542

Parameters	Water pressure
Data response rate	46%
Median data confidence	Less reliable
Confidence Response Rate	33%

The data set indicates that the average operating pressure for networks for each population density exceeds the optimal range. This may be due to data errors. When reviewing the data, it appears network operators may have used units, other than the units specified when providing responses (i.e. metres instead of kPa). Network pressure this high can cause damage to assets and increase water loss in the network.

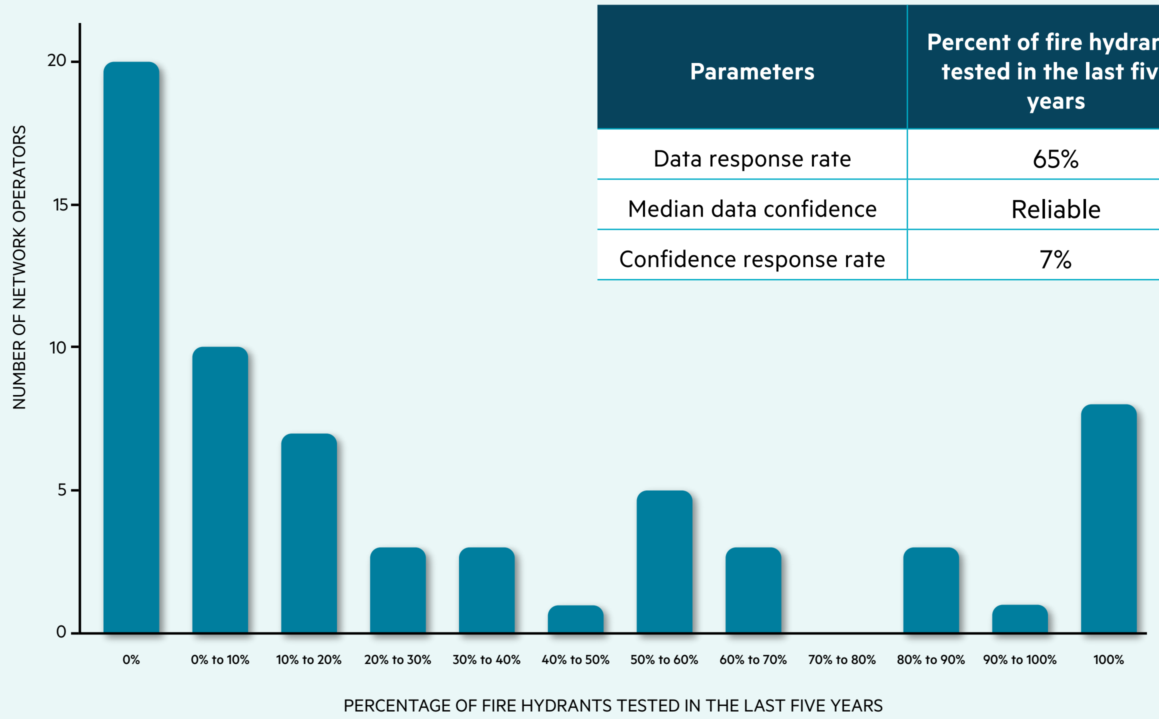
Sufficient firefighting water

As part of the measure regarding sufficient firefighting water, network operators were asked if they adopted the Fire and Emergency New Zealand Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008). Of the 63 territorial authority network operators and CCOs whose data was included in this analysis, 40 have adopted the FENZ Code of Practice.

Maintenance of the firefighting equipment installed in the network is critical. Proper asset management will ensure enough water is supplied in the event of a fire while maintaining sufficient pressure and ensuring that backflow does not occur.

The FENZ Code of Practice requires all fire hydrants to be tested at least once every five years. As an indication of network maintenance, network operators were asked to submit the percentage of fire hydrants tested in the previous five years. Only 40 out of the 63 territorial authorities and CCOs provided information regarding fire hydrant testing.

Figure 7: Percentage of fire hydrants tested in the last five years



Parameters	Percent of fire hydrants tested in the last five years
Data response rate	65%
Median data confidence	Reliable
Confidence response rate	7%

Figure 7 shows that of the 40 network operators that have provided data, only eight network operators have tested 100% of their hydrants as outlined in the FENZ Code of Practice. 12 operators tested 10% or less of the hydrants in their networks and 19 network operators did not provide any data. The data indicates that, on the whole, territorial authorities are unlikely to be carrying out effective preventative maintenance on fire hydrants installed in their networks. The reliability of hydrants is integral to fire services. If a fire occurred and the hydrant failed to provide sufficient water the fire could spread, creating a bigger health and environmental risk and damaging more infrastructure.

Fire hydrants are often utilised during network maintenance. When purging sections of the network or dead ends, operators will open fire hydrants and direct the water into storm drains. This simultaneously tests the fire hydrant and flushes the network.

Outcome: Services are resilient

In evaluating drinking water network environmental performance, it is useful to understand the resilience of the service. Resilience refers to the network or operator's ability to withstand or recover quickly from difficult conditions such as a flood, earthquake or extreme weather events. The current measure used to help us determine this are below.

- **Water restrictions** – the number of days a drinking water network is affected by water restrictions can indicate that customer demand has exceeded supply, or a disaster has occurred.
- **Critical assets** – these are assets for which failure would have significant consequences, either in the ability of the system to provide services to customers or the effect on the environment.

Water restrictions

The number of days a drinking water network is affected by water restrictions provides an indication of the resilience and reliability of a water supply. Water restrictions may be caused by factors outside the control of a network operator, such as when a natural hazard event or emergency occurs. Water restrictions are an accepted way to manage supply and demand, however water restrictions may also occur when networks are poorly maintained and there are high rates of leakage.

Table 20: Comparison of days of water restrictions by population density

Population type	Number of days[20]	Average	Minimum	Maximum
Rural	1,079	34	0.00	365
Mixed	191	17	0.10	95
Urban	64	16	0.02	50

Parameters	Number of Days of Water Restriction
Data response rate	92%
Median data confidence	Reliable
Confidence response rate	15%

20 The total number of days is aggregated across all territorial authority networks that fall into each population density category. This means then total number may exceed 365 days despite this measure being recorded over a year.

There are a range of reasons why a network would be placed under water restrictions, including the desire to keep users aware of their usage and promote sustainable water use regardless of availability. In future years we will ask network operators to provide comments to provide more context on how water restrictions are used.

Five councils appear to have water restrictions throughout the year with at least one of these council applying year-round restrictions as a sustainability measure. This may be indicative of dry weather conditions or network leakage. Water restrictions are also defined individually by each network operator and therefore, each level may not be equivalent to the levels of another network. Further information on this will be requested for future reports.

Critical assets

It is important that network operators identify assets in which failure would have significant consequences, either in the ability of the system to provide services to customers or the effect on the environment.

Managing critical assets can include ensuring equipment is monitored and maintained, and appropriate investment to ensure it does not fail. For this report, network operators were asked if an assessment to identify critical assets was performed. Table 20 shows a breakdown of the responses.

We will look at building on this measure in the future, including considering whether there needs to be a common approach to undertaking this assessment. For this report, network operators were provided a link to the Infrastructure Grading Guidelines 1999 – Water Assets and IPWEA's International Infrastructure Management Manual for guidance.

Table 21: Network operators who have performed an assessment of critical assets

Response	Number of network operators
Yes	55
No	11
No response	3

Parameters	Performed an assessment of critical assets
Data response rate	93%
Median data confidence	Reliable
Confidence response rate	77%

Most network operators that reported have performed a criticality assessment on their networks. Having this information coupled with the asset condition assessments is the first step to creating a robust asset management plan.

Outcome: Services are economically sustainable

A drinking water network needs to budget for its ongoing operation and maintenance to make improvements where necessary and to meet anticipated growth. Economic sustainability (or financial sustainability) refers to practices designed to balance revenue, expenditure, and costs to those who use water services while ensuring community and environmental impacts are addressed.

The following measures were introduced for 2023/24 and will be reported on in the 2024 Report:

- expenditure, broken down into capital and operating expenditure
- forecast expenditure for the next reporting period (one year) broken down into capital and operating expenditure
- total revenue received relating to drinking water.

We expect this information will be valuable for the future economic regulator. Once that future regime is developed, we anticipate all economic data will be collected by the economic regulator and shared with us.

PART THREE: Wastewater networks

In this part, we talk about the environmental performance of wastewater networks and our role in improving them. We also focus on wastewater overflows.

We consider the following characteristics are indicative of good environmental management of wastewater networks.

- Meaningful engagement with iwi, hapū, and communities occurs throughout the life cycle of the network, including through the design and ongoing operation.
- Te Mana o te Wai or similar principles are considered throughout the design and operation of the network and any discharges consider the receiving environment, including the sensitivity of that environment and any potential social, cultural and environmental impacts.
- Wastewater treatment plants (WWTPs) are designed, operated, and maintained to treat wastewater to an appropriate standard, with safe discharges to the environment and associated monitoring.
- The nature of untreated wastewater discharged from the piped network (known as 'overflow') is known and reduced, or avoided where practicable and responded to appropriately.
- Freshwater inflow and infiltration are understood and addressed, particularly during wet weather events.
- Sludge and biosolids are disposed of, or re-used, safely.
- Trade or industrial wastes entering the network are known and managed.
- Greenhouse gas emissions and odours are managed responsibly.

To effectively maintain and improve environmental performance, wastewater networks must be resource efficient, resilient, reliable with suitable financial planning to ensure that the necessary maintenance, renewals and upgrades can be implemented.

We did not require mandatory reporting against wastewater measures. As reporting was voluntary in the reporting period, this section contains commentary on environmental performance based on other sources of information.

We invited network operators to provide information on wastewater measures on a voluntary basis using measures based on those previously used by Water New Zealand for their NPR. We commend the 11 councils who provided this information. Given the small sample of information collected, we have not included any analysis in this report.

