2017–2018

NATIONAL PERFORMANCE REVIEW

water NEW ZEALAND

The New Zealand Water & Wastes Association Waiora Aotearoa

COVER IMAGE

Sven Harlos, Projects Manager Construction Delivery, Watercare conducts an inspection of new Reactor A-recycle pumps installed as part of the new Biological Nutrient Removal process at Mangere Treatment Plant. The major expansion to New Zealand's largest treatment plant will provide the extra treatment capacity needed to cater for Auckland's rapidly growing population.

Photographer: Matt Girvan, Mechanical Engineer, Beca

2017-2018 NATIONAL PERFORMANCE REVIEW

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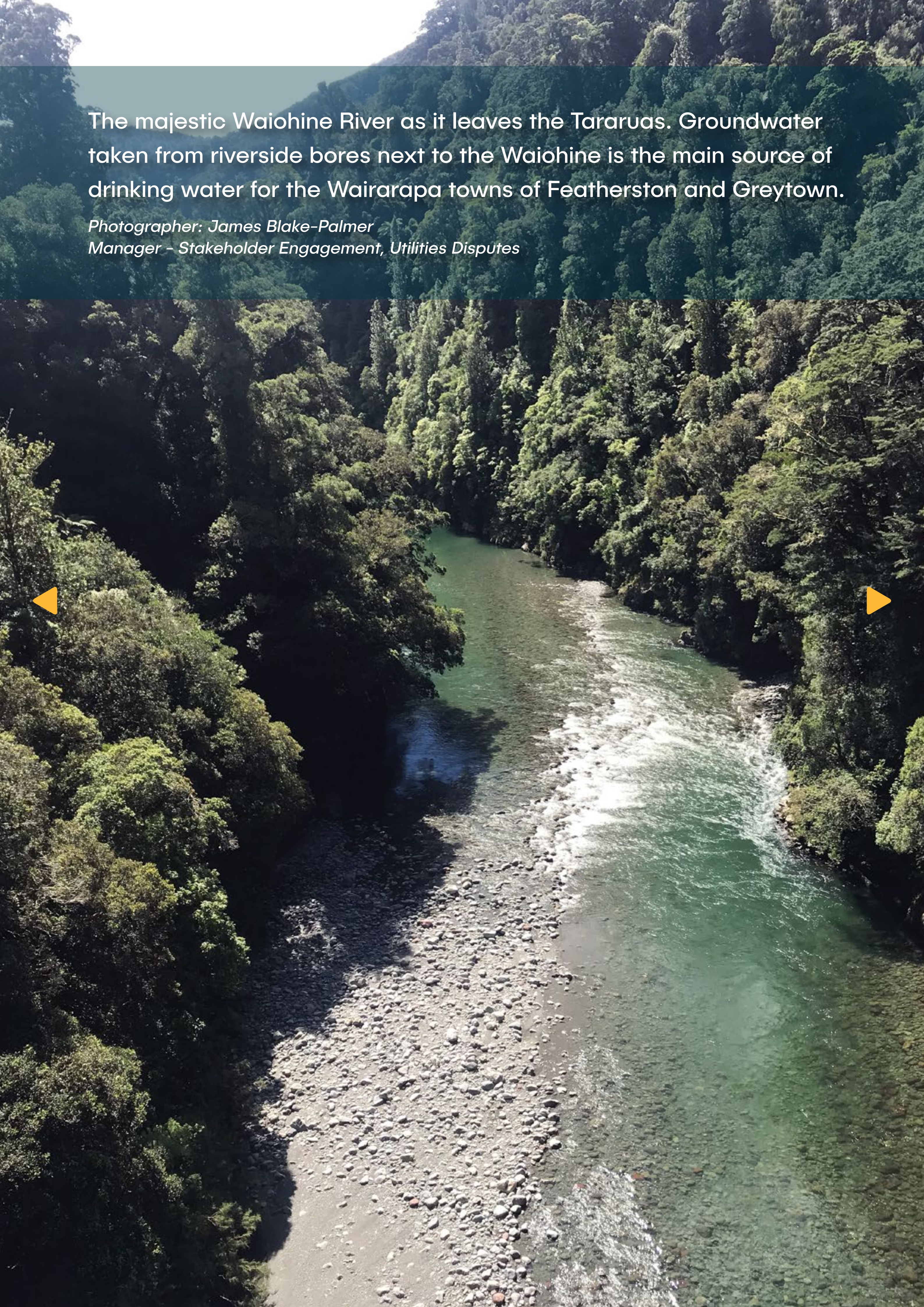
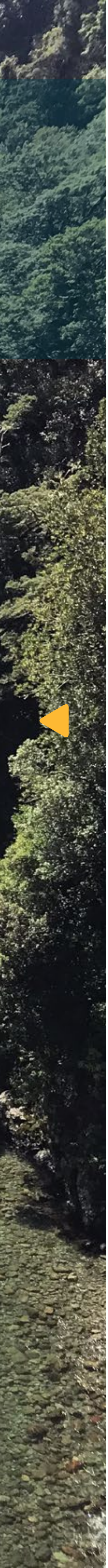


The majestic Waiohine River as it leaves the Tararuas. Groundwater taken from riverside bores next to the Waiohine is the main source of drinking water for the Wairarapa towns of Featherston and Greytown.

Photographer: James Blake-Palmer
Manager - Stakeholder Engagement, Utilities Disputes



FOREWORD

The National Performance Review is an annual benchmarking exercise of drinking water, wastewater, and stormwater service delivery across New Zealand. Benchmarking and the development of this report is co-ordinated by Water New Zealand, an independent not-for-profit organisation representing water professionals and organisations.

Water New Zealand's staff prepare the report, supported by a project advisory group of representatives from participating entities. Water New Zealand thanks the following individuals who have been a part of the 2017-18 group:

- Sarah Pitches, Waipa District Council
- Mark Baker, Queenstown Lakes District Council
- Mike Schruer, Tasman District Council
- Howard Wilkinson, South Taranaki District Council
- Robert Blakemore, Wellington Water
- Martyn Cole, Kapiti Coast District Council

We would also like to extend our thanks to the talented photographers whose pictures are featured throughout this report. Photos were originally provided as entries to the annual Water New Zealand photo competition.

The financial resources to complete the project are provided by participants themselves, who also contribute their time and expertise to provide the data that underpin the Review. Their efforts demonstrate a strong commitment within the sector to the continuous improvement and transparency of water service delivery. Water New Zealand extends thanks to all involved in the process.

This report provides the most contemporary snapshot of the state of our drinking water, wastewater, and stormwater services in New Zealand.

With changes to governance arrangements for the sector being considered by central government, the accessibility of comprehensive and accessible data is vital to underpin good decision-making. To this end, Water New Zealand is are pleased to make the National Performance Review available to the sector's many stakeholders.

EXECUTIVE SUMMARY

The National Performance Review (NPR) is an annual benchmark of drinking water, wastewater, and stormwater service provision throughout New Zealand. The NPR is undertaken by and for water service managers, and is co-ordinated by Water New Zealand. The aim is to identify opportunities to improve service delivery, as well as provide stakeholders with accessible and comparable data.

This year 46 Councils and two Council Controlled Organisations (CCO) participated in the Review. An additional 16 Territorial authorities have responsibility for water, wastewater and stormwater but declined to participate. Appendix I: Participant acronyms and categorisation shows which service providers are included in the report and which are not.

Participants in the 2017-18 NPR have jurisdictions that provide for 4,513,457 New Zealanders, which is approximately 94% of the population. With assets worth more than $38 billion, annual revenue collection of over $2 billion, and employment provided for around 4,000 people, reported information underscores the significance of the water industry.

This report covers the critical functions of drinking water, wastewater, and stormwater services, along with key aspects of service provision: protecting both public health and the environment, and providing services that are reliable, resilient, economically sustainable, resource-efficient, and customer-focused.

Data and trends at the national level are presented in the report, and links are provided to online benchmarks which show individual participants' performance results. The report shows that gains are being made in some areas, and further progress is required in others. A summary of significant sector trends is provided.

Vacancy levels in the water sector are high in comparison with New Zealand overall

More than 4,000 people are employed full-time in the water sector, and nearly 2,500 are employed directly by participants in the NPR. This same group reported 235 vacant positions, which equates to almost 10% of the total positions in their operations. New Zealand's overall June 2018 unemployment rate of 3.9%, by contrast, suggests that effort is required to enhance recruitment pathways into the water industry.

Efficiency of scale is evident in a number of performance metrics

There is a large variation in the size of entities providing data to the NPR. The largest organisation, Watercare, has annual revenue of $611,385,000 and employs more than 900 staff. At the other end of the scale are six participants who collect annual revenue of less than $2 million, and employ between two and 14 staff members. To facilitate comparisons between like-sized entities, participants have been grouped into categories: small (servicing fewer than 20,000 water and wastewater connections), medium, and large (servicing more than 90,000 connections).

There are a number of performance metrics where efficiency of scale is evident. Relative staffing levels are lower for large entities, with median staffing levels of 1.01 employees per 1,000 properties serviced with water and wastewater, compared with a median staffing level of 1.41 for small entities. Water and wastewater charges are also co-related with scale, with customers of small entities paying median charges of $1,057 a year, and customers of large participants paying $723 a year.

The management of wastewater overflows during wet weather has room to improve

Wet-weather overflows occur during heavy rainfall events when stormwater infiltrates the wastewater system, exceeding its capacity. Wastewater consequently overflows from gully traps, manholes, or engineered overflow points. The costs involved in making sewers either extremely large or 100% water tight place a constraint on the ability to contain sewage during wet weather, meaning there will always be some level of wet-weather overflow. In 2017-18, participants collectively recorded more than 2,000 overflows of wastewater as a result of wet-weather events (this number is likely, however, to be under-reported).

Tracking of wet-weather overflows is currently achieved through one of two methods: hydraulic models of the sewer networks that identify when and where sewage overflows occur, and that are calibrated to real-world conditions through monitoring; and verbal reports by staff or members of the public. Eleven participants employed the calibrated hydraulic models, while eight relied on verbal reports. Participants relying on verbal reports recorded less than one fifth of the wet-weather-related wastewater overflows when compared with those which used calibrated hydraulic models.

Design requirements for sewage containment have a large influence on the frequency of overflows. Fifteen participants did not specify whether they had such requirements in place, and there was large variation in the requirements for those that did. Some participants based their design standards on the annual exceedance probability (that is the likelihood of a wet-weather-related overflow occurring in a given year), with design standards varying between 10% and 50%. Others based standards on peak wet-weather to average dry-weather flow ratios, with standards ranging between 1.89 and 10.

The adoption of calibrated hydraulic models, and agreement on best practice design standards for sewage containment, would improve the management and modelling of wet-weather sewage overflows.

Blockages are the most common cause of wastewater overflows during dry weather

Wastewater overflows can occur in dry weather as a result of blockages in the network, or mechanical faults such as pump failures or power outages. Participants reported 1,642 dry-weather wastewater overflows caused by blockages, which is almost 10 times the number of dry-weather overflows caused by mechanical failures (177 recorded). Blockages can occur as a result of tree roots making their way into sewers, or the incorrect disposal of fats and other non-dispersible products such as wet wipes.

The number of reported dry-weather overflows has increased from a median of 0.402 overflows per 1,000 properties in 2015-16 to 1.199 per 1,000 properties in 2017-18. This signals that concerted interventions are required if this worsening trend is to be reversed.

A large proportion of wastewater treatment plants have upcoming effluent consent renewals

A recent Department of Internal Affairs report estimating costs for upgrading wastewater treatment plants highlighted the often lengthy and expensive processes of renewing a wastewater treatment plant consent (GHD-Boffa Miskel, 2018). It estimated that the average consenting process can take between two and four years, and cost, on average, around $500,000.

Of the 247 wastewater treatment plants included in the NPR, 26 wastewater treatment plants were operating on expired effluent discharge consents, and 44 had consents soon to expire. Of these, 33 had resource consents lodged with regional councils, and one was undergoing resource consent hearings. The large proportion of wastewater treatment plants requiring consent renewals in the near future suggests that national cost savings through streamlining wastewater treatment plant consent processes could be significant. Water New Zealand has previously advocated for the adoption of a National Environmental Standard (or similar instrument) for wastewater discharges.

Variation in stormwater management practices

There is a large variation in management practices and consenting of stormwater discharges. Slightly under half the NPR's participants have implemented stormwater quality monitoring or catchment management plans (23 and 22 respectively). A further eight have stormwater catchment management plans under development.

The variation in management practices is likely a reflection of the different consenting approaches for stormwater discharge. A minority of participants (eight of 38 providing data) had all stormwater discharges covered by resource consents. A further 24 had consents for some stormwater discharges. External audits of discharge consents noted that "[m]ost organisations indicated they will eventually move to a global consent arrangement" (AECOM, 2018).

The data signals that a gradual move to stormwater quality monitoring is underway, suggesting that there is an opportunity for territorial and regional councils to share information on stormwater consenting and management practices.

Water and wastewater affordability is likely to be a challenge for some households served by small or medium-sized suppliers

There is currently no official definition of 'water affordability' in New Zealand, however international water affordability metrics range from 2% to 5% of household income (Garnett & Sirikhanchai, 2018). While no participants charged in excess of the 5% figure, 15 participants in the small and medium-sized categories had combined water and wastewater charges in excess of 2% of average household income, and participants in the large category had charges ranging between 0.65% and 1.63%

of average household income. Higher charges were, therefore, faced by customers who also tend to have lower average incomes, which suggests that affordability is likely to continue to be a challenge for small and medium-sized suppliers.

Revenue and expenditure on water, wastewater and stormwater service provision is increasing

Median revenue collected per property has risen from $426 to $543 (27.5%) for water supply services, from $477 to $614 (28.7%) for wastewater services, and from $122 to $144 (18%) for stormwater services. These rises in revenue are likely attributable to an increase in capital expenditure, with capital expenditure for water supply systems rising from $280 million in the 2015 fiscal year to $319 million in 2018 (a 13% increase), wastewater systems rising from $286 million to $446 million (a 56% increase), and stormwater systems rising from $147 to $225 million (a 55% increase). The average price of consumer goods tracked in the consumer price index rose 13.7% over the same period (Statistics New Zealand, 2018).

The proportion of interest paid on water assets often exceeds benchmarks for whole-of-local-government services

Interest paid as a proportion of revenue collected is greater than 10% for 14 water supply networks, 19 wastewater networks, and 20 stormwater networks. Three participants were spending more than a third of revenue collected servicing debt for wastewater and stormwater networks.

Borrowing costs could be expected to be higher for water, wastewater, and stormwater networks than whole-of-council operations, given that debt is a commonly-used funding mechanism for long-lived assets. These debt levels exceed debt-servicing benchmarks contained in the Local Government (Financial Reporting and Prudence) Regulations 2014 (New Zealand Government, 2015) which apply to council operations as a whole, and specify that a benchmark is met if borrowing costs are less than 10% of a local authority's revenue per year (or 15% for a high-growth council). This implies that, for some councils, debt carried against water, wastewater, and stormwater systems will limit the opportunity to borrow to finance other operations.

Variation in pipeline condition assessment approaches is limiting opportunities to collectively improve understanding of asset failures

Participants commonly assign a grade of one to five to indicate the condition of their assets (with one indicating assets are in very poor condition and five being very good). Such condition assessments could offer a glimpse into the state of assets, however variation in assessment methodologies makes it difficult to infer meaningful information at a national level, and to share data across authorities. Six different manuals are in use for asset condition assessment, as well as a variety of in-house and informal approaches. Work is needed to harmonise data standards, data capture methodologies and asset condition guidance to enable collaborative approaches to understanding asset failures.

The majority of water suppliers could economically reduce water-loss levels

Participants lost a total of 108,474,706m3 of water through their systems, equivalent to more than 43,000 Olympic-sized swimming pools. This constituted more than 20% of the 535,165,575m3 of water supplied (to systems with known water-loss levels). Only three participants achieved water-loss levels low enough that further reduction of losses would be considered uneconomic. This signals there is room to save both money and water through the implementation of water loss initiatives.

Nearly half of residential water consumers have their water metered and this number is gradually growing

Collectively, participants had in place 105,321 non-residential and 763,479 residential water meters in 2017-18. This covered 82% of 128,186 non-residential properties receiving water services, and 47.6% of 1,325,898 residential properties receiving water services. The proportion of residential properties metered, and growth in metering at a national level, is weighted by New Zealand's largest centre, Auckland, which has full residential metering. The majority of NPR participants (29 of 46 providing data) had low levels or no residential water metering.

Four participants, Mackenzie, Tararua, Hauraki, and Grey, recorded water consumption in excess of 500 litres per person per day (L/person/day). Of these, Hauraki was the only authority to have significant levels of residential water metering coverage. Whakatane reported the lowest average daily residential water consumption rate, at 139L/person/day, and had 79% of its sites covered by residential water metering. The median value of average daily residential water consumption across all participants was 263 Litres/person/day.

Electricity used in the conveyance and treatment of water and wastewater is responsible for 0.3% of New Zealand's total greenhouse gas emissions

Energy is needed to treat and convey water through water and wastewater systems. Collectively, participants' water and wastewater systems consumed 3,252,997GJ and 3,710,067GJ of energy respectively. Assuming all energy is sourced from electricity, this equates to a total of 230 kilo tonnes of carbon dioxide-equivalent gases, approximately 0.3% of New Zealand's total emissions of 78,727 kilo tonnes (Ministry for the Environment, 2018).

Few water supplies are compliant with The New Zealand Fire Service Firefighting Water Supplies Code of Practice

The Code specifies that all fire hydrants must be inspected and flushed every five years by an approved tester. Currently, this is being achieved by only six participants, with a further two achieving near-compliance. Across all participants, 1,156 hydrants were found to be non-compliant with the requirements of the Code. Fire and Emergency Services are currently reviewing the code, making it timely to assess what further work is needed to improve code compliance.

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Finishing touches are put on a new trunk water main supplying the town of Temuka. The 9.1km, $3.3 million high density polyethylene pipe was put in place to replace a 60-year old asbestos cement pipe, improving both the resilience and the capacity of the towns supply.

Photographer: Lenard Smythe
Development & Renewals Engineer, Timaru District Council

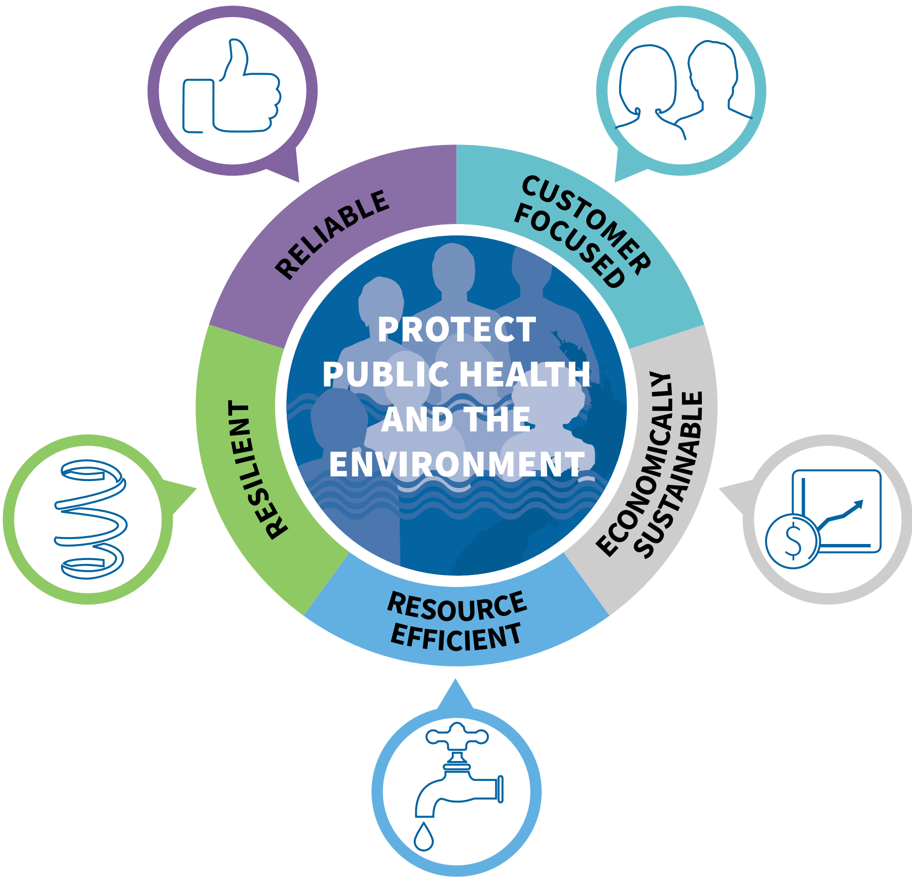
1. ABOUT THE NATIONAL PERFORMANCE REVIEW

The National Performance Review (NPR) is an annual benchmark of water, wastewater, and stormwater service delivery throughout New Zealand. It has been produced since 2008. The exercise is a voluntary process, initiated by Water New Zealand members who commit the time and resources to enable its delivery.

This year's NPR covers 48 Council and CCO participants whose jurisdictions cover 94% of New Zealand's population. Reporting entities are generally territorial councils which have responsibility for water, wastewater, and stormwater service delivery. The NPR also includes two council-controlled organisations, Watercare and Wellington Water, which provide services to Auckland and Wellington regions respectively. Further detail on participants and aspects of their service provision covered by this report is listed in Section 2.5 *Report coverage*.

Core elements of water service delivery addressed by the NPR are shown in Figure 1. This report does not focus on drinking and freshwater quality, which are the focus of the *Annual Report on Drinking Water Quality* (Ministry of Health, 2018) and the freshwater chapter of *Environment Aotearoa 2017* (Ministry for the Environment & Stats NZ, 2017).

Figure 1: Aspects of 3 Waters service provision addressed by the National Performance Review



This report provides a high-level summary of data and trends. Individual participant data presented in comparative benchmarks is presented separately in an online data portal, with related links provided throughout this report. The data portal and other supporting information are available at www.waternz.org.nz/NationalPerformanceReview .

The central purpose of the NPR is to provide water service managers with information that can be used to enhance their service delivery. Providing comparative performance information enables participants to identify opportunities for improvement, and fast track learnings through the experience of others.

A secondary function of the NPR, and a key aim of this report, is to collate information on 3 Water services into a single place to inform stakeholder decision-making. Stakeholders include central government, researchers, and the sector's many service providers. In registering for the report, participants acknowledge that their information will be made available in the public domain. Information requests, and collaboration with third parties seeking data that will assist them to advance the sector's interests, are welcomed.

This report does not provide qualitative judgements on the reason for performance outcomes, or what needs to be done to improve performance. The information is used by the Water Services Managers Group, Water New Zealand board, and National Performance Review Advisory Group to assess opportunities for initiatives that will advance the sector's performance. Third parties are encouraged to use the data provided to inform decision-making in relation to 3 Waters.

The NPR is unique in that it is the only ongoing mechanism by which data on New Zealand's drinking water, wastewater, and stormwater systems is regularly collated. The quality of the data presented is, however, variable. Those intending to use information from this report are encouraged to first read information in *Section 2 Interpreting information in the report*, which outlines the limitations of the collected data.

Repairs on a diffuser airline in an wastewater aeration basin at Pukete Wastewater Treatment are completed by a member of the maintenance team at Hamilton City Council.

The basin had to be emptied for this work to be completed.

Photographer: Martin Scott
Lead Operator Wastewater,
Hamilton City Council

2. INTERPRETING INFORMATION IN THE REPORT

2.1. Limitations and use of data

Water New Zealand endeavours to provide data that is as consistent and accurate as possible. Section 2.2 *Data quality assurance processes* details the processes in place. The completeness and reliability of information is, however, limited by the information that individual participants have made available.

Data collection and reporting mechanisms vary greatly across participants, with some having invested in comprehensive data-management infrastructure and technology, and others relying on pen-and-paper-based data collection. This can mean that participants with robust reporting mechanisms sometimes rank comparatively poorly on metrics based on a high count, when compared with those whose reporting mechanisms are less sophisticated. For example robust customer complaints management systems might record a higher number of complaints than a pen-and-paper-based complaints system, suggesting performance levels that are poorer than in reality. The inverse is also true, where less-sophisticated reporting systems suggest unrealistically good performance outcomes.

Water service delivery can be influenced by a number of factors outside a water managers' control. Drivers of performance can include the split of residential versus non-residential users, tourism numbers, service area density, topography, quality of source water, and receiving environments.

Report readers are encouraged to contact their relevant water service managers to get an understanding of any data limitations or performance drivers before making decisions based on the information contained in this report.

2.2. Data quality assurance processes

NPR measures in place to ensure that the data provided and contained in this report is as consistent and accurate as possible include:

- **Confidence grades:** Each performance indicator is assigned a confidence grade of 1 to 5. This information is used to understand how robust data is and, where data confidence is low, confidence grades are included on comparative performance figures.
- **Commentaries:** A field is provided for participants to include a description of anomalies, and the audit process follows up with questions on major outliers. Examples of commentary are provided in this report.
- **Automated data checking:** Submitted data is run through an automated review process to highlight anomalies such as data that is out of historic range of values, has changed significantly from previous years, or fails a set of basic log checks.
- **Multiple review cycles:** Participant data reviews are conducted following automated data checks and publishing of comparative benchmark tables. Both reviews are used to highlight anomalies, and give participants an opportunity to correct any data points that appear to be in error.
- **Third party scrutiny:** AECOM is employed to conduct an external audit of submitted data. The audit focuses on measures which have been recently introduced, previously inconsistent, or difficult to report against. External audits are rotated around participants each year, and target 20% of those involved. A copy of this year's external audit report is accessible online at www.waternz.org.nz/NationalPerformanceReview .

2.3. Data definitions

Data definitions for performance measures in the review are included in a separate document, available online at www.waternz.org.nz/NationalPerformanceReview.

References to definition guidelines are generally provided in figures and tables using indicator codes delineated with brackets. Codes for data definitions are included in order for definition guidelines to be cross-referenced. Codes adhere to the following format:

- Characters1-2: Denotes whether the data is related to Water Supply (WS), Wastewater (WW), or Stormwater (SW).
- Character 3: Denotes whether information refers to Background (B), Asset (A), Social (S), Environmental (E), or Financial (F) characteristics.
- Characters 4-5: Numbering to delineate between the different data points.

For example indicator SWB1 relates to stormwater background data and is the first data point listed in the definition guidelines.

