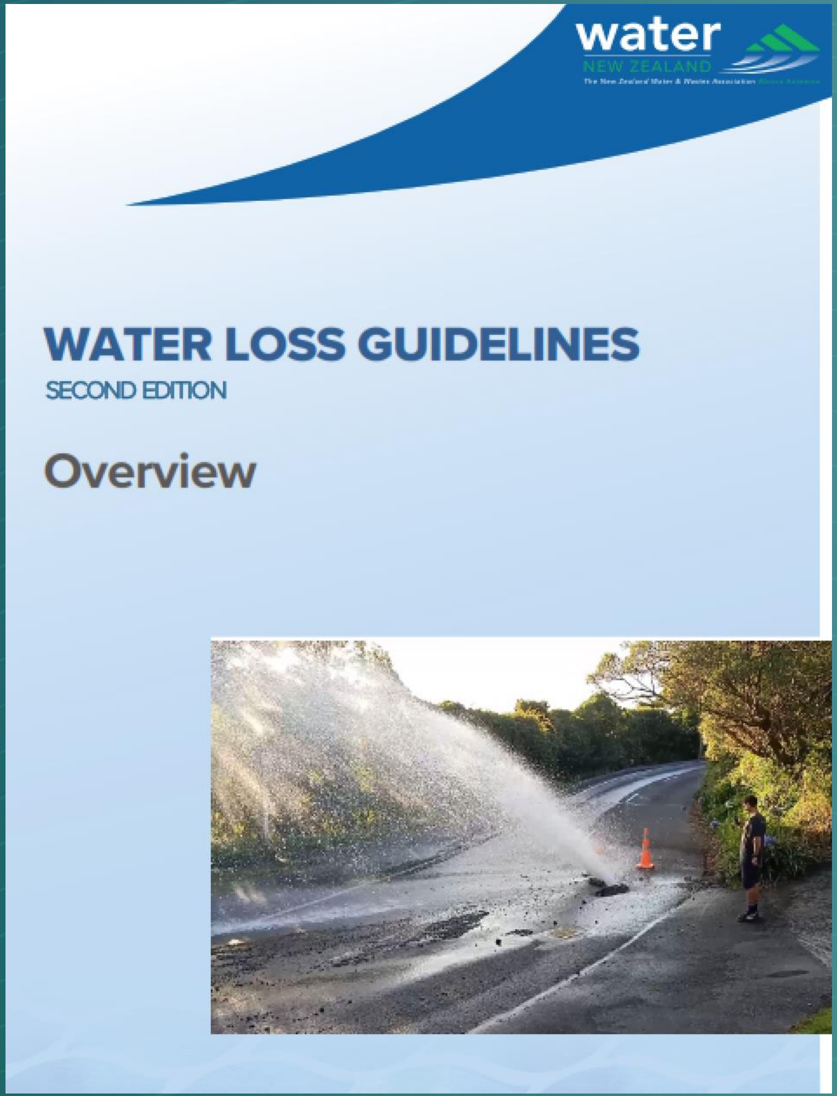
Water Loss Guidelines



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

Todays agenda:

Water loss business case and drivers

Guideline content

Navigating the guide and water loss maturity

Scene setting

- Annually water loss is more than the combined volume of water supplied to Wellington Water and Christchurch networks

2019/2020 National Performance Review

- Nationally water loss is around 20% of water supplied to our networks

https://www.waternz.org.nz/NationalPerformanceReview

- When private side leakage is included losses can be a lot higher. E.g. Losses in wellington are reportedly ranging from 41-52%

https://www.thepost.co.nz/a/nz-news/350070337/wellington-faces-highest-level-water-restrictions-summer

Access the guide and supporting resources at:

www.waternz.org.nz/ResourceHub

Thanks to:

- The Water Efficiency Conservation Action Network (WeCAN)
- The Water Service Managers Group
- The guides authors:
  Thomas Consultants Ltd as lead consultant (Richard Taylor), Water Cycle Consulting (Christine McCormack), BECA (Jon Reed), WSP (Dan Johnson) and Water Loss Research & Analysis Ltd (Allan Lambert).
- Our advisory group: Julian Fyfe Awa environmental, Elliott Kennedy Wellington Water, Kobus van Zyl University of Auckland, Lucas Gan Watercare, Gulzar Ali Clutha DC, David Moore Watercare
- Lattitude Consulting

The business case for leakage management

- Drivers
  - Te mana o te wai
  - Reporting & network integrity
  - Resource Consents
  - Climate change

- Developing the business case

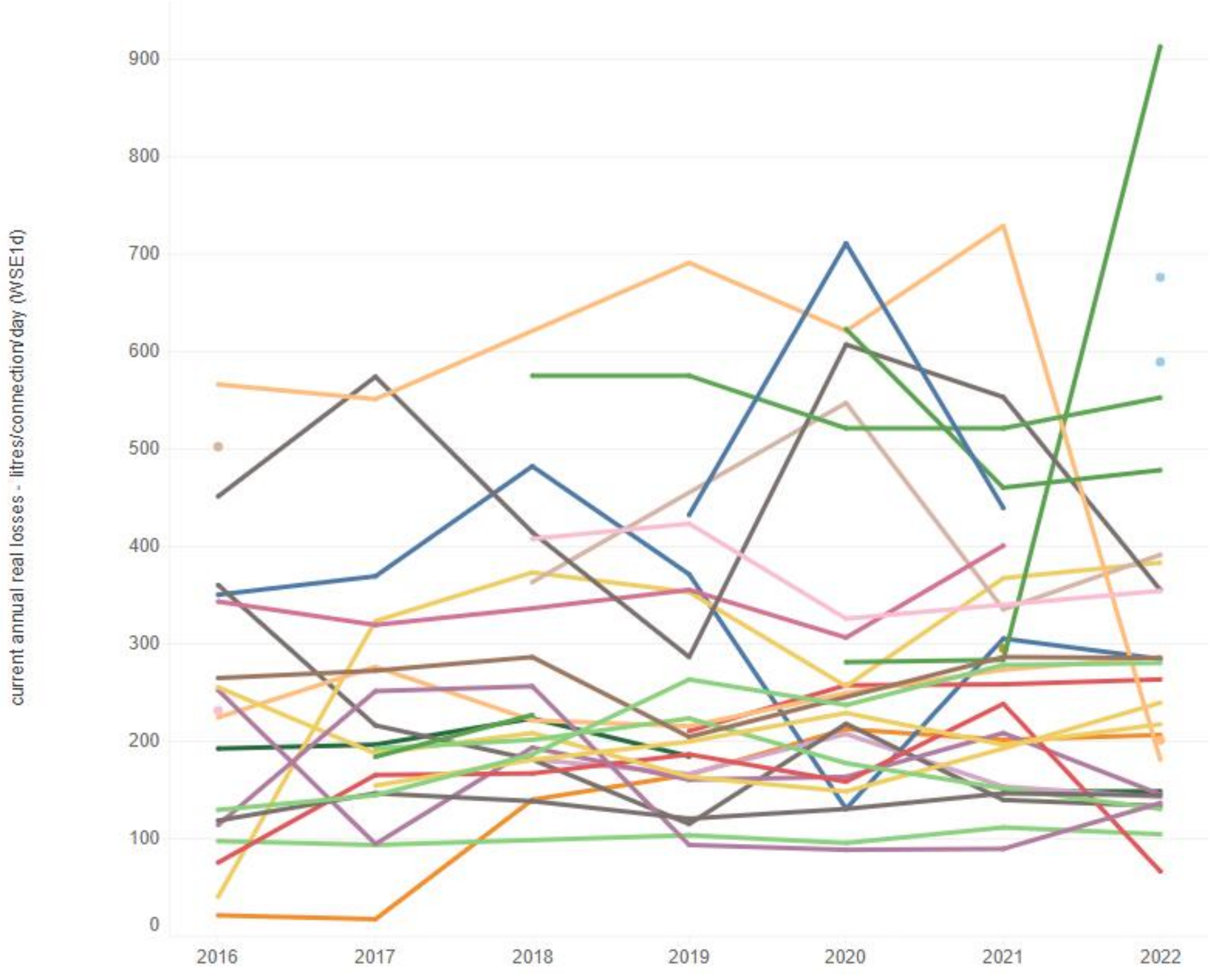
Drivers – Te mana o te wai

- Give effect to te mana o te wai
- Leakage management enables us to only use what we need

Credit: Taumata Arowai

Drivers – Reporting and consumption

- Reporting of losses
- Comparative regulation
- Demonstrate stewardship of water resources and the 'social licence' to operate

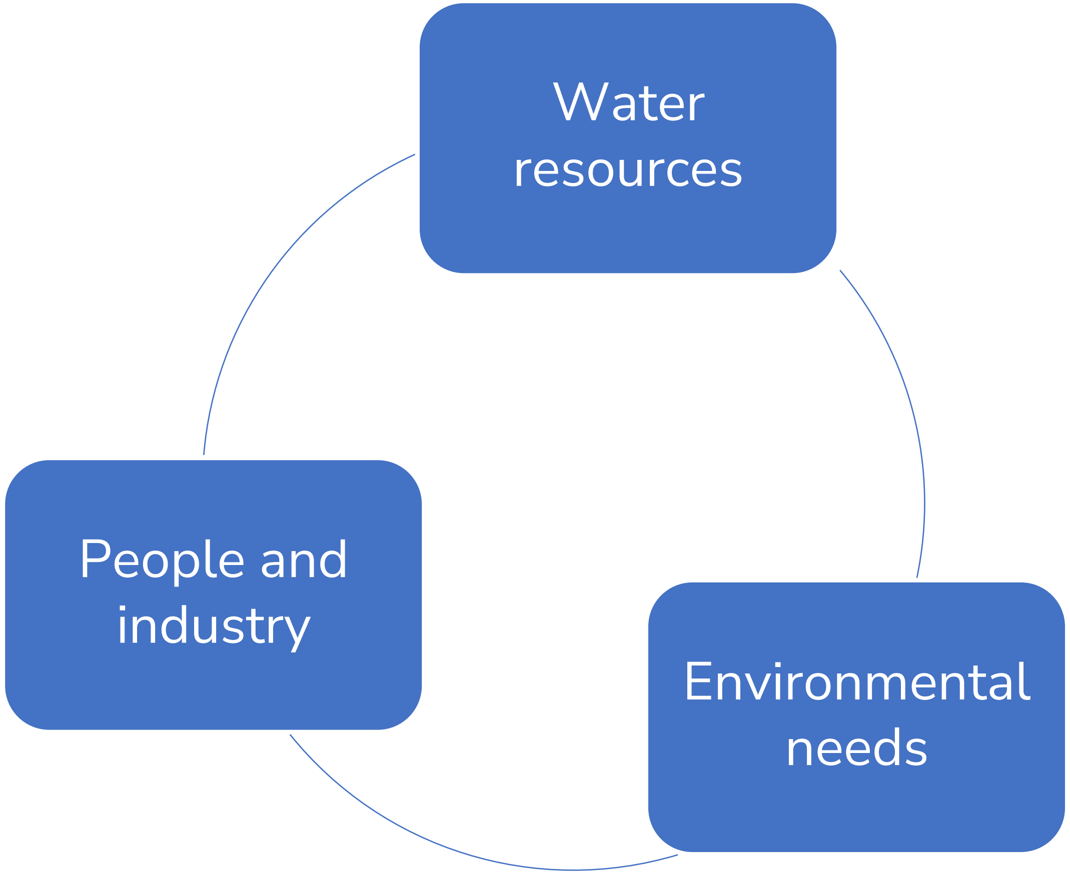


Drivers – network integrity

- Water loss a measure of network integrity
- Low levels of leakage suggest good management and pro-active asset management
- Greater risk of contamination if negative pressures