We consulted on proposed wastewater measures in late 2022 and network operators are required to start collecting this information from 1 July 2024. **Appendix 1** provides further detail on the potential environmental impacts of wastewater networks and provides a summary of the measures that will be required to be reported in the future.

Our role in the progressive improvement of wastewater network performance

The Resource Management Act 1991 (RMA) is Aotearoa New Zealand's primary environmental legislation. Under the RMA, regional councils respond to directions in national instruments and establish planning frameworks, including setting local objectives, policies and rules for water takes, structures in water bodies, and contaminant discharges like wastewater, stormwater and biosolids.

Regional councils process and make decisions on resource consent applications and impose conditions on consents to ensure adverse effects are avoided, remedied, or mitigated. They are also responsible for compliance, monitoring, and enforcement of resource consents they have granted.

Part of our role is to provide oversight and advice on the regulation, management and environmental performance of wastewater networks. We also have a specific obligation to report on the extent to which networks are being operated in compliance with their resource consents, and the extent to which network operators are avoiding, remedying, or mitigating adverse effects on the environment.

We also have the power to make environmental performance targets and standards that apply to wastewater networks and their operators, to support improved environmental outcomes. Targets can set performance expectations that network operators should aim to meet in the future, while standards will set minimum requirements that must be met now. Once an environmental performance standard is made, a regional council cannot grant a resource consent contrary to the standard.

Wastewater treatment standards are a common feature of many jurisdictions that New Zealand compares itself to, such as the European Union, United Kingdom, Australia, Canada and South Africa. Over time, these standards have driven efficiencies in reinvestment and upgrade of infrastructure. We expect standards will provide more certainty to the sector by setting a minimum baseline for discharges.

Profile of public wastewater networks

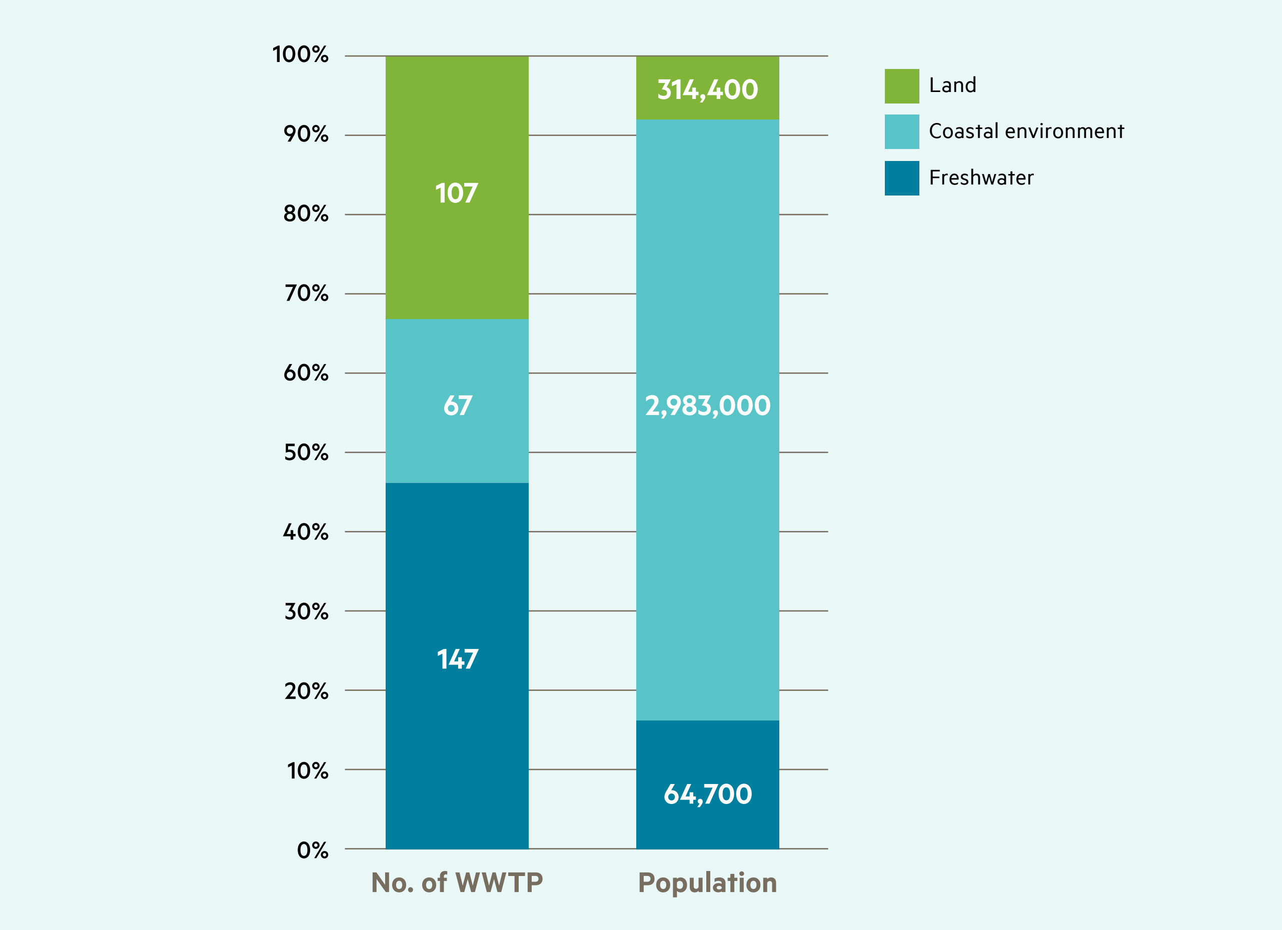
All 67 territorial authorities (city and district councils, including unitary authorities) are operators of one or more wastewater networks. As required by the Act, we developed a Public Register of Wastewater Networks in late 2023 which provides a basic record of wastewater networks operated by territorial authorities. The register identifies 316 networks, of which 294 provided population data – summarised in Table 21. The data shows that, of those networks that provided population data, 47% of wastewater networks serve less than 1,000 people which presents challenges in funding upgrades or replacements.

Table 22: Council wastewater treatment plants by size

Size range of community serviced by the council wastewater network	Number of wastewater networks
Less than 1,000 people	150
Between 1,000 and 5,000 people	75
Between 5,000 and 10,000 people	26
Between 10,000 and 100,000 people	36
Greater than 100,000	7

Analysis in The New Zealand Wastewater Sector Report 2020 (Ministry for the Environment) reported that most wastewater treatment plants discharge to freshwater, followed by land, with the fewest WWTPs discharging to the coastal environment. However, when the estimated volumes of discharge into each environment are considered (using the population the network serves), the greatest volume of wastewater is discharged to the coastal area, followed by freshwater, with the smallest volume discharged to land.

Figure 8: Wastewater treatment plant discharge receiving environments (source: The New Zealand Wastewater Sector Report 2020 (kindly reproduced with permission from MfE)



Resource consent compliance

Regional councils grant resource consents and undertake associated compliance, monitoring, and enforcement for various aspects of wastewater networks, including:

- discharge of untreated wastewater from the network
- discharge of treated wastewater from the treatment plant
- discharges to air, including odours
- discharge and/or reuse of biosolids.

The scope of the resource consent granted and compliance of the network operator with the consent and its conditions, are key factors in ensuring good network environmental performance.

What do we know about resource consents and compliance?

The National Stocktake of Municipal Wastewater Treatment Plants 2019 found that there are significant systemic issues with the regulation of wastewater treatment plants under the RMA. These findings are below.

- Only five regional planning documents contained provisions specifically addressing the discharge from municipal wastewater treatment plants, although resource consent is required in all regions.
- Resource consent duration for relevant activities varies from two years to 35 years.
- Nearly a quarter of the wastewater treatment plants (73 plants) were operating on expired consents.[21] The average time operating on an expired consent was four years.

21 It is unclear from the report whether these councils have met the legal requirements of RMA s124, which allows operation under an existing consent until a new consent is granted (and any appeals resolved), subject to the new application being made within specified timeframes before expiry.

- Consenting challenges include lengthy and often difficult consultation processes and challenges with meeting community expectations within affordability constraints. Networks also need to continue to provide wastewater services to protect public health, despite the consent being expired.
- Consenting costs range from several hundred thousand dollars through to several million dollars. This is on top of the cost of required upgrades to the wastewater network determined through the consenting process.
- Variable monitoring requirements for water quality parameters, and imposition of limits.
- Variable regional council use of compliance tools available, and a low level of enforcement (noting some conditions are unenforceable, or the consequence of non-compliance is low risk).
- Information on compliance and reporting is generally not readily publicly available or accessible.
- In 2017/18, full compliance was only achieved at 27% of wastewater treatment plants and the estimated proportion of plants with moderate or significant non-compliance was 47%.

The New Zealand Wastewater Sector Report 2020 (Ministry for the Environment) notes a study commissioned to explore consent conditions in more detail. Themes of the review included inconsistency in monitoring parameters, reporting and the use of compliance limits, and a lack of iwi/cultural considerations and monitoring.

The 2021/22 Water New Zealand NPR reported that for the **36 network operators who participated**:

- nearly 10% of wastewater treatment plants were operating on expired consents and the 'majority' had lodged new consent applications
- 412 consent non-conformances were reported, and only 36 compliance actions were taken in response
- only five councils held resource consents for overflows from wastewater networks. Regional council frameworks for addressing such discharges varied. Some network operators consider them 'emergency' discharges,[22] while one considers them to be a permitted activity.

22 As provided for in RMA s330.

Wastewater overflows

A key aspect of interest when evaluating environmental performance is overflows from wastewater networks. An overflow is where untreated wastewater flows out from the network into the environment. Often, directly or indirectly, these overflows enter water bodies.

Overflows can result from any of the following root causes.