2.4. Interpreting tables and figures

Participant classifications

Participants have been classified as small, medium, or large, based on the total number of properties they service. Participants servicing fewer than 20,000 water and wastewater properties (a property with both a water and wastewater connection is counted as two) are classified as small, and participants servicing more than 90,000 water and wastewater properties are classified as large. A list of participant full names and classifications is shown in Appendix I.

Colour coding

Drinking water, wastewater, and stormwater system figures are colour-coded as shown.

Time periods

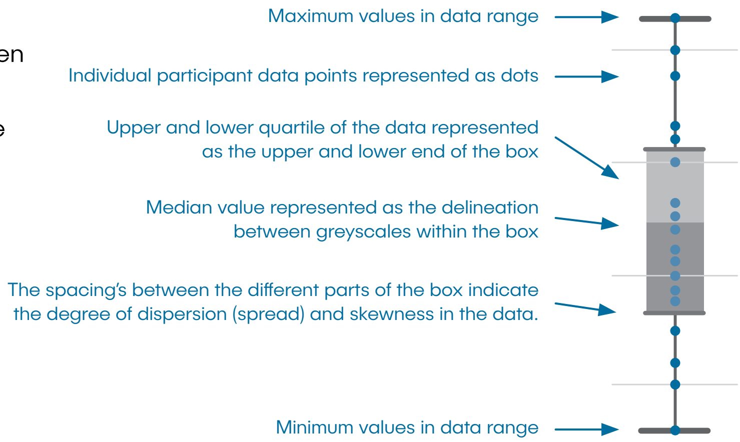
Data is collected annually, and relates to the government's fiscal reporting year. Data for this report was collected between 1 July 2017 and 30 June 2018. Figures and tables throughout the report refer to this time period as FY 2018.

Trended data

Trended figures utilise the data of participants with four years' concurrent reporting to the NPR (FY 2015 to FY 2018) only. This includes Wellington Water, which manages assets on behalf of several councils and, prior to 2018, reported each council's data individually. Participants whose data is included in trends are identified in Appendix 1: *Participant acronyms and categorisation.*

Box and whisker plots

Box and whisker plots have been included throughout the report. Box and whisker plots show the following information:



2.5. Report coverage

This year's report draws on data from 48 participants, whose collective jurisdictions cover 94% of New Zealand's population. Participants are listed in Appendix I: *Participant acronyms and categorisation*.

In this report participant names have been abbreviated to remove city and district council references. Exceptions are Wellington Water who are referred to as such and provide services on behalf of Greater Wellington Regional Council, Lower Hutt City Council, Porirua City Council, Upper Hutt City Council and Wellington City Council. Also, Watercare who provide water and wastewater services on behalf of Auckland City Council is referred to as 'Auckland'. Auckland Council provides stormwater services to Aucklanders and is referred to as Auckland Council to distinguish them from Watercare. Participant full names and associated acronyms are also listed in Appendix I: *Participant acronyms and categorisation.*

In general data in the report relates to the provision of all water, wastewater or stormwater services in a participants jurisdiction. Exceptions are noted in Table 1. The table also details where participants have noted that their data deviates from the data definition guidelines referenced in Section 2.3.

Table 1: Reporting exceptions

Entity	Reporting exception
South Wairarapa	Stormwater data has not been included as the council does not rate stormwater, and properties are required to dispose of stormwater on site. Culverts, etc. are funded through roading rates.
Auckland Council	Provides stormwater services only.
Southland	Provides water services to seven urban water schemes, five combined water schemes with high stock water supply, and nine rural water schemes for stock water only. Only the seven urban water schemes (covering 84% of the population) have been included, in order to make for more meaningful performance comparisons with other councils: • Edendale Wyndham • Manapouri • Otautau • Riverton • Te Anau • Tuatapere • Winton In order to maintain consistency of reporting, wastewater and stormwater data is reported for the same schemes. The Council manages 19 sewer schemes and 23 stormwater schemes.
Watercare	Provides water and wastewater services only. Other deviations from the data definitions, consistent throughout Watercare data, are as follows: • Water- and wastewater-serviced properties: this is the number of domestic accounts for connection to the Watercare network, which differs from the number of dwellings serviced. For example, an apartment building or terrace complex may have one body-corporate connection servicing many residential dwellings. • Water- and wastewater-serviced non-residential properties: this is the number of non-domestic accounts for connection to the Watercare network. It differs from the number of properties and/or connections, the major differences being: ▪ most office buildings may have only one connection to the network, but may have numerous tenants; ▪ large businesses may have several accounts for the same property; and ▪ one property may have many connections and accounts. • Water supply data: as retail customer meters are only read every two months, data is provided for the period May to April in order to meet Water New Zealand's deadline for the 2017-18 NPR.

2.6. Supporting material

2.6.1. Data portal

The data portal shows individual participant benchmarks, and can be accessed at www.waternz.org.nz/NationalPerformanceReview

Information in this report generally provides a summary of data and sector trends. Links to associated information in the data portal is listed in each of the relevant sections of this report.

2.6.2. International benchmarking

New Zealand data may be compared with international benchmarks using the World Bank's *International Benchmarking Network for Water and Sanitation Utilities* (IBNET) database. This enables international comparisons of some performance indicators, which can be accessed online at https://database.ib-net.org.

Indicators in the NPR do not always match IBNET indicators exactly. A Frequently Asked Questions sheet outlining the assumptions that have been used to map NPR indicators with IBNET can be accessed on the NPR home page.

A worker conducts a soakage asset inspection on SH1, between Gilies Ave and Kyhber Pass. Soakage assets dispose runoff where a surface water outlet is not available and function by allowing treated water to discharge by slowly infiltrating into the surrounding soil.

Photographer: Peter Mitchell
Stormwater Asset Manager, Auckland Motorways

3. SECTOR OVERVIEW

3.1. Assets under management

3.1.1. Volume of assets

This report covers assets worth a combined value of almost $38 billion. A breakdown of asset value by network is shown in Table 2.

Figure 2 provides a geographic indication of asset values around New Zealand. Assets in the Auckland region (including assets managed by both Watercare and Auckland Council) have the largest value at $13.5 billion, followed by Christchurch at $7.5 billion.

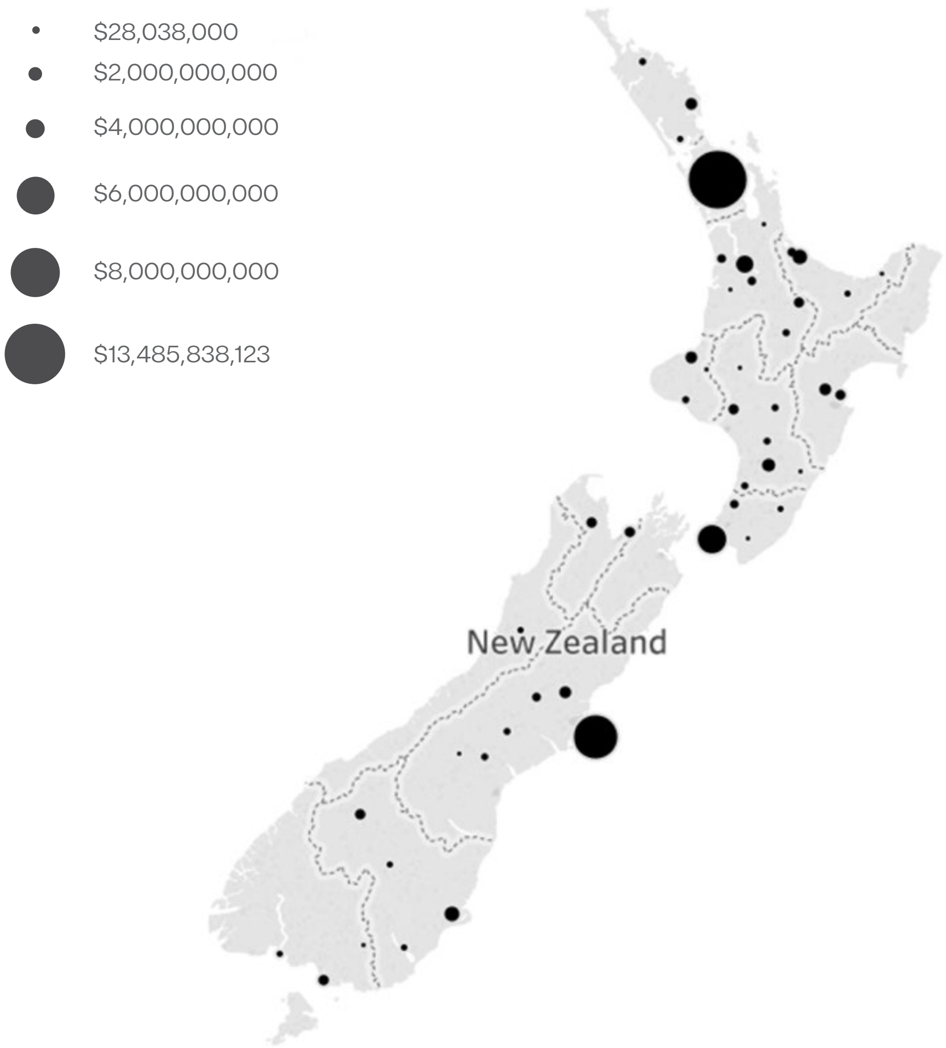
Combined sewer and stormwater pipelines are relatively uncommon, with the only reported values being in Auckland (198km), followed by Gore (53km), Grey (17km), and Whanganui (10km).

Table 2: Number and value of assets covered by this report

Assets	Covered by this report	Value
Water treatment plants	370	$2,392,438,679
Length of water supply pipes (km)	43,497	$9,736,779,489[1]
Water pump stations	874	
Water supply system total asset value		*$12,129,218,168*
Wastewater treatment plants	225	$3,215,978,242
Length of wastewater pipes (km)	27,582	$12,159,533,525[1]
Length of combined wastewater and sewer pipelines (km)	278	
Wastewater pump stations	3,146	
Wastewater system total asset value		$15,375,511,767
Length of stormwater pipes (km)	17,982	$10,328,434,524[1]
Stormwater pump stations	257	
Stormwater asset value		*$10,328,434,524*
Total asset value		***$37,833,164,459***

1 Value also includes "other" water, wastewater, and stormwater assets not explicitly listed in this table.

Figure 2: Value of assets per participant (WWF24a, WWF24b, WSF23a, WSF23b, SWF20)[2]



2 Assets shown in Auckland include the value of assets managed by both Watercare and Auckland Council.

3.2. Workforce

3.2.1. Employees, contractors and vacancies

Participants in the NPR employed nearly 4,000 full-time employees, with 2,493 directly as staff and a further 1,405 as contractors. Within participant operations, 235 vacant positions were reported (not including contractor vacancies), which is almost 10% of the total of internal staff employed overall.

Figure 3 shows the median staffing levels for small, medium, and large organisations, showing that larger organisations reported, on average, a lower number of employees per properties serviced.

Figure 4 represents normalised staffing levels as dots, showing that there is a large spread in the number of staff employed per organisation. Each participant's individual staffing levels can be viewed online at the data portal link below.

Table 3: Total number of staff, contractors and vacancies

	Internal Staff (CB10)	Contracted Staff (CB11)	Staff Vacancies (CB10a)
Total numbers	2493	1405	235
Median staffing numbers per 1000 water and wastewater properties serviced[3]	0.758	0.465	-0.063

Figure 3: Median staffing levels per 1000 water properties shown by participant size

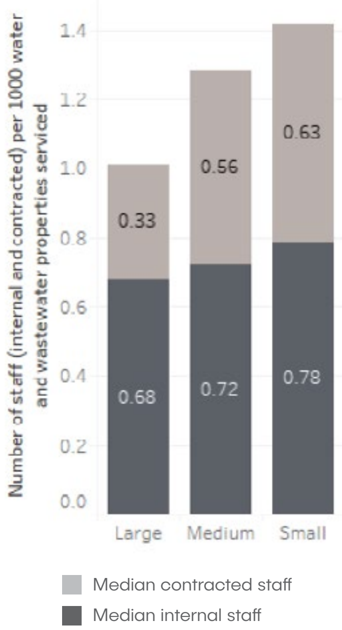
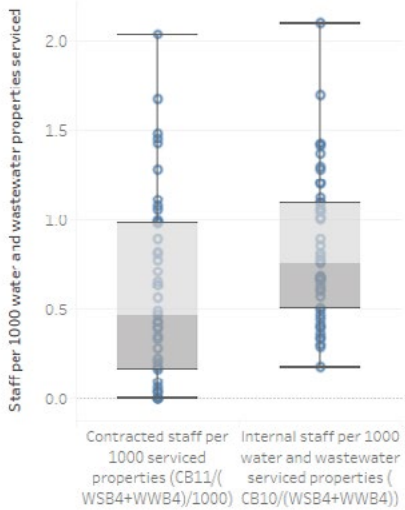


Figure 4: Spread in number of staff employed per 1000 water and wastewater properties serviced



The definition of internal staff includes staff providing 'overhead' functions who spend more than 50% of their time supporting water service delivery. It was noted in external audits that there is some variation, based on the nature of the organisation, in how this measure has been interpreted. Wellington Water and Watercare, as solely water-focused organisations, reported all staff overheads, whereas organisations with specific business units set up to manage 3 Waters tended not to report support or administration-type roles outside of their business units.

Data portal link 1: Number of staff, contractors and vacancies per participant
https://www.waternz.org.nz/workforce

3.2.2. Health and safety

Near-miss and lost-time injuries reported for staff and contractors have been recorded since 2016. Reported values are shown in Table 4 and Figure 5, with each individual participant's data point illustrated by a circle. Outliers are labelled on the Figure.

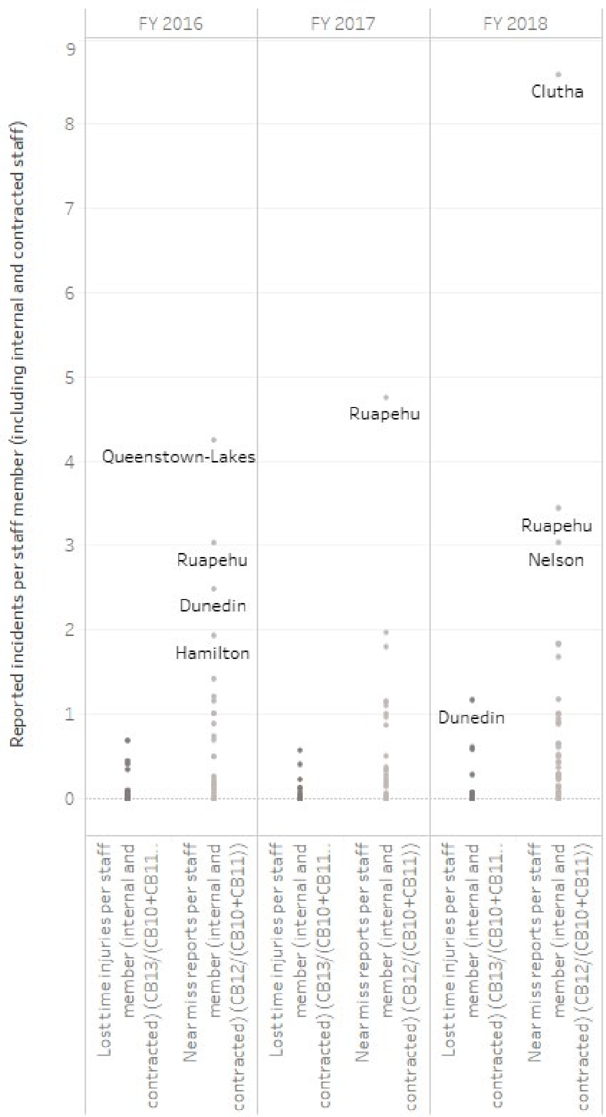
Just over a third of participants providing data on this metric (16 of 43) reported some lost-time injuries, however nearly half of lost-time injury days in 2017-18 related to incidents in Dunedin, where 145 lost-time injury days were reported.

Reporting of near misses was significantly more common, with 70% of participants (31 of 44) providing data on this metric having at least one near miss.

There was a large jump in the number of near-miss reports in 2018. It is not possible to determine whether this is attributable to improvements in the robustness of near-miss reporting or workplaces becoming less safe.

Supporting guidance and additional measures for performance reporting in health and safety are included in the Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry (BECA, 2016).

Figure 5: Near miss reports and lost time injuries per staff member reported over the last three years



Data portal link 2: Number of lost time injuries and health and safety incidence per participant https://www.waternz.org.nz/ohs

Table 4: Total number of lost time injuries and near miss reports

Year	Days of lost-time injuries	Number of near misses	Number of participants reporting lost-time injuries	Number of participants reporting near misses
FY 2018	275	2,109	43	44
FY 2017	250	1,344	40	41
FY 2016	156	1,330	47	47

3.3. Technology

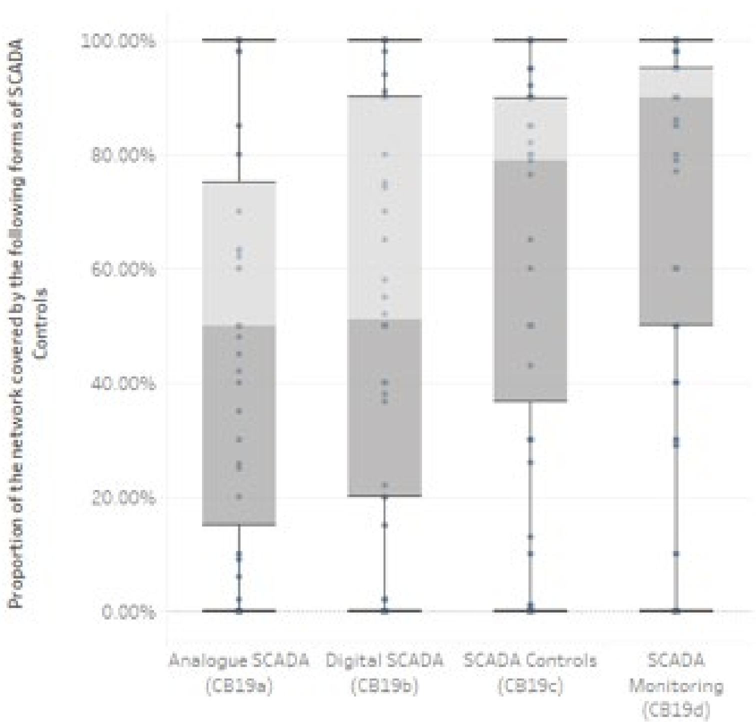
3.3.1. Supervisory Control and Data Acquisition systems (SCADA)

To indicate the extent that advances in automation are being utilised to run water and wastewater systems, four questions on SCADA where introduced in this year's NPR. Feedback received throughout the data-reporting period suggested that the definition of these questions was not sufficiently clear for results to be interpreted in a consistent fashion.

Figure 6 shows the range of responses provided, which should be interpreted bearing in mind the aforementioned limitations. Participant responses are represented as dots on the figure, which illustrates that some reported having no SCADA automation, while others reported that their systems were fully automated.

On average, participants had approximately half their networks automated using analogue and digital SCADA. The median coverage of analogue SCADA was 50%, with 51% for digital. The proportion of control points with SCADA monitoring had a median of 90%, slightly more than the median number of SCADA controls (78.5%).

Figure 6: Approximate proportion of the SCADA system, with analogue and digital controls



The Washover gravel infiltration gallery, at Rastus Burn is the water supply intake for the Remarkables Ski Area, Queenstown.

Possibly New Zealand's highest commercial water supply intake at 1630m, the supply has operated trouble free for over 30 years, despite being buried under several metres of snow in winter.

Photographer: Ken Gousmett, Construction Management Services, Queenstown

4. PUBLIC HEALTH AND ENVIRONMENTAL PROTECTION

4.1. Connections to drinking water and wastewater systems

Participants in the NPR have responsibility for jurisdictions covering 4,513,457 New Zealanders, which is approximately 94% of the population. Table 5 shows the proportion of this population who receive reticulated water and wastewater services.

Table 5: Water and wastewater coverage statistics

	Water Supply		Wastewater	
Population serviced	3,928,503	(87%)	3,822,272	(85%)
Population not serviced	584,954	(13%)	691,185	(15%)
Residential properties serviced	1,325,898		1,291,502	
Non-residential properties serviced	128,186		105,774	
Total properties serviced	1,453,009		1,397,276	

For the purposes of this report, a stormwater-serviced property is defined as a property that is billed for stormwater services. This reflects that a number of properties do not have direct connection to the stormwater system (many instead employ soakage pits), but receive the benefits of stormwater infrastructure in public areas such as roads. However, given the varying nature of billing for water services, not all participants were able to identify data for this measure. For this reason, statistics on stormwater have been excluded from this section of the report.

4.1.1. Service coverage

The proportion of the population serviced by participants' water and wastewater systems is shown in Figure 7 and Figure 8. Water service coverage varies from 31% (in Kaipara) up to full coverage. Median water service coverage across all participants is 88%.

Wastewater coverage rates did not correlate with water service coverage and, on average, were slightly lower, with a median coverage rate of 76%. At 97%, Hamilton had the highest proportion of population connected to the reticulated wastewater system, while Otorohanga reported the lowest at 28%.

Figure 7: Water Supply Service Coverage Levels

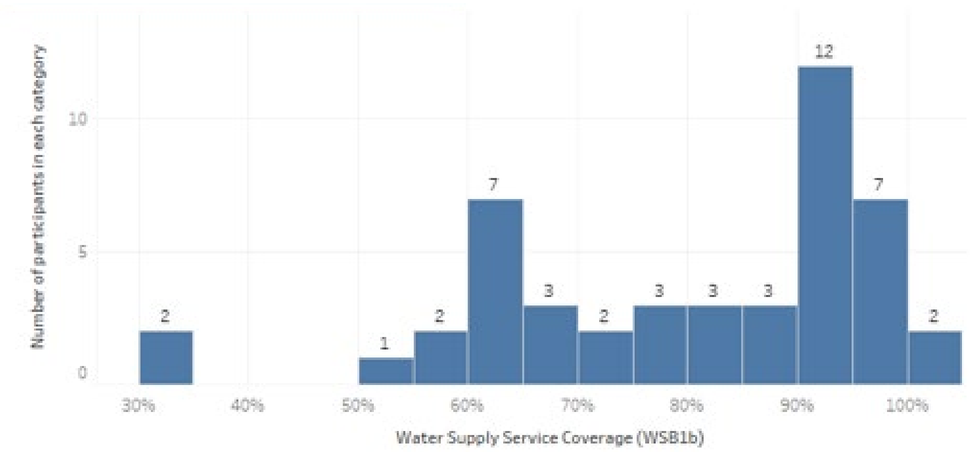
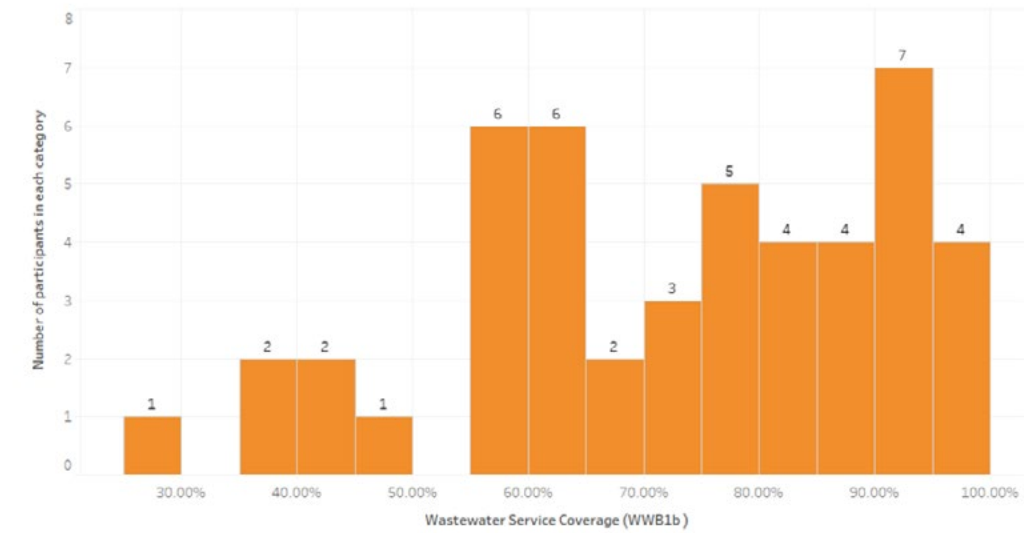


Figure 8: Wastewater Service Coverage Levels



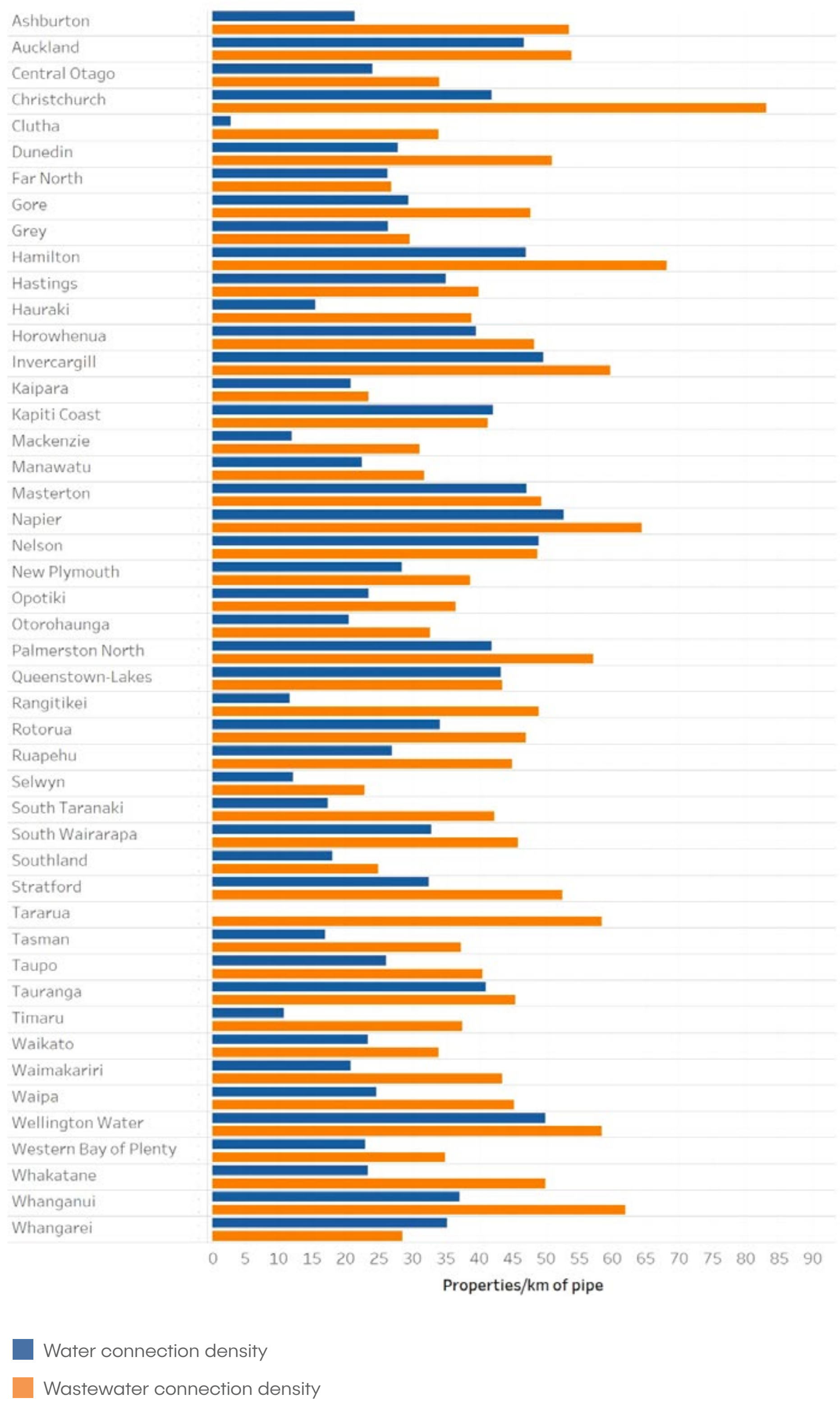
Individual participants' service coverage figures for water and wastewater are available at the data portal link below.