Drivers – Resource Consents

- Increased pressure on water resources
- Water take volumes might be less or higher 'hands off' flows
- Need for the water supplier to demonstrate efficient water use



Drivers – Climate Change

Adaptation

- More frequent and severe droughts
- Deterioration in the Level of Service
- Reducing real losses enables water suppliers to continue to meet demand

Mitigation

- Reduce operational emissions (pumping, treatment, etc)
- But at a carbon cost related to renewals and active leakage control
- Bring whole life carbon impacts into the business case

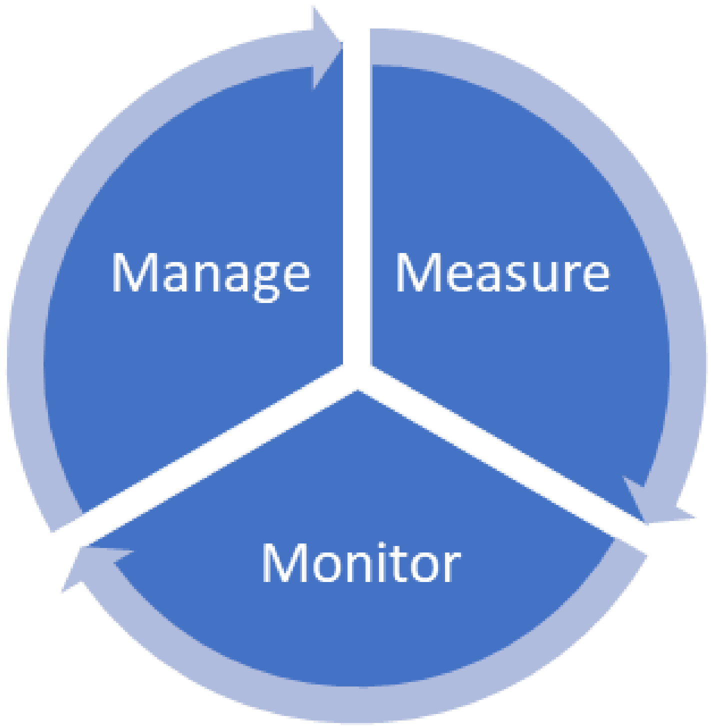
Developing the business case

1) Understanding leakage rates and costs

Monitoring

- Leakage rates
- Costs of active leakage control

If possible understand the cost of any step changes



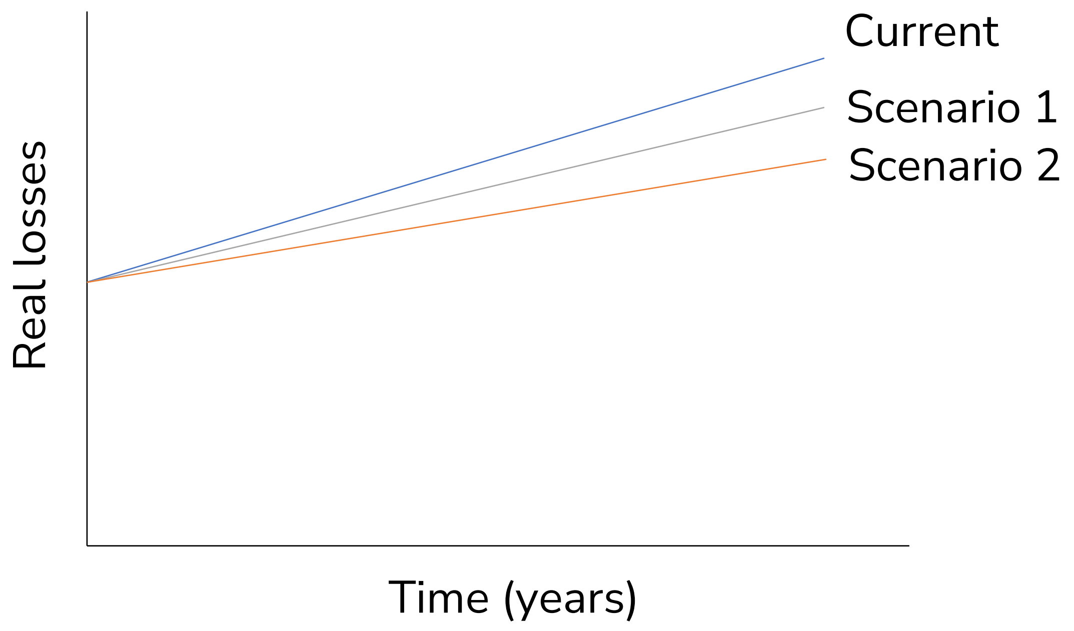
2) Develop different potential leakage reduction scenarios

Current leakage rates and costs

Benchmarking and long term targets

Potential leakage scenarios

$ and time and benefit of different scenarios



3) Compare with other options

Develop several realistic and achievable scenarios

Consider the whole life cost and carbon costs

Determine the costs / carbon of each of the strategies

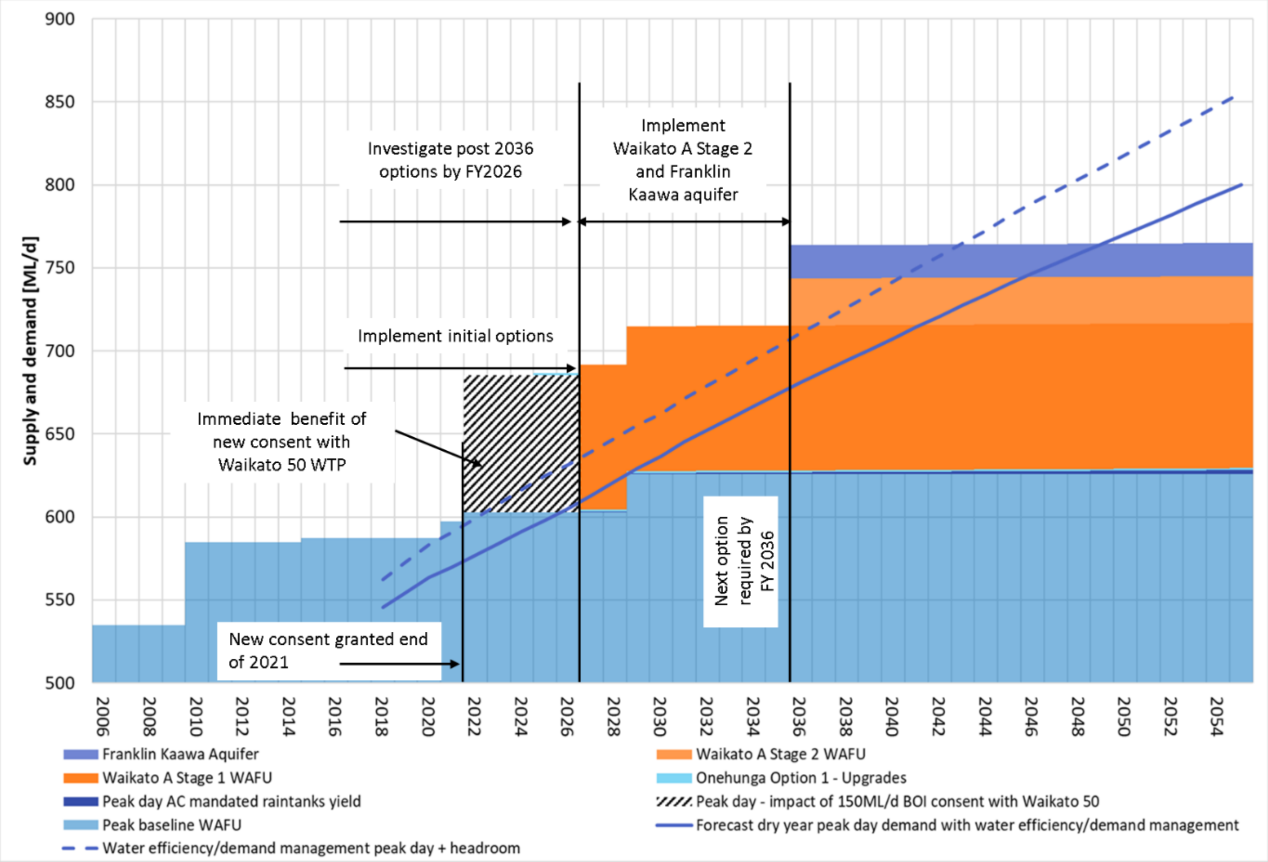
- Compare costs
- Compare benefits
- Understand how different approaches can help achieve different objectives

Supply / demand balance - Example

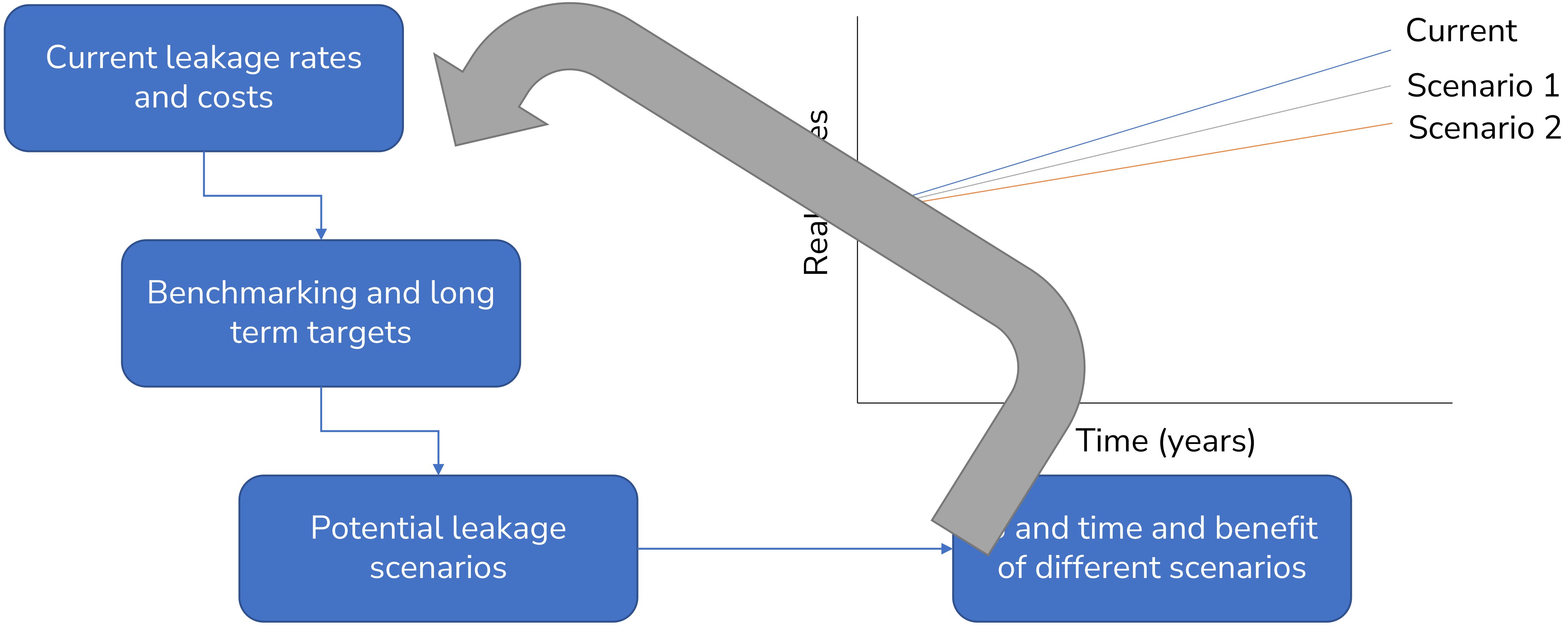
Watercare Board of Inquiry for the Waikato water take