- **Blockages** – physical matter, such as fat, oil or grease builds up, or tree roots intrude into the network, causing a physical blockage.
- **Plant failure or equipment damage** – for example, a pipe breaks or a pump stops working properly.
- **Capacity being exceeded in the wastewater network** – this is typically due to too much inflow (e.g. incorrectly plumbed stormwater systems from private properties, or through damaged or low-lying gully traps or manholes), or infiltration (e.g. groundwater entering through defects or joints in pipes).

The first two causes are sometimes called ‘dry weather’ overflows and may occur anywhere in a network. Capacity exceedances are sometimes called ‘wet weather’ overflows and these may occur at various points of system entry, such as manholes, or via deliberately constructed outfalls and are typically because of heavy rainfall. In the future we propose to avoid the need to reference weather conditions and to further define what constitutes ‘wet weather’ or ‘heavy rainfall’ and instead describe discharges based on their root causes.

Historically, recognition and provision for these network discharges has been mixed across the country. Generally, consenting has focussed on WWTPs and not discharges from reticulated networks, although this is now changing.

While some regional councils manage overflows through resource consent requirements in regional plans, others prohibit overflow discharges or consider them emergency discharges under the RMA. Network operators need to reduce the occurrence of these through good maintenance and management of their networks. Minimising and mitigating the occurrence of these overflows to help give effect to Te Mana o te Wai principles is critical.

There is not currently a nationally consistent approach to monitoring and reporting on wastewater overflows. In future reports network operators will be required to provide details on overflows, including how they are monitored and the total number. Over time, we intend to develop a consistent way to monitor and report on wastewater overflows so that a robust national picture of overflow occurrence and regulation can be presented. The 2021/22 Water New Zealand NPR highlighted the lack of a consistent national regulatory approach to overflows as an issue, noting that for those network operators that participated in the NPR 1,154 overflows were reported, and only five councils held consents for them.

Case Study: Auckland sinkhole

In September 2023 a major wastewater pipe in Auckland collapsed, resulting in a 13 metre deep sinkhole and 25 metres of blockage. In the 23 days it took to repair the pipe, an estimated 8,640,000 litres of untreated wastewater entered the Waitematā Harbour every day. A rāhui was put in place for the harbour and was only lifted after 65 days. This sinkhole was not an isolated incident, as Watercare dealt with up to 30 sinkholes in Auckland linked to rainfall events in 2023.

PART FOUR: Stormwater networks

In this part, we take a closer look at stormwater, stormwater networks and the challenges operators face in managing them. We also talk about our role in the progressive improvement of the environmental performance of urban stormwater networks.

What is stormwater?

Stormwater is run-off of rainfall[23] from land, including hard surfaces (such as roofs, roads, driveways and footpaths). Run-off naturally flows from higher to lower ground and ultimately discharges into natural waterbodies, such as streams, rivers, lakes, wetlands or the sea.

When a grassed or bush-clad area is developed, the volume of stormwater from the area generally increases due to run-off from new hard surfaces such as roofs, roads and carparks. This can in turn cause flooding in low lying areas. Human activities, particularly industry and traffic, can result in the build-up of sediments and contaminants on the surfaces, and in the areas, where they occur. These can be washed off during rains and can enter natural waterbodies impacting their health.

What is a stormwater network?

Our community stormwater systems comprise of a network of drains, pipes, catch-pits, detention ponds, stopbanks, stormwater reserves and other associated infrastructure. Unlike drinking water and wastewater, which are piped systems otherwise separated from our environment, stormwater systems often include features like natural watercourses (rivers, ephemeral channels and wetlands), parks and reserves, and the kerb and channel or open ditches (referred to as swales) that drain roads.

Various parts of our stormwater systems are owned and operated by different people. For example, while councils are typically responsible for much of a community network and local roads, the New Zealand Transport Agency Waka Kotahi is responsible for drainage from state highways. Some key components of a stormwater network may be in private ownership, such as small watercourses that traverse private property, which may be open or may contain privately owned structures that could affect water flow, such as culverts or bridges.

Our role is in relation to public stormwater networks in urban areas. You can read more about our role further on in this section.

Components of good environmental management

Stormwater networks should be designed, maintained, and upgraded to protect our homes, businesses and communities from the effects of surface flooding whilst also protecting and enhancing receiving environments through effective management of contaminants and hydrology.

We consider the following characteristics are indicative of good environmental management of stormwater networks.

- Meaningful engagement with iwi, hapū, and communities occurs throughout the life cycle of the network, including through the design and ongoing operation.

23 Or any precipitation, such as hail or snow.

- Te Mana o te Wai or similar principles are considered throughout the design and operation of the network and any discharges consider the receiving environment, including the sensitivity of that environment and any potential social, cultural and environmental impacts.
- The level of service intended to be provided is identified and delivered.
- Overland flow paths and watercourses are identified and kept clear of obstructions.
- Quantity of stormwater entering or being discharged from the system is appropriately managed to prevent flooding and meet levels of service. Examples of solutions include water-sensitive urban design and the use of 'green infrastructure', which absorb stormwater and minimise peak flows.
- Quality of stormwater entering or being discharged from the system is appropriately managed. Some of the solutions to stormwater quality issues are the same as quantity issues. Examples include water-sensitive urban design and the use of 'green infrastructure', which filter stormwater through natural processes or filtration devices. This also means preventing contaminant discharges to the network. Examples include stormwater bylaws or education campaigns, street sweeping or litter campaigns, or the use of engineering solutions to reduce the entrainment of contaminants in the discharge, such as catchpits or litter traps.

To be effective in maintaining or improving environmental performance, stormwater networks must be resource efficient, resilient and reliable, and with suitable financial planning to ensure that the necessary improvements can be implemented.

A WSP 2020 stocktake of provisions (objectives, policies, rules and methods) relevant to stormwater in a selection of Resource Management Act planning documents[24] found that while more recent plans and provisions for stormwater management in New Zealand are heading in the right direction to achieving good management practices, there is still a long way to go in achieving an integrated approach to stormwater management.

The report recommended that at the regional plan level, resources should be managed in an integrated way through integrated catchment management so that development and freshwater management are considered alongside each other, and that there be a requirement to adopt a water sensitive urban design approach.

Our role in the improvement of stormwater networks

We have a role in providing oversight and advice on the regulation, management, and environmental performance of urban stormwater networks.

Stormwater networks are defined in the Act as those networks operated by councils, council controlled organisations, government departments and the New Zealand Defence Force | Te Ope Kātua o Aotearoa in 'urban' areas. An urban area means an area identified in a territorial authority's district plan or proposed district plan as being primarily zoned for residential, industrial or commercial activities together with adjoining special-purpose and open-space zones, but not rural or rural-residential activities.

As identified above, there are various owners and operators of stormwater networks. There is a significant interplay between land uses and river systems.

- Under the RMA, territorial authorities and regional councils control land use in various ways. Subdivision and development processes have a particularly substantial impact on stormwater services.
- Regional councils are generally responsible for waterbodies and discharge management.
- Regional councils may operate flood schemes as part of their flood protection responsibilities.
- While territorial authorities operate the most substantive urban stormwater networks, integral parts of those networks can be owned and operated by other network providers or private individuals.
- Building consent authorities – usually territorial authorities – also administer requirements in relation to stormwater performance and natural hazard management.

24 Storm-water-policy-and-plan-provisions.pdf (environment.govt.nz)

- Road controlling authorities (Waka Kotahi | NZ Transport Agency and territorial authorities) are responsible for the roading network, which plays a significant role in draining stormwater in urban areas and is often co-designed with the underlying stormwater network.

We also have the power to make environmental performance targets and standards that apply to stormwater networks and their operators to support improved environmental outcomes. Targets can set performance expectations that network operators should aim to meet in the future, while standards will set minimum requirements that must be met. Once an environmental performance standard is made, a regional council cannot grant a resource consent contrary to the standard.

We invited network operators to provide information on stormwater measures on a voluntary basis using measures based on those previously used by Water New Zealand for their NPR. We commend the 11 councils who provided this information. Given the small sample of information collected, we have not included any analysis in this report.

We have begun to turn our mind to developing network environmental performance measures for stormwater. These will be introduced in the future.

Stormwater network management challenges

The following key reports give us an overview of the challenges of managing stormwater environmental performance:

- Our freshwater: A 2023 report by the Ministry for the Environment and Statistics New Zealand
- The vital importance of urban green spaces: A 2023 report on urbanisation by the Parliamentary Commissioner for the Environment.
- Managing stormwater systems to reduce the risk of flooding 2018 by the Office of the Controller and Auditor-General.
- The 2023 Auckland Anniversary weekend storm: An initial assessment and implications for the infrastructure system by the New Zealand Infrastructure Commission Te Waihanga.

The findings of these reports are summarised below.

Ministry for the Environment and Statistics New Zealand Our Freshwater report

The report focuses on freshwater but points to the impacts from stormwater where it is a source of freshwater contaminants, such as pathogens from pastoral animal faeces, overflows from wastewater systems to stormwater systems, and heavy metal contaminants from vehicles and industrial yards.

It also discusses the role of repo (wetlands) as being sites of cultural significance and providing environmental benefits, such as storing carbon, regulating water flow during storms, and purifying water through filtering out nutrients and sediments. The extent and condition of repo habitats and ecosystems, impacts these important processes.

The report states that flooding from stormwater can damage housing and transport, energy, stormwater, and wastewater systems, and in 2013 about 675,000 New Zealanders were estimated to live in areas prone to flooding from rainfall and overflowing rivers.

Parliamentary Commissioner for the Environment on the vital importance of urban green spaces

The report outlines the important trade-offs between increasing housing supply through denser, infill housing within the pre-existing boundaries of cities with the amount of urban green space that will remain.

The analysis found that 75% of the residential titles created in Greater Wellington since 2016 are within the pre-existing urban footprint. The equivalent figures in Auckland and Hamilton are approximately 70% and 60% respectively. Most of this development involved small scale two or three lot subdivisions of pre-existing residential sections. This has obvious implications for the amount of green space in our cities.