Data portal link 3: Proportion of properties connected to the reticulated water and waste water system
https://www.waternz.org.nz/servicecoverage

4.1.2. Connection density

Water and wastewater connection density influences other performance metrics. Participants with lower connection densities have a relatively lower revenue base upon which to service their pipelines. Individual connection densities are shown in Figure 9, and should be considered when interpreting participant performance elsewhere in the report. Lower water supply connection density figures generally occur where participants operate rural water supply schemes or operate submains along property frontages increasing the total length of mains per property serviced.

Figure 9: Water and wastewater connection density (water and wastewater serviced properties/km of pipe)



4.2. Boiled water notices

The Annual Report of Drinking Water Quality (Ministry of Health, 2018) is the authoritative source for most drinking water quality information. Boil water notices are not covered by the Ministry's report, and so have been included in the NPR.

Reporting on boil water notices comprises the number of affected residents multiplied by the number of days restrictions were in place (resident days). Just over half the respondents had issued boiled water notices at some stage during the fiscal year (23 of 45 participants supplying data on this metric).

Collectively, boil water notices were in effect for 633,911 resident days. A large proportion of these (252,333) were attributable to a single event when cyclone Gita caused a tree to fall and disrupt a water supply main servicing New Plymouth, Bell Block, Waitara, Tikorangi, Onaero, and Urenui.

Figure 10 shows the spread in the number of resident days for which boil water notices were issued, with each participant represented as a dot.

The number of boil water notices issued by individual participants is shown at the data link below. Performance comparisons based on boil water notices should be applied with caution, as the threshold at which participants chose to apply a boil water notice varied.

Figure 10: Number of resident days affected by boil water notices per participant

Data portal link 4: Boiled water impacts (affected population x days affected) per participant
https://www.waternz.org.nz/boiledwater

4.3. Wastewater overflows

Wastewater overflows occur when sewage spills from gully traps, manholes, engineered overflow points, or pump stations, and flows into public or private property, waterways, or the sea.

Overflows are commonly categorised as either dry or wet, depending on the cause of the overflow. Dry-weather overflows can occur due to either blockages or system failures. Wet-weather overflows occur during rainfall events when stormwater makes its way into wastewater pipes. Table 6 shows the total number of overflows reported by all participants, categorised by cause[4].

A breakdown of overflows per participant is available at the data portal link below.

Table 6: Total numbers of overflows reported in the 2018 Fiscal Year

Dry-Weather Wastewater Overflows[4]	**1850**
Overflows caused by blockages	1642
Overflows caused by mechanical failures	177
Wet-Weather Wastewater Overflows	**2172**
Overflows from combined stormwater and wastewater networks	359
Overflows from wastewater networks	1813
Total wastewater overflows	***3987***

Data portal link 5: Wastewater overflows per participant
https://www.waternz.org.nz/wastewateroverflows

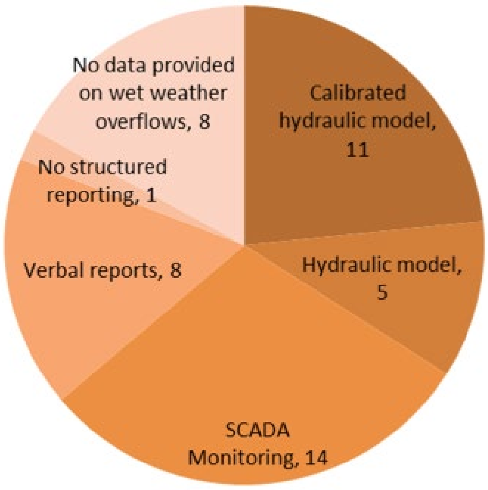
[4] Rotorua, Palmerston North, and Southland were unable to distinguish dry-weather overflows by cause, so are included in overall dry-weather overflow figures, but not blockage or mechanical failure figures.

4.3.1. Wet weather overflows

Participants were asked to provide information on the method they used to monitor wet-weather overflows. The most sophisticated method is calibrated hydraulic models, followed by uncalibrated hydraulic models, monitoring of overflow points with SCADA, and verbal reports. Figure 11 shows the most sophisticated modelling method broken down by the number of participants using it.

Figure 12 shows the average reported number of overflows per 1,000 properties categorised by the most sophisticated modelling method employed by the participant. Participants relying on verbal reports recorded an average 0.295 overflows per 1,000 properties they serviced, while those utilising calibrated hydraulic models recorded an average over five times this figure, with 1.514 overflows per 1,000 properties. This suggests under-reporting of wet-weather overflows is occurring amongst participants yet to develop sophisticated approaches for wet-weather overflow management.

Figure 11: Number of participants using each wet-weather overflow monitoring method



Eight participants did not supply data on the number of wet-weather overflows they experienced, and Kaipara did not supply data on the approach used to monitor wet-weather overflows.

Figure 12: Average wet-weather overflows recorded, categorised by recording approach

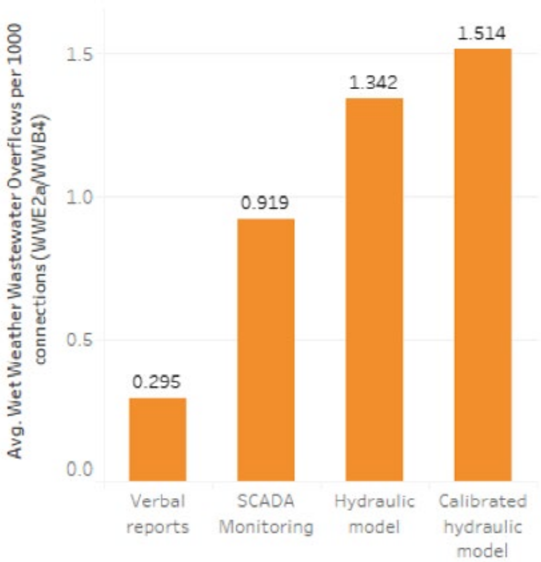
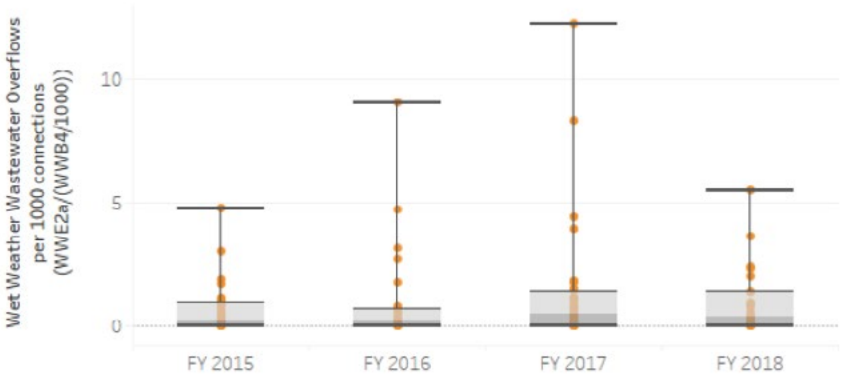


Figure 13: Trend showing maximum, minimum and median number of wet weather overflows per connections serviced



Wet-weather overflows are heavily influenced by extreme rainfall events. Both 2016-17 and 2017-18 experienced wetter-than-normal conditions (2017-18 rainfall is discussed in further depth in Section 9.4 *Flooding*). Median wet-weather overflow events recorded in these two years were higher than those in previous years: 0.47 in 2016-17 and 0.37 in 2017-18, versus 0.21 and 0.23 in 2014-15 and 2015-16 respectively.

Participants were asked to supply data on the average annual exceedance probability of wet-weather overflows from their network (that is the average likelihood of wet weather causing wastewater to overflow). This measure proved problematic to report for the majority of participants, with only 16 supplying data. Changes have been suggested to this measure, which may make it easier to report in the future. Figure 14 shows the data supplied.

Figure 14: Wet weather annual exceedance probabilities in the following ranges

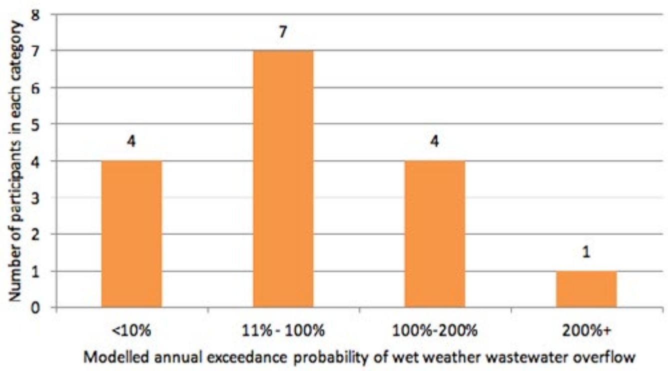
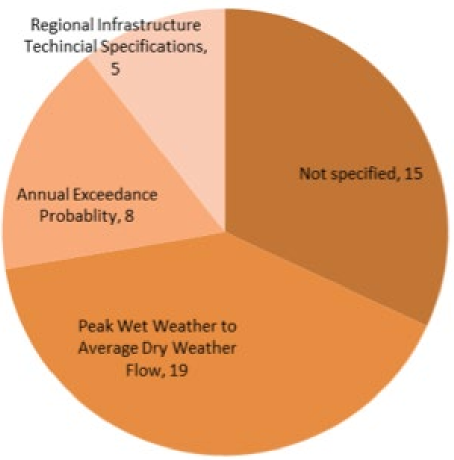


Figure 15: Design approach for sizing wastewater pipelines to accommodate wet weather flows



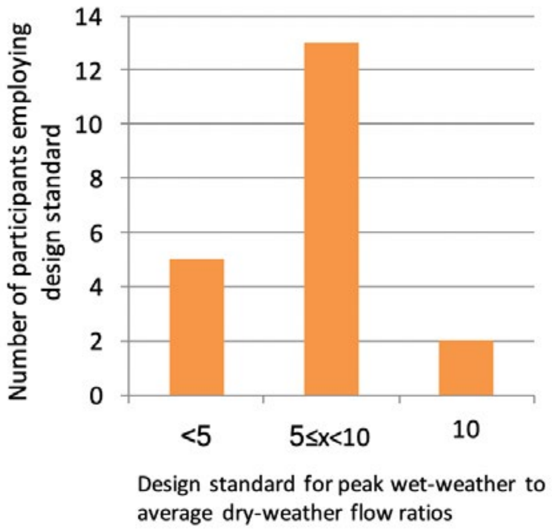
Participants were asked for information on their networks' designed sewage containment capacity during wet-weather events, specified as either the annual exceedance probability of a wet-weather overflow, or as the peak wet-weather to average dry-weather flow ratio. The number of participants employing each of the reported approaches is shown in Figure 15. Design standards employed are shown in Figure 16.

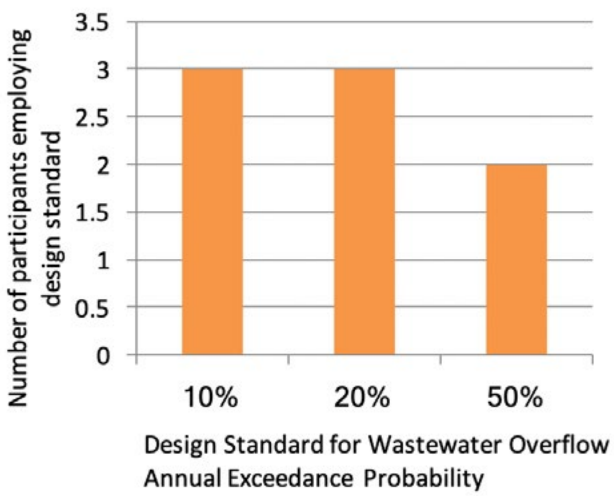
Hamilton, Hauraki, Otorohanga, Waikato, Waipa (and Matamata-Piako and South Waikato who have not participated in this year's NPR) have design standards for wastewater sizing laid out in the *Waikato Local Authority Regional Infrastructure Technical Specifications* (Waikato Local Authority Shared Services, 2018). The Standards supply design criteria for determining domestic average daily flow, peak daily flows, and peak wet-weather flows. The peak wet-weather to average dry-weather flow ratio used varies across catchments depending on a surface water ingress (factored at 16,500 litres per hectare), and a peaking factor that varies based on population equivalency and whether the catchment is predominantly commercial or residential.

Kaipara reported that design standards differ across the catchment due to varying levels of inflow and infiltration, but that, in the case of Dargaville, peak wet-weather flow is more than ten times the average dry-weather flow.

Both Queenstown and Horowhenua referenced *NZS 4404:2010 Land Development and Subdivision Infrastructure Standard* (Standards New Zealand, 2010) in their response. The Standard recommends default peaking factors of 2.5, and dilution/infiltration factors of 2 for wet weather, corresponding to a peak wet to average dry-weather flow ratio of 5.

Figure 16: Sewage design standards for containing wet weather flows





4.3.2. Dry weather overflows

Wastewater overflows can occur in dry weather as a result of either blockages in the network or mechanical faults such as pump failures or power outages. Participants reported a total of 1,642 dry-weather wastewater overflows caused by blockages, which is almost 10 times the number caused by mechanical failures (177).

The number of dry-weather overflows reported appears to be increasing. Figure 18 shows the range of dry-weather overflows per 1,000 properties serviced reported over the last four years by participants who have continuously supplied data. Dry-weather-related overflows have trended upwards throughout this period, from a median of 0.402 overflows per 1,000 properties in 2014-15 to 1.199 overflows per 1,000 properties in 2017-18.

Not all participants provided information on the number of blockages within their networks. Kaipara noted that it had 60m^3 of wastewater overflow as a result of blockages, but did not provide the number of separate occasions on which dry-weather overflows occurred. Rotorua, Palmerston North, and Southland were unable to distinguish between the causes of dry-weather overflows. Manawatu, Tararua, Rangitikei, and Waikato did not provide any data on dry-weather overflows.

Figure 17: Causes of dry weather overflows

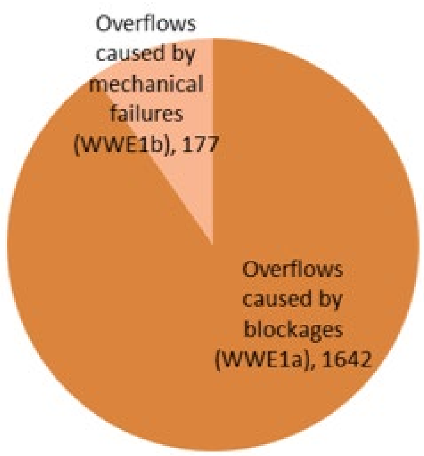
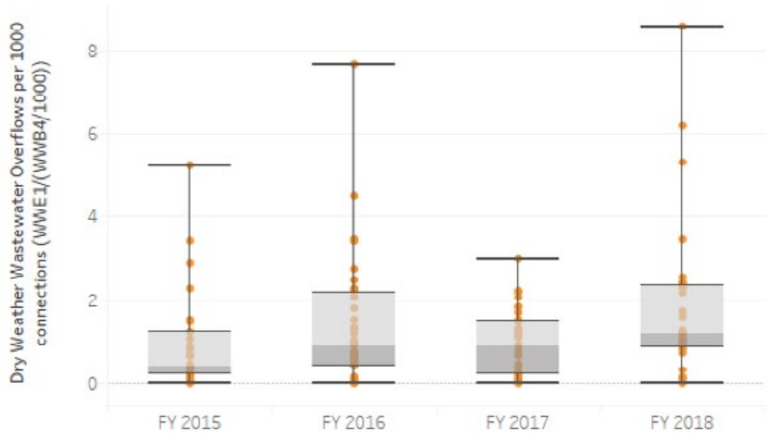


Figure 18: Trend showing maximum, minimum and median number of dry weather overflows per connections serviced



4.4. Wastewater treatment

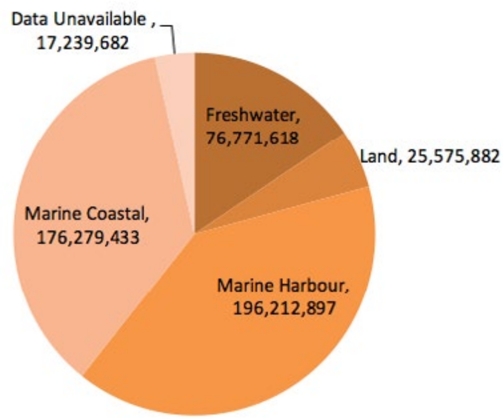
Wastewater treatment plants are operated to protect public health and to minimise the impacts of sewage on receiving environments. A summary of those receiving environments, associated with the proportion of wastewater that is discharged into them, is shown in Figure 19.

Information collected on individual wastewater treatment plants through the NPR is available on an online wastewater treatment plant inventory available at https://www.waternz.org.nz/WWTPInventory.

This section of the report summarises some of the data from the inventory. The following details for each treatment plant are included at the link above:

- Managing organisation
- Treatment plant location and receiving environment
- Treatment level
- Volume of wastewater treated
- Proportion of trade waste treated
- Consent status
- Sludge production and disposal routes
- Backup generation
- Peak wet- to average dry-weather flow ratios

Figure 19: Receiving environment for wastewater discharges by volume (million m^3)



4.4.1. Consent status

Wastewater treatment plants require consents for discharging treated effluent. Twenty-six wastewater treatment plants were operating on expired effluent discharge consents, and 44 were shortly to expire. Of these, 33 had resource consents lodged with regional councils, and one was undergoing resource consent hearings.

Figure 20: Wastewater treatment plant effluent discharge resource consent expiry dates

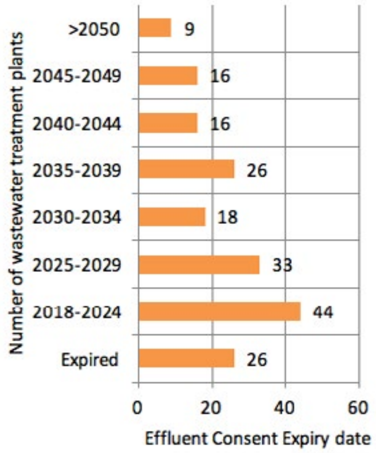
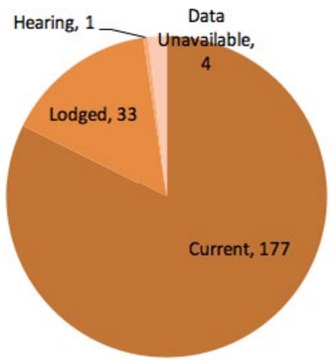


Figure 21: Wastewater water treatment plant effluent consent status

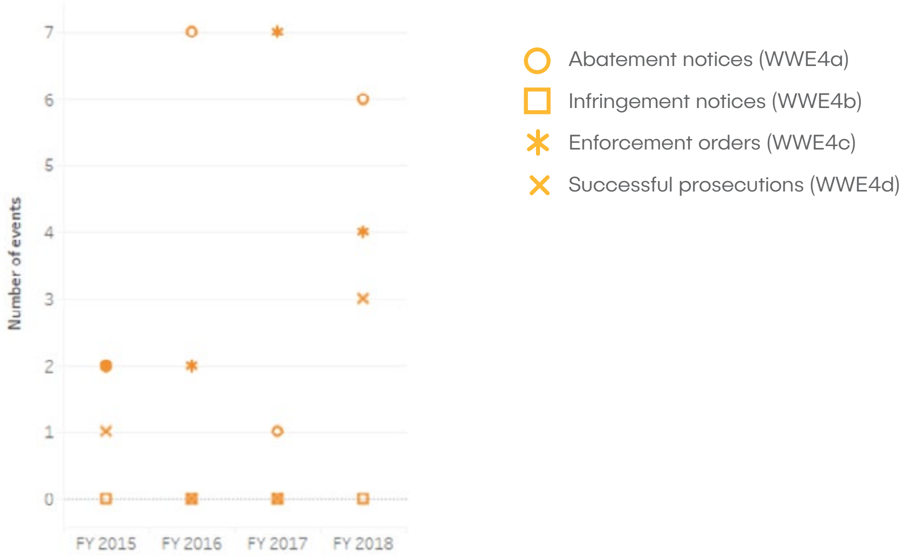


4.4.2. Consent non-compliance

Figure 22 shows the number of wastewater consent abatement, enforcement, and infringement notices and successful prosecutions reported by all participants. Six consent abatement notices were reported by Dunedin, two from the Far North, one from Hamilton, one from Kaipara, and one from South Taranaki. Dunedin, Manawatu, Rangitikei, and Whakatane each reported one infringement notice. Queenstown Lakes was the only participant to report a successful prosecution. No consent enforcement orders were reported.

Overall, the number of consent non-compliance events reported against these measures is low, continuing a trend seen in previous years. External audits of these measures (AECOM, 2018) noted that "[t]he impression is that Regional Councils prefer to work quite closely with organisations to ensure improvements are made and it is only if there was repeat non-compliance would the Regional Councils get heavy-handed."

Figure 22: Wastewater consent non-compliances by type[5]



4.5. Stormwater discharges

4.5.1. Consent status

There is a large variation in the nature and extent of council stormwater discharge consents, with only a minority of participants (8 of 38 providing data) having all stormwater discharges covered by a consent. Figure 23 shows the proportion of stormwater discharges managed by participants with stormwater consents.

External audits of stormwater consent data (AECOM, 2018) noted that "[m]ost organisations' consents cover multiple discharge points. Most organisations indicated they will eventually move to a global consent arrangement."

Participants with all stormwater discharges consented where Christchurch, Kapiti, Nelson, Taupo, Tauranga, Waipa, Western Bay of Plenty, and Whanganui. Christchurch, Kapiti, and Nelson noted that they had global consents that cover all stormwater network discharges. Waipa had all stormwater discharges covered by one of three consents, and Tauranga had five comprehensive stormwater consents.

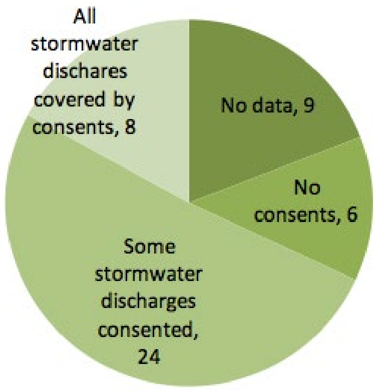
Masterton, Queenstown, Rangitikei, Ruapehu, South Taranaki, and South Wairarapa all reported having no stormwater discharge consents.

5 Unlike other trend data shown in this report, this figure shows all non-compliance events reported in the previous four years, not only those reported by participants supplying data for four consecutive years.

Where participants reported that some stormwater discharges were consented, the nature of the types of discharges consented varied:

- **Ashburton** had 37 "formal" stormwater discharges to rivers/creeks or basins, 29 of which were consented. The majority of stormwater was, however, discharged to ground via soak pits (~500) the majority of which were not explicitly consented.
- **Dunedin** had resource consents for major stormwater outfalls which discharge to the Dunedin Harbour and St Clair beach.
- **Manawatu** had a global stormwater consent for Feilding catchments with industrial land uses.
- **New Plymouth** had consents for stormwater discharges to the Waiongana and Waitaha streams and tributaries.
- **Tasman** had stormwater consents which related to stormwater upgrades or private subdivisions.
- **Wellington Water** had 244 stormwater discharges with resource consent in primary stormwater reticulation networks.

Figure 23: Proportion of participants with stormwater discharge consents



4.5.2. Consent non-compliance

Figure 24 shows the number of stormwater consent abatement, enforcement, and infringement notices and successful prosecutions reported by all participants. This included five consent abatement notices: one from Palmerston North, and four from Waikato. Hastings and Invercargill both reported one stormwater infringement notice, and Nelson reported two. No stormwater enforcement orders or prosecutions were reported.

This data should be interpreted with the limited number of stormwater discharges covered by resource consents (addressed in Section 4.5.1) in mind.

Figure 24: Stormwater consent non-compliances by type[6]

6 Unlike other trend data shown in this report, this figure shows all non-compliance events reported in the previous four years, not only those reported by participants supplying data over four consecutive years.

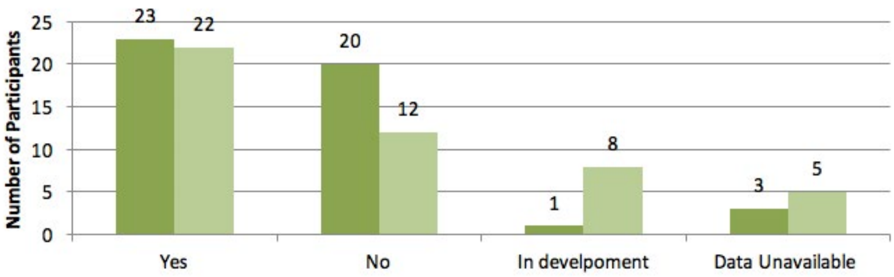
As with wastewater, the overall number of consent non-compliance events reported against these measures is low, continuing a trend seen in previous years. External audits of these measures (AECOM, 2018) again noted that "[t]he impression is that Regional Councils prefer to work quite closely with organisations to ensure improvements are made and it is only if there was repeat non-compliance would the Regional Councils get heavy-handed."