Leakage improvements were 'hard wired' in as part of a policy decision

- Baseline of 110 l/conn/day
- Reducing by 18 L/conn/day by 2030
- Costs included in the strategy



4) Loop back and review



Setting targets as part of a business case

- All about the customer
- Leakage is a great place for water suppliers to engage with customers
  - Different leakage scenarios
  - Discuss the costs, benefits and any alternative approaches
- Use this as a method of engaging with customers and agreeing a suitable, benchmarked target

Summary

- Many different drivers for reducing leakage
- Best considered as part of a wider water resources plan
- Include leakage scenarios in the plan and use as the basis of consultation with your customers to agree a target
- Comparative regulation will drive performance improvements

Outline of the Updated WaterNZ Water Loss Guidelines

Webinar 18 September 2023
Presentation by Richard Taylor
Thomas Consultants Ltd

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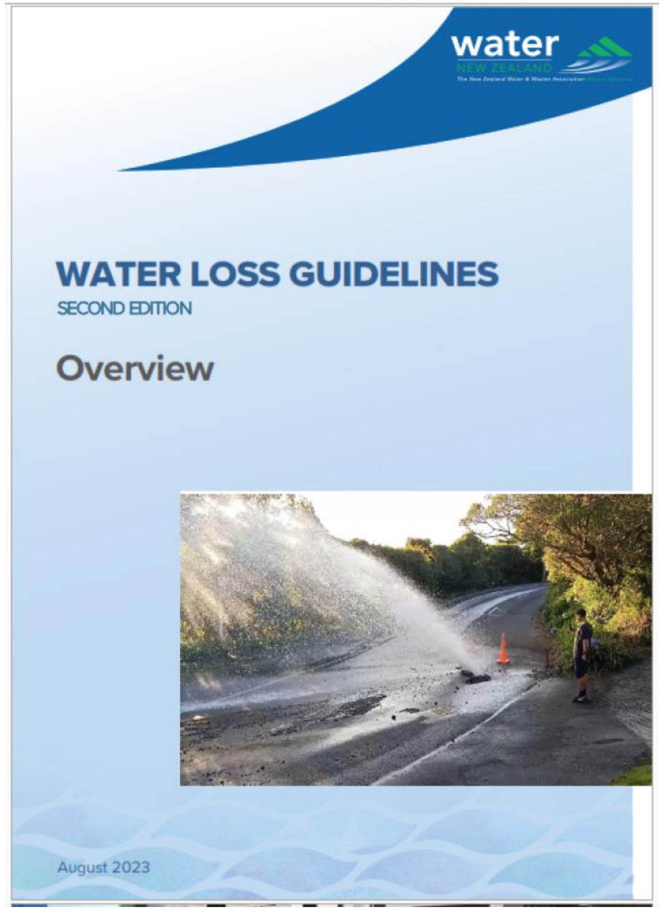
Updated WaterNZ Water Loss Guidelines

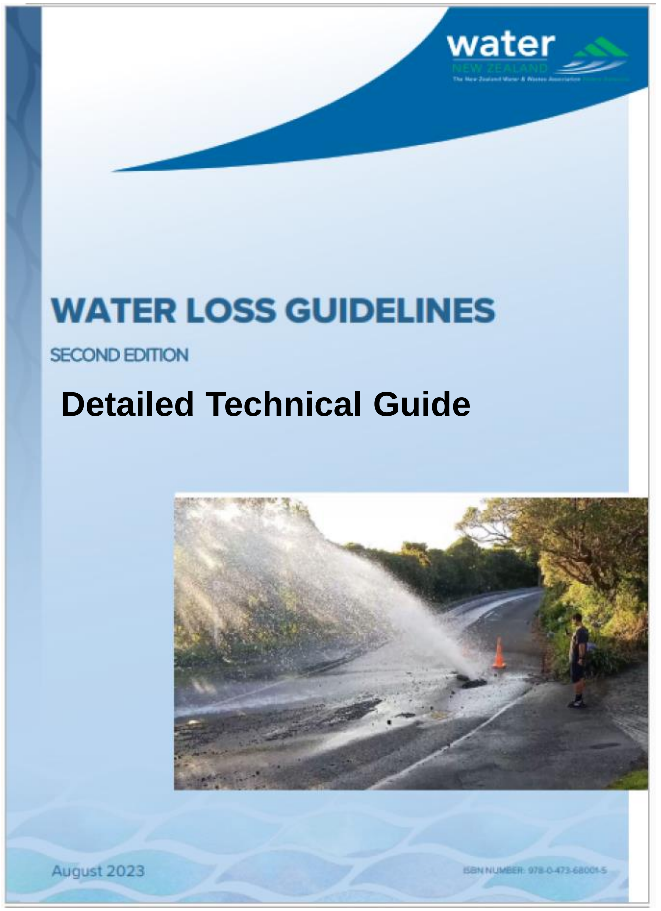
COMPONENTS

1. **New Overview Document - '*Managing Water Losses in New Zealand*'**
2. **Updated - Detailed Technical Guide**
3. **Two new Excel based calculators**

The project was carried out by a consortium of consultants – Thomas Consultants (as lead consultant) (Richard Taylor), WSP (Dan Johnson), Water Cycle Consulting (Christine McCormack), BECA (Jon Reed) and Allan Lambert (UK)

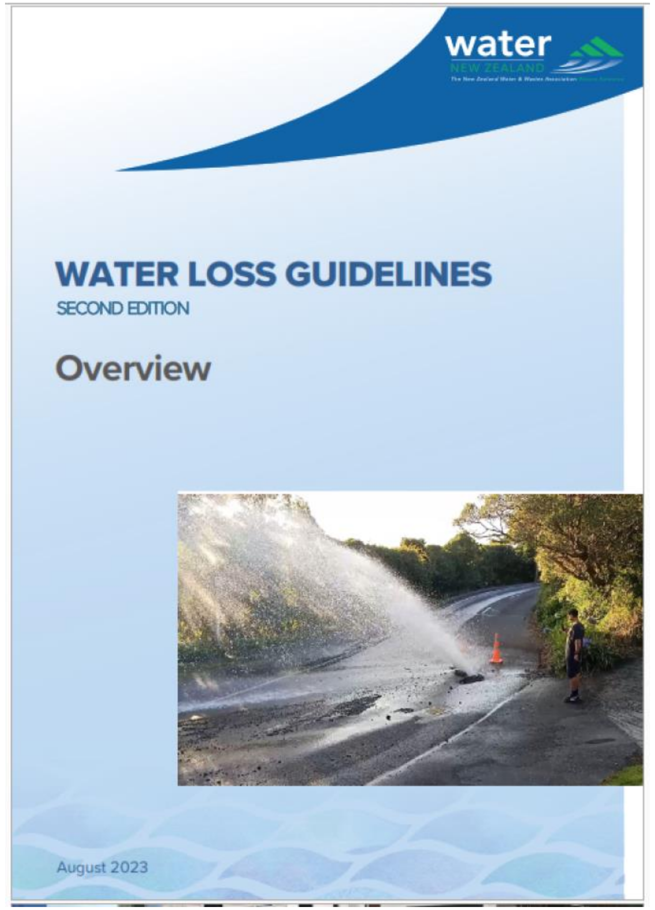
Updated WaterNZ Water Loss Guidelines





Plus two Excel based calculators

WaterNZ Water Loss Guidelines – Overview Document



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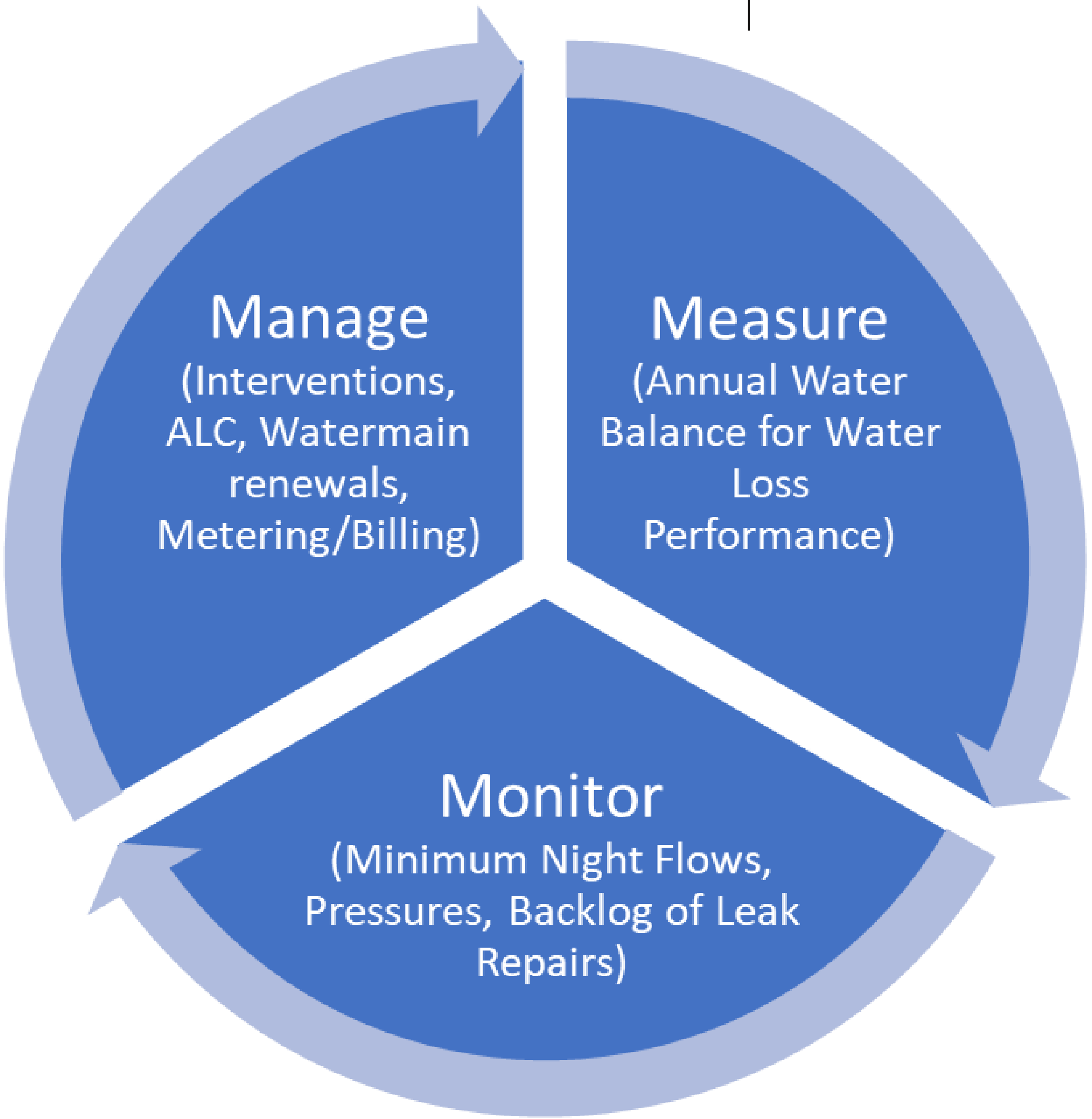


WaterNZ Water Loss Guidelines – Overview Document

MEASURE, MONITOR & MANAGE water losses

WaterNZ Water Loss Guidelines – Overview Document

If just starting out ...