The report identifies three particular concerns with declining urban green space. Of relevance to this report is the importance of the environmental services that green spaces provide, including temperature regulation, air filtration, carbon

sequestration, habitat provision and stormwater management. Recent flooding events in Nelson and Auckland are provided as examples of the perils of creating large, hardened and impermeable surfaces that cannot cope with higher rainfall volumes as a result of climate change.

The report notes that green spaces act like giant sponges, slowing the flow of rainwater and trapping and filtering pollutants. Evaporation from plant surfaces means that some rainwater never reaches the ground. Urban development can sever the dynamic connection between surface and groundwater, reducing the proportion of rainfall that replenishes underlying water tables and groundwater, resulting in some urban streams, rivers and aquifers, flowing more slowly and at lower levels.

The discussion in the report concludes there is likely to be less green space at precisely the time the services it provides are needed most. Eight recommendations are given to support the provision of green space.

Auditor-General on council management of stormwater

The Controller and Auditor-General (Auditor-General) is an officer of the New Zealand Parliament. They are responsible for auditing public bodies, ensuring public money is being spent properly, and that local communities are being served as planned. In 2018 the Auditor-General audited three councils to understand how they managed their stormwater systems to protect people and their property from the effects of flooding. The review findings are below.

- The audited councils had an incomplete understanding of the flood risk in their districts. Much of their assessment of flood risk was based on information collected after a flood. This reactive approach risks councils focusing on reducing the effects of the most recent flood, rather than considering all possible flooding events and their effects. It also means that they cannot forecast accurately and risk being poorly prepared for unanticipated events.
- The audited councils had gaps in their understanding of the current state of their stormwater systems. These gaps limit their ability to make well-informed and deliberate decisions about how to manage those systems. This means that these councils are unlikely to have had informed conversations with their

communities about the potential risk of flooding and the costs of reducing that risk.
- Councils are planning to continue spending less than depreciation on the renewal of stormwater assets, which might indicate that they are under-investing in the maintenance of those assets. If nothing changes, this will increase the risk of stormwater systems being unable to cope with rainfall that results in flooding.
- All councils faced challenges around ageing infrastructure, limited capacity, managing costs to the community and having the right people and skills in their organisations.

The Auditor-General recommended that councils work to what is outlined below.

- Understand the current and likely future flood risks in their district or city sufficiently to take a proactive approach to reducing the risks and effects of flooding.
- Provide elected members with the necessary information and options, including about local flood risks and their stormwater systems, to make well-informed and deliberate decisions about investment in their systems.
- Improve the information they make available to their communities. This includes the potential risk of flooding, and what the council is doing to manage that risk, including how it is managing the stormwater system and at what cost, and what the remaining risk is to the community.
- Improve their understanding of their stormwater systems, which will entail ensuring the adequacy of their stormwater asset data, including condition assessments and information on the performance and capacity of their systems.
- Identify and use opportunities to work together with relevant organisations to manage their stormwater systems more effectively. This includes improving their capability in asset management or in responding to climate change.
- Ensure they effectively monitor and manage contractor performance where stormwater network maintenance is outsourced.

New Zealand Infrastructure Commission Te Waihanga on the Auckland anniversary weekend floods as they relate to stormwater management

In late January 2023, a storm of unprecedented intensity and scale occurred over the Auckland anniversary weekend. Flooding was widespread, inundating homes, causing major slips, and closing motorways. Four people tragically lost their lives and thousands of homes were damaged by flooding and landslides.

Initial findings on the role of stormwater management in the floods are reported in The 2023 Auckland Anniversary weekend storm: an initial assessment and implications for the infrastructure system (New Zealand Infrastructure Commission Te Waihanga). Some findings are below.

- The resilience of various infrastructure is interconnected, and failure in one sector can cascade into failures in other sectors e.g. potable water supplies were impacted by power outages.
- Responsibilities for stormwater are fragmented and design standards vary.
- Alignment of stormwater management and land use planning is important, with implications for institutional design.
- More fundamental discussion is needed about the level of risk that people are willing and able to tolerate, and the costs that should be incurred to manage risk. Infrastructure will never be able to eliminate the risk of stormwater flooding.

PART FIVE:
Improving network management

In this part, we focus on best practice and guidelines that already exist within the water industry. We give general advice and guidance on assessing the condition of network assets, managing ageing infrastructure and water loss in drinking water networks.

Best practice

What is best practice?

The Act requires us to report on best practices for networks. This may be in response to specific risks or concerns that we observe in individual networks, or system wide network performance and practices. We will develop best practices over time as we fulfil our monitoring and reporting role and develop this annual report series.[25]

Best practice is generally considered to be practices or methods that may be officially accepted or prescribed as being the best to use, or widely accepted as the most effective or correct to use in a particular industry. For this report we have chosen to highlight various existing water industry, local and central government network and environmental best practices, to establish a baseline from which to build in the future.

For this report, inclusion of best practice simply highlights what the water industry, and some local and central government agencies, generally consider to be best practice at the time of publication. We acknowledge that some detail within these documents may be due for review. While all the Water New Zealand best practice documents are free to download for members, some may require purchase by non-members.

Existing industry best practice and guidelines

- Good Practice Guide for Addressing Wet Weather Wastewater Network Overflow Performance, 2022, Water New Zealand
- Water Loss Guidelines, 2023, Water New Zealand
- Navigating to Net Zero: Aotearoa's water sector low-carbon journey, 2021, Water New Zealand
- Te Mana o te Wai in the water services sector, 2021, Water New Zealand
- Carbon Accounting Guidelines for Wastewater Treatment: CH_4 and N_20 2021, Water New Zealand
- Pressure Sewer National Guidelines, 2020, Water New Zealand
- Guideline for Assessing Technical Resilience of Three Waters Networks, 2020, Water New Zealand
- New Zealand Gravity Pipe Inspection Manual, 2019, Water New Zealand
- Guidelines for Water Metering and Volumetric Charging on Domestic Dwellings, 2019, Water New Zealand
- Wastewater Renewals Framework – Gravity Pipelines, 2019, Water New Zealand
- Guidelines for Beneficial Use of Organic Materials on Land, 2017, Water New Zealand
- Good Practice Guide for Waste Stabilisation Ponds: Design and Operation, 2017, Water New Zealand

25 We have already developed guidance relating to drinking water safety, including guidance for preparing a drinking water safety plan, however that guidance falls outside the scope of this report.

Best practice materials produced by local government

- Regional best practice guide for the management of wastewater overflows, 2019, Tauranga City Council
- Best Practice Guide: Wastewater Over Pumping, 2016, Christchurch City Council

Other regulatory best practice

- Best Practice Guidelines for Compliance, Monitoring and Enforcement under the RMA 2018, Ministry for the Environment | Manatū mō te Taiao

General advice and guidance

As a result of our observations on the collection of data for this 2022/23 report, we provide the following general advice and guidance.

Assessing the condition of network assets

Assessing the condition or quality of various parts of a drinking water, wastewater or stormwater network is critical to inform proactive plans for network maintenance, repair and replacement. Without condition assessments network management is reactive rather than proactive. Reactive management is generally accepted as being less efficient and planning needs to occur before issues arise.

Standard methods should be applied when performing condition assessments and grading assets. A standardised framework allows for comparison of the performance of assets across the sector, which is crucial to the advancement of best practice in the water industry. To support data collection for this report a number of industry documents have been referenced in the guidance document that we provided to support data collection.

Non-invasive tests are a common method used for condition assessments. For above ground assets a visual inspection is performed, while underground assets use ultrasound, ground penetrating radar, air valve monitoring, closed circuit television and acoustic testing to determine condition.

Invasive testing is required when more information or greater confidence is required regarding an asset condition. Invasive tests can range from the installation of monitoring equipment to the removal of a portion or all the asset for off-site investigations.

Best practice is to perform a full condition assessment of all assets every three years, creating a trend for the asset's condition over time. We expect network operators to think about their whole system when completing a condition assessment. An assessment should cover the whole network using a standard assessment method and network operators should use their condition assessment information to inform their future investment strategy.

Maintaining ageing infrastructure

Across Aotearoa New Zealand, ageing infrastructure is a significant problem. Many networks are under stress, dealing with issues such as population growth, urbanisation and climate change. Coupled with systemic underinvestment in the sector, ageing infrastructure is causing budgetary pressure, loss of revenue (where volumetric charging is used), and potentially increased health risks to communities.

Repairing and replacing ageing infrastructure has become a high priority in the water industry. Although there are no simple solutions to this issue, there are many steps that can be taken to mitigate the problem. These include:

- a preventative, proactive approach to managing assets
- a holistic view when evaluating a network
- making informed decisions with accurate data, such as asset conditions, life cycle analysis, population growth models, and network models
- financial planning for capital projects, such as asset management plans and long-term plans.

Managing water loss in drinking water networks

Managing water loss (or leakage) from drinking water networks has increased in priority as various factors like ageing infrastructure, population growth and increased environmental events due to climate change all place increased demands on source water. Water loss is a systemic issue worldwide.

We expect network operators to set water loss targets and monitor their performance. This can help give effect to Te Mana o Te Wai, particularly where these targets are developed with tangata whenua and other affected communities.

Best practice requires a drinking water network operator to adopt a proactive and effective long term strategy that is both appropriate for the size and nature of the network, is funded and addresses:

- pressure management
- active leak control
- speed and quality of repairs
- future investment in infrastructure.

Best practice also requires a drinking water network operator to have reliable information about their network so they can:

- prioritise future investment and preventive maintenance based on a reliable inventory of all assets including a condition report and the identification of critical assets
- undertake a robust water balancing analysis
- monitor the network's performance, including leakages.

A solely reactive approach to managing water loss is not best practice.

PART SIX:
Key findings and recommendations

In this part, we summarise several key findings identified throughout this report. Our findings should be considered in the context of the data completeness and quality challenges that have been identified. We also share key recommendations for the sector.

This report relies largely on infrastructure information many network operators are familiar with reporting for Water New Zealand's National Performance Review. This information forms the basic building blocks of understanding networks.