4.5.3. Stormwater quality monitoring

Just under half of the participants reporting data on stormwater quality monitoring and catchment management reported having neither catchment management nor stormwater quality initiatives in place.

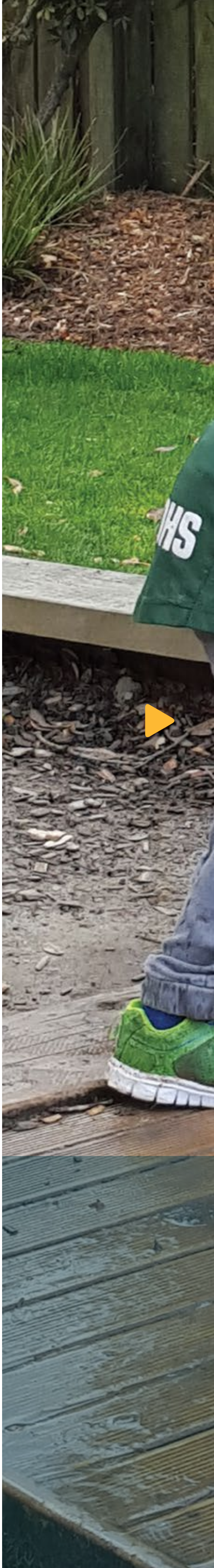
Eight participants, however, indicated that they had stormwater catchment management plans under development, suggesting that stormwater quality monitoring may also increase in future years.

Figure 25: Stormwater quality monitoring and catchment management plans in place



Have implemented stormwater quality monitoring

Have implemented stormwater catchment management plans



Two young boys enjoy a messy refreshment break.
An affordable, continuous water supply underpins the livelihood of all New Zealander's. The collection and reporting of the services provided to customers has seen rapid growth amongst New Zealand's water suppliers in the last few years.

Linda Whatmough, Manager Corporate Serivces, Water New Zealand

5. CUSTOMER FOCUS

5.1. Complaints

Customer complaints are reported against complaint categories used in the *Non-Financial Performance Measure Rules* (Department of Internal Affairs, 2013).Distinct from these Rules, however, NPR complaints are defined as instances where customers have expressed dissatisfaction.

High complaint volumes may reflect mature complaint-recording systems, rather than high levels of customer dissatisfaction. For this reason, this report does not present comparisons of participants' complaint data. Rather, the range of complaints per 1,000 properties serviced is shown in Figure 26, where the number of complaints reported by each participant in each of the 3 Water categories is represented by a dot. Figure 27 shows the total number of complaints reported by all participants by complaint type.

Figure 26: Complaints per 1000 properties serviced

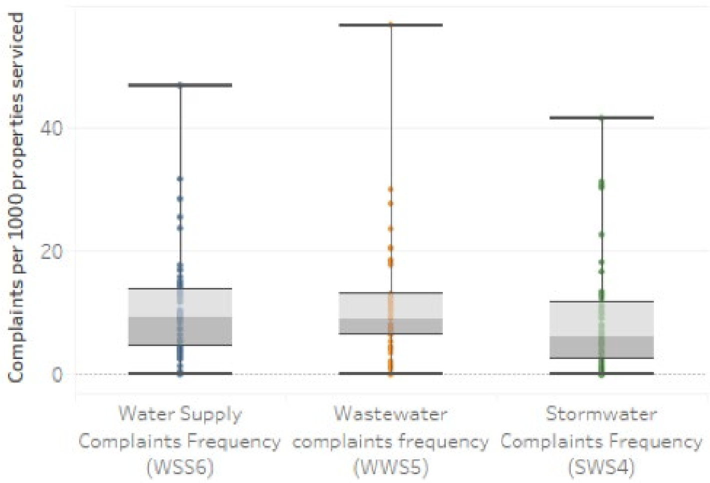
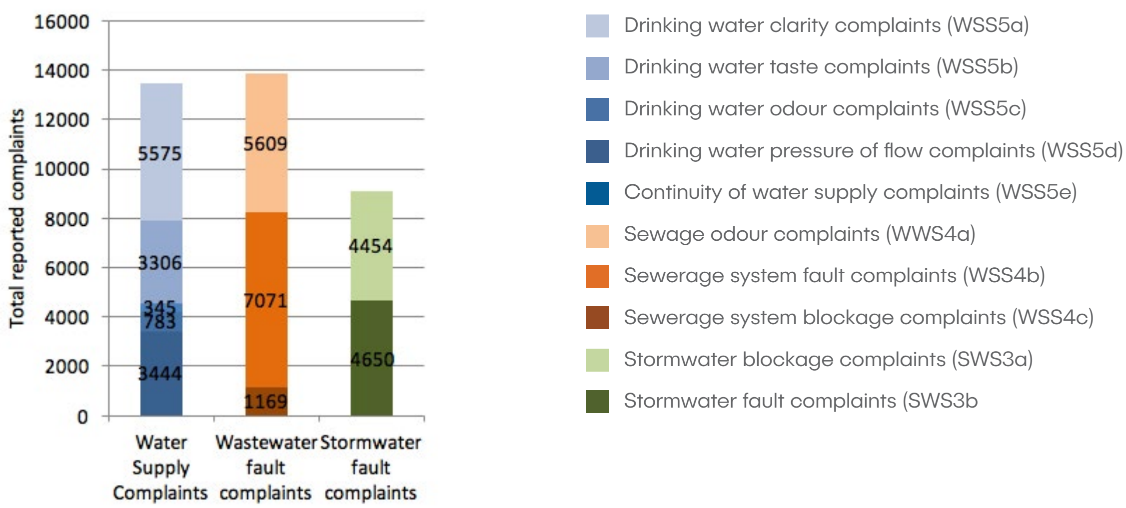


Figure 27: Complaints reported by complaint type



The median number of complaints recorded over the last four years is presented in Figure 28. This shows a gradual increase in complaints, which may reflect either improvements in customer complaint systems, or an increase in customer dissatisfaction.

Figure 28: Trend in median number of complaints reported

5.2. Fault response attendance and resolution

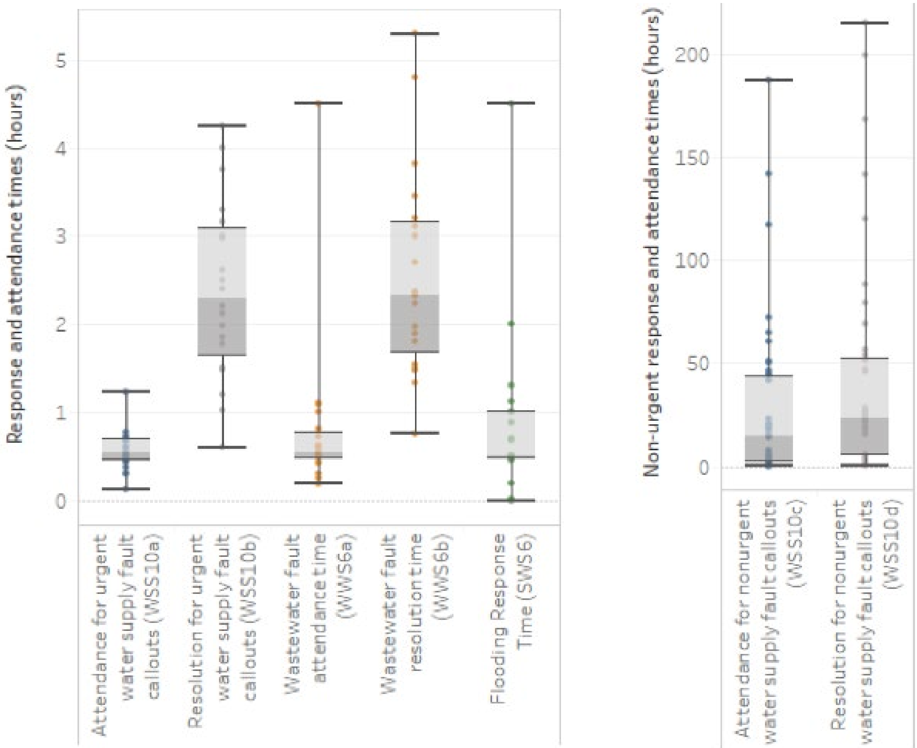
Information on water supply and wastewater fault attendance and resolution times, and flooding response times is collected in line with the *Non-Financial Performance Rules* (Department of Internal Affairs, 2013). A summary of participant data is provided in Figure 29, and individual participants' responses and attendance times are available at the data portal link below.

The Non-Financial Performance Rules were introduced in 2013, came into force on 30 July 2014, and were required to be reported on for the first time in councils' 2015-16 annual reports. Since then, there has been a steady increase in the number of participants reporting customer attendance and response time data, reflected in Figure 30 through to Figure 32.

There is, however, no discernible trend evident in the time taken for local authorities to attend or resolve customer call-outs. It is likely that average trends in performance are obscured by the increasing number of authorities reporting this information.

Sector trends are less relevant for flooding events, and so are not included in this report. This is because not all participants experience flooding events. In addition, participants experiencing flooding events were often not first responders, making flooding response times generally less consistent across participants.

Figure 29: Median time taken to respond and attend to faults in the water supply, wastewater and stormwater system[7]



Data portal link 6: Attendance and resolution times for water supply and wastewater and flooding
https://www.waternz.org.nz/responsetimes

[7] Large outliers in water, wastewater and flooding response times have been excluded from the data set. This included data on water supply from Central Otago, flooding response from the Far North, Kapiti Coast and South Taranaki and wastewater response data from Stratford

Figure 30: Trends in data collection and median response times for attending to and resolving wastewater faults (in hours)

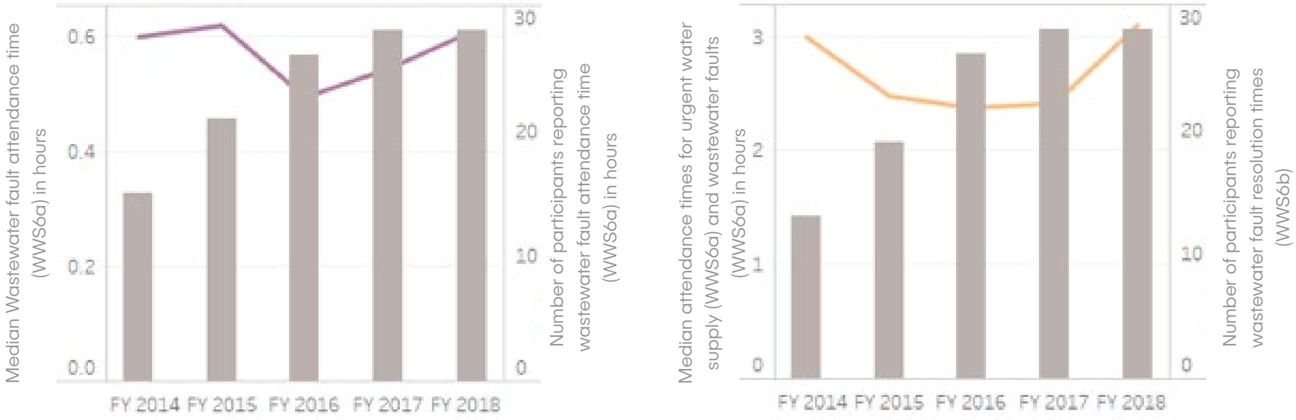


Figure 31: Trends in data collection and median response times for attending to and resolving urgent water supply faults (in hours)

Figure 32: Trends in data collection and median response times for attending to and resolving non-urgent water supply faults (in hours)

- Median attendance times (hours)
- Median resolution times (hours)
- Number of participants reporting data

5.3. Charges

The manner in which water, wastewater, and stormwater is charged varied across participants, and some participants had multiple approaches for charging based on individual schemes. This makes the presentation of a comprehensive comparison of charges difficult. Average charges for individual participants are summarised at the data portal link below. Benchmarked figures show either a weighted average charge, or the most commonly employed charge, depending on what best represents a participant's jurisdiction.

The number of different charging regimes each participant has in place for residential water users is summarised in Figure 33.

A recently released report by BRANZ attempts to paint a comprehensive picture of water charges in New Zealand, and provides a reference for those wanting a more in-depth explanation of water and wastewater charging than is provided here (Garnett & Sirikhanchai, 2018).

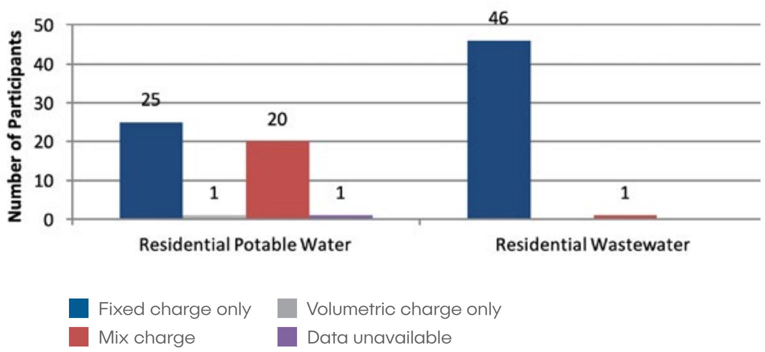
Figure 33: The number of different regimes in place for charging for residential water

5.3.1. Residential water and wastewater charges

The approaches used by participants to charge residential users for water and wastewater is summarised in Figure 34. Only Aucklanders are charged for water and wastewater based entirely on volume used. The most common form of charging for water and wastewater is to levy a single fixed annual charge by using a targeted rate, a uniform annual general charge, or a general charge (while general charges vary based on property values, these are still considered a fixed charge for the purposes of this report, as they do not vary for residents based on usage).

A combination of fixed and volumetric charging is common for water supply systems. In some cases, charges only apply when a certain volume of water has been exceeded, and in other cases charges vary based on the volume of water used (with charges either increasing or decreasing as volumes increase). A summary for those applying volumetric charges to residential properties is shown in Table 7.

Figure 34: Residential charging approach for water and wastewater



Data portal link 7: Drinking water, wastewater and charges and affordability
https://www.waternz.org.nz/charges

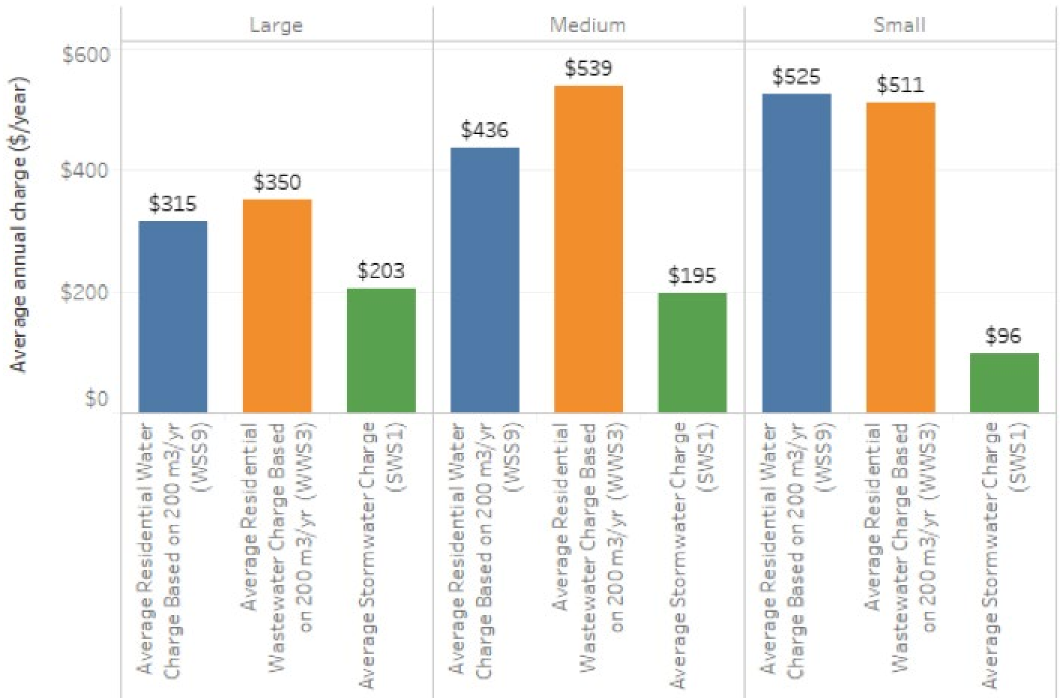
Table 7: Residential volumetric charges (including GST)

Council	Fixed charge ($/year)	Volumetric applies only above the following volume (m^3/year)	Flat volumetric rate ($/$m^3$)	Ascending volumetric rate	Descending volumetric rate
Ashburton	370.3	365	0.92		
Auckland			1.48		
Central Otago	323.46		0.6		
Far North	287.88		3.06		
Hauraki	114				0-200m^3 = $1.84 200-400$m^3$ = $1.54 >400$m^3$ = $1.39
Horowhenua	401.1			0-50m^3 = $0.64 51-100$m^3$ = $1.28 >101$m^3$ = $1.92	
Kaipara	188		3.27		
Kapiti	207		1.09		
Manawatu	350		1.45		
New Plymouth	30		1.11		
Opotiki	255		0.655		
Ruapehu	901.27	375	2.3		
Selwyn	266		0.44		
South Taranaki	592	350	2.48		
South Wairarapa	562		1.84		
Tararua	95.265		1.43		
Tasman	332.74		2.17		
Tauranga	29		1.89		
Timaru	297	500	0.6		
Waipa	128.2			0-250m^3 = $1.03431/$m^3$ >250m^3 = $1.49868/$m^3$	
Western Bay of Plenty	440.45		1.3		
Whangarei	34.5		2.26		

Average annual charges for a household consuming 200m3 a year of water for water, wastewater, and stormwater are shown in Figure 35 for each participant size category. This illustrates that average drinking water charges were inversely proportional to category size, while average charges for wastewater were highest for those in the medium size category. Combined water and wastewater charges ranged from an average $665 for large councils, up to $975 for medium-sized councils, and $1,026 for small councils. This suggests that as the as the scale of drinking and wastewater services increases, there are efficiencies of scale resulting in lower averages costs to consumers.

The correlation was reversed for stormwater, with charges decreasing as the size of the organisation increased. This likely reflects lower levels of impervious surfaces in smaller population centres, decreasing the need for stormwater conveyance and treatment systems.

Figure 35: Average residential charges for a household using 200m3 a year for drinking water, wastewater, and stormwater based on participant size



5.3.2. Affordability

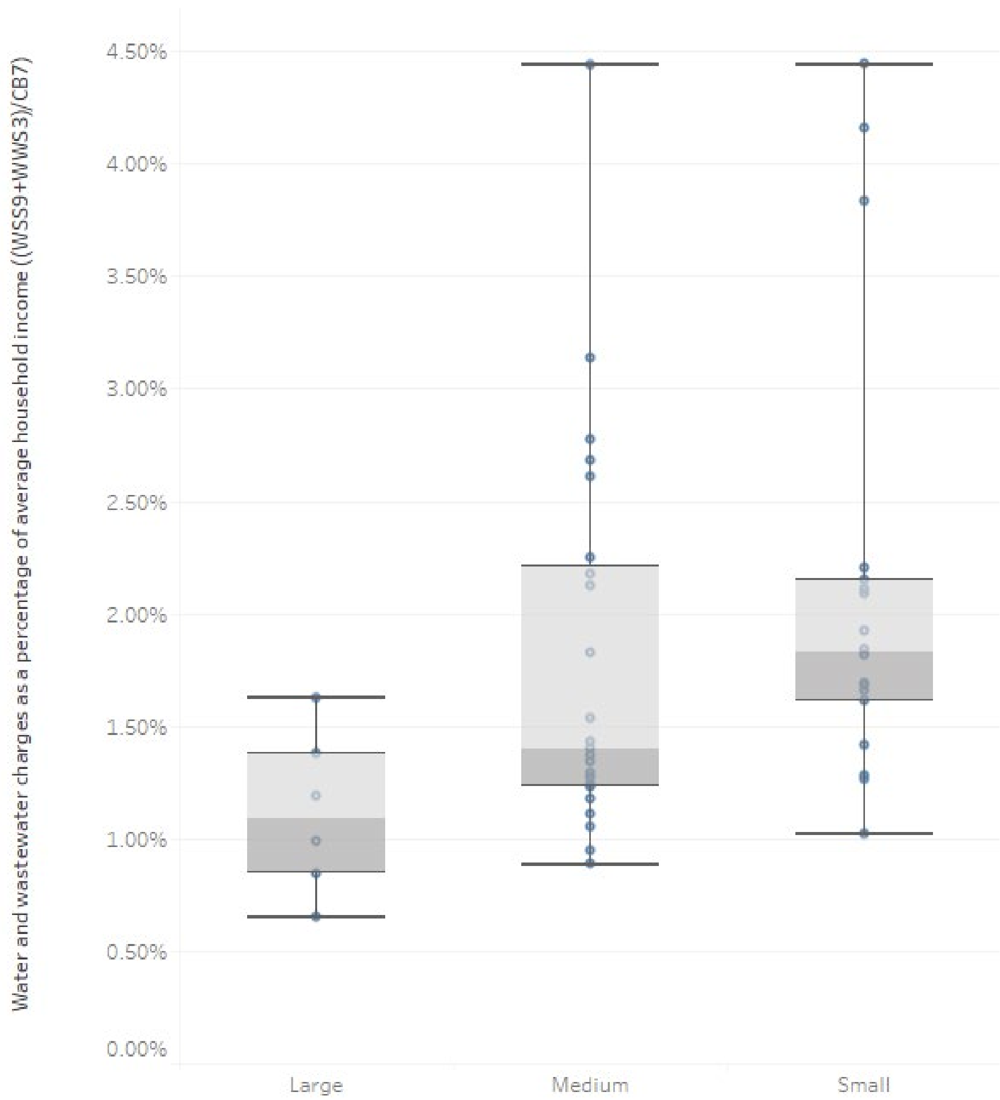
The affordability of water and wastewater charges has been calculated based on the ratio of combined water and wastewater charges (for a household consuming 200m^3 of water per year) to average household income (Statistics New Zealand, 2013).

Median water and wastewater charges average 1.09% of household income for large councils, 1.4% for medium-sized councils, and 1.83% for small councils. This suggests a correlation between the size of entities and communities' ability to pay for water services.

While there is currently no official definition of 'water affordability' in New Zealand, international water affordability metrics range from 2% to 5% of household income. While no participants charged in excess of the 5% figure, Far North, Western Bay of Plenty, Tasman, Horowhenua, Hauraki, Whangarei, Taupo, Waikato, Ruapehu, Kaipara, South Wairarapa, Rangitikei, South Taranaki, Masterton, and Opotiki all applied water and wastewater charges that were in excess of 2% of total average household income.

The affordability of water charges in New Zealand is discussed in further depth in Residential water tariffs in New Zealand (Garnett & Sirikhanchai, 2018).

Figure 36: Affordability/water and wastewater charges plotted against scheme size



5.3.3. Non-residential charges

Not all local authorities differentiated between different types of users when setting water tariffs. While it was common for participants to have in place trade-waste charges for industrial discharges by non-residential users, significantly fewer differentiated water charges for non-residential water consumers, with 14 authorities using the same charging approach for both residential and non-residential customers.

Figure 37: Different charging regimes for residential and non-residential water and wastewater supplies

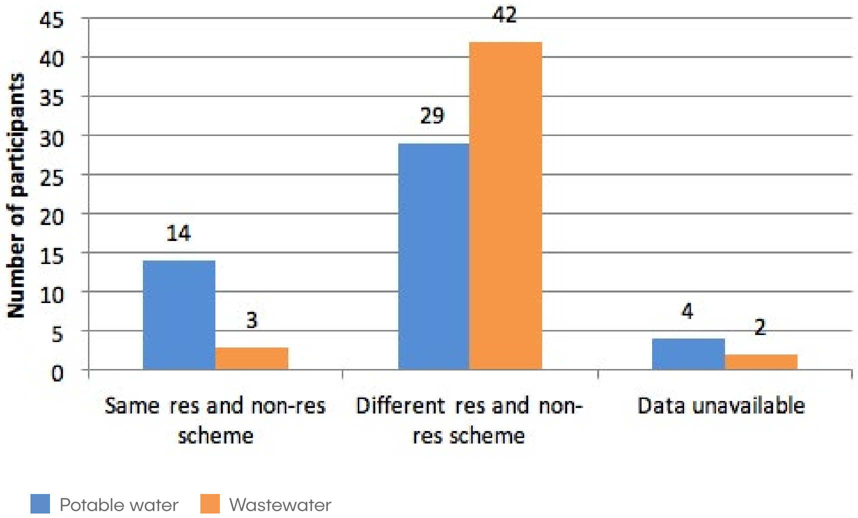
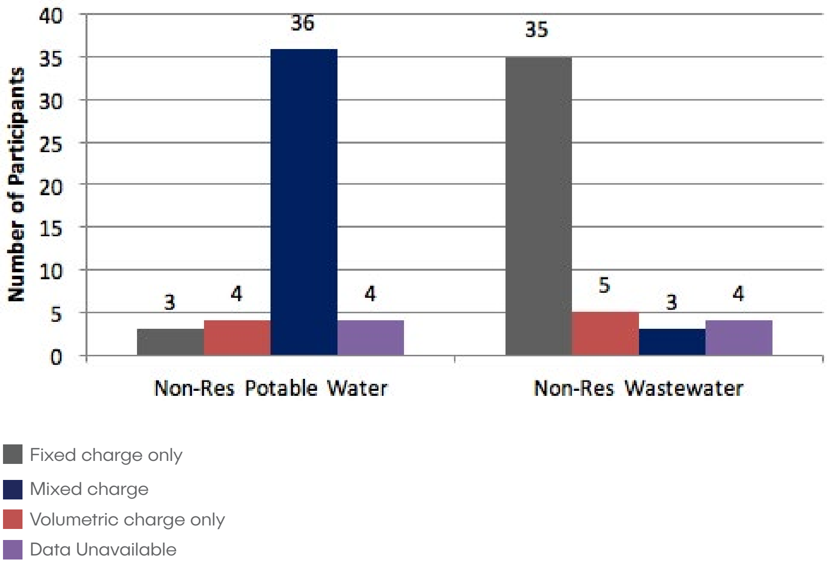


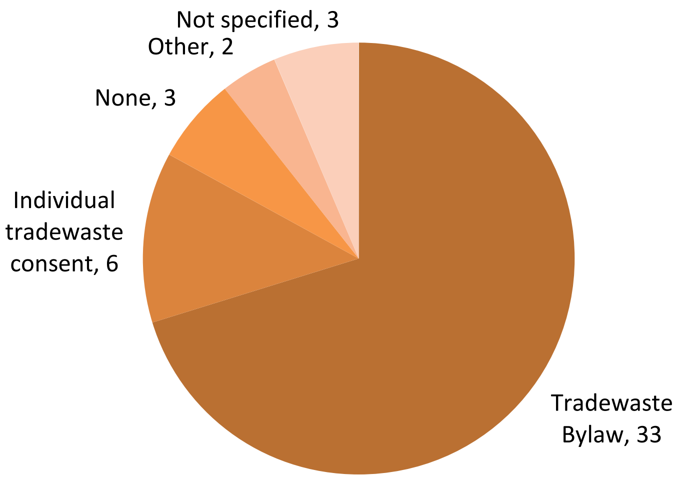
Figure 38: Non-residential charging approach for water and wastewater



5.4. Trade-waste management

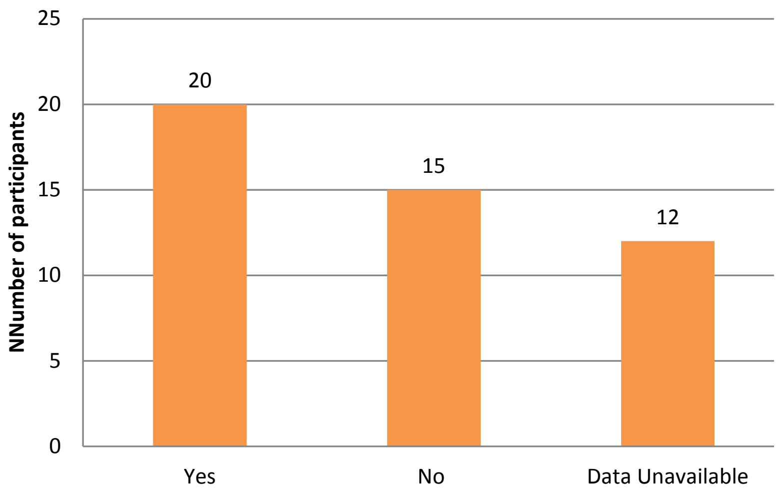
The majority of participants responding to this report either employed individual trade-waste consents, or used trade-waste bylaws to manage industrial discharges into the wastewater system. Only Clutha, Far North, and Stratford indicated they had yet to put in place a trade-waste management approach. A further three participants (Dunedin, Tararua, and Waimakariri) did not specify their approach to managing trade waste.