Initial Assessment and Strategy

WaterNZ Water Loss Guidelines – Overview Document

Figure·4:·General·Description·of·Meaning·of·World·Bank·Institute·Bands·A·to·D¶

Developed Countries ILI range	BAND	Calculated ILI for this System	General description of Real Loss Management Performance Categories for Developed and Developing Countries
Less than 2	A		Further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost-effective improvement
2 to < 4	B	2.3	Potential for marked improvements; consider pressure management, better active leakage control practices, and better network maintenance
4 to < 8	C		Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyze level and nature of leakage and intensify leakage reduction efforts
8 or more	D		Very inefficient use of resources; leakage reduction programs imperative and high priority

¶

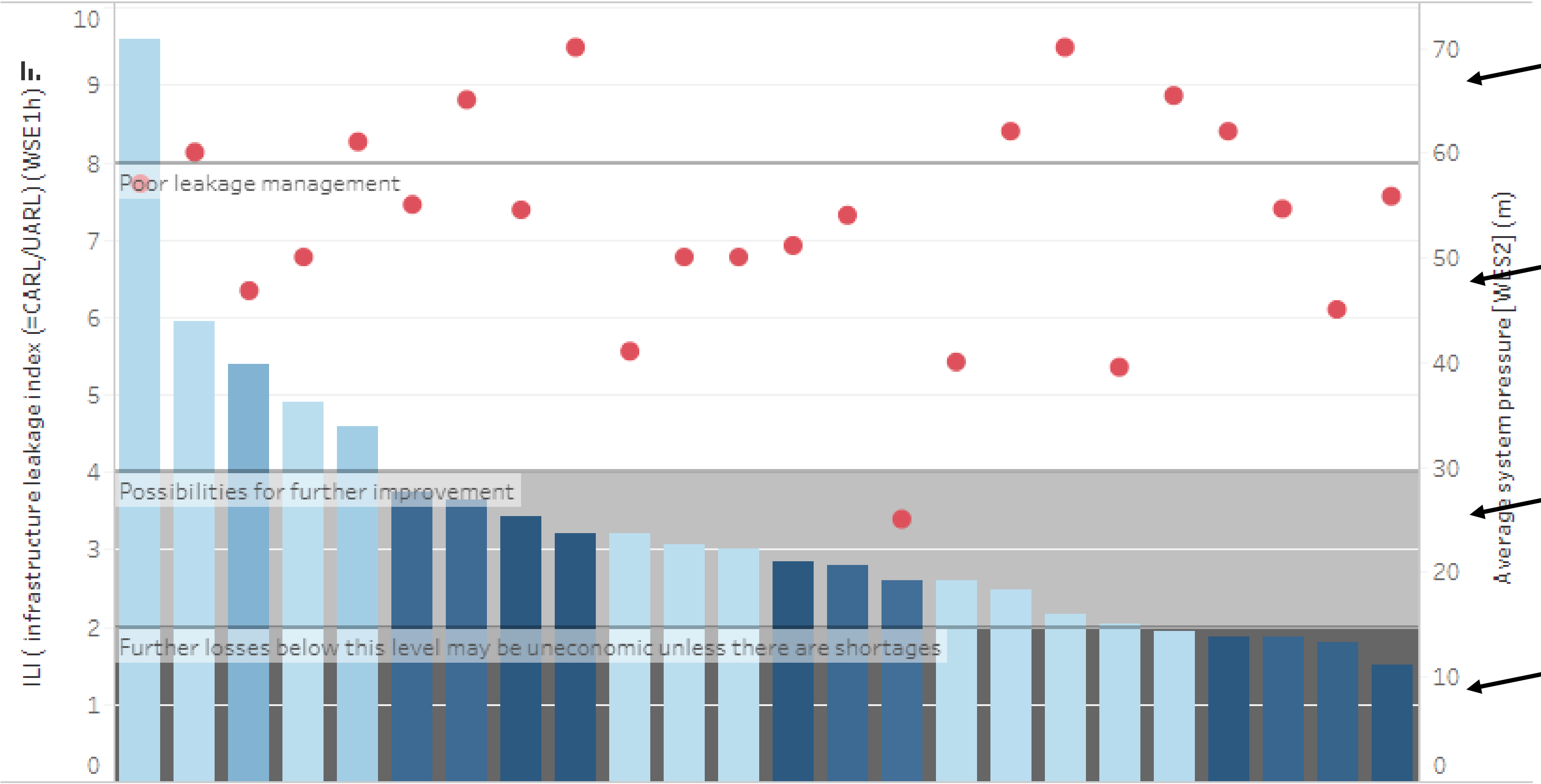
Source:·CheckCalcsNZ·2008¶

What does a well managed network look like?

WaterNZ NPR Results

for Medium & Large Systems

What does a well managed network look like?



An ILI of 8.0 or more
Very inefficient use of resources

An ILI of 4.0 – 8.0
Poor leakage management

An ILI of 2.0 – 4.0
Room for Improvement

An ILI less than 2.0
Relatively good performance

WaterNZ Water Loss Guidelines – Overview Document

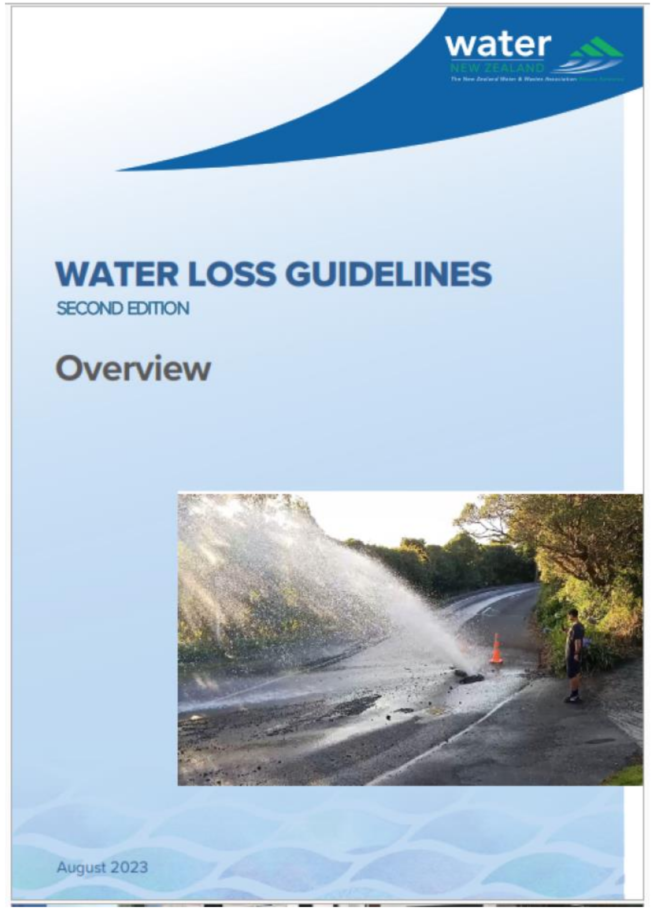
Table 3: Showing Appropriate Long-Term Targets/Acceptable Levels of Real Water Losses in NZ

Size of Network	Fully Metered System	Partly Metered System (residential properties unmetered)	ILI
Small Town	Up to 180 litres/conn/day	Up to 200 litres/conn/day	Up to 3.0
Medium Town/City	Up to 160 litres/conn/day	Up to 180 litres/conn/day	Up to 2.5
Large City	Up to 140 litres/conn/day	Up to 160 litres/conn/day	Up to 2.2
Major City	Up to 120 litres/conn/day	Up to 140 litres/conn/day	Less than 2.0

Note: For this table, a Small Town is considered to have a serviced population of less than 5,000 people, a Medium between 5,000 and 40,000, and Large between 40,000 and 100,000, and a Major City of over 100,000 serviced population.

What does a well managed network look like?

WaterNZ Water Loss Guidelines – Overview Document



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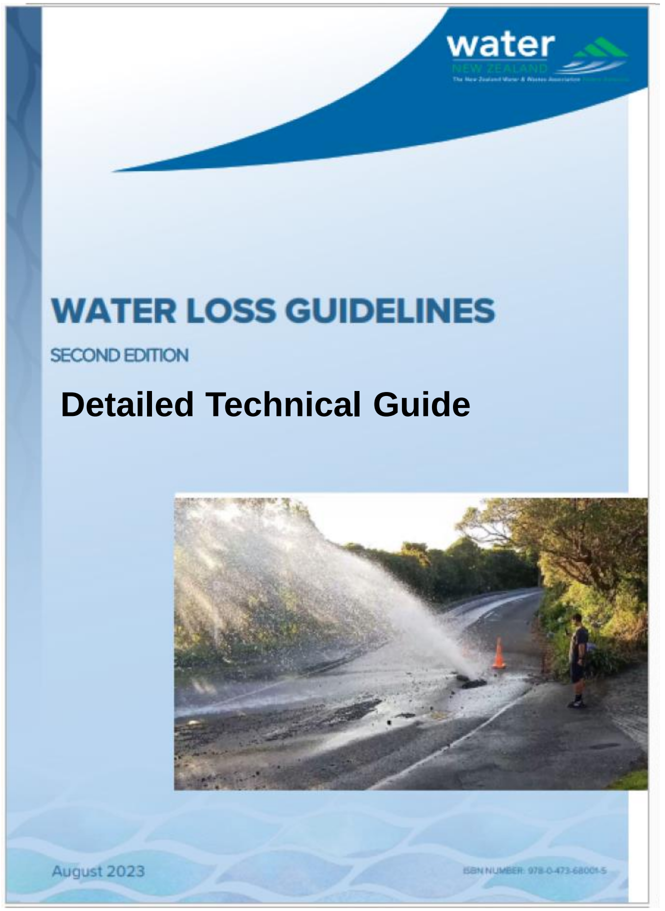
Water Loss Guidelines – Detailed Technical Guide (1)



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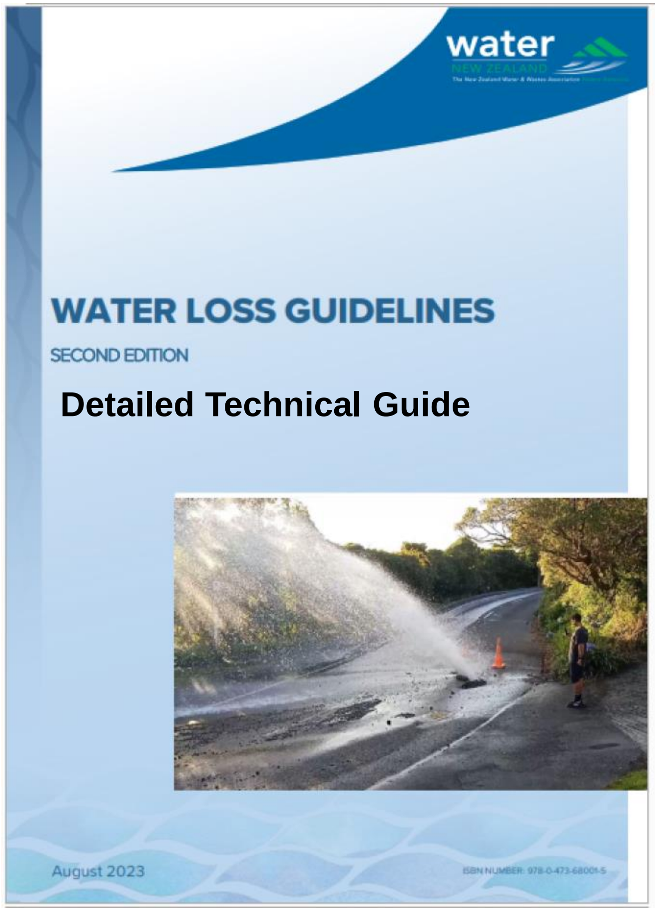