Over time we will build on this information to provide a clearer picture of the environmental performance of networks and their operators. We are phasing requirements to report on this information as we recognise the sector is not currently able to consistently provide this information, largely due to capacity and capability constraints.

Our key findings have been grouped into those that tell us something directly about the environmental impact and those that are more related to basic asset information that helps us understand how networks are managed.

Key findings relating to the environmental impact of the networks

- The 69 network operators covered in this report operate a total of 458 drinking water networks with over 1,200 resource consents. The large number of resource consents provides an indication of the complexity and time involved in understanding consent compliance for regional councils, network operators and Taumata Arowai. Future versions of this report will include an indication of network operators' compliance with consents. Our approach to understanding consent compliance will be phased due to the complexity and amount of data needed.
- Reported water loss was high. However, only just over half of network operators provided data and their average confidence in the data was 'less reliable'. The low confidence levels indicate that network operators do not understand the full extent of water loss within their networks. Water can become contaminated from breaks or leaks in pipes if pressure is lost, so it is important that network operators understand where their networks are leaking and to minimise these leaks.
- Initial data to show how networks and operators are giving effect to Te Mana o te Wai, including information about the volume of water taken, used and lost, indicates that network operators frequently take and treat more water than consumers need. While more data will become available as further measures are introduced in coming years, early information indicates network operators have more work to do around how to embed the principle of putting the health of water at the heart of decision-making.
- There is a lack of information and low confidence in the data regarding the condition of drinking water infrastructure. Of the network operators that provided data about pipe conditions, on average 59% of their pipes have been assessed and 13% of those pipes are in a poor or very poor condition. This indicates that the condition of pipes across the country is not well known and it will be difficult for network operators to prioritise maintenance and renewals to where they are needed most.

- Most network operators have undertaken an assessment of their critical assets. We have not collected any data on how these assessments were undertaken, or how councils identified which assets were 'critical', we plan to build on this information in future reports.

The data quality issues identified in this report indicate that network operators do not hold good information about their networks which is likely to impact their ability to manage those networks and may increase costs because operators are more likely to be undertaking reactive maintenance rather than planning strategically.

Data completeness and quality challenges

We acknowledge the challenges within the sector and the significant capacity constraints that network operators face in providing good data. The data completeness and quality issues identified in this report have limited our ability to make recommendations based on specific aspects of network operation and maintenance.

- The response rate for the district level measures (92%) was higher than the network level measures (65%), indicating that operators across the country have less information at the network level than they do broadly across the district.
- A lot of network operators did not provide an indication of the confidence they had in the data they provided. The confidence response rate for the water restrictions and firefighting water measures was particularly low.
- Water abstracted, water pressure, water use and asset condition all had particularly low confidence levels and low response rates, with fewer operators providing information for these measures.

Recommendations

We have identified the following key recommendations for the sector.

We recommend network operators prioritise resourcing the collection of necessary information to help them understand the performance of their networks and identify potential risks to human health and the environment. Gaining a better understanding of the condition of assets and any inefficiencies and incorporating this understanding into strategic planning may enable cost savings. Good asset information is also essential for informing effective and robust asset management processes and moving from reactive to proactive maintenance.

We also recommend network operators prioritise identifying and managing water loss across their networks. While the data we collected is affected by the quality issues identified, water loss issues are well documented and have been for some time. We consider management of water loss critical to supplying safe drinking water and minimising environmental impacts.

We (Taumata Arowai) recognise that we have a role to play in supporting the sector.

By reviewing our data collecting and reporting processes, we can support network operators to provide more complete and accurate data. We have developed an approach to undertake more rigorous data validation and correction processes for the next report. We will continue to refine our approach taking into account feedback from network operators.

GLOSSARY

Technical terms

Term	Definition
Act, the Act	The Water Services Act 2021
Backwash	Water from the filtration and contaminant removal processes at a drinking water treatment plant.
Current Annual Real Losses (CARL)	The total amount of water lost through all types of network leaks, bursts and overflows, up to the point of measurement, estimation, or consumer consumption.
Department level	Applies to reporting by central government departments or the New Zealand Defence Force | Te Ope Kātua o Aotearoa. Some measures are to be reported at a 'department level', which means data should be aggregated and reported for all water services operated by the department.
District level	Applies to reporting by councils or council-controlled organisations. Some measures are to be reported at a district level, which means data should be aggregated and reported for all water services operated by the local council and council-controlled organisation or regional council.
Drinking water network	For guidance purposes in this report, means a drinking water supply (operated by, for, or on behalf of a drinking water network operator) with elements comprising a system used to abstract, store, treat, transmit or transport drinking water for supply. Defined in section 140 of the Act.
Greywater	Liquid waste from domestic sources, including sinks, basins, baths, showers and similar fixtures, but does not include sewage, or industrial and trade waste.
Infrastructure Leakage Index (ILI)	ILI is the ratio of Current Annual Real Losses (CARL) to Unavoidable Annual Real Losses (UARL)
Level of service	Service parameters or requirements for a particular activity or service area (e.g. provision of drinking water, wastewater or stormwater network services) against which performance may be measured. Such service levels can relate to dimensions of, for example, quality, quantity, reliability, responsiveness, environmental acceptability, and cost.
Municipal	Belonging to a town or city, or its governing body.
Network	The infrastructure and processes associated with drinking water networks, stormwater networks or wastewater networks, as defined in the Act.
Network environmental performance measure (measure)	For guidance purposes here, this means indicators used to monitor certain key aspects of the environmental performance of networks that we are interested in. Provided for in section 145 of the Act. A list of the current measures, data points and detailed definitions can be found on our website.
Network level	Some measures are to be reported at an individual network level, which means that data should be collated and reported for all connections relating to each network.
Network operator	Defined in relation to stormwater networks, wastewater networks, and drinking water networks in sections 5 and 140 of the Act. Also see Part One: Introduction. For guidance purposes here, this means an organisation that operates a network, being a council, council controlled organisation, government department or the New Zealand Defence Force | Te Ope Kātua o Aotearoa.
National Performance Review (NPR)	An annual report published by Water New Zealand from 2008 to 2022, on the performance of council drinking water, wastewater and stormwater services.
Overflow	Instances where untreated or partially-treated wastewater or stormwater contaminated with wastewater, spills, surcharges, discharges or otherwise escapes from a wastewater network to the external environment.
Regional council	Defined in section 5 of the Local Government Act 2002, including unitary authorities to the extent they exercise regional council responsibilities, duties, and powers. In the context of this report, regional councils are the primary regulators of the environment under the RMA, although in this report three regional councils also reported data as drinking water network operators.
Resilient	Able to withstand or recover quickly from difficult conditions.
RMA	Resource Management Act 1991.

Term	Definition
Sewage	Human excrement and urine.
Stormwater network	For guidance purposes in this report, means an urban stormwater system (operated by, for or on behalf of a stormwater network operator) with elements comprising a system used to collect, store, transmit through reticulation, treat and discharge stormwater. Defined in section 5 of the Act.
Territorial authority	City and district councils, including unitary authorities (whichthat are territorial authorities that have regional council responsibilities, duties, and powers conferred on them). In the context of this report, all territorial authorities are network operators.
Trade or industrial waste	Defined in section 5 of the Act as: Any waste that is: a) produced for an industrial or a trade purpose, or a related purpose; and b) discharged into a wastewater network. Also defined in the National Planning Standards as: industrial and trade waste means liquid waste, with or without matter in suspension, from the receipt, manufacture or processing of materials as part of a commercial industrial or trade process, but excludes sewage or greywater.
Treated wastewater	In the context of this report, means treated wastewater leaving a wastewater treatment plant ready for discharge into the receiving environment. In other documents, the term 'effluent' is sometimes used interchangeably with 'treated wastewater' and effluent may also be used to refer to livestock liquid waste (e.g. dairy effluent). To avoid any confusion, we use the term 'treated wastewater'. Also see 'wastewater'.
Unavoidable Annual Real Loss (UARL)	A simplified equation to estimate the volume of water that is expected to be lost (m^3/year) even in a water supply of good condition with intensive active leakage control. It is based on the length of main, number of service connections, length of service connection pipes and the average operating pressure.
Urban area	For guidance purposes here, means an area identified in a district plan or proposed district plan as being primarily zoned for residential, industrial, or commercial activities, but not including areas zoned primarily for rural or rural-residential activities. Defined in section 5 of the Act.
Water networks	The infrastructure and processes associated with drinking water networks, stormwater networks, and wastewater networks.
Water New Zealand	A water industry body representing water management professionals and organisations.
Wastewater	Any combination of two or more of the following wastes: sewage, greywater or industrial and trade waste.
Wastewater network	Defined in section 5 of the Act. For guidance purposes in this report, means a wastewater system (operated by, for, or on behalf of a wastewater network operator), with elements comprising a system used to collect, store, transmit through reticulation, treat, and discharge wastewater, including: • distribution system (including a piped network and storage) • wastewater treatment plant.

Kupu Māori

Term	Definition
Hapū	Kinship group, tribe
Iwi	Extended kinship group, tribe
Kaitiakitanga	Guardianship and stewardship. The obligation of tangata whenua to preserve, restore, enhance and sustainably use freshwater for the benefit of present and future generations.
Mahinga kai	Means kai (food) is safe to harvest and eat, generally referring to freshwater species. It can also mean customary resources are available for use, customary practices are able to be exercised, and tikanga and preferred methods are able to be practised.
Mana	Prestige, authority, control, power.
Mana whenua	Customary authority exercised by an iwi or hapū in an identified area.
Mauri	Life force
Tangata	People, persons, human beings.
Tangata whenua	People of the land. In relation to a particular area, means the iwi, or hapū, that holds mana whenua over that area.
Taiao	Natural world, environment.
Te Mana o Te Wai	At its core, Te Mana o te Wai is about restoring and preserving the balance and wellbeing between the wellbeing of water, the environment, and our communities. Also see Part One: Introduction.
Te Puna	The Māori advisory group for Taumata Arowai, established by section 14 of the Taumata Arowai–the Water Services Regulator Act 2020.
Tikanga	The customary system of values and practices that have developed over time and are deeply embedded in the social context.
Wai	Water
Whakatauākı	Proverbs or significant sayings that give some insight into a traditional Māori world.