Figure 39: Trade waste management approach



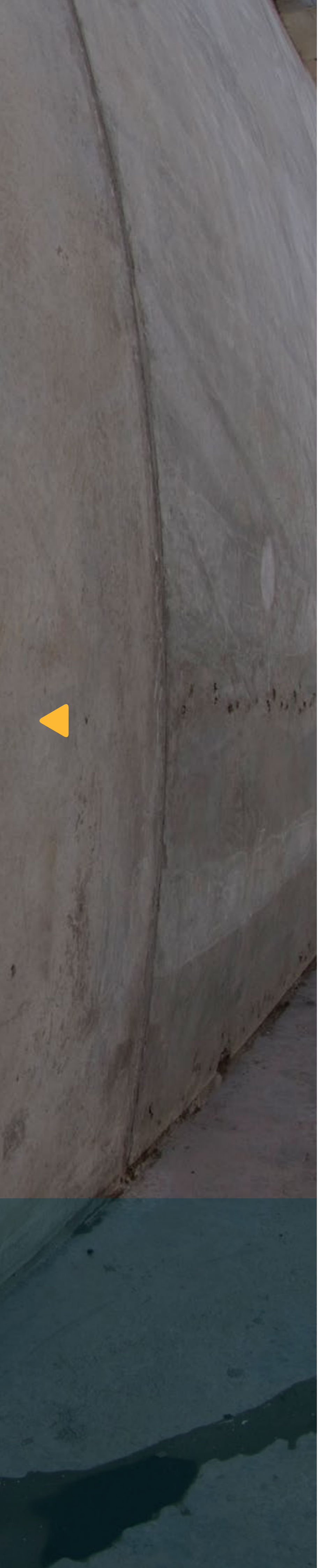
Of the 38 participants who specified that they had trade-waste management approaches in place, only twenty specified that they used contaminant-based charging as part of their trade-waste management approach. Provided values are shown in Appendix II: *Contaminant-based charges.*

Figure 40: Contaminant based charging employed



An engineer at work in the new wastewater reactors for Auckland. The $141 million dollar upgrade involved up to 250 workers a day, 500,000m3 of earthworks and 15,000m3 of concrete poured illustrates the scale and effort that can be involved in protecting public health and environment from wastewater discharges.

Photographer: Sven Harlos, Projects Manager Construction Delivery, Watercare



6. ECONOMIC SUSTAINABILITY

6.1. Revenue

In the 2018 fiscal year, participants collected just over $2 billion in revenue for the provision of water, wastewater, and stormwater services. The average revenue collected per property for individual participants is available at the data portal link overleaf.

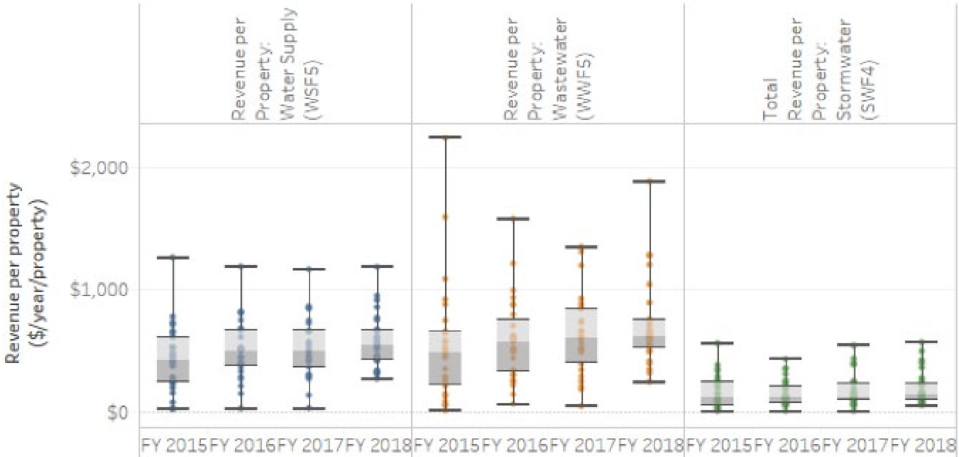
The majority of revenue collected was operational, consisting of revenue obtained from fixed charges (usually administered through rates), volumetric charges, special levies, lease of land or space reserved for assets, revenue from asset sales, and other operational income such as interest.

Table 8: Total 3 Waters revenue

	Water Supply	Wastewater	Stormwater
Operating Revenue	$668,791,306	$945,924,610	$240,865,104
Developer Contribution Revenue	$41,096,165	$68,601,522	$51,049,395
Revenue from the Supply of Services to other authorities	$5,935,962	$11,155,274	
TOTAL	***$715,823,433***	***$1,025,681,406***	***$291,914,499***

Figure 41 shows revenue collected per property for participants supplying data from the fiscal years 2015 to 2018, with each participant represented as a dot. During this time, median revenue collected per property has risen from $426 to $543 (27.5%) for water supply services, from $477 to $614 (28.7%) for wastewater services, and from $122 to $144 (18.0%) for stormwater services. The average price of consumer goods tracked in the consumer price index has risen 13.7% over the same period (Statistics New Zealand, 2018).

Figure 41: Trend in revenue per property

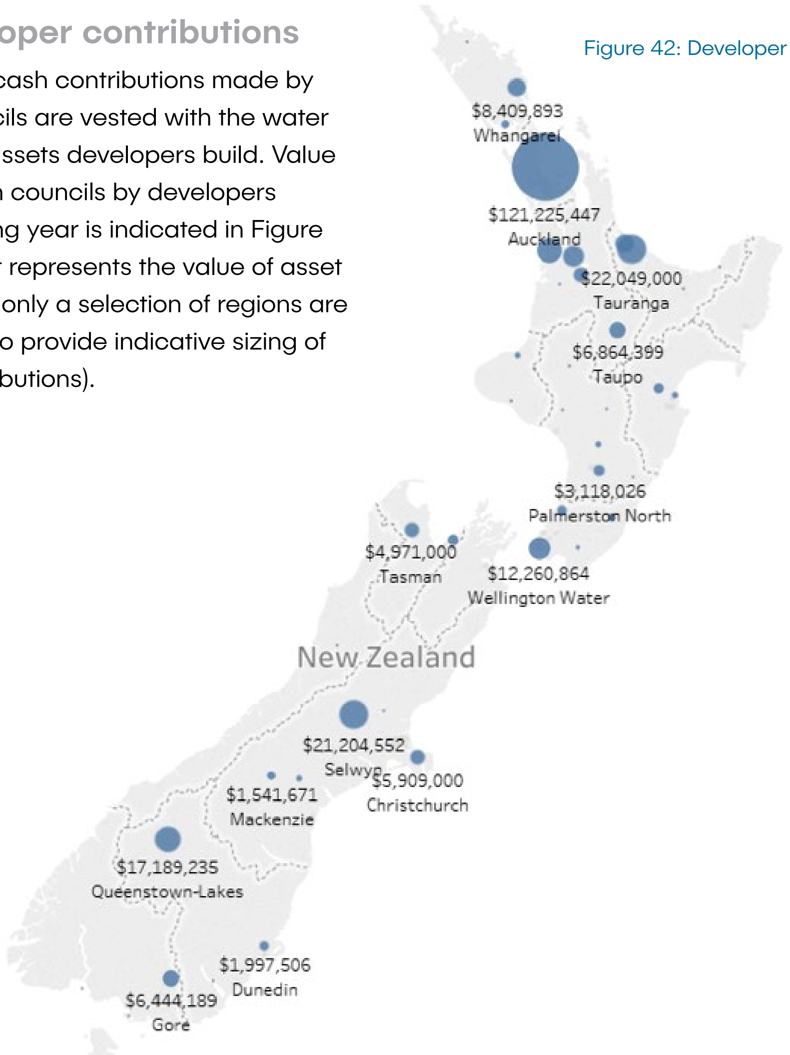


Data portal link 8: Revenue per property for water supply, wastewater and stormwater servives
https://www.waternz.org.nz/revenue

6.2. Developer contributions

In addition to the cash contributions made by developers, councils are vested with the water and wastewater assets developers build. Value of assets vested in councils by developers during the reporting year is indicated in Figure 42. The size of dot represents the value of asset contributions (NB: only a selection of regions are labelled, in order to provide indicative sizing of the value of contributions).

Figure 42: Developer asset contributions



6.3. Expenditure

Expenditure across all participants totalled slightly over $2.1 billion. Of this, interest accounted for $213 million, which is approximately 10% of expenditure. A breakdown of expenditure is provided in Table 9.

Table 9: Total expenditure across all participant systems

	Water Supply	Wastewater	Stormwater
Capital Expenditure	$369,008,627	$511,247,062	$238,873,994
Operating Expenditure	$323,317,626	$375,081,832	$103,263,693
Interest	$50,918,410	$128,316,436	$34,134,649
TOTAL	$743,244,663	$1,014,645,330	$376,272,336

6.3.1. Operational expenditure

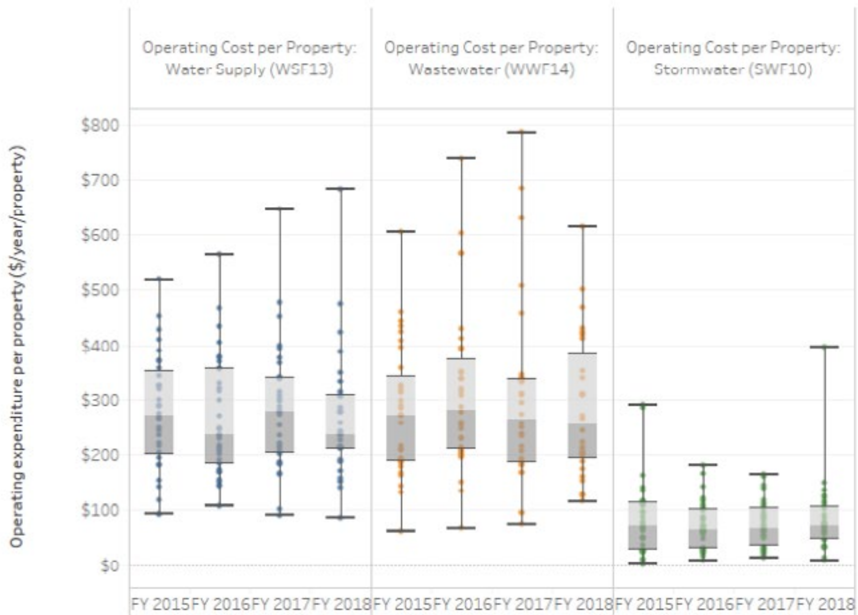
Categories of operational expenditure across all participants are aggregated in Table 10. Operational expenditure on stormwater systems trails operational expenditure on water and wastewater systems by slightly more than two thirds.

Table 10: Operational expenditure across all participant systems

	Water Supply	Wastewater	Stormwater
Energy costs	$29,625,793	$33,731,238	
Chemicals and consumables	$17,079,511		
Sludge disposal costs		$15,061,634	
Routine maintenance	$72,980,975	$88,253,389	$29,256,638
Reactive maintenance	$63,505,400	$67,932,930	$22,333,108
Management costs	$121,894,830	$152,603,838	$42,054,870
Operating costs	$323,317,626	$375,081,832	$103,263,693

Operational expenditure per property over the past four years for water supply, wastewater, and stormwater systems is shown in Figure 43, and reveals no discernible trends.

Figure 43: Trend in operational expenditure per property



A comparison of individual participant operational expenditure is provided at the data portal link below.

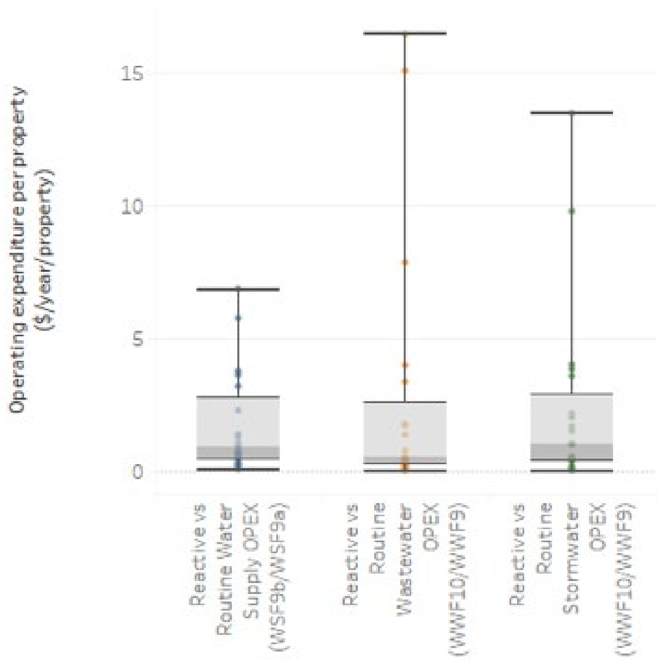
Data portal link 9: Operational expenditure per property
https://www.waternz.org.nz/opex

Participants in the NPR were asked for the first time this year for a breakdown of routine and reactive maintenance expenditure. This breakdown was not available for approximately one quarter of participants, the majority of whom included reactive expenditure in the routine maintenance category.

The range of ratios for routine versus reactive maintenance expenditure is shown in Figure 44. The median ratio of reactive to routine maintenance (0.5) was lower for wastewater systems than for water supply (0.88) and stormwater systems (1.03).

The large spread of ratios suggests there is room to improve collection and consistency around these data.

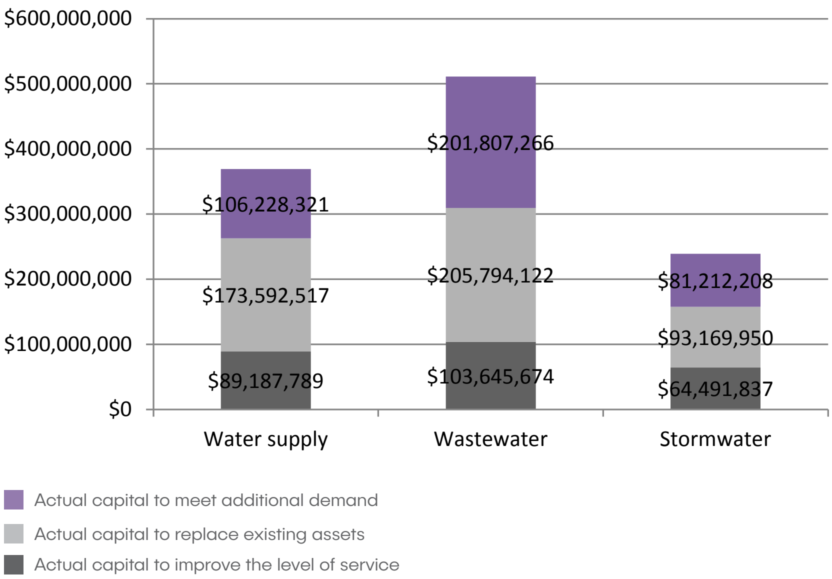
Figure 44: Reactive vs. routine maintenance ratio



6.3.2. Capital expenditure

Participants' capital expenditure totalled slightly over $1.1 billion in the 2018 fiscal year. A breakdown of expenditure by purpose is shown in Figure 45.

Figure 45: Total 3 Waters capital expenditure by purpose



Capital expenditure for participants who have supplied data to the review over the past four years is shown in Figure 46. There has been a gradual increase in capital expenditure by this group between the 2015 and 2018 fiscal years: from $280 million to $319 million (13%) for water supply, from $286 million to $446 million (56%) for wastewater, and from $147 million to $225 million (55%) for stormwater systems.

Spikes in capital expenditure on wastewater systems and stormwater systems in 2016 and 2017 are largely attributable to expenditure by Christchurch City Council, where earthquake rebuilding has been ongoing.

Figure 46: Increase in actual capital expenditure for 3 Waters between 2015 and 2018

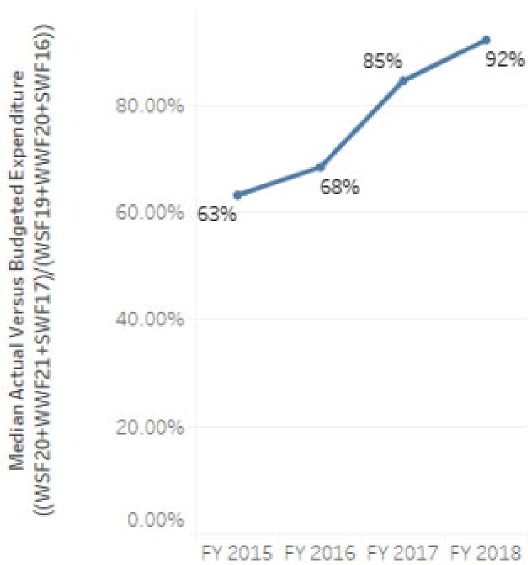
In general, the average amount of capital spent trails the budgeted amount.

The gap has gradually been closing, however, for participants supplying data over the last four years, with the median ratio of actual capital to budgeted capital rising from 63% in the 2015 fiscal year to 92% in 2018.

This is slightly higher than the median for all participants supplying data in 2018, for whom the ratio was 86%. 2018 figures were slightly skewed by Ruapehu, whose capital was 239% of that originally budgeted, and Hastings, whose capital was 208%.

Actual capital spent versus budgeted capital for individual participants can be viewed at the data portal link shown below.

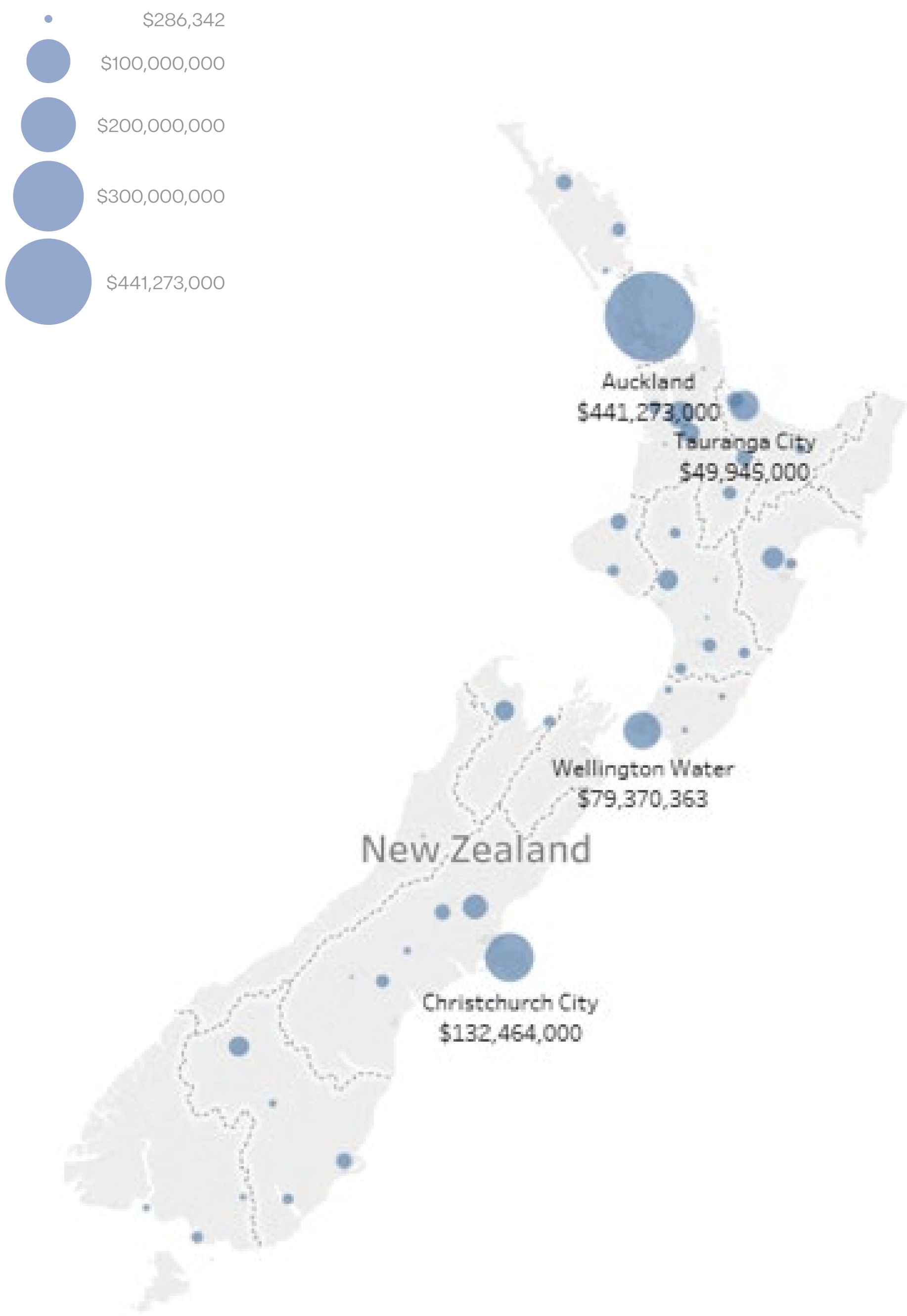
Figure 47: Actual versus budgeted expenditure trend



Data portal link 10: Actual capital expenditure as proportion of budgeted capital expenditure
https://www.waternz.org.nz/balancedbudget

Capital expenditure on water and wastewater systems is clustered around the major centres. The size of circles in Figure 48 is indicative of the amount of capital expenditure across 3 Water systems by each participant. Those with expenditure greater than $40 million are labelled on the map.

Figure 48: Total capital expenditure around New Zealand



Data portal link 11: Capital expenditure per property for water, wastewater and stormwater
https://www.waternz.org.nz/capex

6.4. Depreciation

Total depreciation across all participants' systems exceeded capital expenditure on their replacement or enhancement, with the exception of stormwater systems.

Table 11: Depreciation and capital expenditure on existing assets

	Water Supply		Wastewater		Stormwater	
	Total	*Asset improvement as a proportion of depreciation*	*Total*	*Asset improvement as a proportion of depreciation*	*Total*	*Asset improvement as a proportion of depreciation*
Annual Depreciation	$287,349,682		$333,235,598		$141,457,239	
Actual capital to replace existing assets (SWF17c)	$173,592,517	60%	$205,794,122	62%	$93,169,950	66%
Actual capital to replace existing assets and improve the level of service (SWF17b + SWF17c)	$262,780,306	91%	$309,439,796	93%	$157,661,786	111%

Data portal link 12: Capital expenditure versus depreciation over the last two years for water, wastewater and stormwater https://www.waternz.org.nz/depreciation

6.5. Cost coverage

6.5.1. Operational cost coverage

This metric shows operational costs, asset depreciation, and interest as a proportion of revenue (excluding developer contributions) for 3 Waters networks to indicate coverage of costs. Depreciation is used rather than capital expenditure, as capital expenditure on water networks is inherently lumpy and commonly funded through debt.

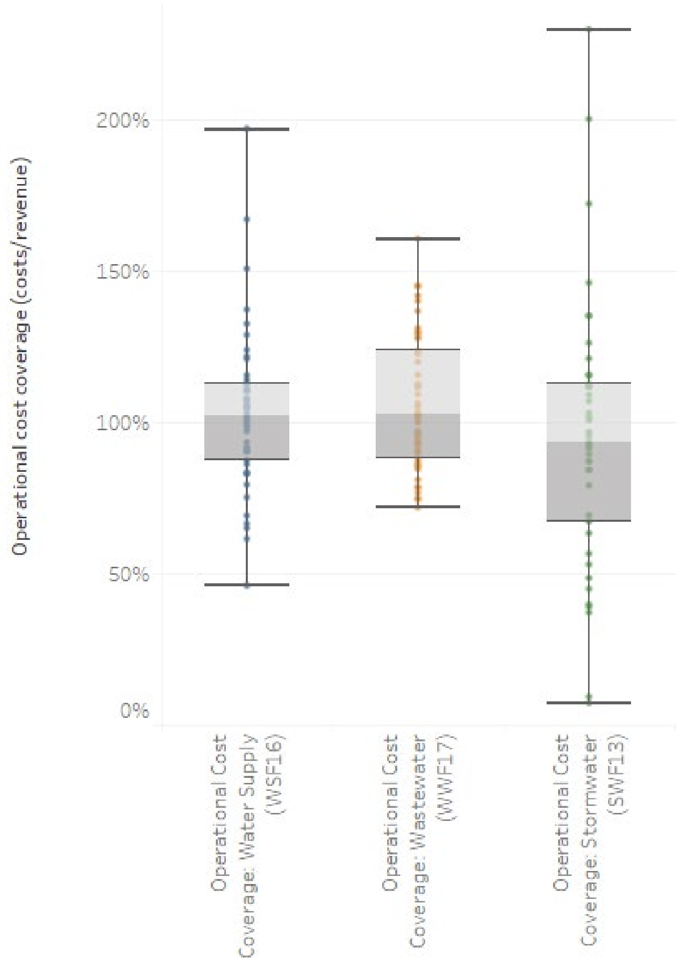
This aligns with the *Balanced Budget Benchmark in the Local Government (Financial Reporting and Prudence) Regulations 2014* (New Zealand Government, 2015),which applies to whole-of-council operations, and is met if revenue exceeds operating expenses.