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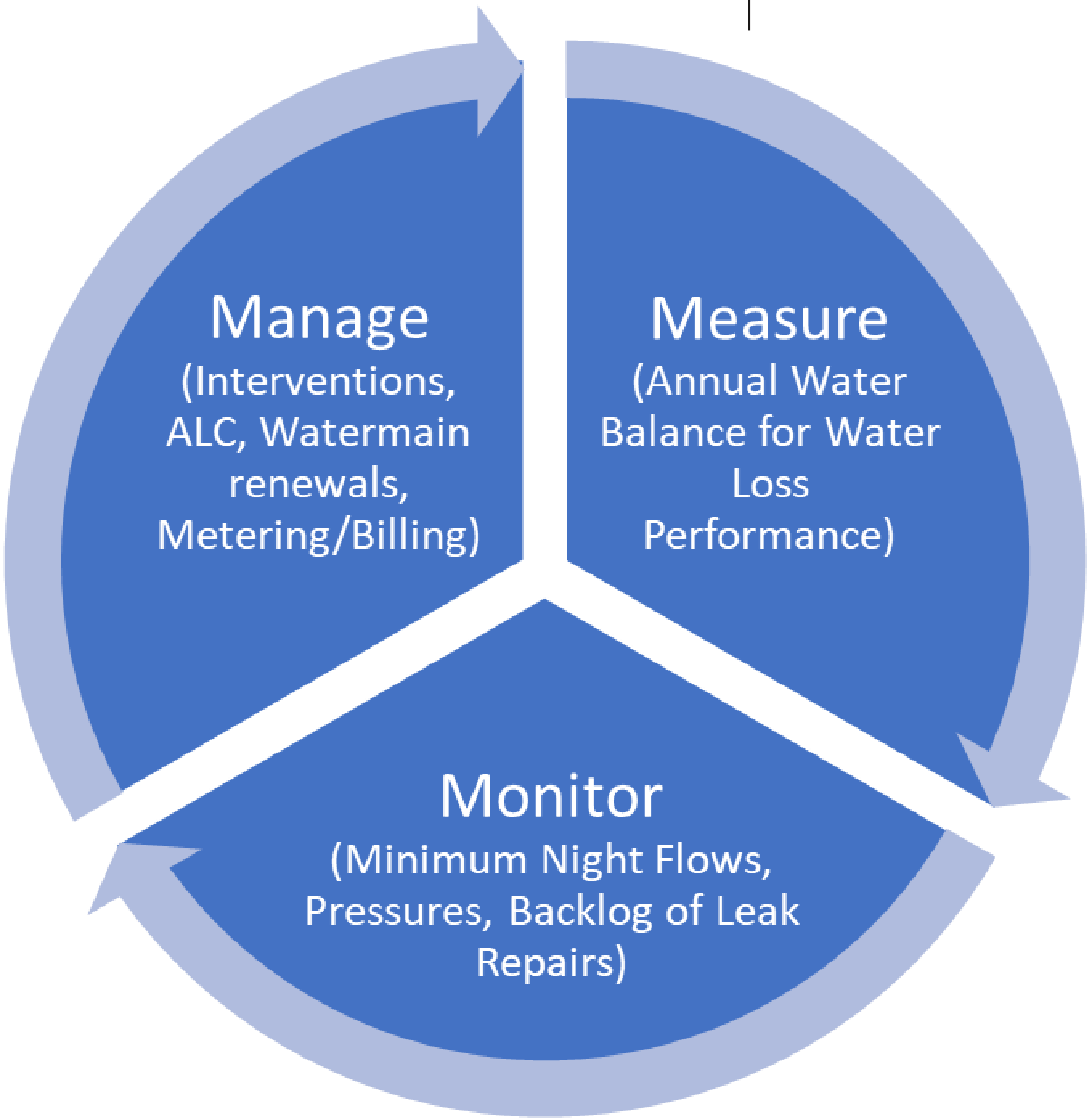


WaterNZ Water Loss Detailed Technical Guide

MEASURE, MONITOR & MANAGE water losses

There are very helpful sections on measuring, monitoring and managing

IWA Standard Water Balance Diagram

Own Sources	System Input	Water Exported			Billed Water Exported to other Systems	Revenue Water
		Water Supplied	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption by Registered Customers	
Water Imported	(allow for bulk meter errors)				Billed Unmetered Consumption by Registered Customers	
				Unbilled Authorised Consumption	Metered	Non-Revenue Water
					Unmetered	
			Water Losses	Apparent Losses	Unauthorised Consumption	
					Customer Metering Under-registration	
				Real Losses	Leakage on Mains Leakage and Overflows at Service Reservoirs Leakage on Service Connections up to the street/property boundary	

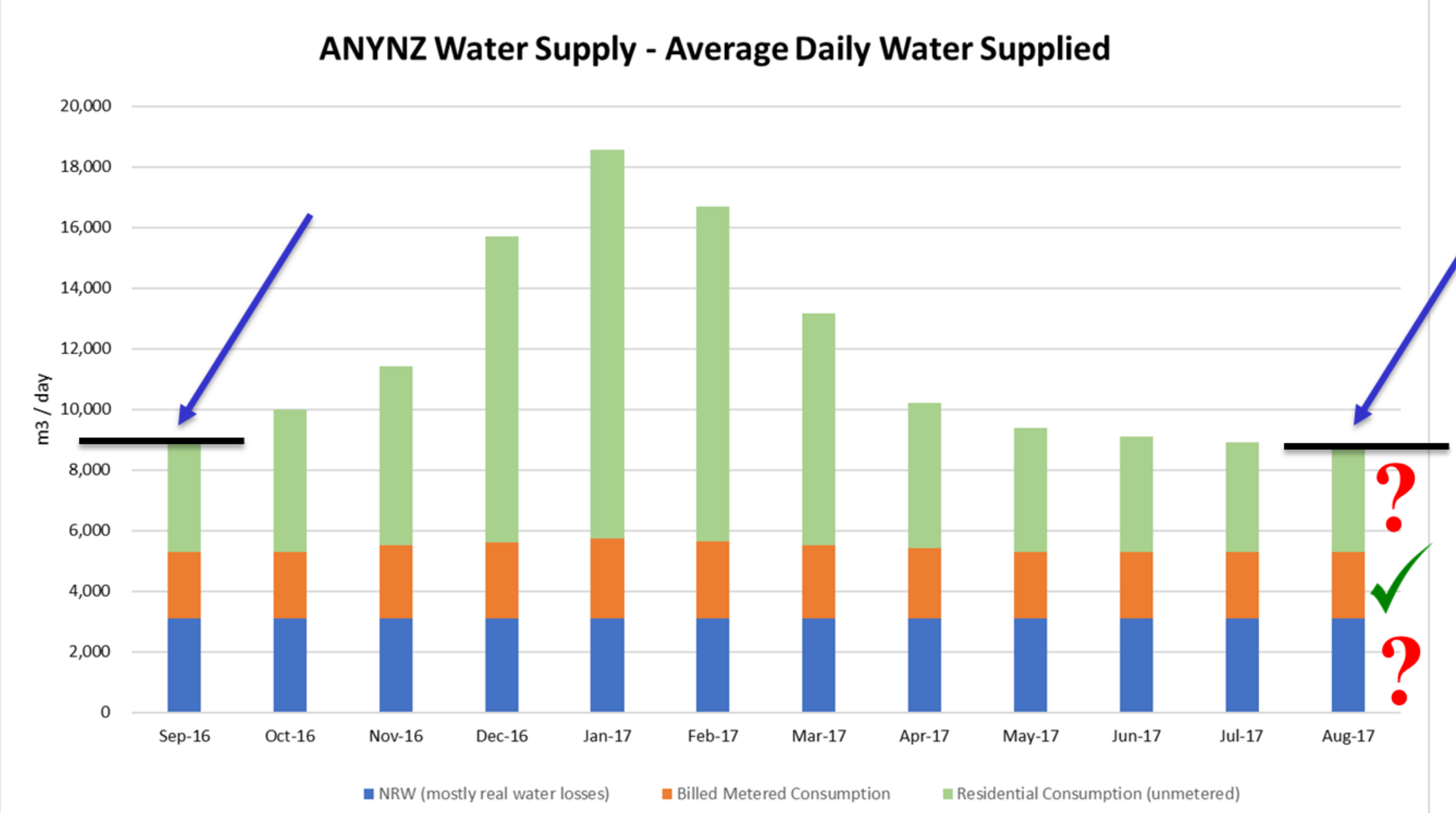
No changes are proposed to the three existing water balance 'Default Values' (ex. WSAA and Allan Lambert)

WaterNZ Water Loss Guidelines – Detailed Guidelines

1. Plot System Input Volume Data and Correct the Data as necessary
2. Analyse Billed Metered Consumption Data
3. Establish the Water Balance Period
4. Calculate System Input Volume
5. Calculate the Volume of Billed Metered Consumption
6. Obtain System Parameters for the network (number of connections etc)
7. Assess Billed Unmetered Consumption (if any) using several methods
8. Calculate and Add Default Values (for three Water Balance components)
9. Finalise the Water Balance and the Volume of Real Losses
10. Calculate Water Loss Performance Indicators

Recommended process for calculating a water balance

Assessing Unmetered Consumption – Using Minimum Night Flows (MNFs) and Winter Water Use as Validation Techniques



Analyse **MNFs (litres/sec at night)** at the start and end of the WB period – when outdoor use is minimal

Analyse **Winter Water Use (m3/day)** when outdoor use is minimal

Two New Software Tools (Excel Spreadsheets)

- **Snapshot ILI Minimum Night Flow Calculation Template**
- **Winter Water Use Analysis Template**

These will be available alongside the BenchlossNZ Software in the WaterNZ Technical Library

There is also a Case Study from Wellington Water in the Guidelines on an alternative 'Bottom-up' MNF Method for calculating the volume of real losses i.e. water balance for networks with unmetered properties, using detailed District Metered Area (DMA) data.

Taumata Arowai – Reporting Period

Required fields for data collection

Data	Data Confidence	Data Source	Reporter Name	Comments
Data pertaining to the financial year beginning 1 July and ending 30 June in the following calendar year. Data entered is to align with data provided in the definition guide.	Data confidence values are required wherever drop-down boxes appears in the 'Data Confidence' column.	Where data is sourced from (e.g. Asset Management System, Water Balance Report etc). This field is included to assist with audits however is not mandatory.	Who provided the data? This field is included to assist with audits however is not mandatory.	An optional field to provide supporting context, note deviations from standard data definitions, list reasons data is not provided, or provide additional information if required.

Figure 3 12: Appendix Six from Taumata Arowai's document *Drinking water network environmental performance measures and guidance material*

3.1.14. Taumata Arowai data collection and confidence

With reference to Appendix Six from *Drinking water network environmental performance measures and guidance material* (Taumata Arowai, 2022) provided in Figure 3.12 below, it is apparent that a reporting period of 1 July to 30 June is desired. However, as outlined above in the section on calculating a water balance, it is evident that adhering strictly to this reporting period will be problematic for many water suppliers due to when customer water meters are read. Strictly adhering to this reporting period will likely result in greater uncertainty and inaccuracy in the reported results.