APPENDICES

APPENDIX 1: Environmental Performance

Drinking water

Drinking water environmental performance

Drinking water in Aotearoa New Zealand is sourced from various sources including freshwater bodies: rivers, lakes, aquifers, and springs. When water is taken out of a freshwater body it decreases the volume available to sustain the aquatic ecosystem and its associated recreational, cultural, amenity and mahinga kai values.

Taking too much source water may impact other water users and the impacts of over abstraction are likely to be worsened by climate change. Demand to take and use available water is very high in some freshwater bodies.

Minimising water losses in the system and ensuring customer usage is efficient can help to reduce the volume of water taken and therefore the impacts on the health and wellbeing of the water body. This is in line with the hierarchy of obligations within Te Mana o te Wai that prioritise the health of the water over the requirements or needs of people.

Instream infrastructure, such as intakes, or dams that store water or increase water depth to enable take, can change natural flow regimes or inhibit fish passage. This can have negative effects on the instream environment.

At water treatment plants, water from the filtration and contaminant removal processes (known as backwash water) requires disposal. This disposal may occur to the environment, including back to the water body. Negative effects may occur if this disposal is not managed appropriately.

Drinking water network environmental performance measures

Under the Act we may develop, publish and maintain network environmental performance measures following consultation.

These measures enable us to develop a picture of the environmental performance of networks. For each measure we have identified data that will help us build this picture, for example we understand water loss by collecting data on the current annual real loss (CARL), unavoidable annual real loss (UARL) and the Infrastructure Leakage Index (ILI).

In early 2022, we consulted on proposed drinking water measures and associated data points. We refined these measures following feedback from consultation and published them in June 2022.

Network operators were required to collect and provide the relevant information associated with each measure from 1 July 2022 for the year ending 30 June 2023, and provide this information to us by 30 September 2023. Several network operators requested an extension on this timeframe, which we granted. The information provided by network operators is included in this report.

Further measures and data points adopted for 2023/24 are being recorded from 1 July 2023 – 30 June 2024 and will be included in the next report.

The measures that were included in this report are shown in the table on the following page with a ✓, new measures that were added for 2023/24 are indicated with a ⊕. For each measure network operators must collect and report one or more data points.

Proposed wastewater network environmental performance measures

Outcome	Measure	2022/23	2023/24
General network identification and information		✓	✓
Environmental and public health is protected	Drinking water network connections	✓	✓
	Volume of water abstracted	✓	✓
	Resource consent information	✓	⊕
	Drinking water treatment by-products		⊕
	Fish passage and screening		⊕
Services are reliable	Fault attendance and resolution	✓	✓
	System interruptions	✓	⊕
	Asset condition	✓	✓
	Water pressure	✓	⊕
	Sufficient firefighting water	✓	✓
Resources are used efficiently	Network losses	✓	✓
	Water use	✓	⊕
	Energy efficiency	✓	✓
	Alternative water use		⊕
Services are resilient	Water restrictions	✓	✓
	Critical assets	✓	✓
	Emergency response planning and preparedness		⊕
	Water security		⊕
Services are economically sustainable	Current expenditure		⊕
	Forecast expenditure		⊕
	Revenue		⊕

Wastewater

Wastewater environmental performance

Wastewater contains human sewage and other contaminants and needs treatment before it can be safely discharged to the environment. Untreated wastewater may also escape from the piped networks in various ways, including due to blockages, equipment failure or because high rainfall volumes overwhelm the network, all of which can have a significant impact and typically do not align with Te Mana o te Wai.

During heavy rainfall, very high flows of wastewater that is often diluted may enter the wastewater treatment plant. These flows can harm the biological treatment systems of the plant. When biosystems are harmed, the plant may be unable to treat wastewater to expected standards for a prolonged period while they re-establish. To avoid an extended period of poor quality wastewater discharge from the plant, some network operators may choose to bypass the plant and discharge untreated or partially treated wastewater to the environment for a short time.

Untreated wastewater discharges to the environment have a range of negative effects. However, when it enters freshwater, it has a particularly negative effect on the health, wellbeing and mauri of the water body, and the plant and animal life that lives within it. Wastewater also poses a risk to human health, with untreated wastewater discharges usually resulting in advice not to swim or collect kai moana.

Wastewater treatment plants are designed to reduce the risk of harm to people and the environment before discharge onto land, or into freshwater or the coast via outfalls.

It is important to consider what waste is being disposed of into the wastewater network. A large proportion of most wastewater comprises ‘domestic waste’, being sewage and greywater. This includes waste from the bathroom, kitchen and laundry. Domestic waste is generally predictable in both quantity and quality. Wastewater networks can also convey industrial or trade waste. Some of that waste can present a greater challenge for transport and treatment due to the quantity or quality. Many councils have trade waste bylaws that set rules and requirements for such discharges.

Gas emissions from wastewater treatment processes include the greenhouse gases nitrous oxide and methane, which contribute to climate change. Management of these emissions is an emerging issue.

Wastewater treatment produces residual, semi-solid material known as sludge, which requires re-use or safe disposal, such as to landfill. Sludge produces biogas that may be used for heat and power generation and with appropriate treatment, it can become ‘biosolids’. Biosolids may be beneficially reused on agricultural land or forestry land as a soil conditioner and fertiliser. For oxidation ponds, which are a common component of wastewater treatment plants in Aotearoa New Zealand, regular desludging is important to manage odour risk and optimise treatment performance.

Unpleasant odours can be emitted from wastewater networks, most commonly at treatment plants, but also from manholes and pump stations. There are a number of options for minimising unpleasant odours to manage the impact on people who live and work near wastewater treatment plants.

Wastewater network environmental performance measures

We will require network operators to start recording data for the first phase of these measures and associated data points from 1 July 2024 for inclusion in the 2024/25 Report. These measures are intended to evolve in time.

As these wastewater measures had not been adopted for the period this report relates to, there was no compulsory requirement for network operators to provide the data for this report. Table 21 summarises the first phase of wastewater network environmental measures that will be adopted this year.

Table 21: Proposed wastewater network environmental performance measures.

Outcome	Measure	Phase 1
General network identification and information		+
Environmental and public health is protected	Wastewater network connections	+
	Resource consent compliance	+
	Wastewater overflows	+
	Inflow and infiltration	+
	Trade waste	+
Resources are used efficiently	Energy efficiency	+
	Process emissions	+
	Sludge	+
Services are reliable	Fault attendance and resolution	+
	System interruptions	+
	Asset condition	+
Services are resilient	Critical assets	+

Stormwater

Stormwater network environmental performance

Stormwater networks are designed to convey rainfall runoff safely from our built environments into land, freshwater or the coast. As with wastewater, stormwater can contain contaminants, but stormwater is not typically treated before disposal so there can be quality issues. Stormwater networks unable to convey peak flows may result in flooding. If not well managed, they can affect the health and wellbeing of water bodies by introducing contaminants or through scouring and erosion of the bed and banks.

The use of green solutions and water sensitive urban design to manage stormwater is increasing in popularity. Increasing green space and the number of plants and trees within an urban space means more stormwater infiltrates into the ground or is taken up by plants, reducing the volume of stormwater. Plants can also be used to treat the stormwater by filtering out contaminants before discharge into freshwater bodies. Green space may also be used to attenuate stormwater during heavy rainfall events to prevent flooding of the surrounding area.

An environmental effect common to drinking water, wastewater and stormwater networks is the contribution to climate change and air pollution through greenhouse gas emissions associated with energy use and generation. These occur through use of purchased electricity, onsite fuel use, vehicle use, use of ancillary goods and services and construction.

Stormwater network environmental performance measures

We have not yet developed stormwater network environmental performance measures.

We are currently considering the measures programme and the next phase of measures to be introduced with consideration for the capacity and capability of the sector.

We will also be considering how Te Mana o te Wai informed measures can be developed to support broader stormwater management and outcomes.

While filling the gap in national information on stormwater networks will be important, we also want to be sure that we are introducing these requirements at the appropriate time.

APPENDIX 2:
Network Operators

This Appendix identifies all network operators required to keep and maintain records relating to national environmental performance measures, and to provide those records to us.

Network operators required to report against the 2022/23 network environmental performance measures	
Territorial authorities	
Ashburton District Council	Ōtorohanga District Council
Auckland Council	Palmerston North City Council
Buller District Council	Porirua City Council *
Carterton District Council	Queenstown-Lakes District Council
Central Hawkes Bay District Council	Rangitikei District Council
Central Otago District Council	Rotorua Lakes Council
Chatham Islands Council	Ruapehu District Council
Christchurch City Council	Selwyn District Council
Clutha District Council	South Taranaki District Council
Dunedin City Council	South Waikato District Council
Far North District Council	South Wairarapa District Council *
Gisborne District Council	Southland District Council
Gore District Council	Stratford District Council
Grey District Council	Tararua District Council
Hamilton City Council	Tasman District Council
Hastings District Council	Taupō District Council
Hauraki District Council	Tauranga City Council
Horowhenua District Council	Thames-Coromandel District Council
Hurunui District Council	Timaru District Council
Hutt City Council *	Upper Hutt City Council *
Invercargill City Council	Waikato District Council
Kaikōura District Council	Waimakariri District Council
Kaipara District Council	Waimate District Council
Kāpiti Coast District Council	Waipa District Council
Kawerau District Council	Wairoa District Council
Mackenzie District Council	Waitaki District Council
Marlborough District Council	Waitomo District Council
Matamata-Piako District Council	Wellington City Council *

Network operators required to report against the 2022/23 network environmental performance measures	
Territorial authorities	
Manawatu District Council	Western Bay of Plenty District Council
Masterton District Council	Westland District Council
Napier City Council	Whakatane District Council
Nelson City Council	Whanganui District Council
New Plymouth District Council	Whangarei District Council
Ōpōtiki District Council	
Regional councils / Unitary Authorities	
Auckland Council	Greater Wellington Regional Council *
Taranaki Regional Council	
Government departments and NZ Defence Force	
Department of Conservation | Te Papa Atawhai	*Ministry of Education | Te Tāhuhu o te Mātauranga*
Ministry of Corrections Ara | Poutama Aotearoa	The New Zealand Defence Force | Te Ope Kātua o Aotearoa

*Wellington Water is the network operator on behalf of these councils

Network operators imformation missing from this report

Masterton District Council

We received data from Masterton District Council after the cut-off date and we were therefore not able to include this data in our analysis. This data will be entered into our database so it can be used in future years for trend analysis.