The balanced budget benchmark was achieved, on average, at an individual asset class level for water and wastewater networks (with median values of 104% and 103% respectively), but not for the average stormwater system (93%). While median values achieved overall cost coverage, 20 authorities did not achieve full cost coverage for water services, 20 for wastewater services, and 23 for stormwater services.

Figure 49 shows the range of cost coverage rates, with individual participant cost coverage results displayed as a dot. The figure shows that there was a broad range of cost coverage being achieved for water, wastewater, and stormwater systems. Cost coverage rates for individual councils are shown at the data portal link below.

Note that this cost coverage figure includes depreciation, which is not always fully funded, so this will affect the achievement of cost coverage as indicated by this measure.

Figure 49: Operational cost coverage for water, wastewater and stormwater



Data portal link 13: Operational cost coverage for water, wastewater and stormwater systems per participant
https://www.waternz.org.nz/costcoverage

6.5.2. Debt Servicing

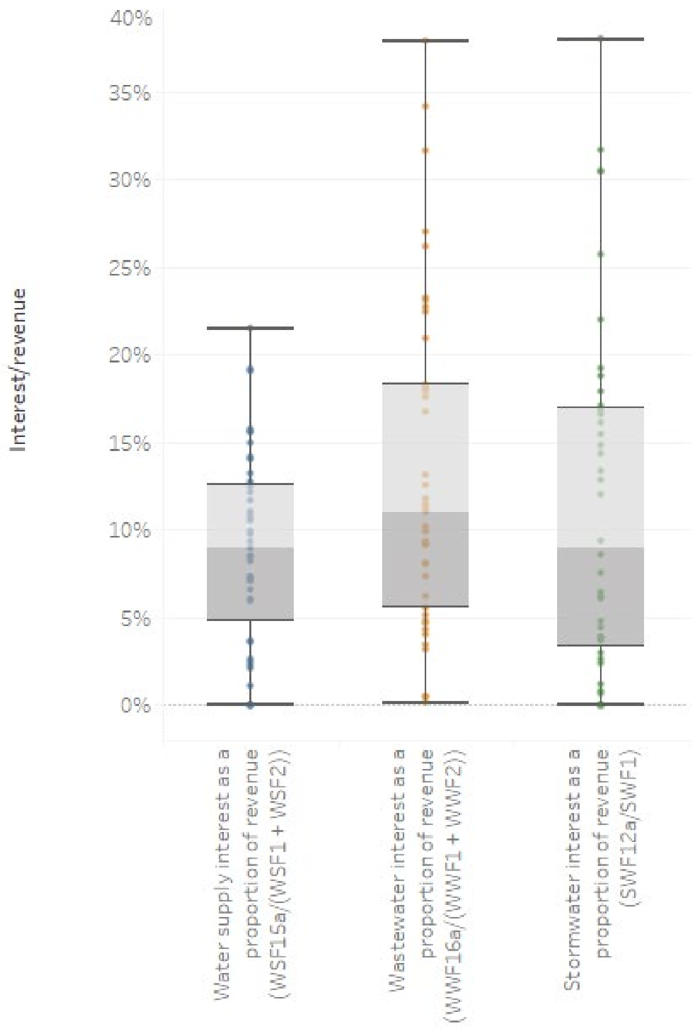
This metric shows the proportion of revenue (excluding developer contributions) spent on interest payments for water, wastewater, and stormwater networks.

The metric aligns with the Debt Servicing Benchmark in the *Local Government (Financial Reporting and Prudence) Regulations 2014* (New Zealand Government, 2015), which applies to whole-of-council operations. It is met if borrowing costs are less than 10% of a local authority's revenue per year (or 15% for a high-growth council).

Considered at an individual asset class level, borrowing costs exceed the benchmark for a number of water, wastewater, and stormwater networks, possibly reflecting that these tend to be long-lived assets and that capital used to finance them is commonly funded through debt.

The median level of debt-servicing across all participants was close to the 10% benchmark, with 9% of interest spent on revenue for water, 11% for wastewater, and 9% for stormwater services. The 10% benchmark was exceeded at an asset class level, however, by 14 participants for water supply systems, 19 for wastewater, and 20 for stormwater. The 15% benchmark was exceeded by 5 participants for water assets, 13 for wastewater, and 12 for stormwater.

Figure 50: Interest as a proportion of revenue for water, wastewater and stormwater



Data portal link 14: interest as a proportion of revenue for water, wastewater and stormwater per participant
https://www.waternz.org.nz/debtservicing

An engineer collects data on the condition of a culvert servicing Auckland's motorway. Regular asset condition inspections form the basis of asset renewal and maintenance programmes are essential to ensuring our communities receive the necessary levels of service from their assets.

Photographer: Peter Mitchell, Stormwater Asset Manager, Auckland Motorways

7. RELIABILITY

7.1. System interruptions

The leading cause of interruptions to water supply arose from unplanned interruptions (which does not include third-party damage). The total number of unplanned interruptions across all participants was 9,305. Third-party interruptions contributed to 3,346 water supply interruptions across all participants, and there were 3,255 planned interruptions to the water supply.

Figure 51 shows the spread of data, with each participant listed as a dot. In each instance, maximum values for Watercare were a significant outlier due to the relatively large number of customers serviced. Median values by interruption type were 73 for third-party incidents, 25 for planned interruptions, and 99 for unplanned interruptions.

A comparison of individual participant interruptions (normalised by either km of pipe or number of properties serviced) is available via the data portal links at the end of this section.

Trends in the median number of interruptions for participants who have supplied continuous data for four years is shown in Figure 52.

Figure 51: Interruptions to water and wastewater systems by type

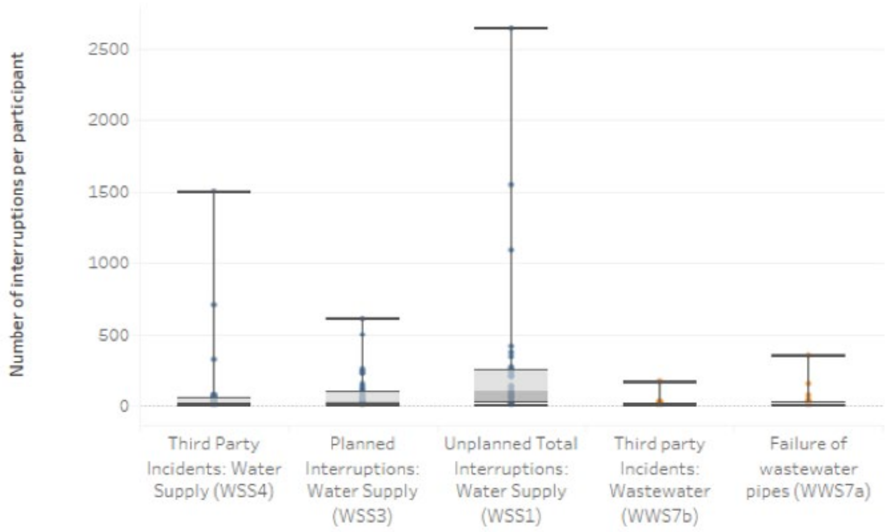
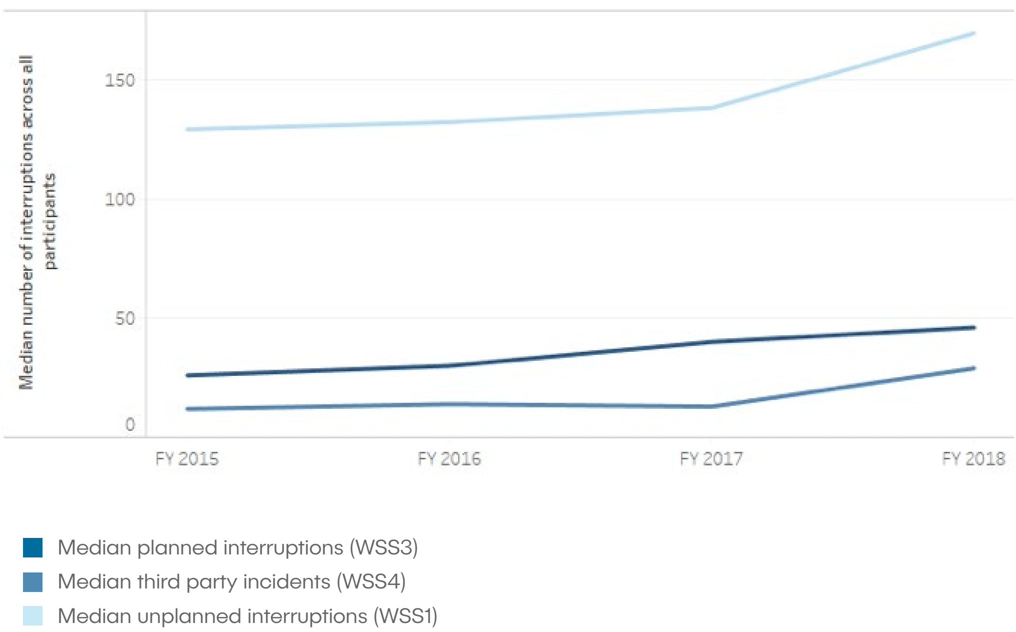


Figure 52: Trend in water supply interruptions by type



Data portal link 15: Third party interruptions affecting the water and wastewater system, planned and unplanned interruptions to the water supply and failure of pipes affecting the wastewater system https://www.waternz.org.nz/interruptions

7.2. Condition assessments

Participants commonly assign a 1 to 5 grading to indicate the condition of their assets (with 5 indicating assets are in very poor condition, and 1 indicating very good). Such condition assessments offer a glimpse into the state of assets, however variation in assessment methodologies makes it difficult to make meaningful comparisons. Table 12 shows the range and frequency of condition grading approaches in use.

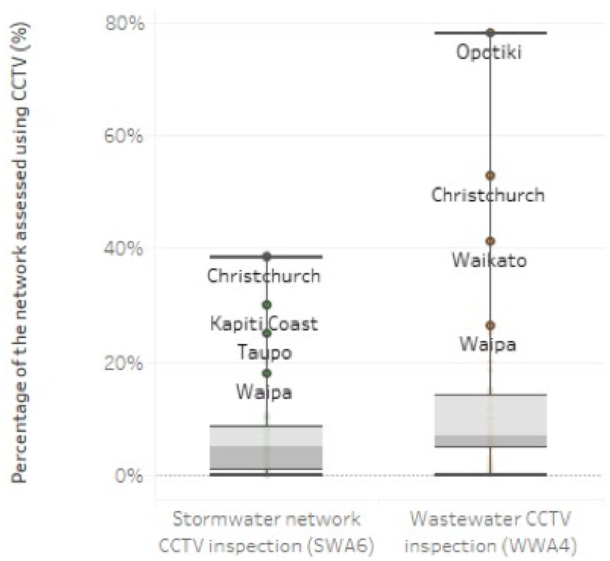
Table 12: Condition grading approaches in use

Condition grading approaches	Water		Wastewater		Stormwater	
	Pipelines	*Above ground assets*	*Pipelines*	*Above ground assets*	*Pipelines*	*Above ground assets*
Informal	4	5	3	4	3	3
In-house	9	6	7	8	8	11
New Zealand Infrastructure Asset Grading Guidelines	3	4	3	5	1	3
NAMS International Infrastructure Management Manual	8	9	4	9	4	6
IPWEA Condition Assessment and Asset Performance Guidelines	1	6	2	4	1	3
Visual Assessment Manual for Utility Assets		2		2		0
New Zealand Pipe Inspection Manual	4		14		14	
IPWEA Practice Note 7: Water Supply and Sewerage	2		1		0	
Other (please specify in comments field)	6	5	5	6	5	7
Not specified	10	10	8	8	11	14

7.2.1. Pipeline condition assessments

CCTV (Closed Circuit Television) is one method commonly used to make assessments of pipeline condition. The proportion of participants' networks assessed using CCTV in wastewater and stormwater networks is shown in Figure 53 (CCTV is not commonly applied to water networks due to water pressure in the networks). High users of CCTV are labelled on the figure.

Figure 53: Proportion of network that has been assessed using CCTV



The completeness of authorities' asset condition data can be determined by looking at the proportion of the network that has yet to receive a condition grading. While some participants had yet to assign a condition grade to any of their pipelines, the majority had assessed most, with the median value of the network not assessed being 4% for water, 2% for wastewater, and 6% for stormwater. Figure 54 shows the proportion of each participant's network that has yet to receive a condition grading. Participants are represented by a dot.

Variation in the proportion of pipeline assets receiving a condition grading partially reflects different condition assessment approaches. For example, Dunedin only assigns an asset a condition when a physical assessment of the asset has been undertaken, whereas other participants have extrapolated pipeline condition gradings based on factors such as asset age or number of breakages.

There is a large spread in the proportion of pipelines assessed as being in poor or very poor condition, as shown in Figure 55. Median values for water, wastewater, and stormwater networks were 8%, 5%, and 2% respectively, while maximum values ranged up to 47%, 61%, and 38%. The proportion of individual participants' networks assessed as being in poor or very poor condition is available in the data portal at the link below. The data portal link also shows participants' confidence in this data, and the accuracy of these figures should be considered in the context of aforementioned variations in condition assessment approaches and data availability.

Figure 54: Proportion of pipelines that have not yet been assigned a condition grading per participant

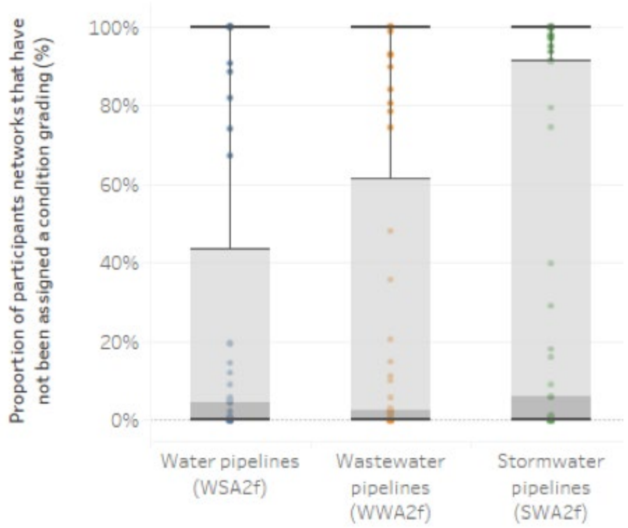
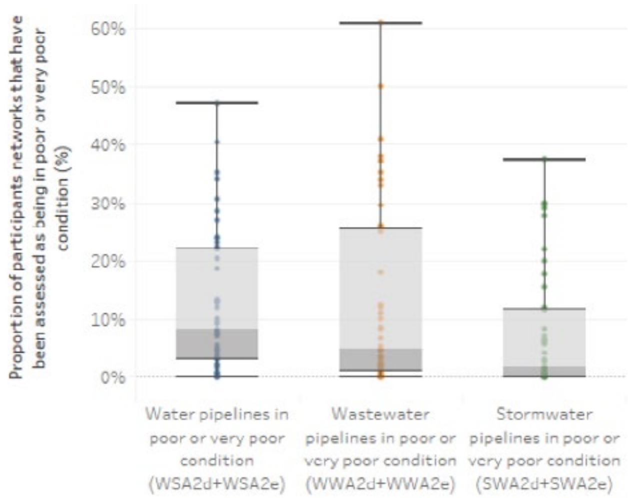


Figure 55: Proportion of pipelines in poor or very poor condition



Data portal link 16: Proportion of water, wastewater and stormwater pipelines assessed in a poor or very poor condition
https://www.waternz.org.nz/pipecondition

7.2.2. Above-ground asset assessments

The majority of participants (37 for water, and 36 for wastewater) had a regular condition assessment programme for above-ground assets. Regular above-ground assessments of stormwater assets were slightly less common (28 of 39), but still employed by the majority.

For those which did assess networks on a regular basis, the proportion of network assessed in a three-yearly asset management cycle is shown in Figure 57 through to Figure 59.

Figure 56: Proportion of participants with an above ground inspection programme for water, wastewater and stormwater networks

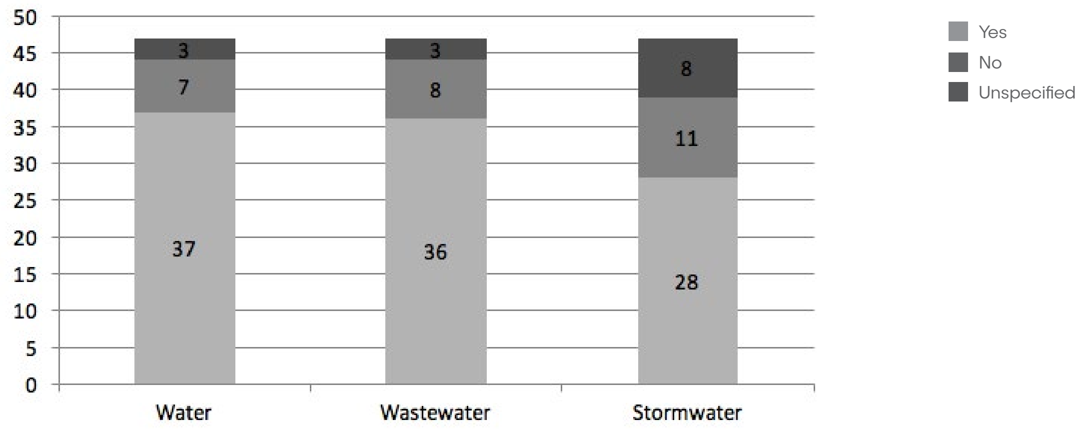


Figure 57: Proportion of above ground assets assigned a condition grading for water

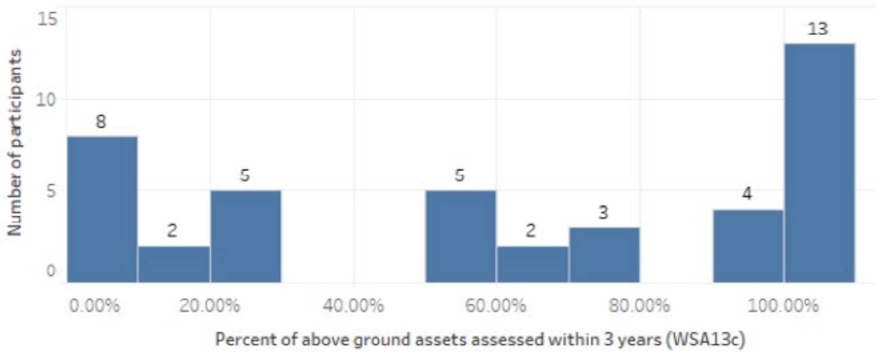


Figure 58: Proportion of above ground assets assigned a condition grading for wastewater

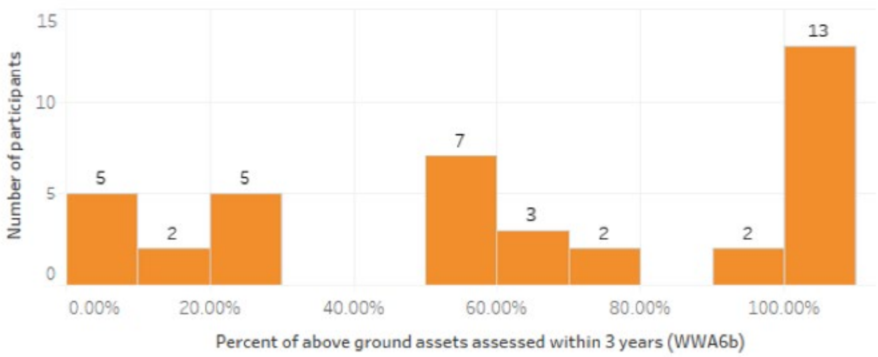
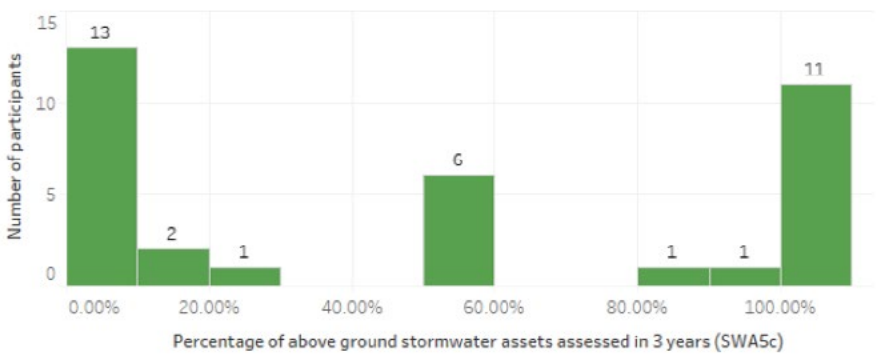


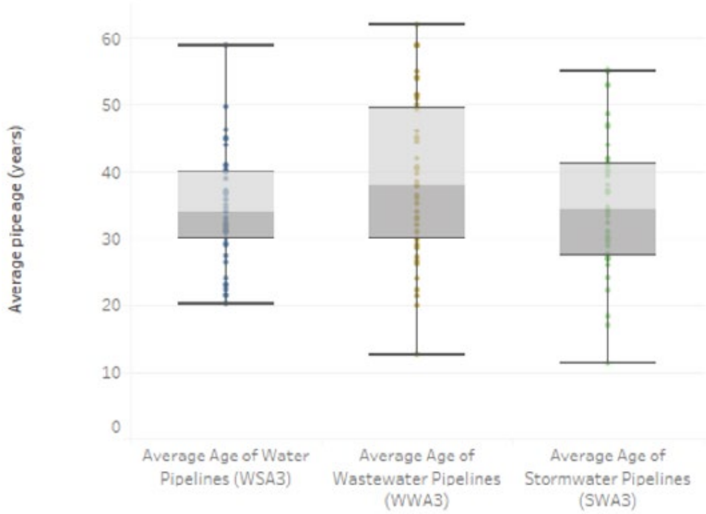
Figure 59: Proportion of above ground assets assigned a condition grading for stormwater



7.3. Pipeline age

The average weighted age of pipelines is shown in Figure 60 with each participant represented as a dot. Newer networks occur in regions experiencing rapid growth including Waimakariri, Selwyn, and Queenstown Lakes. The average weighted network age for all individual participant is available at the data portal link below.

Figure 60: Average pipeline age for water, wastewater and stormwater



Data portal link 17: Average water, wastewater and stormwater pipeline age per participant
https://www.waternz.org.nz/pipeage

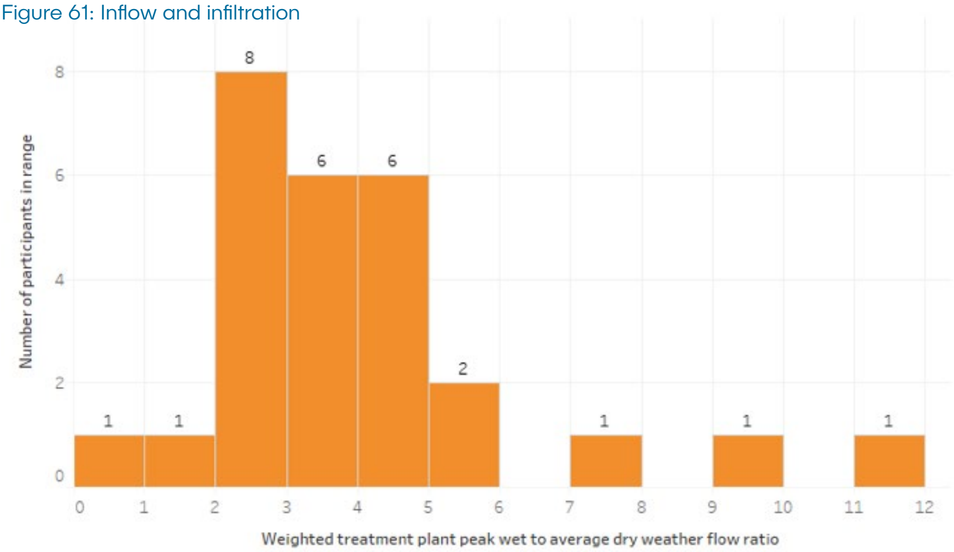
7.4. Inflow and infiltration

Of 47 participants supplying data on wastewater, 27 provided data on the peak wet-weather to average dry-weather flow ratio entering their wastewater treatment plants. This metric provides an indication of stormwater inflow and infiltration into wastewater networks.

The average inflow and infiltration values for each participant, weighted by treatment plant volume, are shown in Figure 61. Peak maximums for individual treatment plants were significantly higher, with one plant reported as having a peak wet- to dry-weather flow ratio of 32, and 14 of 123 treatment plants having flow ratios in excess of 10.

Weighted average values, as well as minimum and maximum ranges, for individual treatment plants can be viewed at the data portal link below.