It is recommended that for water loss reporting, the reporting period is based on the most recent set of customer meter readings prior to 30 June (or readings taken prior to the deadline for reporting).

Taumata Arowai – Data Confidence

Data confidence definitions

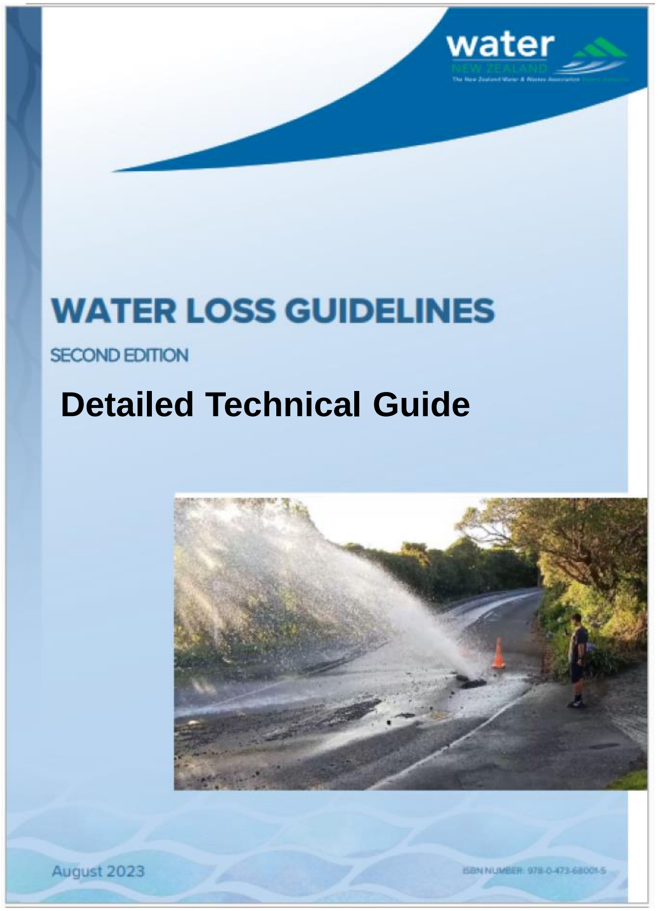
	Highly reliable/ Audited	Reliable/ Verified	Less Reliable	Uncertain	Very uncertain
Processes	Formal process to collect and analyse data. Process is documented and always followed by all staff.	Strong process to collect data. May not be fully documented but usually undertaken by most staff.	Process to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

Figure 3 13: Appendix Seven from Taumata Arowai's document ***Drinking water network environmental performance measures and guidance material***

Table 3 4: An assessment of likely outcomes for water suppliers carrying out water balance calculations for reporting on real water losses from water supply networks

	Highly reliable/ audited	Reliable/ verified	Less reliable	Uncertain	Very uncertain
Taumata Arowai Description - Process	Formal	Strong process	Process is established	Semi formal process. Poor documentation.	Ad hoc procedures
Water Balance – If using the process outlined in the NZ Guidelines	Fully metered	Only residential unmetered	Residential and many non-residential unmetered		
Taumata Arowai description – asset data	Very high level of data confidence. Data 95-100% complete and +/- 5% accurate	Good level of data confidence. 80-95% complete and +/- 10-15% accurate	Average level of data confidence. 50-80% complete and +/- 15-20% accurate	Not sure of data confidence	Very low data confidence
Water balance – likely scenarios	Fully metered. Reliable daily system input data All meters are used for billing. Water loss result will probably have 95% confidence limits of +/- 10%	Only residential properties are unmetered. 4 monthly or more frequent billing. Reliable system input metering. Water loss result will probably have 95% confidence limits of +/- 30-50%	All residential and many non-residential properties are unmetered. Reliable system input metering. Water loss result will probably have 95% confidence limits of +/- 50 - 90% or more	All residential and many non-residential properties are unmetered. Unreliable system input metering. Water loss result will probably have 95% confidence limits of more than +/- 90%	No meter recording system input volume. Water loss result will probably have 95% confidence limits of more than +/- 150%

Water Loss Guidelines – Detailed Technical Guide (2)



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Outline of the Updated WaterNZ Water Loss Guidelines

Any Questions?

Webinar 18 September 2023

Presentation by Richard Taylor

Thomas Consultants Ltd

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Navigation of the Overview and the Detailed Technical Guidelines

The New Zealand Water & Wastes Association Waiora Aotearoa

Content map

Content map

What	This document is the second edition of the *New Zealand Water Loss Guidelines*. It is supported by an Overview document titled *Managing Water Losses in New Zealand*. *The colours and italics in this content map cross-reference to the relevant sections of the Overview and Guidelines.*		
Why	Understand how measuring and reducing losses will help give effect to Te Mana o te Wai and find out about Taumata Arowai requirements and other drivers for action *(Overview section A, Guidelines section 2)*		
Where to start	Understand how your 'status quo' measures up to best practice for various size networks, and what an improved situation might look like (*Overview section B, H and I, Guidelines section 4*)		
What does best practice look like	**Measure**	**Monitor**	**Manage**
	Find out how leaky the network currently is: • Calculate an annual water balance; that is, the current level of water losses with or without customer water meters. *(Overview sections C and D, Guidelines section 3)*	Find out where the leaks are: • Weekly monitoring of minimum night flows in network sectors or segments. • Monitor pressure and any backlog of leak repairs. *(Overview section D, Guidelines section 5)*	Work out where to focus activities: • Active leakage control (ongoing leak location and repair) • Speed and quality of repairs • Asset management (materials, installation, maintenance, renewal) • Pressure management *(Overview section D and E; Guidelines sections 6, 7, 8 and technical guidance notes)*

Why

Content map

What	This is an overview of the *New Zealand Water Loss Guidelines*, aimed to support drinking water network operators to measure and understand water losses and how to improve network management to reduce losses. *The colours and italics cross-reference to the relevant sections of this Overview and the Guidelines*
Why	Understand how measuring and reducing losses will help give effect to Te Mana o te Wai and find out about Taumata Arowai requirements and other drivers for action *(Overview section A, Guidelines section 2)*

A. Why reducing water loss matters

The importance of water loss cannot be overstated.

Water is essential for life, and communities the length and breadth of New Zealand expect a safe and adequate supply of water to their homes and workplaces. Taumata Arowai, as the new water services regulator in New Zealand, is also taking a keen interest in this topic, and one of its key functions is to monitor the environmental performance of water networks.

2. Building the business case for reducing real losses – the drivers

2.1 Introduction

Building the business case for reducing real loss starts with the 'why'. Why do we need to care about how much water is lost from drinking water networks?

2.2 Te Mana o te Wai

The Water Services Act 2021 requires that drinking water suppliers and network operators in carrying out their duties under the Act must give effect to Te Mana o te Wai. This is a legislative requirement that will apply to all drinking water networks.

Where to start

Content map

What	This is an overview of the *New Zealand Water Loss Guidelines*, aimed to support drinking water network operators to measure and understand water losses and how to improve network management to reduce losses. *The colours and italics cross-reference to the relevant sections of this Overview and the Guidelines*
Why	Understand how measuring and reducing losses will help give effect to Te Mana o te Wai and find out about Taumata Arowai requirements and other drivers for action *(Overview section A, Guidelines section 2)*
Where to start	Understand how your 'status quo' measures up to best practice for various size networks, and what an improved situation might look like (*Overview section B, H and I, Guidelines section 4*)

B. Understanding water balance and definition of real water losses

Calculating a water balance is generally accepted as the best way to 'measure' the level of water loss in a water supply network. This section describes the key elements. Detailed guidance on how to calculate a water balance, even when a significant proportion of water connections/customers are not metered, is contained in the Water Loss Guidelines Section 5.

The key elements are shown in Figure 1 below, a simplified International Water Association (IWA) standard water balance.

Water enters as system input volume and becomes either authorised consumption or water losses. Authorised consumption can be billed or unbilled. The unbilled portion becomes part of non-revenue water (NRW). Water losses form the remainder of NRW and are either:

- Apparent losses- water used but not paid for (theft, customer meter under-registration)
- Real losses - leaks, bursts, and overflows from the systems of water suppliers.

Measure

What does best practice look like	Measure	Monitor	Manage
	Find out how leaky the network currently is: • Calculate an annual water balance; that is, the current level of water losses with or without customer water meters. *(Overview sections C and D, Guidelines section 3)*	Find out where the leaks are: • Weekly monitoring of minimum night flows in network sectors or segments. • Monitor pressure and any backlog of leak repairs. *(Overview section D, Guidelines section 5)*	Work out where to focus activities: • Active leakage control (ongoing leak location and repair) • Speed and quality of repairs • Asset management (materials, installation, maintenance, renewal)

C. Performance indicators for real water losses

Real water losses performance indicators are expressed as:

- litres/connection/day (for urban systems with connection density > 20 conns/km main);
- m^3/km main/day (for rural systems with low connection density < 20 conns/km main); and
- Infrastructure Leakage Index (ILI). This is the ratio of actual water losses (current annual real losses or CARL) to the unavoidable annual real losses (UARL) (see below).

the Department of Internal Affairs (DIA) mandatory 'non-financial' performance indicators (water loss as a percentage of supply).

NRW is generally expressed as a percentage of water supplied, based on volumes for each water balance component, and is considered a financial performance indicator.

Reporting real water losses as percentages is not recommended by the international water loss fraternity, because this relates water losses to water

3. MEASURE: Calculating a water balance – practical guide

3.1 Overview

Calculating a water balance is generally accepted as the best way to 'measure' the level of water loss occurring in a water supply network. This section provides guidance on calculating a water balance, which can be used even when a significant proportion of water connections/customers are not metered.

NOTE: Where the majority of customers are unmetered, a viable alternative to the 'top-down' water balance approach detailed below, is a 'bottom-up' Minimum Night Flow (MNF) approach. The MNF approach can also be adopted (as per the UK) for annual reporting, plus it has added advantages to track the natural rate of rise, supporting a targeted leak detection programme.

4. Current water loss performance in NZ

Reported water efficiency and reliability data from the National Performance Review (2021/22) is presented in the following figure set of figures. In Figures 4-1 and 4-2, levels of real water loss is categorised by network size to show how levels of water loss tend to be higher as network size decreases. Metered schemes also tend to have lower levels of real losses. The categories are as follows: Major city >100,000 serviced population, Large city 40,000 – 100,000, Medium town/city 5,000 – 40,000 serviced population. In all graphs, networks with metered connections (>80% residential connections metered) are shown in dark blue and unmetered networks shown in light blue.

Monitor

	Measure	Monitor	Manage
What does best practice look like	Find out how leaky the network currently is: • Calculate an annual water balance; that is, the current level of water losses with or without customer water meters. *(Overview sections C and D, Guidelines section 3)*	Find out where the leaks are: • Weekly monitoring of minimum night flows in network sectors or segments. • Monitor pressure and any backlog of leak repairs. *(Overview section D, Guidelines section 5)*	Work out where to focus activities: • Active leakage control (ongoing leak location and repair) • Speed and quality of repairs • Asset management (materials, installation, maintenance, renewal)

D. Measure, monitor and manage water losses

Managing water demand includes managing the level of real water losses to ensure there is an adequate supply of water to meet current and future needs while also protecting the health and mauri of freshwater.

Managing water losses is no different from managing other products and services where the best results are achieved with the cyclic process of measurement, monitoring, and managing to achieve better outcomes as shown in Figure 2. Detailed information relating to each of these three activities is provided in the respective sections of the New Zealand Water Loss Guidelines document.