Ministry of Education | Te Tāhuhu o te Mātauranga

The Ministry of Education | Te Tāhuhu o te Mātauranga (the Ministry) did not report on the network environmental performance of the 123 schools that fall under the scope of this report's requirements. The profile of these schools is summarised as follows:

Profile of schools that are self-supplied	
Maximum population served per school	804
Minimum population served per school	56
Average population serviced per school	211
Medium population served per school	167
Total schools self-supplied drinking water	440
Total schools currently registered in Hinekōrako	411
Estimated number of schools that are 'network operators'	123

The Ministry currently records 440 schools as supplying their own drinking water, of which 411 are registered on our drinking water register in Hinekōrako. 29 schools are currently unregistered and are not required to be registered until 2025. Of these 411 schools 123 meet the criteria as 'network operators' and therefore should have reported on the Network Environmental Performance Measures.

The Ministry did not provide us any data for the purpose of the Network Environmental Performance Measures using the required reporting template or data. The Ministry provided some limited information in a narrative format, which the following table summarises:

Performance measure	Data points	Data
Drinking water network information	Kilometres of pipe	No data on pipe network extents, material, sizes, or age.
Volume of water abstracted (m^3/year)	Water supplied to the drinking water network	No data available
	Water imported from other operators to the network	No data available
Resource consent compliance	Number of resources consents, by type and expiry date, that are held	Data is limited to whether a school is aware they have a consent
Fault attendance and resolution		No data available
System interruptions		No data available
Asset condition		No data available
Water pressure		There is no data available on average system pressure and no reference level of pressure has been set
Drinking water network water losses		No data available
Water use		There is no water saving education programme within the property division of the Ministry.
Critical assets	Have you undertaken an assessment to identify critical assets?	The Ministry has developed a critical asset framework that includes water services assets based on the impact of failure on school operation and the importance of proactive maintenance to performance. Systems and processes are not yet in place to enable collection of asset data and identification of these assets.

From the next reporting period (year ending 30 June 2024) the Ministry has advised it will continue its work to confirm the sources of school drinking water networks and user numbers. Work will also continue on responsibility for all school drinking water networks that do not receive reticulated water from a municipal water operator.

The Ministry is also working on developing an asset hierarchy and asset data system to enable data on water services assets (including drinking water assets) to be captured and maintained. If implemented, then some data for some of the Ministry's drinking water networks may be viable at the end of the next reporting period (30 June 2024) but no significant change of available data levels is expected.

APPENDIX 3:
Drinking water networks data summary

This section provides a summary of the responses received for each measure.

The drinking water network environmental performance measures and associated guidance material was provided to network operators for this report. This material:

- sets the 2022/23 environmental performance measures for drinking water networks and the associated definitions for each measure
- outlines the associated information that drinking water network operators must record and provide.

We acknowledge that there may be Māori data implications in the data we have included here and we will continue to work with network operators, iwi and hapū where specific issues or matters arise.

All raw data is available to view at taumataarowai.govt.nz/water-services-insights-and-performance/.

Note in the summary below we have presented the data as provided to us, this means we have not excluded any outliers.

General asset information

Measures	Minimum	Median	Maximum	Commentary
District level measures				
Number of drinking water networks (A1)	1	7	26	The number of networks is determined by a range of local considerations that results in a diversity of network design approaches.
Number of treatment plants (A2)	0	8	58	
Number of reservoirs (A3)	0	39	299	
Number of pump stations (A4)	0	13	88	
Length of pipe (km) (A5)	0.7	11,266	603,224	Thirteen13 network operators reported they had over 1,000km of pipe whichthat is outside of the expected range.
Network level measures				
Number of drinking water abstraction points (A6)	0	6	15	Four network operators stated they had zero abstraction points.
Drinking water network source types (A7)	Water may be sourced from a variety of places, such as surface-supplies (rivers, lakes etc) or below-ground (aquifers), and some networks are fed by multiple sources. Three network operators did not provide any data as to their water source(s).			

Environmental and public health is protected

Measures	Minimum	Median	Maximum	Commentary
District level data				
Water imported from other suppliers (m^3/year) (EH6)	14	147,501	8,010,149	Only 11 network operators reported that they imported water from other suppliers. It is not clear if the other 58 operators did not import any water or did not provide data.
Water exported to other suppliers (m^3/year) (EH7)	30	160,867	8,200,031	Only 10 network operators reported that they exported water to other networks. It is not clear if the other 59 operators did not import water or did not provide data.
Number of resource consents that are held by each network operator (EH9)	0	18	87	Three network operators reported that they had no resource consents.
Network level measures				
Number of residential connections in network (EH1)	0	20,521	433,170	11 network operators reported zero residential connections in their network.
Number of non-residential connections in network (EH2)	0	2,232	33,995	10 network operators reported zero non-residential connections in their network.
Total population served by the network (EH3)	0	58,622	1,399,673	Five network operators reported a zero population served by their network - it was not clear if this was the case, or no data was provided.
Water supplied to the drinking water network (m^3/year) (EH5)	14,919	8,607,895	150,564,344	The highest volume of water abstracted was for Watercare Auckland, which represents 25% of the total water abstracted. Six network operators did not provide data.
Non-residential water use (m^3/year) (EH8)	1	1,760,745	30,994,316	18 network operators reported zero - it was not clear if this was the case, or no data was provided.
Types of resource consent (EH10)	Statistical analysis of the various types of resource consents is not applicable for a table such as this, but it is intended to provide an appropriate breakdown in future years.			
Resources consent reference numbers (EH11)	While reference numbers are useful to identify individual consents, they are not applicable for statistical analysis in a table such as this.			
Expiry dates for resource consents (EH12)	Data was not provided to us in the requested format, so could not be analysed at this time. However, we will endeavour to undertake further analysis to assess such issues as the number of resource consents that either have expired or are due to expire in the near future.			

Services are reliable

Measures	Minimum	Median	Maximum	Commentary
District level data				
Median hours to attend an urgent fault (R1)	0	5	206	Three responses were zero – it was not clear if this was the response rate, or there were no urgent faults to respond to, or no data was provided.
Median hours to attend a non-urgent fault (R2)	0	32	552	Three responses were zero – it was not clear if there were no non-urgent faults to respond to, or no data was provided.
Median hours to resolve an urgent fault (R3)	0.3	11	168	Three network operators did not provide data.

Measures	Minimum	Median	Maximum	Commentary
Median hours to resolve a non-urgent fault (R4)	0.6	69	1,227	Three network operators did not provide data.
Number of planned interruptions (R5)	0	65	1,249	13 responses were zero – it was not clear if there were no planned interruptions, or no data was provided.
Number of third party incidents [15] (R6)	0	18	221	19 responses were zero – it was not clear if there were no incident, or no data was provided.
% of pipeline that have received a condition grading (R7)	0	59	100	22 network operators reported 100%. 17 responses were zero – it was not clear if pipes had not received a condition grading, or no data was provided. Note average was used in place of median because 17 out 69 network operators recorded 0% of their pipes as being assessed and therefore the median provided an inaccurate picture of the amount assessed.
% of pipelines in poor or very poor condition (R8)	0	13	52	16 responses were 0%. Two network operators reported 50% or more of their pipeline was in poor or very poor condition. Note average was used in place of median because 16 of 69 network operators recorded 0% of their pipes as being in poor or very poor condition and therefore the median provided an inaccurate picture of the amount assessed. It is considered unlikely that these networks actually had none of their pipes in poor or very poor condition.
Average age of water pipelines (years) (R9)	5	32*	100	Network operators were asked to provide the weighted-average age of all water pipes using a calculation set out in the Network Environmental Performance Measures and Guide document. A weighted average has therefore been used rather than median to indicate the average response to this measure. Nine network operators had pipes with an average age of over 50 years. Four network operators did not provide data.
% of above ground assets that have received a condition grading (R10)	0	72	100	15 network operators reported 100%. One response was 0%, and 24 operators did not provide data.
% of above ground assets in poor or very poor condition (R11)	0	13	95	One response was 0%, and 29 operations did not provide data. Two network operators reported that 50% or more of their above-ground assets were in poor or very poor condition.
Has a reference level for water pressure been set? (R13)	55 operators have set a reference level for water pressure, and 13 have not. It should be noted here that there are no requirements to set a reference level, but it may be useful to do so in some instances. One operator did not provide data.			
Total number of days that water restrictions were in place across the district or department area (R14)	0	38	365	Seven network operators had 100 or more days of water restrictions during the reporting year. 41 responses were for zero days of restrictions. Four operators did not provide data.
Number of properties affected by water restrictions (R15)	0	1,749	29,480	42 network operators reported there were no properties affected by water restrictions. One network operator did not provide data.
Have you adopted Fire and Emergency New Zealand Code of Practice (SNZ PAS 4509:2008)? (R16)	40 operators have adopted the FENZ CoP, and 18 operators have not. 11 operators did not provide data.			
% of fire hydrants tested in the previous five years (R17)	0.2	45	100	Nine network operators responded that 100% of their fire hydrants had been tested in previous five years, and 37 operators had not done so. 23 network operators did not provide data.
Network level measures				
Average system pressure (kPa) (R12)	0.2	65	1,100	16 network operators did not provide data.