Figure 61: Inflow and infiltration



Data portal link 18: Inflow and infiltration range per participant
https://www.waternz.org.nz/inflowandinfiltration

7.5. Water loss

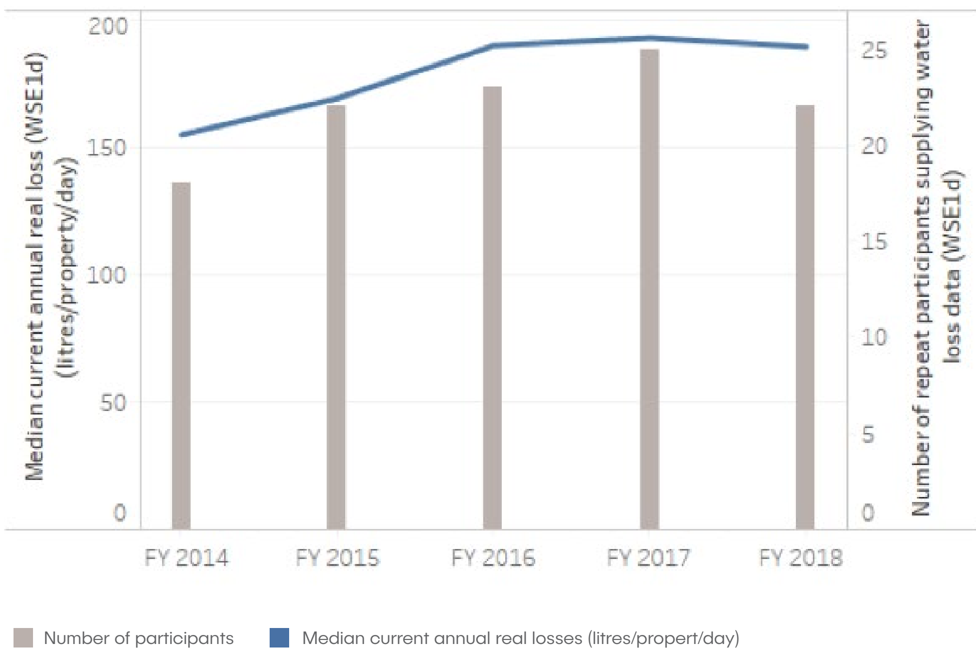
Participants lost a total of 108,474,706m^3 of water through their water supply systems, equivalent to over 43,000 Olympic-sized swimming pools. This constituted over 20% of the 535 million cubic meters of water supplied to systems with known water loss[8].

Changes in system water loss can be compared by looking at changes in current annual real loss levels (CARL), commonly measured using the metric of litres of water lost per property per day. A trend in the median levels of CARL for participants who have continuously supplied data to the NPR is shown in Figure 62. While it appears there may have been a slight increase in water loss levels, this is possibly influenced by those continuous participants who have switched from not reporting to reporting on this particular metric[9].

The Infrastructure Leakage Index (ILI) is the metric recommended by international experts for comparing water losses across different systems. ILI is determined by dividing current annual real water loss levels by unavoidable annual real losses. Thirty-three of 47 participants supplied data on their ILI. The number of participants achieving each of the ILI performance bands contained in *Water New Zealand's Water Loss Guidelines* (Lambert & Taylor, 2010) is shown in Figure 63. Only three participants (Opotiki, Dunedin, and Tauranga) achieved water loss levels low enough that further reduction of losses would be considered uneconomic.

Individual participants' Infrastructure Leakage Index and changes to current annual real losses over time are available at the data portal link overleaf.

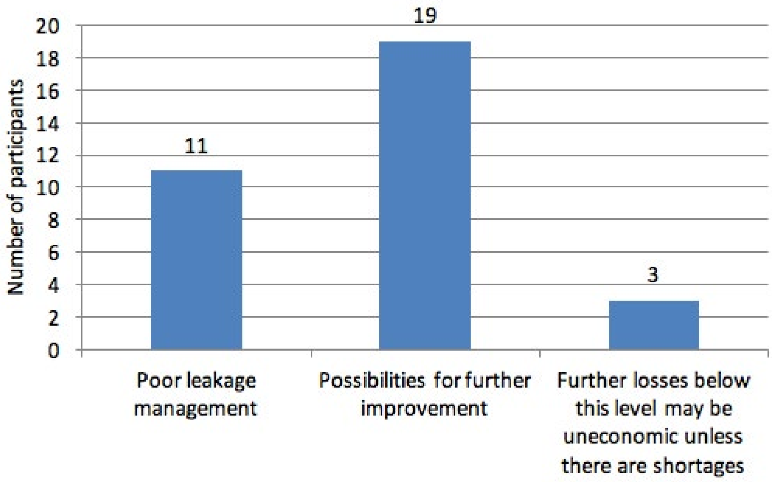
Figure 62: Changes in median and number of entities reporting current annual real loss of water in litres/property/day

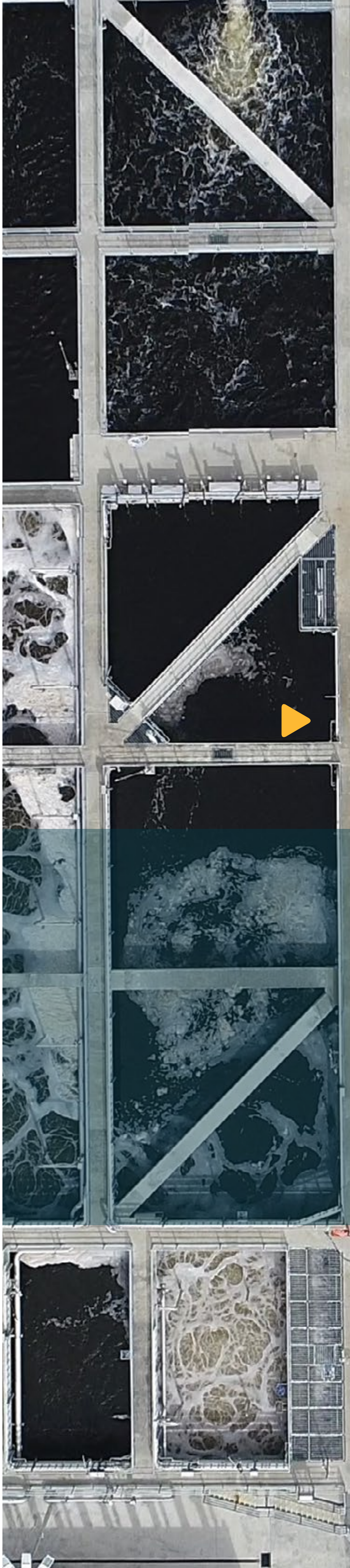


8 Grey, Manawatu, Tararua, Taupo and Whanganui did not supply data on the volumes of water lost through their systems so the water supply value in this section differs from the total water supplied volume all of all participants

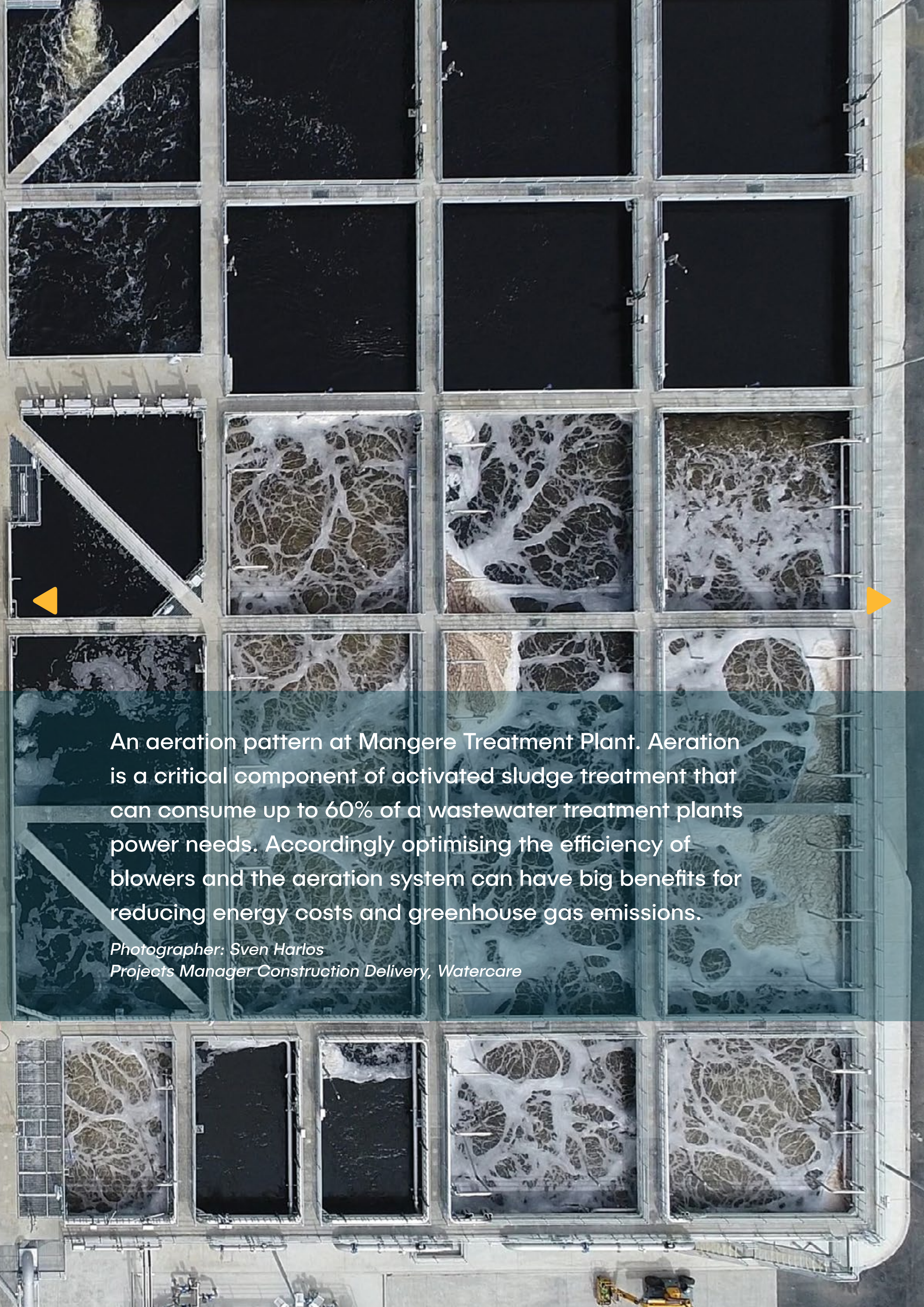
9 The apparent drop in entities reporting on current annual real losses of water in the 2018 financial year is owing to the consolidation of Wellington Waters reporting into a single entity, whereas previously data was reported separately for Upper Hutt, Hutt, Wellington City, Porirua and Greater Wellington Councils.

Figure 63: Infrastructure Leakage Index





Data portal link 19: Water losses using current annual real losses over time and the infrastructure Leakage Index
https://www.waternz.org.nz/waterloss



An aeration pattern at Mangere Treatment Plant. Aeration is a critical component of activated sludge treatment that can consume up to 60% of a wastewater treatment plants power needs. Accordingly optimising the efficiency of blowers and the aeration system can have big benefits for reducing energy costs and greenhouse gas emissions.

Photographer: Sven Harlos
Projects Manager Construction Delivery, Watercare

8. RESOURCE EFFICIENCY

8.1. Water abstractions

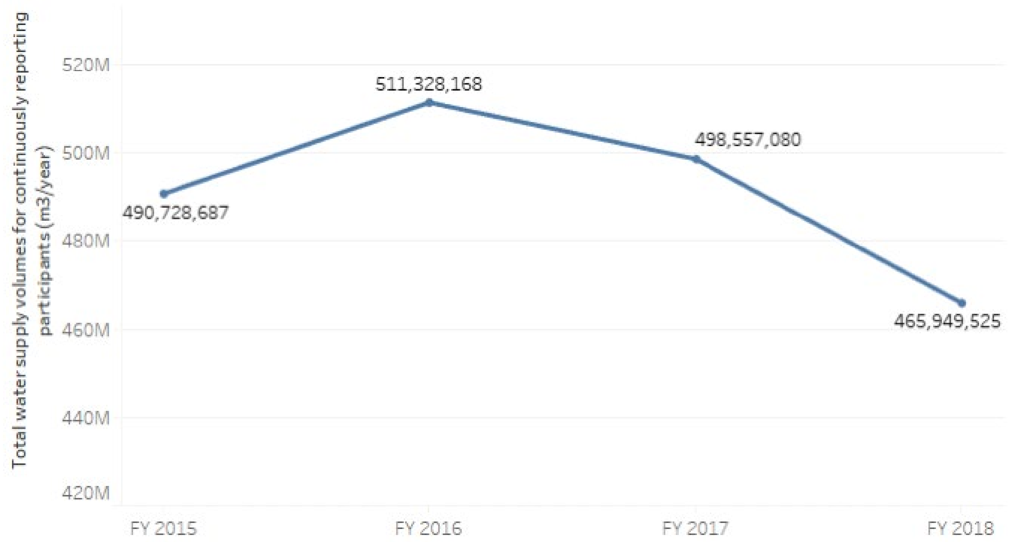
Collectively, participants supplied 560 million cubic meters of water in 2017-18, roughly equal to the volume of 224,000 Olympic-sized swimming pools. A breakdown of water by major end-use categories is shown in Table 13.

Table 13: Total water supply volumes by end use (m^3/year)[10]

Water end use	Total volume supplied (m3/year)
Non-residential water consumption (WSB7)	136,358,708
Estimated residential consumption (WSB5-WSB7-WSE1a)	314,532,064
Total network water loss (WSE1a)	108,474,706
Water Supplied to Own System (WSB5)	**559,365,478**

Trends in the total volume of water supplied for participants continuously providing data over the last four years[11] are shown in Figure 64. Lower consumption figures in the later two years may relate to wetter-than-average conditions over much of New Zealand throughout 2016-17 and 2017-18 fiscal years (discussed further in Section 9.4 *Flooding*).

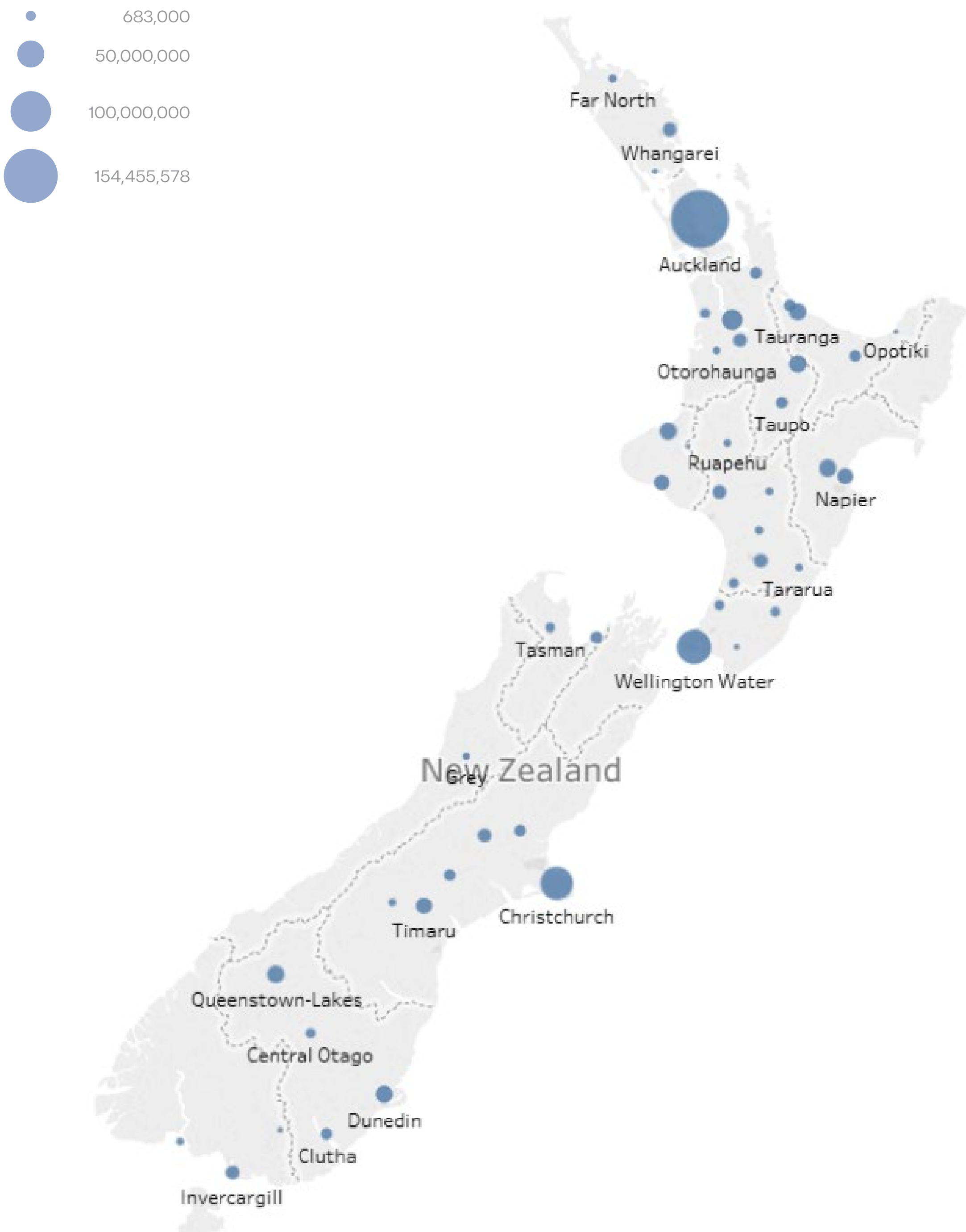
Figure 64: Total water supply volumes over the previous four years for participants continuously supplying data



10 The total volume of non-residential water use in the table is under-represented and residential consumption overestimated as Hauraki, Napier, Opotiki, Selwyn, South Wairarapa, Southland, Tararua, and Waimakariri did not provide volumes of non-residential water use.

11 Excluding Kaipara who did not provide total water supply volumes in 2015

Figure 65: Water abstractions for drinking water per participant



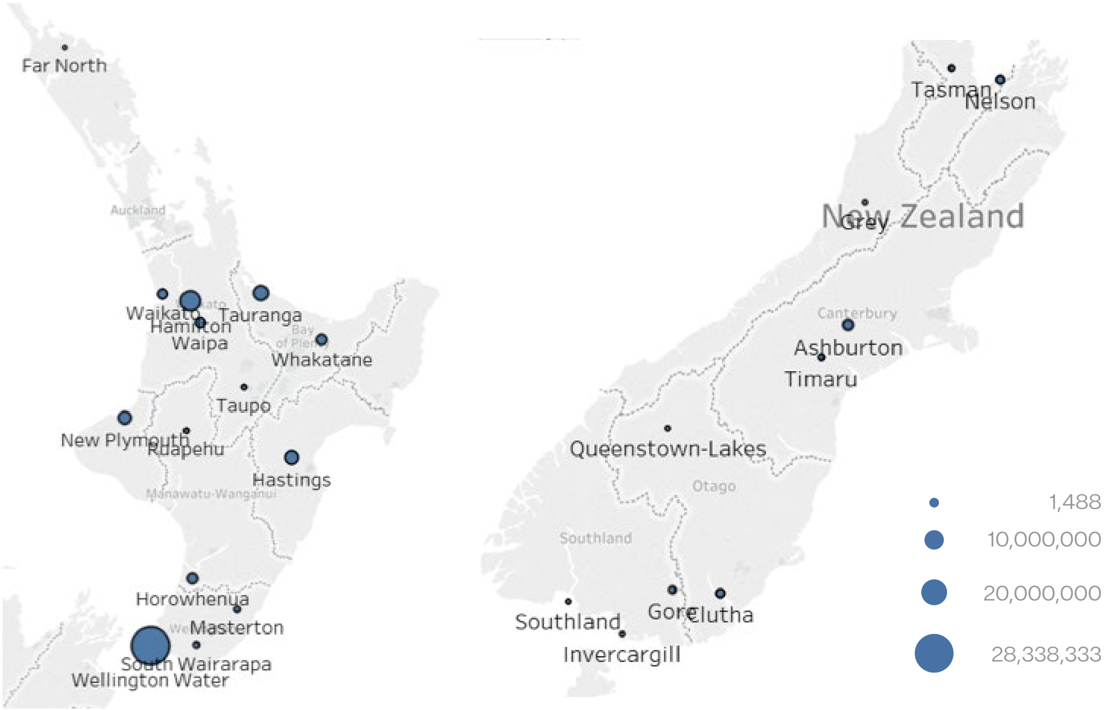
8.2. Water demand management

8.2.1. Water restrictions

Water restrictions were employed by 25 of the 47 participants at some point in 2017-18, and used most extensively by Wellington Water where 28,338,333 resident days were affected by water restrictions.

A scaled map of resident-affected days is shown in Figure 66.

Figure 66: Population days of water restrictions per participant

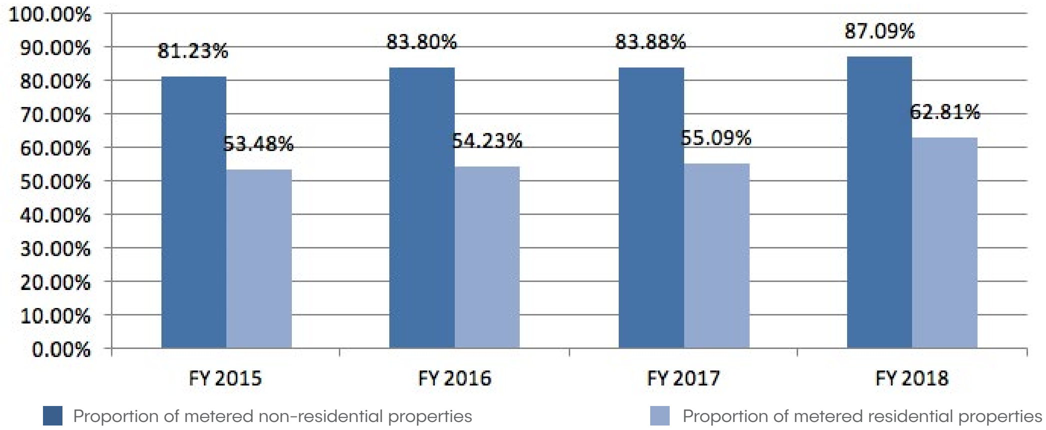


8.2.2. Water metering and restrictors

Collectively, participants had 105,321 non-residential and 763,479 residential water meters in place in 2017-18. This covered 82% of the 128,186 non-residential properties receiving water services, and 47.6% of the 1,325,898 residential properties receiving water services.

Over the previous four years, the proportion of meters has gradually increased, partly reflecting high growth in Auckland where there is full residential water metering.
The proportion of water-serviced properties for participants supplying four years' continuous data is shown in Figure 67.

Figure 67: Changes in the proportion of properties with water metering



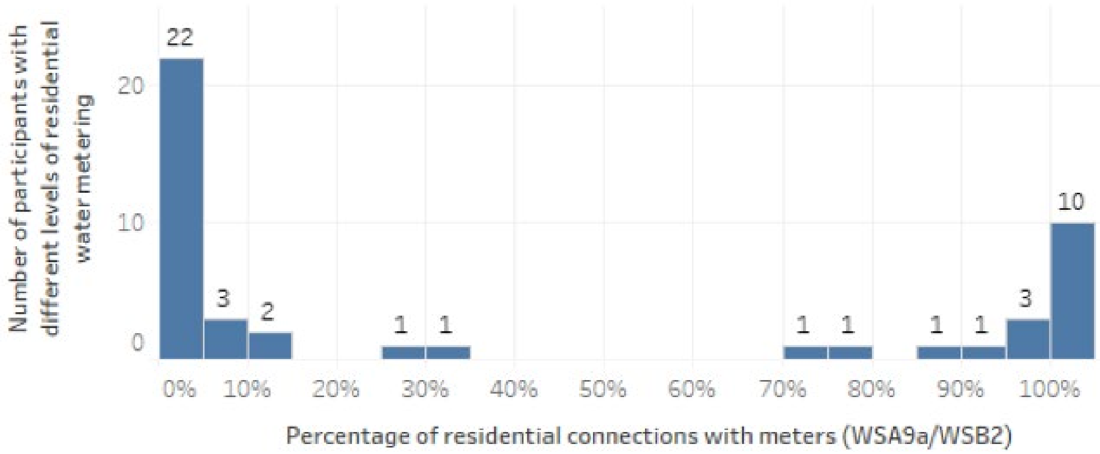
Auckland, Christchurch, Far North, Hauraki, Kaipara, Kapiti Coast, Nelson, South Wairarapa, Western Bay of Plenty and Whangarei have 100% residential water metering coverage, and Tauranga, Opotiki, Selwyn, Central Otago, Tasman, Whakatane and Waikato all have the majority of residential properties metered with coverage levels of greater than 70%.

While almost half the residential properties nationwide were reported as having a water meter, this largely reflects near-total metering coverage in large centres such as Auckland, Christchurch, and Tauranga. The majority of participants (29 of 46 providing data) had no or low residential water metering levels.

While Christchurch residential properties are metered the meters are not used to collect revenue, unless exceptionally high water use occurs. These meters are read approximately every two years, and used to provide an indication of water consumption to inform water loss and management initiatives.

The levels of metering coverage employed at all participant sites are summarised in Figure 68. Metering levels at individual participant sites are available at the data portal link below.

Figure 68: Proportion of participants with varying levels of residential water metering



Data portal link 20: Percentage of properties with water meters for residential and non-residential
https://www.waternz.org.nz/metering

8.2.3. Residential water efficiency

The median average daily residential water consumption across all participants was 263 litres per person per day (L/person/day); however there was a large spread in average consumption. This is shown in Figure 69.

Four participants (Mackenzie, Tararua, Hauraki, and Grey) recorded water consumption in excess of 500 L/person/day. Of these, only Hauraki had significant levels of residential water metering. Whakatane reported the lowest average daily residential water consumption rate, at only 139 L/person/day, and had 79% of its residential sites covered by water metering. Figure 70 shows residential water efficiency overlaid with metering coverage.

Individual results for all participants are available at the data portal link below.