5. MONITOR - Network and water loss monitoring

5.1 Background information

Measurement and analysis of night flows from small systems, or sub-systems within a larger distribution system, is also a practical and effective way to identify:

- The presence of significant amounts of detectable leakage

The easiest way to identify distribution DMAs with high leakage is a visual check on the 24-hour flow and pressure profiles. DMAs where the night flow is consistently a high proportion of the average inflow (Figure 5-2) will generally have higher leakage and be a priority for active leak detection.

Manage

	Measure	Monitor	Manage
What does best practice look like	Find out how leaky the network currently is: • Calculate an annual water balance; that is, the current level of water losses with or without customer water meters. *(Overview sections C and D, Guidelines section 3)*	Find out where the leaks are: • Weekly monitoring of minimum night flows in network sectors or segments. • Monitor pressure and any backlog of leak repairs. *(Overview section D, Guidelines section 5)*	Work out where to focus activities: • Active leakage control (ongoing leak location and repair) • Speed and quality of repairs • Asset management (materials, installation, maintenance, renewal) • Pressure management *(Overview section D and E; Guidelines sections 6, 7, 8 and technical guidance notes)*

E. Four main components of managing water loss

The four main components of managing water loss from (public) water supply networks, recognised internationally, are shown in Figure 3.

The yellow rectangle represents the current level of annual real losses (CARL). The blue rectangle is the theoretical level of unavoidable annual real losses (UARL) for the system, which is a theoretical calculation of what water losses levels can be achieved (at the current pressure) with advanced water loss management. The ratio CARL/UARL is called the Infrastructure Leak
is a good performance indica
losses between water suppli
internationally.

6. MANAGE – Managing real water losses – practical guide

6.1 The big picture – where to start

The best place to start when managing water losses is to establish the levels of water loss and leakage in the network. Calculating a water balance as outlined above (under MEASURE) can establish the level of water loss with some level of certainty/uncertainty. Then reference can be made to Figure 6-1 and Table 6-1 below.

Gap analysis

Evaluate	Benchmark against performance indicators, identify achievable target. *(Overview section C, Guidelines section 4)*	Compare to NZ averages. Identify priority areas for active leakage control. *(Guidelines section 5)*	Use information from measuring and monitoring to identify opportunities to reduce losses *(Guidelines section 6)*
Gap analysis	Where are there areas for improvement? What are the priorities? *Overview section G,H,I and Appendix A, Guidelines technical guidance note 1*		
Strategy/ long-term plan	Set targets, timeframe, budget/indicative costs and priority actions *(Overview section F and Guidelines 2.5.4 and 6.1)*		

G. What does a well-managed network look like?

This is a good question and the answer will likely depend on numerous factors such as raw water supply availability, supply risk, network capacity, network risk, environmental factors, the size/scale of the network/supply, resource consenting factors, economic factors, political influences, and so on.

3. Good customer metering and billing systems.
4. Good monitoring and management of water us demand.

It is possible to assess what a reasonable level of water loss for a network might be in the New Zealand context. Table 1, showing World Bank

Technical Guidance Notes (TGN)

1. Detailed descriptions of water loss maturity

	Description	Basic/core	Intermediate	Advanced	Guidelines reference
ALCULATIONS	System input volume (12-month volume of water supplied into a water supply network for water balance calculation)	System input volume is unreliable due to the absence of, or inaccurate meter(s) (such as an oversized meter, or a very old mechanical meter). No SCADA data is being transmitted, but manual meter readings are taken at least monthly.	System input volume is reliable with a suitably sized water meter(s) in place. Flow data (15 min or less frequency) and daily volume data is being transmitted using the SCADA system. No quality control of SCADA data (i.e., no checks that SCADA volumes = meter throughput). Only ad-hoc manual (visual) checks are made to ensure daily flows and volumes are within the expected range.	System input volume is reliable with a suitably sized water meter(s) in place. Flow data (15 min or less frequency) and daily volume data is being transmitted using the SCADA system. Manual meter reads are taken and used to confirm the accuracy of the SCADA data (i.e., annual volume ex SCADA = throughput volume on meter register). Automated systems in place to report of data outages or of very high/low flowrates. Unusual trends in daily or weekly water use are automatically reported.	3.2.1

Strategy / Long term plan

Evaluate	Benchmark against performance indicators, identify achievable target. *(Overview section C, Guidelines section 4)*	Compare to NZ averages. Identify priority areas for active leakage control. *(Guidelines section 5)*	Use information from measuring and monitoring to identify opportunities to reduce losses *(Guidelines section 6)*
Gap analysis	Where are there areas for improvement? What are the priorities? *Overview section G,H,I and Appendix A, Guidelines technical guidance note 1*		
Strategy/ long-term plan	Set targets, timeframe, budget/indicative costs and priority actions *(Overview section F and Guidelines 2.5.4 and 6.1)*		

F. Water loss strategy

Ideally, a water loss strategy is developed which encompasses all four main components of managing real losses, with associated budgets and funding requirements, and with a long-term target in mind. This strategy can then be linked to water resource and demand management plans.

Other important aspects of managing water loss include specifications and performance measures for leak response and repair, ensuring the overall condition of the water network is maintained or improved (achieved by ensuring an adequate and appropriate water main renewals programme), managing customer water metering (inventory and

Water Loss Maturity

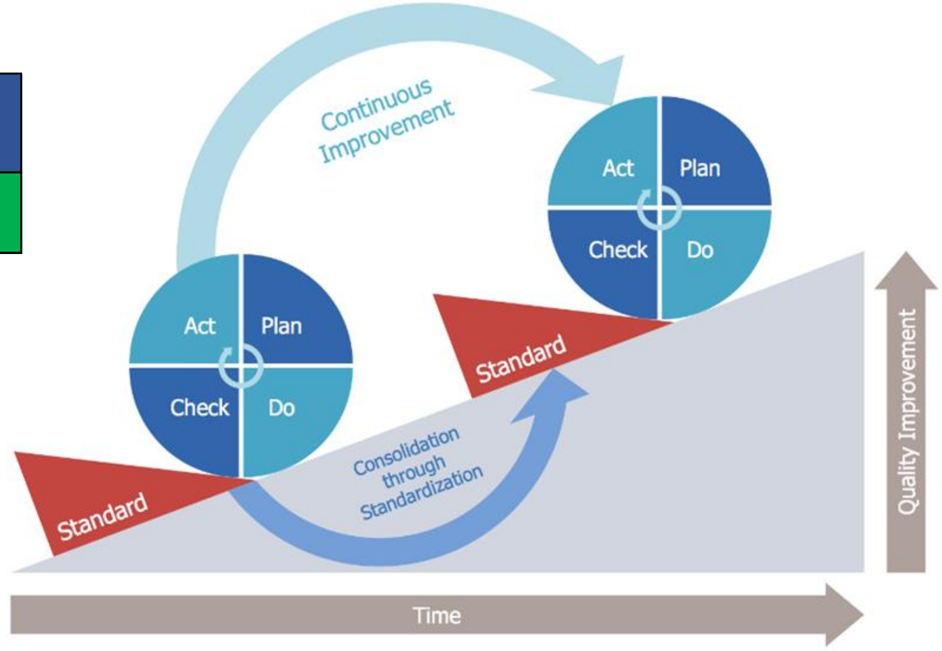
The New Zealand Water & Wastes Association Waiora Aotearoa

Maturity Assessment

Modelled on the Asset Management Maturity Assessment approach (IIMM)

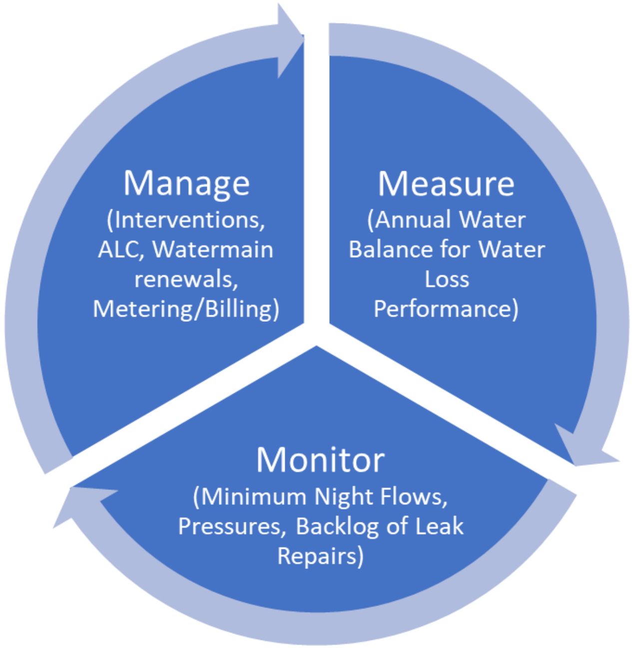
Maturity Levels				
Aware	Basic	Core	Intermediate	Advanced

Water Loss Maturity		
Basic/Core	Intermediate	Advanced



Maturity Assessment topics

1. Water balance calculations
2. Water loss performance measures
3. Four main components of managing real losses
4. Resourcing for water loss management
5. Enhanced use of water balance calculations
6. Water loss management – General (network size)



Overview

APPENDIX A – BASIC DESCRIPTION OF WATER LOSS MATURITY

	Description	Basic/Core	Intermediate	Advanced	Water loss guidelines section
FOR WATER BALANCE CALCULATIONS	Ability to carry out robust water balance calculations	System input volume is unavailable or unreliable due to the absence of, or inaccurate meter(s)	System input volume is reliable but no SCADA Data is available	System input volume is reliable and SCADA data is available	4.2.1
FOR WATER BALANCE CALCULATIONS	Billed metered consumption (over the 12-month water balance period)	Infrequent customer meter readings (i.e., annual or six-monthly) and using manual (hard copy) meter reading sheets.	Six-monthly meter reading and billing, plus monthly accounts for high water users.	All meters are read and billed either two-monthly or monthly using digital handheld devices for meter reading and/or smart meters.	4.2.2 7.9
FOR WATER BALANCE CALCULATIONS	Customer water meters	Customer meters are very unreliable and likely to be inaccurate.	Customer meters are quite unreliable and may be inaccurate.	Customer meters are mostly accurate and well-maintained.	4.2.2 7.9
FOR WATER LOSS PIs	System parameters (i.e., length of mains, number of connections, average system pressure)	GIS is not up-to-date and does not show all water mains and connections. Uncertain data.	GIS is up-to-date and accurate, showing all water mains and connections.	GIS is up-to-date and accurate, showing all water mains and connections.	4.3.2

Overview

APPENDIX A – BASIC DESCRIPTION OF WATER LOSS MATURITY

FOUR MAIN COMPONENTS OF MANAGING REAL LOSSES

Description	Basic/Core	Intermediate	Advanced	Water loss guidelines section
Speed and quality of repairs	Leaks are not repaired promptly (often takes days or weeks to repair).	Leaks are repaired in a timely manner (generally within 12-24 hours).	Leaks are fixed in a very timely manner (generally within 4-6 hours).	6.4 TGN 2 (a)
Network composition and condition – general	The network is in a poor condition with predominantly old water mains likely to be leaking.	The network is in an 'average' condition with numerous old water mains likely to be leaking.	The network is in very good condition with a low percentage of old water mains likely to be leaking.	6.5 TGN 2 (b)
ALC - network monitoring	No regular monitoring of water use.	Infrequent monitoring of water use.	Regular (at least weekly) monitoring of water use and flow rates.	3.3.3, 6.1-6.4, 6.7 TGN 2 (c) TGN 3
ALC – Leak detection and repair	No ALC is undertaken except in an emergency.	Occasional use of ALC on an 'ad-hoc' basis.	Frequent and effective use of ALC (and as part of a demand management strategy)	5.1 - 5.4, 7 TGN 2 (c) TGN 8
Pressure management – general	High operating pressures (>65m average supply pressure). No attempt has been made to manage supply pressures.	The average supply pressure is less than 60m, with some pressure management in place.	The average supply pressure is less than 50m, with appropriate pressure management in place.	6.8 TGN 2 (d)