Resources are used efficiently

Measures	Minimum	Median	Maximum	Commentary
District level measures				
Do you have a water conservation education programme in place? (RE5)	40 operators have a water conservation education programme in place, and 29 operators do not.			
Number of residential connections with water meters (RE6)	0	12,608	433,170	18 network operators responded with zero.
Number of non-residential connections with water meters (RE7)	0	1,724	33,995	Seven network operators responded with zero.
Grid electricity use (kWh) (RE8)	0	4,121,823	44,167,558	One network operator responded with zero and 19 operators did not provide data.
Energy use from other fuels (GJ) (RE9)	0	410	22,277	57 responses were zero – it was not clear if this meant no energy was provided by other fuels, or no data was provided.
Energy generation (GJ) (RE10)	0	1,765	117,040	62 responses were zero – it was not clear if this meant no energy was generated, or no data was provided.
Network level measures				
Estimated total drinking water network water loss (m^3/year) (RE1)	0	1,819,419	21,736,970	10 responses were zero – it was not clear if this meant there were no water losses, or no data was provided.
Current annual real loss (CARL) (RE2-1)	0.1	206	14,259,336	These numbers provide a summary of the raw data provided by network operators. In the text we have presented the raw data and Taumata Arowai calculated CARL.
Infrastructure Leakage Index (CARL/UARL) (RE3)	0.5	5	27	19 network operators did not provide data.
Median residential water consumption (l/day/connection) (RE4)	55	758	2,982	The maximum water consumption figure is considerably higher than is expected, but this may in-part be due to the fact that many network operators were not able to separate 'residential-only' water use from 'mixed-use' where sub-networks may also supply water to commercial, industrial or agricultural consumers. 19 network operators did not provide data.

Services are resilient

District level measures	
Have you undertaken an assessment to identify critical assets? (RL1)	55 network operators have undertaken an assessment to identify critical assets, 11 have not. Three network operators did not provide data.

Future measures

Drinking water treatment by-products

Treatment of drinking water generates waste or 'by-products', as suspended solids and other substances are removed from the raw water. It is difficult to reduce the volume of by-products because they are a direct result of the quality of the source water. However, by-products must be safely disposed of.

From 2023/24 onwards we will be seeking data on the amount of sludge and screenings removed from raw water during treatment, and the volumes of backwash water generated, as well as information on their disposal. These measures will be reported in the 2024 report.

Fish passage and screening

Structures in water bodies associated with drinking water takes, for example, dams, weirs, flap gates or culverts, can stop fish from entering or migrating. Intakes and outfalls can harm fish if they are not properly screened to prevent fish from entering. The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 establishes requirements for new structures and alteration of some existing structures, whether they are installed and used as permitted activities or through a resource consent.

Therefore, we will be seeking data on whether network operators have assessed impediments to fish passage and implemented processes to prevent fish ingress into intakes.

Alternative water use

One option to address the difference between the available freshwater resources and increasing water demand is to supplement supply with reclaimed or reused wastewater, or stormwater. This alternative brings its own challenges, including managing risks of the interaction between potable (drinkable) water and non-potable supplies, and the public perception and cultural concerns of reusing treated wastewater.

Network operators will be required to measure and report the volume of recycled wastewater, either supplied to customers or used to recharge the source water aquifer, or the volume of urban stormwater captured for reuse. This measure was introduced for 2023/24 and will be reported on in the 2023/24 Report.

Emergency response planning and preparedness

It is important that network operators have considered their response to restoring services following an emergency, as shown by events such as the Christchurch Earthquake and Cyclone Gabrielle. This measure was introduced for 2023/24 and will be reported on in the 2024 report.

Water security

It is important that network operators have considered their response to situations where source water availability is reduced, e.g. in a drought or situations where source water turbidity is too high for treatment and supply. This measure was introduced for 2023/24 and will be reported on in the 2024 Report.

Te Mana o te Wai measures

Te Mana o te Wai informed measures will need to consider Māori data sovereignty, Treaty of Waitangi obligations, and meaningful engagement with iwi and hapū in their development. These measures could include more qualitative data such as consideration of value statements, partnership agreements, or monitoring and oversight funding to enable local iwi and hapū to work collaboratively with network operators to improve outcomes at a local level.

APPENDIX 4: Data quality and confidence

To provide a good-quality evaluation of performance, we rely on good-quality data from network operators.

The reliability of the data informing this report is limited by the data that individual network operators have provided.

While some councils have many years' experience collecting and reporting data to Water New Zealand for the NPR, the process is new to us and some councils as well as all the government network operators.[27] We expect the overall quality and completeness of data to improve year-on-year.

As network measures are developed and, in some cases, further developed with the sector and Māori, this will contribute towards a more complete picture and increased confidence in the data. This includes increased expectation that networks will identify and work with their partners to gather data, and their response relating to how they are giving effect to Te Mana o te Wai.

While the overall response rate of network operators was good, the quality of the data provided was mixed.

Water New Zealand spent considerable time auditing the data supplied for the NPR and working with network operators to improve the data as necessary. The NPR was developed by the water sector, for the water sector, and this level of support from the industry body was considered necessary to deliver a quality report.

As the water services regulator, we publish this report not only for the water sector, but for the public, iwi, hapū, Māori, central government, and to inform other regulators including regional councils. We are seeking data from network operators that should form the basis of their asset management plans. Network operators must prioritise understanding their networks, ensuring they are appropriately resourced to provide data that not only supports our evaluation of their environmental performance, but satisfies their own governance boards, decision makers, community, partners and stakeholders in demonstrating the quality of their service and highlighting where further work is needed.

Quality review process

We followed up with all network operators who did not provide their data by the due date of 30 September 2023. We also did a high-level review of the data received. We engaged with network operators regarding data requirements and allowed time extensions for data submission as requested. We selected a sub-set of the data to assess and for those data points contacted the 40 network operators we identified as reporting data outside of the expected ranges. Of these network operators, 21 came back with self-corrections.

Significant lessons have been learnt from the data collection process this year and we intend to make improvements for the 2023/24 report.

We have developed an approach to undertake more rigorous data validation and correction processes for the next report. This will include an automatic check of all the data to identify data points outside of the expected range. We will continue to refine our approach taking into account feedback from network operators.

All raw data is available to view at <<insert link>>.

To give an indication of where network operators are at in their experience of data collection and reporting, we asked network operators to provide a self-evaluation on their 'level of confidence' in their data. This also:

- encourages network operators to look at the robustness of their data collection and reporting processes, and identify (where practicable) ways in which they may be able to improve this over time; and
- provides readers of this report with a sense of the reliability of the reported data.

.

The data confidence definitions that were provided to the network operators are:

Grading	Definitions for 'processes'	Definitions for 'asset data'
Highly reliable / audited	Formal process to collect and analyse data. Process is documented and always followed by all staff.	Very high level of data confidence. Data is believed to be 95-100% complete and +/- 5% accurate. Regular data audits verify high level of accuracy in data received.
Reliable / verified	Strong process to collect data. May not be fully documented but usually undertaken by most staff.	Good level of data confidence. Data is believed to be 80-95% complete and +/- 10% to 15% accurate. Some minor data extrapolation or assumptions have been applied. Occasional data audits verify reasonable level of confidence.
Less reliable	Process to collect data established. May not be fully documented but usually undertaken by most staff.	Average level of data confidence. Data is believed to be 50-80% complete and +/- 15 to 20% accurate. Some data extrapolation has been applied based on supported assumptions. Occasional data audits verify reasonable level of confidence.
Uncertain	Semi -formal process usually followed. Poor documentation. Process to collect data followed about half the time.	Not sure of data confidence, or data confidence is good for some data, but most of dataset is based on extrapolation of incomplete data set with unsupported assumptions.
Very uncertain	Ad hoc procedures to collect data. Minimal or no process documentation. Process followed occasionally.	Very low data confidence. Data based on very large unsupported assumptions, cursory inspection, and analysis. Data may have been developed by extrapolation from small, unverified data sets.

When the data submission was completed, a review was performed by our technical services team. Analysis of the data was automated to ensure all information was processed in a similar way. There were several data point issues with some of the measures. Some of the data points required multiple entries into a single cell with comma separations. Because this instruction was not followed accurately by all network operators, the data could not be processed automatically. Due to the time constraints, a manual review was only performed on the drinking water data.

The data confidence provided by network operators was not factored into the information vetting process. Consideration was given to using data with a "reliable" (or better) confidence rating, but this eliminated a large portion of the dataset. Instead, the average data confidence was provided for each data point along with the number of responses.

When reviewing the performance of network operators against each measure, population densities were used to analyse the data. Population densities are less relevant to government organisations and regional council operators and therefore these network operators were not included in those specific measures.

In our guidance, any data points that were unknown were supposed to be left blank. Unfortunately, several network operators responded to data points with a zero. For certain data points this was an acceptable answer, while in others it would cause issues with averaging. For the purposes of this report, if network operators entered a zero it would be counted as a response, but if it was not within the acceptable ranges for that measure, it was omitted.

Regarding the omission of data, if any network operator that submitted data that far exceeded the expected range of the measures, that data was omitted where specified or discussed further in the relevant section.

Standard statistical analysis was used on all data points for each measure (i.e. mean, median and mode). Comparisons were also made against other measures to find correlations between the data. The most common comparison of the measures was against population density. These population brackets were obtained from Stats NZ.

27 Since 2014 all territorial authorities have had to report under the Non-financial performance measures rules 2013 for:
- the percentage of real water loss from system (including a description of the methodology used).
- performance to call-outs for faults or unplanned interruptions.
- drinking water pressure or flow
- the average consumption of drinking water per day per resident

TAUMATA AROWAI

taumataarowai.govt.nz