Figure 69: Average daily residential water efficiency

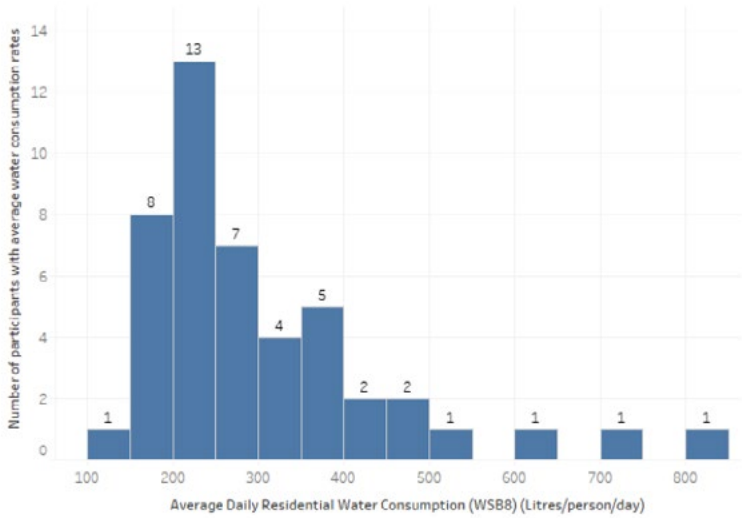
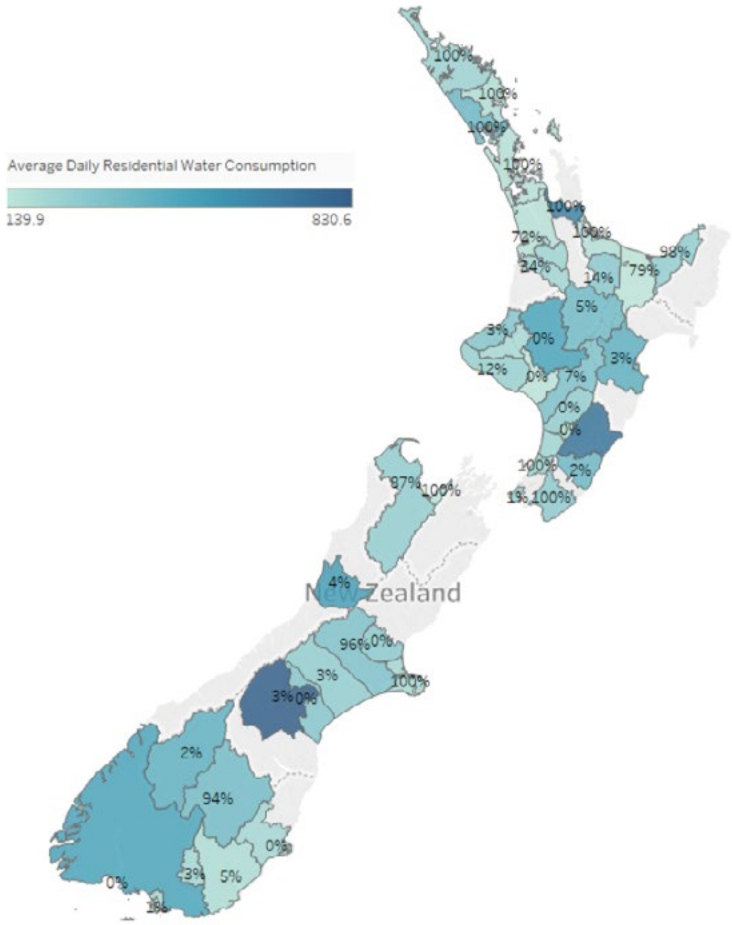


Figure 70: Levels of non-residential water metering (shown with numbers) and residential water use (shown with colour)



Data portal link 21: Average daily residential water use (litres/person/day)
https://www.waternz.org.nz/residentialefficiency

8.3. Biosolids

Biosolids are the solid fraction produced by sewage treatment. When treated and managed appropriately, biosolids can be beneficially reused as a fertiliser or an energy source. Landfill, however, was the most commonly used disposal route, with this being the major disposal route for 56% of biosolid disposal routes reported.

78 treatment plants did not specify biosolid volumes produced at the plant, or disposal routes for these. This may be because a large number of New Zealand's wastewater treatment plants are oxidation ponds, which are often not desludged annually so may not produce biosolids in any given year.

Disposal routes listed in the "Other" category in Table 14 include sludge stored on site, applied to pasture (that was not harvested for reuse), or sent to other treatment plants.

Table 14: Biosolid disposal routes in use

Sludge disposal routes	Known volumes going to disposal route (tonnes of dry solids)	Number of wastewater treatment plants employing disposal route
Stockpile	11,473,002	6
Landfill	271,105,906	37
Compost	109,539,537	18
Other	59,167,393	17
Unknown	34,163,415	104
TOTAL	485,449,252	182

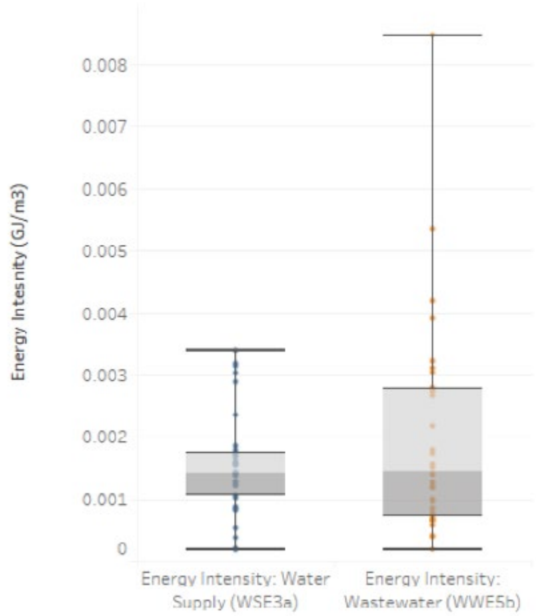
8.4. Energy and greenhouse gas emissions

Energy is consumed in the treatment and conveyance of water and wastewater. Collectively, participants' water and wastewater systems consumed 3,252,997 GJ and 3,710,067 GJ of energy respectively. Assuming that all energy is sourced from electricity with an emissions factor of 0.119 kgCO^{2}-e/kWh (Ministry for the Environment, 2016), this equates to a total of 230 kilo tonnes of carbon dioxide-equivalent gases, approximately 0.3% of New Zealand's total emissions of 78,727 kilo tonnes (Ministry for the Environment, 2018).

This estimate is based on the assumption that energy used for water and wastewater supply is sourced from the electricity grid. This is not, however, always the case. For example, Christchurch energy sources include biogas for electricity and heat, landfill gas and wood waste for biosolids drying, diesel for standby and peak lopping, and gas for boiler operations.

In addition to greenhouse gas emissions related to energy consumed through the supply and disposal of water and wastewater, fugitive greenhouse gas emissions (predominantly methane and nitrous oxide) are also generated through wastewater treatment. An estimate of the average emissions from all sources of the water supply cycle is included in *Voluntary greenhouse gas reporting for organisations*, published by the Ministry for the Environment using data from 2016.

Figure 71: Energy intensity for water and wastewater systems



Data portal link 22: Energy intensity for water and wastewater systems
https://www.waternz.org.nz/energyuse

SH16 causeway is inundated by high tides. While flooding impacts identified by tidal inundation are not included in the rising numbers of floods reported in this years NPR, sea level rise is one of many resilience challenges being faced by drinking water, wastewater and stormwater assets alike.

Photographer: Peter Mitchell, Stormwater Asset Manager,Auckland Motorways

9. RESILIENCE

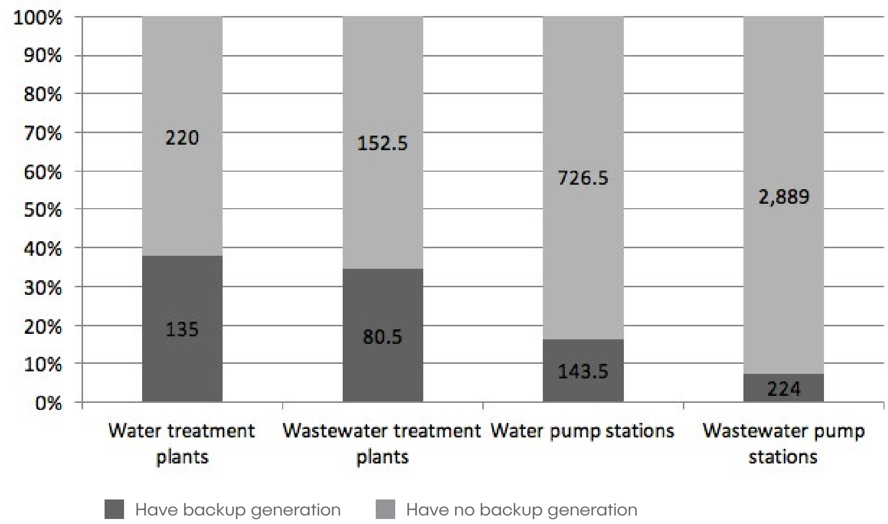
9.1. Backup power supplies

Slightly over one third of water and wastewater treatment plants had back-up generation capabilities. Back-up generation was less common at water and wastewater pump stations, as shown in Figure 72.

The number of plants and pump stations with and without back-up generation for individual participants is shown at the data portal link below.

In addition to back-up generators, some participants had co-generation facilities that could provide additional resilience. For example, Tauranga City Council had co-generation capabilities at its Chapel St treatment plant, which provided additional resilience in the case of wet-weather events.

Figure 72: Proportion of sites with backup generation



Data portal link 23: Number of water treatment plants, wastewater treatment plants, water pump stations, wastewater pump stations with and without backup generation
https://www.waternz.org.nz/backupgeneration

9.2. Firefighting water

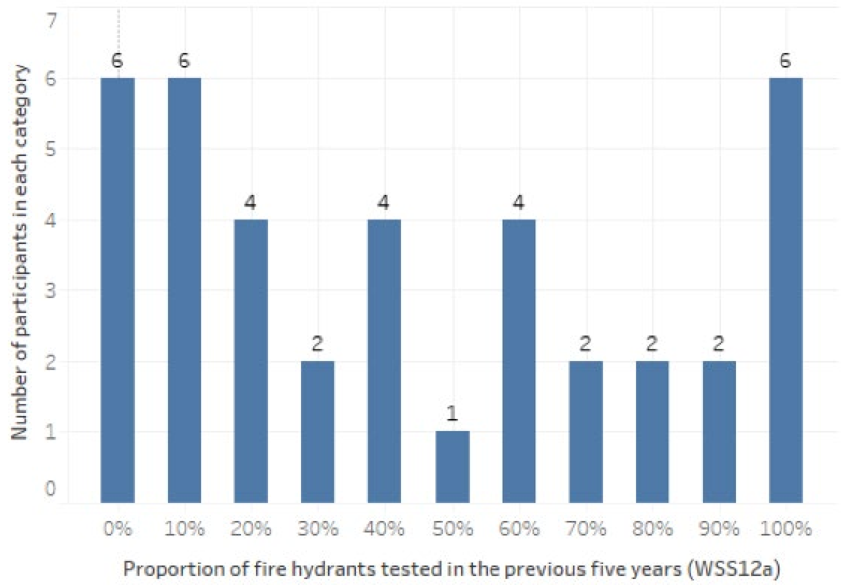
The *New Zealand Fire Service Firefighting Water Supplies Code of Practice* (Standards New Zealand, 2008) provides direction on what constitutes a sufficient supply of water for firefighting in urban fire districts.

The Code specifies that all fire hydrants must be inspected and flushed every five years by an approved tester. This was achieved by six participants: Kaipara, Selwyn, Timaru, Waimakariri, Masterton, and Western Bay of Plenty. A further two, Horowhenua (98.2%) and Wellington Water (99.8%), achieved near-compliance.

Three authorities (Clutha, McKenzie, and South Taranaki) had not tested any hydrants against the Code of Practice, however South Taranaki noted that 62% of fire hydrants had been tested in the last five years, but not relative to this Code specifically. A further six authorities did not provide data on how many hydrants had been inspected.

Across all participants, 1,156 hydrants were found to be non-compliant with the requirements of the Code.

Figure 73: Proportion of fire hydrants tested every five years by number of participant



Data portal link 24: Proportion of fire hydrants tested in the previous five years per participant and non-compliant hydrants per participant https://www.waternz.org.nz/hydrants

9.3. Water storage

In general, water storage levels were relatively high. Three participants (Grey, Hamilton, and Nelson) reported having average reservoir levels less than two thirds full for the 2017-18 year. Figure 74 summarises average reservoir levels across all participants.

The number of days' worth of storage these average volumes represent is summarised in Figure 75. Timaru and Dunedin had the most water storage, at 3.63 and 3.12 days respectively.

Individual participant results are available at the data portal link shown over leaf.

Figure 74: Average reservoir storage levels

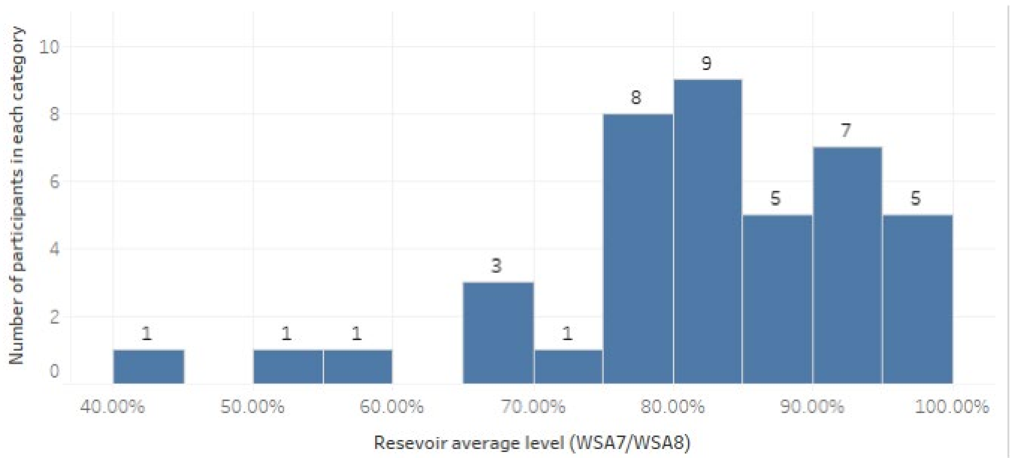
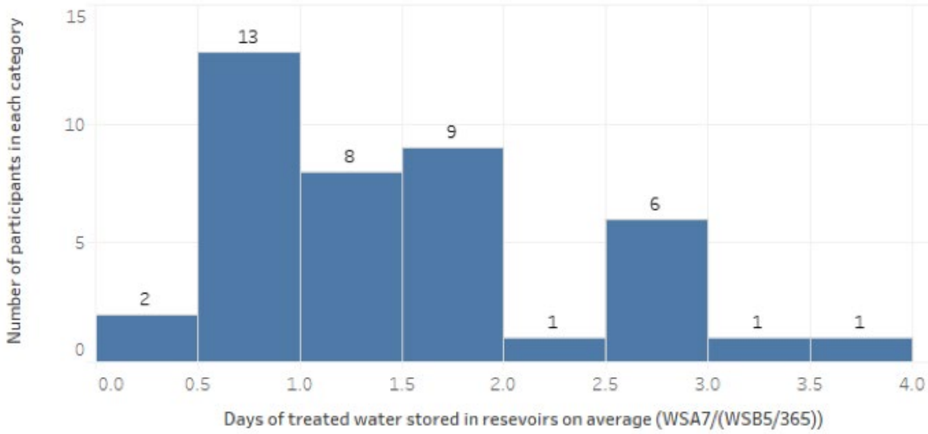


Figure 75: Days of treated water stored in reservoirs on average



Data portal link 25: Reservoir average days storage and storage levels
https://www.waternz.org.nz/reservoirlevel

9.4. Flooding

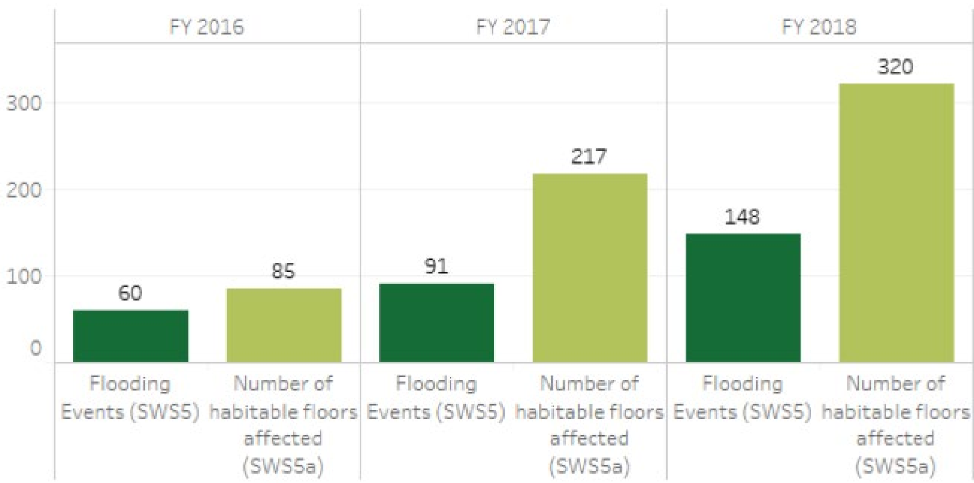
9.4.1. Flooding events

The NPR definition of a flooding event includes those affecting habitable floors, and does not include floods that occur outside of areas with stormwater services, or floods impacted by tidal inundation. There were 166 flooding events recorded, affecting 322 habitable floors.

Auckland recorded the highest number of such events at 77, impacting 48 habitable floors. Rotorua, however, recorded the highest number of impacted habitable floors (179) from only two flooding events. On 28-29 April 2018, Rotorua received 167.8 mm of rainfall over a 36-hour period, which is almost 1.5 times its normal rainfall for the whole of April (NIWA, 2019). Individual breakdowns for other participants are shown at the data portal link below.

The number of flooding events and habitable floors impacted has progressively risen for participants who have supplied data over the previous three years. This is perhaps unsurprising, with two ex-tropical cyclones making landfall in New Zealand in early 2018 (Fehi on 1-2 February, followed by Gita on 20-21 February). These events caused heavy rainfall and significant flooding, particularly in portions of the South Island. Above-normal rainfall was also recorded in several parts of New Zealand throughout the 2017-18 fiscal year (NIWA).

Figure 76: Number of flooding events and habitable floors impacted by repeat participants in the previous years



Data portal link 26: Number of flooding events recorded and the number of habitable floors
https://www.waternz.org.nz/floodingevents

9.4.2. Flood design standards

The number of participants targeting various levels of service for the design of stormwater networks is summarised in Figure 77 and Figure 78. The figures show the annual exceedance probability (AEP) for both primary and secondary networks (i.e. the chance or probability of a flooding event occurring in any given year).

The primary stormwater network typically consists of pipes, culverts, and soak holes designed to minimise nuisance flooding. The secondary network refers to the stormwater flow path designed to convey excess stormwater with a minimum of damage when the primary system is overloaded and typically includes drains and other overland flow paths through private property and along roadways.

Figure 77: The annual exceedance probability targeted during the design of the primary stormwater network

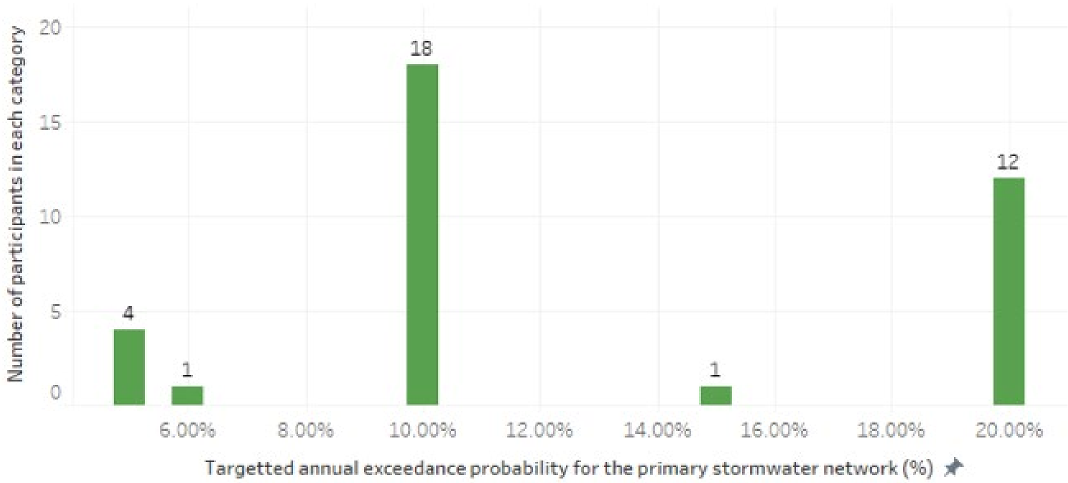
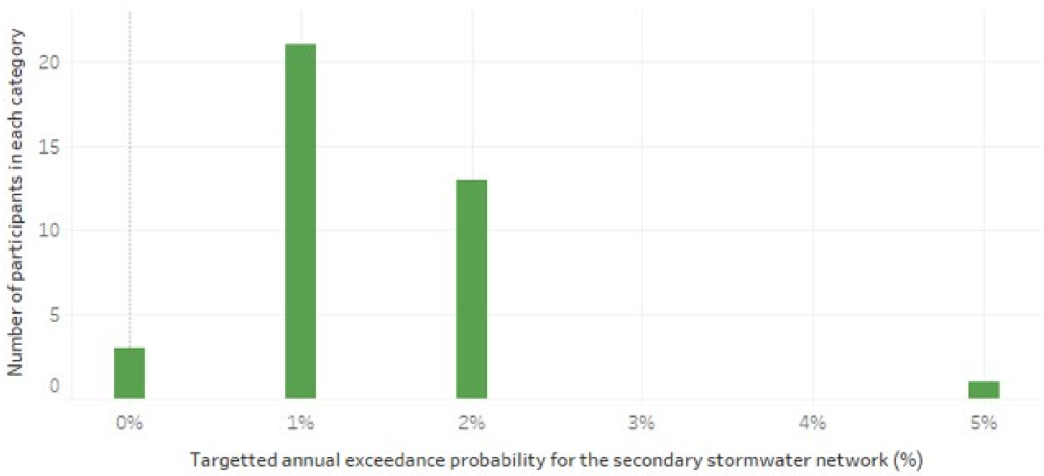


Figure 78: The annual exceedance probability targeted during the design of the secondary stormwater network



Data portal link 27: Annual Exceedance Probability of events designed to be contained by Primary and Secondary Stormwater networks https://www.waternz.org.nz/stormwaterstandards

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Appendix I: Participant acronyms and categorisation

Organisations participating in the 2017/18 National Performance Review

Participant name	Report reference	Size Categorisation	Valid trends
Ashburton District Council	Ashburton	Small	Yes
Watercare	Auckland	Large	Yes
Auckland City Council	Auckland Council	Large	Yes
Central Otago District Council	Central Otago	Small	Yes
Christchurch City Council	Christchurch	Large	Yes
Clutha District Council	Clutha	Small	
Dunedin City Council	Dunedin	Large	Yes
Far North District Council	Far North	Medium	
Gore District Council	Gore	Small	Yes
Grey District Council	Grey	Small	
Hamilton City Council	Hamilton	Large	Yes
Hastings District Council	Hastings	Medium	
Hauraki District Council	Hauraki	Medium	Yes
Horowhenua District Council	Horowhenua	Medium	
Invercargill City Council	Invercargill	Medium	Yes
Kaipara District Council	Kaipara	Small	Yes
Kapiti Coast District Council	Kapiti Coast	Medium	Yes
Mackenzie District Council	Mackenzie	Small	Yes
Manawatu District Council	Manawatu	Small	
Masterton District Council	Masterton	Small	
Napier City Council	Napier	Medium	
Nelson City Council	Nelson	Medium	
New Plymouth District Council	New Plymouth	Medium	Yes
Opotiki District Council	Opotiki	Small	
Otorohanga District Council	Otorohanga	Small	
Palmerston North City Council	Palmerston North	Medium	Yes
Queenstown-Lakes District Council	Queenstown-Lakes	Medium	
Rangitikei District Council	Rangitikei	Small	
Rotorua District Council	Rotorua	Medium	Yes
Ruapehu District Council	Ruapehu	Small	Yes
Selwyn District Council	Selwyn	Medium	Yes
South Taranaki District Council	South Taranaki	Small	Yes
South Wairarapa District Council	South Wairarapa	Small	
Southland District Council	Southland	Small	
Stratford District Council	Stratford	Small	
Tararua District Council	Tararua	Small	
Tasman District Council	Tasman	Medium	Yes
Taupo District Council	Taupo	Medium	Yes
Tauranga City Council	Tauranga	Large	Yes
Timaru District Council	Timaru	Medium	Yes
Waikato District Council	Waikato	Medium	Yes
Waimakariri District Council	Waimakariri	Medium	Yes
Waipa District Council	Waipa	Medium	Yes
Wellington Water	Wellington Water	Large	Yes
Western Bay of Plenty District Council	Western Bay of Plenty	Medium	Yes
Whakatane District Council	Whakatane	Medium	Yes
Whanganui District Council	Whanganui	Medium	
Whangarei District Council	Whangarei	Medium	Yes

Organisation with water, wastewater and stormwater service responsibilities not participating in the 2017/18 National Performance Review

Council	Sector 2015-16 onwards
Buller District Council	Small
Carterton District Council	Small
Central Hawkes Bay District Council	Small
Gisborne District Council	Medium
Hurunui District Council	Medium
Kaikoura District Council	Small
Kawerau District Council	Small
Marlborough District Council	Medium
Matamata-Piako District Council	Medium
South Waikato District Council	Small
Thames - Coromandel District Council	Medium
Waimate District Council	Small
Wairoa District Council	Small
Waitaki District Council	Small
Waitomo District Council	Small
Westland District Council	Small

Appendix II: Contaminant-based charges

Council	Solids		Oxygen Demand			Nutrients		Heavy Metals			Flow Based Charges
	SS ($/kg)	TSS ($/kg)	COD ($/kg)	BOD ($/kg)	BOD_5 ($/kg)	Total Phosphorous ($/kg)	TKN ($/kg)	Cu ($/kg)	Zn ($/kg)	Ni ($/kg)	($/L/minute)
Ashburton					1.9						
Christchurch	0.36				0.5			Charge (price not provided)	Charge (price not provided)	Charge (price not provided)	
Dunedin		Charge (price not provided)		Charge (price not provided)							
Gore		Charge (price not provided)		Charge (price not provided)		Charge (price not provided)					
Hamilton	Charge (price not provided)										
Invercargill	0.386			0.405							
Nelson											The annual charge is the average flow rate of a customer in litres per minute multiplied by $606.11
New Plymouth	1.4			2.97				274.71	91.59	458.68	
Rotorua	Charge (price not provided			Charge (price not provided)							
South Taranaki		2.15 (Eltham) 1.10 (Hawera) 0.42 (Other)	0.5 (Eltham) 0.29 (Hawera) 0.28 (Other)								
South Wairarapa		Charge (price not provided)		Charge (price not provided)							
Tasman		1.48	0.12		0.97	2.14	3.84				
Waipa	Charge (price not provided)					Charge (price not provided)	Charge (price not provided)				
Wellington Water	Charge (price not provided)		Charge (price not provided)	Charge (price not provided)							
Western Bay of Plenty	Based on tradewaste bylaw (Charges nor contaminants provided)										
Whangarei		0.58	0.52				0.68				