Detailed Guidelines – Water balance calculations

FOR WATER BALANCE CALCULATIONS

Description	Basic/core	Intermediate	Advanced	Guidelines reference
System input volume (12-month volume of water supplied into a water supply network for water balance calculation)	System input volume is unreliable due to the absence of, or inaccurate meter(s) (such as an oversized meter, or a very old mechanical meter). No SCADA data is being transmitted, but manual meter readings are taken at least monthly.	System input volume is reliable with a suitably sized water meter(s) in place. Flow data (15 min or less frequency) and daily volume data is being transmitted using the SCADA system. No quality control of SCADA data (i.e., no checks that SCADA volumes = meter throughput). Only ad-hoc manual (visual) checks are made to ensure daily flows and volumes are within the expected range.	System input volume is reliable with a suitably sized water meter(s) in place. Flow data (15 min or less frequency) and daily volume data is being transmitted using the SCADA system. Manual meter reads are taken and used to confirm the accuracy of the SCADA data (i.e., annual volume ex SCADA = throughput volume on meter register). Automated systems in place to report of data outages or of very high/low flowrates. Unusual trends in daily or weekly water use are automatically reported.	3.2.1
Billed metered Consumption (over the 12-month water balance period)	Infrequent customer meter readings (i.e., annual or six-monthly) and using manual (hard-copy) meter reading sheets. Poor data quality and lack of processes for dealing with unusual meter readings. May involve the use of spreadsheets to record meter readings. No reliable billing reports.	Six-monthly meter reading and billing, plus monthly accounts for high water users, using digital handheld devices for meter readings. Good dat ensuring billing da Informal meter rea water wri Good wa water bill	All meters read and billed either two monthly or monthly using digital handheld devices for meter reading and/or smart meters.	3.2.2 6.9
Customer water meters	Customer meters are very unreliable and likely to be inaccurate. There are no maintenance or replacement programmes in place.	Custome significan There is a programr		

ENHANCED USE OF WATER BALANCE CALCULATIONS

Description	Basic/core	Intermediate	Advanced	Guidelines reference
Other		Water balances are being carried out more frequently than annually for leakage-management purposes, using six-monthly billed metered consumption data. This provides a more frequent 'measure' of water loss performance in the network.	Water balances are being carried out more frequently than annually for leakage-management purposes, and for sub-areas, using two- or three- monthly billed metered consumption data for specific zones and/or using smart metering data. This provides a more frequent 'measure' of water loss performance in the network. Where the network has smart meters on all connections/customers, water balances are effectively available daily, providing daily accurate water loss measurement and performance.	7 TGN 8

Detailed Guidelines – Water loss performance measures

	Description	Basic/core	Intermediate	Advanced	Guidelines reference
FOR WATER LOSS PERFORMANCE MEASURES	Accuracy of system parameters (i.e., length of mains, number of connections, average system pressure), which affect ILI calculations	GIS is not up-to-date and does not show all water mains and connections. Water billing system (if any) may not have complete records of every metered water connection. Rating system may not have an accurate record of unmetered properties (paying a uniform annual charge). There are no processes in place to manage new connections, meter changes, disconnections etc. Casual informal approach. No water network model. Figure for average system pressure is approximate only.	GIS is up-to-date and accurate, showing all watermains and connections. Water billing system probably has full and complete records of every metered water connection. Rating system likely has an accurate record of unmetered connected properties (paying a uniform annual charge). Some processes are in place to manage new connections, meter changes, disconnections etc. Water network model is not up-to-date or calibrated. Figure for average system pressure is not necessarily accurate.	GIS is up-to-date and accurate, showing all water mains and connections. Water billing system has full and complete records of every metered water connection. Rating system has accurate record of unmetered connected properties (paying a uniform annual charge). Formal processes are in place to manage new connections, meter changes, disconnections etc. Water network model is up-to-date and calibrated so that the figure for average system pressure is accurate.	3.3.2

Detailed Guidelines – Four components of managing real loss

	Description	Basic/core	Intermediate	Advanced	Guidelines reference
FOUR MAIN COMPONENTS OF MANAGING REAL LOSSES	Speed and quality of repairs	There are no performance standards in place for leak repair times. Large leaks are repaired within 24 hours. Reported leaks are mostly repaired within two weeks. Some reported leaks take three months or more to repair.	Maintenance contract specifies performance standards for leak repair times. Large leaks are fixed within 12 hours. Reported leaks are mostly repaired within one week. Some reported leaks take one or two months to repair.	Maintenance contract specifies performance standards for leak repair times and has performance-based payments/penalties. Large leaks are fixed within six hours. Reported leaks are mostly repaired within two or three days. A few complex leaks take up to several weeks to repair.	6.4 TGN 2 (a)
	Network composition and condition - general	Network includes more than 10% of water mains at high risk of leakage (i.e., old galvanised steel, old unlined steel mains, alkathene, early PVC etc). There are no 'leakage-focused' water-main renewals occurring. The overall condition of the network is deteriorating, and the level of leakage is increasing. The situation is becoming 'out of control'.	Network includes more than 5% of water mains at high risk of leakage. There is an inadequate level of 'leakage-focused' water-main renewals occurring. The overall condition of the network is only just being maintained. Leakage is only just 'under control'.	Network includes less than 3% of watermains at high risk of leakage. There is an appropriate on-going water-main replacement programme. The overall condition of the network is improving. Leakage is 'under control'.	6.6 TGN 2 (b)

Detailed Guidelines – Four components of managing real loss

FOUR MAIN COMPONENTS OF MANAGING REAL LOSSES

Description	Basic/core	Intermediate	Advanced	Guidelines reference
Network composition and condition – general – condition rating of network	Water-main condition is assumed based on pipe material and age.	Limited (ad-hoc) water-main condition data is collected and recorded. No formal condition rating programme or initiatives are undertaken.	There is a good understanding of water-main condition in the network as appropriate condition data is collected when repairs are undertaken, and appropriate pipe sampling is also undertaken. Condition data is recorded on the asset management system and used when selecting water mains for renewal.	6.5 TGN 2 (b)
Active Leakage Control (ALC) - network monitoring meters	The few existing network monitoring meters are probably not recording low flows (MNFs) accurately.	More than 70% of network monitoring meters are appropriately sized and are accurately recording the full range of flows, especially MNFs.	All network monitoring meters are appropriately sized and are accurately recording the full range of flows, especially MNFs.	3.3.3 TGN 3
ALC - network monitoring	No formal monitoring of MNFs or daily volumes.	MNFs can be monitored, but there are no front-end monitoring systems in place. Staff manually check MNFs and intervene on an ad-hoc basis.	Front-end monitoring systems have been developed to manage the high number of DMAs.	6.1-6.4 6.7
ALC - Network Sectorization	No sectorisation (i.e., network is 'open' with 3,000 or more connections).	Sectorisation of r… undertaken but r…		
ALC – Leak detection and repair	No ALC is undertaken except in an emergency situation.	Occasional use c… Step testing is ca… Procedures are r…		

FOUR MAIN COMPONENTS OF MANAGING REAL LOSSES

Description	Basic/core	Intermediate	Advanced	Guidelines reference
ALC – Use of new technologies	No knowledge or interest in new technologies to locate leaks.	Slow to adopt any new technologies for locating leaks.	Actively seeking, learning about, and adopting the latest technologies for locating leaks (where appropriate, effective, and economic).	7 TGN 8
Pressure management - general	High operating pressures (>65m average supply pressure). No attempt has been made to manage supply pressures.	Average supply pressure is less than 60m, with some pressure management in place.	Average supply pressure is less than 50m, with appropriate pressure management in place. Some sophisticated control of pressure-reducing valves is in place.	6.8 TGN 2 (d)
Pressure Management - Transients	No knowledge or investigations into pressure transients in the water networks.	Basic interventions such as soft-starters at pump stations, but no transient monitoring.	Pressure transients are monitored appropriately in the network using high-rate pressure loggers. Pressure calming in the network is recognised as important and managed accordingly.	6.8 TGN 2 (d)

Detailed Guidelines – Resourcing for water loss management

	Description	Basic/core	Intermediate	Advanced	Guidelines reference
RESOURCING FOR WATER LOSS MANAGEMENT	Resourcing	There is no recognition that resource needs to be allocated to network monitoring and leakage management.	Insufficient human resource has been allocated to network monitoring and leakage management.	Real losses are being well managed 'week-to-week'. Adequate human resource has been allocated to network monitoring and leakage management.	6.12

Detailed Guidelines –Water loss management : Network size

WATER LOSS MANAGEMENT - GENERAL

Supply Size	Serviced population	Basic	Intermediate	Advanced	Guidelines reference
Small town	Up to 5,000	Unable to monitor MNFs into the network due to inadequate metering at reservoirs and/or lack of real-time (daily) data.	MNFs can be monitored, but no attention or resource is applied to managing real losses.	MNFs are monitored at least weekly. There is a good understanding of water loss performance in each DMA.	5.2
Medium town/ city (such as Cambridge, Levin or Rolleston)	5,000 – 40,000	Unable to monitor MNFs into areas within the network due to inadequate zoning, inadequate metering at reservoirs and/or lack of real-time (daily) data. There is no understanding of water loss performance in any of the zones.	MNFs can attention managing Water ope water loss individual		

WATER LOSS MANAGEMENT - GENERAL

Supply Size	Serviced population	Basic	Intermediate	Advanced	Guidelines reference
Large city (such as Whangarei, Nelson, Invercargill)	40,000 – 200,000	Unable to monitor MNFs into areas within the network due to inadequate zoning, inadequate metering at reservoirs and/or lack of real-time (daily) data.	MNFs can be monitored, but there are no front-end monitoring systems in place. Staff manually check MNFs and intervene on an ad-hoc basis.	Front-end monitoring systems have been developed to manage the high number of DMAs. There are automated systems to alert of high/increased levels of leakage. Intervention levels for each zone are in place. There is a good understanding of water loss performance in each DMA.	6.2
Major metropolis (Auckland, Wellington, Christchurch)	Over 200,000		MNFs can be monitored, but there are no front-end monitoring systems in place. Staff manually check MNFs and intervene on an ad-hoc basis.	Sophisticated front-end monitoring systems are developed to manage data from the large number of DMAs. There are automated systems to alert of high/increased levels of leakage. There is a good understanding of water loss performance in each DMA.	6.2
Rural schemes (such as at Hauraki Plains, Hurunui, Clutha)	NA. Restricted supply to extensive rural/ farming areas.	No management of water losses or water demand at all. No checks on restrictors (on individual connections). No interventions (ALC, network inspections etc) are carried out except in a supply emergency.	Daily volumes are being monitored infrequently (say monthly). Restrictors (on connections) are being checked every two to three years. Interventions (ALC, network inspections etc) are carried out infrequently to manage real losses and water demand.	Daily volumes are being monitored at least weekly and compared against allocated units. Restrictors (on connections) are being checked at least annually. Large rural networks are sectorised and 24-hour data is being received from network meters for monitoring. Interventions (ALC, network inspections etc) are carried out effectively to manage real losses.	6.2

He pātai?
Questions